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(ORAL PRESENTATION)

Use of Herbal Drugs and Essential Oils for Treatment in Organic Farm Animal Production

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Abstract
Organic animal production is a natural breeding system in which maintenance and feeding methods suitable for the physiological needs of animals are implemented and animal health is protected by prioritizing alternative medication and treatment when necessary. Increase in the number of strains resistant to antibiotic and antiparasitic drugs used in animal husbandry, the occurrence of drug residues in animal products and their causing serious health problems in humans consuming them led to the search for alternative herbal solutions. Some herbal drugs and essential oils are used in our country for the treatment of internal diseases, birth and gynecological problems, surgical diseases and parasitic diseases in farm animals. Some herbal drugs include quince shell, hellaboms stems, barley flour, juniper branch, flaxseed, apple cider vinegar, hibiscus leaf, chamomile flower, pine gum resin, planago leaf, oak bark, willow leaf, wheat grain, mistletoe leaf, onion body, sugar beet root, cabbage leaf, lemon fruit, tea lea and aloe vera plant. In the current study, the parts of the natural herbal drugs used for treatment, how they are used and where they are used are discussed. In addition, properties of some essential oils, their effects on animals and their use in treatments are also mentioned. These essential oils include the ones extracted from sage, juniper, bergamot, rosemary, dill, clove, pheasant's eye, wild angelica, eucalyptus leaves, orange peel, centaury, cinnamon and ginger. The current study also aims to contribute to spreading the use of natural herbal drugs instead of any synthetic drug used for the protection of the herd health.

Key Words; Essential Oil, Herbal Drug, Organic Animal Husbandry, Treatment.

INTRODUCTION

The flora of our country is important in terms of the abundance and diversity of plants containing essential oils. Turkey's geographical location and climate in addition to the diversity of the intersection of three important as floristic take place in other genera and species of aromatic plants has led to the increased diversity. Turkey's kind of close to 10,000 registered flora 1 / 3'n is known consisting of aromatic plants. (Yeşilbağ, 2007) These aromatic plants can be used for treatment of organic animal production. Organic animal production is a natural breeding system where care and feeding methods are applied in accordance with the physiological needs of the animals and the animal health is protected by giving priority to alternative medicine and treatment when necessary. In this direction, the use of all kinds of additives, especially antibiotics, which may adversely affect animal and human health and cause environmental pollution, is prohibited in organic livestock (Güler and Dalkılıç, 2005). Therefore, the increasing number of strains resistant to antibiotic and antiparasitic drugs used in animal husbandry, the occurrence of drug residues in animal products and causing important health problems in people consuming these products have led to the search for alternative herbal solutions (Çetin, 2012).

Approximately 75-80% of the world's population relies on herbal resources instead of ordinary medicines (Çetin, 2012). Herbal drugs have been used traditionally in the treatment of various animal diseases among the people for centuries (Yaşar et al., 2015). In this study, it is aimed to

disseminate the use of natural herbal drugs instead of synthetic drugs used in the protection and treatment of herd health.

Field of Usage of Herbal Drugs and Aromatic Plants for Animal Treatment

Usually used herbal drugs and aromatic plants used in animals for therapeutic purposes and effects are indicated below.

Quince (CydoniaoblongaMill.): Quince pectin, such as astringent substances such as tannin, sugars (glucose, saccharose), apple acid and vitamin C (Baytop, 1963), given the consideration of quince bark infusion used in complementary and supportive treatments may be an example of rival. It can be claimed that it is an application (Sinmez and Yaşar, 2017).

Bundle grass (Helleborus L.): The composition of bundle grass saponin-type glycosides (helleborine and helleborein) localirritan effect, so that the irritation of the blood collected in that region and reports that the function of leukocytes increased (Erdemir, 2007). It can be argued that the edema in cattle is consistent with the rational treatment method by allowing the area where the edema of the herb called edema or bundle grass to be drained and draining the region (Sinmez and Yaşar, 2017).

Barley (HordeumvulgareL.): In the treatment of abscesses, nail cracks, sprains and crushes, raw eggs and barley flour were mixed and the problematic feet were wrapped with a cloth. by binding to the head of the steam is inhaled, barley flour mixed with hot water obtained from the birth of the lean cows were determined to be followed by birth. It can be said that practices may serve as an example for complementary and supportive therapies in veterinary medicine (Sinmez and Yaşar, 2017).

Juniper (Juniperusoxycedrus L.): They report that the antiseptic and antiparasitic effects of juniper tar are due to phenol derivatives (gaiacol, ethyl, creosol) in its composition (Erdemir, 2007).

Flax (LinumusitatissimumL.): Yellowish-brown, a protective oil of the dietary antiparasitic effect, high iodine number of unsaturated fatty acids (linoleic, linolenic and oleic acids) are reported to contain (Baytop, 1963) Flax seed preserves the crawl and digestive tract (Kaya, 2008). Bezir oil, buffalo skin tick treatment, sun burns, bit-fleas and nocturnal was determined to protect the hold. It can be said that the practices are of a rational nature that overlaps with the literature (Sinmez and Yaşar, 2017).

Apple (MaluspumilaMill.): Reported that apple cider vinegar is antiseptic effective (Javanmardi et al, 2003). It was. It can be said that the use of vinegar for antiseptic purposes is similar to the literature (Sinmez and Yaşar, 2017).

Hibiscus (MalvasylvestrisL.): Because of the protective, softening effect of the leaves of the hibiscus, it can be used as a pain reliever in oral and dental abscesses, some skin diseases and boils (Koçoğlu et al., 1996). 1963). It can be considered that the mulching of the hibiscus leaf for the purpose of maturing boils and relieving pain in bee stings is among the rational practices that overlap with the above literature data (Sinmez and Yaşar, 2017).

Chamomile (Matricariachamomilla L.): Chamomile is antispasmodic, degassing and soothing; (Kaya S. 2008) reported that terpenic substances in the composition of daisy are antispasmodic, antibacterial and anti-inflammatory and also used as infusion as antipyretic, sedative, perspirant, intestinal gas relievers and painkillers (Yazar et al. 2007). In cases of tympani and sheep occurring in sheep, it can be said that the infusion of chamomile flowers in the form of infusions for one to two liters is a rational treatment example that is in line with the literature (Sinmez and Yaşar, 2017).

Pine (Pinusnigra L.): Pine gum, Turkish codex adhesive adhesive (emplastrumadhaesivum), veterinary medicine used in the cantarid patch (emplastrumcantharidum) and the name of the preparations are registered with the name of the cantarid pomad (Erdemir, 2007), resin, 70-90% of the resin. That up to 30 are composed of essential oils (Kaya S. 2008); pine tar antimicrobial (Kızıl et al. 2002), have reported wound-healing effects (Sinmez and Yaşar, 2017). It is applied in the treatment of abscess, cattle external parasitic and fungal infestation (Trichophytosis) treatments and to stop bleeding in horn fractures; pine resin was used for burn and open skin injuries (Sinmez and Yaşar, 2017). The use of pine tar, gum and resin in the treatment of antiseptic, antiparasitic, wound

and burns can be said to have a rational quality that is consistent with the above literature information (Sinmez and Yaşar, 2017).

Pervin (PlantagolanceolataL.): The composition of pervin is musilage, tannin and pectin, emollient effect is due to mucilage, anti-inflammatory, softening, wound healing and antimicrobial effect reported (Kaya 2008). In the treatment of abscesses, weed was used as a mush and softener. It can be said that the application has a rational feature that overlaps with the above literature information (Sinmez and Yaşar, 2017).

Oak (Quercus pubescens L.): The effect of oak bark is composed of tannins, pectic acid, mucilage, magnesium and potassium salts (Kaya, 2008); oak bark is antibacterial and antifungal effective (Şöhretoğlu et al. 2007). It can be said that oak bark is used in the treatment of open wounds and abscesses in powder form, and the use of infusion form in diarrhea treatment in calves is included in the rational practices that overlap with the literature information (Sinmez and Yaşar, 2017).

Willow (SalixalbaL.): The antipyretic, appetite-enhancing, strengthening properties of willow tree leaves and the pain-reducing, antipyretic and inflammation-suppressing effect of the active ingredient of the willow bark extract are considered. It can be said that the willow leaf infusion used has a rational quality (Sinmez and Yaşar, 2017).

Wheat (Triticumaestivum L.): In the treatment of horses' water pot and emphysema, it was determined that the boiled wheat was put into a cloth bag and the vapor of the horse was tied to the head of the horse. It can be argued that the practice has a rational quality that can serve as an example for complementary and supportive therapies (Sinmez and Yaşar, 2017).

Mistletoe-Gokce (Viscumalbum L.): In the composition of Gokce, viscose, tannin, urson, inocyte, an alkoloid (viscotoxin) and one acid, and the other neutrophsin (sapotoxin) are two glycosides (Baytop, 1963); reported that mistletoe has been used in various cancer cases and in the treatment of some cardiovascular diseases, and that viscotoxins in its composition have cytolytic effect on tumor cells and polyholosides are effective against cancer was used (Ergun and Deliorman, 1995). Considering that mistletoe has immunostimulatory, softening, expectorant and expectorant effects on the airways, it is said to be rational (Sinmez and Yaşar, 2017).

Onion (AlliumcepaL.): Onion is a drug containing antibiotics that inhibit certain bacteria and microorganisms (Benkeblia, 2004); The onion burning, startle effect of the essential oil bearing allylpropyldisulfide, and the fire-preventing effect of the structure of flavonoids (quercetin) is due to report (Kaya, 2008). Abscess treatment in cattle, crushed and thin in case of ash cooked onion porridge applications can be said to be used in parallel with the literature data (Sinmez and Yaşar, 2017).

Sugar Beet (Beta vulgaris L.): It reports that sugar beet has antioxidant and anti-inflammatory effects (Chakole et al, 2011). Boiled beet was used to reduce the horns of cattle with pointed and long horns. It can be argued that its use as a maturing and wound healing is a rational practice which is consistent with the literature knowledge (Sinmez and Yaşar, 2017).

Cabbage (BrassicaoleraceaL.): The cabbage leaf is dressed externally to heal boils and purulent wounds, cabbage leaves and seeds also have worm-reducing and slurry effects. In this context, it can be said that the uses have a rational character that overlaps with the literature data (Sinmez and Yaşar, 2017).

Lemon (Citrus lemon L.): Lemon extract is reported to be antiseptic effective. It was determined that lemon juice was dripped into the eye for antiseptic treatment in the treatment of infectious keratoconjunctivitis, and it was drunk as antiparasitic in the treatment of scabies and internal parasites. It can be said that the applications have a rational quality parallel to the literature data (Sinmez and Yaşar, 2017).

Tea (Camelliasinensis L.): Tea astringent and toughening effect of the composition of tannic acid (5,10) is known to come from the combination of. . When the calming and astringent effect of tea is considered, it can be argued that the applications are rational (Sinmez and Yaşar, 2017).

Pumpkin (CucurbitamoschataL.): It reports that the antihelmentic effect of pumpkin seed is due to the resin called peporesin (Sucu, 1978.). It may be suggested that the antiparasitic effect should be supported by clinical studies to be used in animal health (Sinmez and Yaşar, 2017).

Red pepper (CapsicumannuumL.): Used in coughing disease in red pepper used in appetite-enhancing, secretion-enhancing and sweating effect reports (Kaya, 2008). In the treatment of rhinitis in sheep, chickens in the treatment of pseudopulmonary disease was determined that the application of red powder pepper. Data can be considered as a supportive treatment example (Sinmez and Yaşar, 2017).

Maize (Zeamays L.): In many published scientific studies, it is reported that corn tassel has antioxidant, antidepressant, diuretic, kidney protective and hyperglycemic reducing effects and these effects are caused by flavonoids and terpenoids in the structure of corn tassel. It was determined that sheep and goats were given infusion of corn tassels for incontinence and diarrhea treatment of calves. It can be argued that the use of maize tassels has a rational character that is consistent with the literature (Sinmez and Yaşar, 2017).

Garlic (AlliumsativumL.): Garlic accelerates the healing of wounds and antiseptic effect (Baytop, 1999), garlic as a worm lowering ascites and oxides effective against ascites (Javanmardi et al, 2003); Ancylostomacaninum, Necatoramericanus), Capillariature, sarcoptic scabies and some protozoa species (such as Entemoebahistolitica, Giardiatures) is effective (Kaya, 2008); reported that the application of topical garlic gives successful results in the treatment of trichophytosis of cattle was applied (Sharma and Dwivedi, 1990). It was also reported that garlic was applied to the mouth of the animal in a cheesecloth in the form of a gem in the removal of leeches from the mouth and throat. It can be argued that the use of garlic for startling, wound healing, antiseptic, antimicrobial, antiparasitic and antifungal effects is one of the rational practices that overlap with the literature data (Sinmez and Yaşar, 2017).

Olives (OleaeuropaeaL.): Olive oil is softening and sliding effect (Baytop, 1999), cattle cattle tympani treatment to reduce the stability of foam can be used to report that the olive oil has antibacterial properties (Rose and Issi, 2010). As a curative, it can be argued that the use of rumentimpanisi and foam extinguisher and constipation effect in constipation may be included in rational treatment practices that are consistent with the literature (Sinmez and Yaşar, 2017).

Thyme (Thymusvulgaris): More seeds are used Thymol and Carvacrolad. Antimicrobial (Agnihotri and Vaidya, 1996), bactericide and bacteriostatic (Burt and Reinders, 2003), anticoxidial (Giannenas et al, 2003), antifungal (Pina-Vaz et al, 2004), antispasmodic (Meister, 1999) and antioxidant (Lee and Shibamoto, 2000) has the effect.

Celery (Celeriac): More leaves are used. Phthalidesad contains the active substance. It has digestive stimulating and appetite enhancing effect, nematicidal and antifungal effect and antioxidant effect (Sinmez and Yaşar, 2017).

Sage (Sage): More leaves are used. It contains the active ingredient Cineolad. Digestive stimulant and antiseptic (Quick, et al, 2003), antioxidant (Campanella et al, 2003) and has antidiabetic effect.

Ginger (Zingiberisrhizoma): More rhizoma is used. It contains the active ingredient zingorolead. It has antimicrobial effect (Maity et al, 2000), antioxidant (Halvorsen, et al, 2002), antidiabetic and antifungal (Agarwal, 2001).

Laurel (Laurel): More leaves are used. It contains the active ingredient Cineolad. Appetite enhancer, digestive stimulant and antiseptic (Quick, et al, 2003), bactericidal and bacteriostatic (Burt and Reinders, 2003) has the effect.

Basil (Basil): More leaves are used. Antimicrobial (Elgayyar et al, 2001), antifungal (Montes-Belmont and Carvajal, 1998.), antioxidants (Campanella, 2003) and antistress (Maity et al, 2000) shows the effect.

Clove (Clove): More flowers and seeds are used. It contains the active substance Eugenolad. Appetite enhancer, digestive stimulant and antiseptic (Quick, et al, 2003), antimicrobial, bactericidal and bacteriostatic, antifungal and antioxidant (Teissedre, and Waterhouse, 2000) has the effect.

Mustard (Sinapisalba L.): More seeds are used Allylisothiocyanate. Appetizing and stimulating the digestion and antioxidant has the effect (Quick, et al, 2003).

Coriander (Coriander): More leaves and seeds are used. It contains the active substance linalolad. Appetite enhancer and digestive stimulant (Quick, et al, 2003), diabetic (Gray and Flatt, 1999.),

antifungal (Basilico and Basilico, 1999.), antioxidant (Campanella, et al, 2003), hypolipidemic (Chithra, and Leelamma) , 2000), antimicrobial (Singh et al, 2002), hypocholesterolemic (Chithra, and Leelamma, 1997) and has anticonvulsant effect.
Horseradish (Cochleariaarmoracia): Root is mostly used Allylisothiocyanate. Appetizing (Quick, et al, 2003) and has a digestive stimulating effect.
Mint (Peppermint): More leaves are used. It contains the active ingredient mentholad. It has an appetite enhancing, digestive stimulating and antiseptic and antifungal effect (Montes-Belmont and Carvajal, 1998).
Black pepper (Pipernigrum): More fruit is used. Piperinead active substance. Digestive stimulants (Quick, et al, 2003), antimicrobial (Dorman and Deans, 2000), anti-inflammatory (Mujumdar et al, 1990), antifungal, larvicidal (Park et al, 2002) and has antidiabetic effect.
Nutmeg: More seeds are used. It contains the active substance called Sabinene. It has an anti-digestive and diarrhea effect (Quick, et al, 2003 and antimicrobial (Dorman and Deans, 2000).
Rosemary (Rosmarinusofficinalis L.): More leaves are used. It contains the active ingredient Cineolad. Digestive stimulating and antiseptic (Quick, et al, 2003), antimicrobial (Del Campo et al, 2000) and antioxidant (Campanella, et al, 2003) has the effect.
Cinnamon (Cinnamon): More bark is used. It contains the active substance Cinnmaldehyde. It has an appetite enhancing and digestive stimulating effect (Quick, et al, 2003), antibacterial (Agnihotri and Vaidya, 1996) and antifungal (Montes-Belmont and Carvajal, 1998).
Parsley (Parsley): More leaves are used. Apiolad active ingredient. It has an appetite, digestive stimulus and antiseptic effect (Quick, et al, 2003).
Cumin (Carumcarvi): More seeds are used. It contains the active substance called cuminaldehyde. It has digestive stimulating (Quick, et al, 2003), bronchodiladator (Boskabady, at al, 2003), antiulcerogenic (Khayyalet al, 2001) and antibacterial (Singh et al, 2001).
Anise (Anise): More seeds are used. It contains the active ingredient anotholead. Digestive stimulant and antiparasitic (Quick, et al, 2003), antibacterial (Singh et al, 2001)) and antifungal (Soliman, and Badeaa, 2002) has the effect.

ANTIOXIDANT ACTIVITIES OF AROMATIC PLANTS

The antioxidant activity of aromatic plants is related to phenolic compounds in their structure. Flavonoids, phenolic acids and phenolic terpenes are the most common compounds (Hindi, 2013). The antioxidant effect of phenolic compounds is due to properties such as free radical scavenging (Rice-Avans, et al, 1995), compounding with metal ions (metal chelating), and preventing or reducing singlet oxygen formation (Rice-Avans, et al, 1995). These compounds can give hydrogen to the hydroxyl groups in aromatic rings to prevent oxidation of lipids and other biomolecules (protein, carbohydrate, nucleic acids) by free radicals (Burda and Oleszek, 2001). Flavonoids and other phenolic compounds are mostly found in the leaves, flowers and woody parts of the plant. Therefore, generally aromatic plants, leaves and flowers are dried in the form of drugs (Baytop, 1999) or extraction, distillation methods are used in the form of essential oil extracts (Bostoglou, 1997). Because the chemical composition of aromatic plants varies depending on many factors, antioxidant effects may also change (Akgul and Ayar, 1993). Grown in Turkey and grown 31 kinds is examined on sunflower oil impact aromatic plant antioxidant is with rosemary effect most powerful antioxidant and followed by the sage, sumac, thyme, marjoram and have determined that zahter the item (Akgül and Ayar, 1993).

CONCLUSIONS AND RECOMMENDATIONS

Utilization of aromatic plants and extracts from these plants will become an increasingly common trend in all societies and animal nutrition will take the necessary share of this development. Our country has an important potential in terms of natural and cultured medicinal and aromatic plants with its rich plant diversity, wide area and structure with different climates. As a country, this advantage should be evaluated. Herbal treatment practices used in veterinary medicine are very similar to the current treatment methods. It has been demonstrated by many researchers that plant

drugs, aromatic plants and essential oils obtained from these plants are highly effective against pathogenic microorganisms and show strong bacteriostatic, bactericidal, antiparasitic and fungicidal effects. However, it is important and necessary to establish the scientific existence of these effects; It was determined that complementary and supportive treatment in veterinary medicine could be gained new knowledge and dimensions in veterinary pharmacology literature.

As a result, synthetic drugs that are prohibited for use in organic animal husbandry such as antibiotics, considering the positive effects of herbal drugs, aromatic plants and extracts on complementary and supportive treatments of various animal species due to their appetite enhancing, digestive stimulating, wound healing, antimicrobial, antioxidant, antifungal and antiparasitic properties. It can be argued that preferring growth-stimulating agents will make positive contributions.

REFERENCES

Agarwal, M., Walia, S., Dhingra, S., Khambay, B.P. 2001. Insect growth inhibition, antifeedant and antifungal activity of compounds isolated/derived from Zingiberofficinale Roscoe (ginger) rhizomes. Pest Manag Sci. Mar;57(3):289-300.

Agnihotri, S., Vaidya, A.D.1996.A novel approach to study antibacterial properties of volatile components of selected. Indian medicinal herbs. Indian J Exp Biol. Jul;34 (7):712-5.

Akgül, A., Ayar, A. 1993. Yerli baharatların antioksidan etkileri. Doğa-TR. J. of Agriculture and Forestry. 17: 1061-1068.

Ball, A. 2000. The New Source in PoultryFeedingAfterThe Ban of GrowthPromoters. V. Uluslararası Yem Kongresi ve Fuarı. 2000. Antalya, 87- 93.

Basilico, M.Z. and Basilico, J.C. 1999. Inhibitory effect of some spice essential oils on Asperdillusochraceus NRRL 3174 growth and ochratoxinAproduction.Leeters in Applied Microbiology 29,238-241.

Baytop T. 1963. Türkiye'nin Tıbbi ve Zehirli Bitkileri. İstanbul Üniversitesi Yayınları No: 1039, Tıp Fakültesi No:59, İsmail Akgün Matbaası, İstanbul, ss: 235-430.

Baytop T. 1999. Türkiye'de Bitkiler ile Tedavi (Geçmişte ve Bugün). 2. Baskı. Nobel Tıp Kitabevi, İstanbul, 480 s.

Benkeblia N. 2004. Antimicrobialactivity of essentialoilextracts of variousonions (Alliumcepa) andgarlic (Alliumsativum). LWT FoodSci. Technol., 37(2): 263-268.

Boskabady, M.H., Ramazani, M., Tabei, T. 2003. Relaxant effects of different fractions of essential oil from Carumcopticum on guinea pig tracheal chains.Phytother Res. Dec;17(10): 1145-9.

Bostoglou, N.A.,Yannakopoulos, A.L., Fletouris, D.J., Tserveni-Goussi, A.S., Fortomaris, P.D. 1997. Effect of dietarythyme on theoxidativestabilite of eggyolk., Journal of Agricultrural and Food Chemistry. 45(10): 3711-3716.

Burda, S.,Oleszek, W. 2001. Antioxidan tandan tiradical activities of flavonoids. Journal of Agricultural and Food Chemistry. 49: 2774-2779.

Burt, S.A., Reinders, R.D. 2003. Antibacterial activity of selected plant essential oils against Escherichia coli O157: H7.LettApplMicrobiol. 36(3):162-7.

Campanella, L., Bonanni A, Favero G, Tomassetti M. 2003. Determination of antioksidan properties of aromatic herbs, olives and fresh fruit using an enzymatic sensor. Anal Bioanal Chem. Apr;375(8):1011-6. Epub 2003 Mar 29.

Chakole RD, Zade S, Charde MS. 2011. Antioxidantand anti- inflammatoryactivity of ethanolicextract of beta vulgarislinn. roots. Int. J. Biomed. Adv. Res., 2(4): 124-130.

Chithra, V. and Leelamma, S. 1997. Hypolipidemic effect of coriander seed(Coriandrumsativum): mechanism of action. Plant Foods Hum Nutr. 51(2): 167-72.s

Chithra, V. and Leelamma, S. 2000. Coriandrumsativum effect on lipid metabolism in 1,2-dimethyl hydrazine induced colon cancer. J Ethnopharmacol. 71(3): 457-63.

Çabuk, M., Alçiçek, A., Bozkurt, M., İmre, N. 2003. Aromatik bitkilerden elde edilen esansiyel yağların antimikrobiyel özellikleri ve alternative yem katkı maddesi olarak kullanım imkanı.II. Ulusal Hayvan Besleme Kongresi. 18-20 Eylül 184-187.

Çetin M. 2012. Hayvan beslemede antibiyotik ve antiparazitlere alternatif olarak bitkisel ekstraklar ve Pelinotu'nun (Artemisiaabsinthium) kullanılması. K.S.U. Doğa Bil. Derg., 15(4):58-63.

Del Campo, J., Amiot, M.J., Nguyen-The, C. 2000. Antimicrobial effect of rosemary extracts. J Food Prot. Oct; 63(10):1359-68.

Dorman, H.J., Deans, S.G. 2000. Antimicrobial agents from plants: antibacterial activity of plant volatile oils. J ApplMicrobiol. Feb;88(2): 308-16.

Elgayyar, M., Draughon, F.A., Golden, D.A., Mount, J.R. 2001. Antimicrobial activity of essential oils from plants against selected pathogenic and saprophytic microorganisms. J Food Prot. Jul; 64(7):1019-24.

Erdemir AD. 2007. Şifalı Bitkiler (Doğal İlaçlarla Geleneksel Tedaviler). 3. Basım. Alfa Yayınları: 928, Melisa Matbaacılık, İstanbul, 472 s.

Ergun F, Deliorman D. 1995. ViscumalbumL. (ökse otu) bitkisinin kimyasal bileşimi. Ankara Ecz. Fak. Der., 24(2): 95-107.

Gray, A.M., Flatt, P.R. 1999. Insulin-releasing and insulin-like activity of the traditional anti-diabetic plant Coriandrumsativum (coriander). Br J Nutr. Mar;81(3):203-9.

Gül Y, İssi M. 2010. Rumen timpanisi. NWSA Vet. Sci., 5(3): 73-84.

Güler T, Dalkılıç B. 2005. Aromatik bitkilerin organik (ekolojik) hayvancılıkta kullanım imkânı (derleme). Doğu Anadolu Böl. Arş., 3(2):13-20.

Halvorsen, B.L., Holte, K., Myhrstad, M.C., Barikmo, I., Hvattum, E., Remberg, S.F., Wold, A.B., Haffner, K., Baugerod, H., Andersen, L.F., Moskaug, O., Jacobs, D.R. Jr, Blomhoff, R. 2002. A systematic screening of total antioksidans in dietary plants. J Nutr. Mar;132(3):461-71.

Javanmardi, J.,Stushnoff, C., Lcke, E., Vivanco, J.M. 2003. Antioxidantactivityand total phenoliccontent of Iranian Acimum Accessions. Food Chemistry. 83:547-550.

Hindi NK. 2013. In vitro antibacterial activity of aquaticgarlic extract, apple vine garand apple vinegar-Garlic extract combination. American J. Phytomed. Clin. Ther., 1(1): 42- 51.

Kaya S. 2008. Tıbbi Botanik ve Tıbbi Bitkiler. Medisan Yayın Serisi: 68, Ankara, ss: 69-232.

Khayyal, M.T., el-Ghazaly, M.A., Kenawy, S.A., Seif-el-Nasr, M., Mahran, L.G., Kafafi, Y.A., Okpanyi, S.N. 2001.Antiulcerogenic effect of some gastrointestinally acting plant extracts and their combination.Arzneimittelforschung. 51(7):545-53.

Kızıl M, Kızıl G, Yavuz M, Aytekin C. 2002. Antimicrobialactivity of the tar obtainedfromtherootsandstems of Pinusbrutia. Pharm. Biol., 40(2): 135-138.

Koçoğlu TK, Çubukçu B, Özhatay N. 1996. Konya ve Karaman illeri halk ilaçları. Geleneksel Folklorik Droglar Derg., 3(1): 1-41.

Maity, T.K., Mandal, S.C., Saha, B.P., Pal, M. 2000. Effect of Ocimum sanctum roots extract on swimming performance in mice.Phytother Res. Mar; 14(2):120-1.

Montes-Belmont, R., Carvajal, M. 1998. Control of Aspergillusflavus in maize with plant essential oils and their components. J Food Prot. May; 61(5):616-9.

Mujumdar, A.M., Dhuley, J.N., Deshmukh, V.K., Raman, P.H., Naik, S.R. 1990. Anti-inflammatory activity of piperine.Jpn J Med Sci Biol. Jun; 43(3):95-100.

Ouattara, B., Simard, R.E., Holley, R.A., Piette, G.J., Begin, A. 1997. Antibacterial activity of selected fatty acids and essential oils against six meat spoilage organisms.Int J Food Microbiol. Jul 22; 37(2-3):155-62.

Özcan E. 2001. Preteolitik Enzim Katkılı LactobasillusunBroyler Yemlerine İlavesinin Performans, İleum pH ve Mikroorganizma Populasyonu Üzerine Etkileri. A.Ü. Fen Bilimleri Yüksek Lisans Tezi, Ankara.

Park, I.K., Lee, S.G., Shin, S.C., Park, J.D., Ahn, Y.J. 2002.Larvicidal activity of isobutylamides identified in Piper nigrum fruits against three mosquito species. J Agric Food Chem. Mar 27; 50(7):1866-70.

Rice-Avans, C.A., Miller, N.J., Bolwell, P.G., Bramley, P.M., Pridham, J.B. 1995. therelativeantioxidantactivities of plant-derivedpolyphenolflavonoids. FreeRadicalResearch. 22 (4): 375-383.

Sharma MC, Dwivedi SK. 1990. Efficacy of a herbaldrugpreparationagainstdermatomycosis in cattleanddog. Indian Vet. J., 67(3): 269-271.
Singh, G., Kapoor, I.P., Pandey, S.K., Singh, U.K., Singh, R.K. 2002. Studies on essential oils: part 10; antibacterial activity of volatile oils of some spices.Phytother Res. Nov; 16(7):680-2.
Sinmez Ç, Yaşar A. 2017.Organik hayvansal üretimde bitkisel drogların kullanılması (Orta anadolu bölgesi halk veteriner hekimliği örneği). Gıda Bilim ve Teknoloji Dergisi,5(13):1690-1695.
Soliman, K.M., Badeaa RI. 2002.Effect of oil extracted from some medicinal plants on different mycotoxigenic fungi. Food ChemToxicol. Nov;40(11):1669-75.
Sucu İ. 1978. Ege Bölgesi Halk İlaçlarındaki Drogların Farmakognozik İncelenmesi. Ege Üniversitesi Eczacılık Fakültesi, (Doktora Tezi), Ankara, ss: 2-74.
Şöhretoğlu D, Ekizoğlu M, Kılıç E, Sakar MK. 2007. Antibacterial and antifungal activities of some quercus speciesgrowing in Turkey. FABAD J. Pharm. Sci., 32: 127- 130.
Teissedre, P.L., Waterhouse, A.L. 2000. Inhibition of oxidation of human low-density lipoproteins by phenolic substances in different essential oils varieties. J Agric Food Chem. Sep; 48(9):3801-5.
Yaşar A, Sinmez ÇÇ, Aslım G. 2015. İç Anadolu Bölgesi Konya Bölümü folklorunda ruminantların paraziter hastalıkları ve tedavi yöntemleri. Kafkas Univ. Vet. Fak. Derg., 21(1):1-7.
Yazar E, Traş B, Elmas M. 2007. Veteriner Hekimliğinde İlaç Kullanımına Pratik ve Akılcı Yaklaşım. Konya, Olgun Çelik Matbaa, 136 s.
Yeşilbağ D. 2007. Fitobiyotikler. Uludag Univ. J. Fac. Vet. Med. 26, 1-2: 33-39.

(ORAL PRESENTATION)

DISTRIBUTION AND CONSERVATION OF *ULMUS GLABRA* HUDS. *(ULMACEAE)* IN GEORGIA (SOUTH CAUCASUS)

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Abstract
The materials of research of the populations of Scots elm Ulmus glabra Huds (Ulmaceae) in Georgia are given in the paper; the map of distribution of the species in GIS program is prepared. The morphological study of a leaf of U. glabra has been carried out. It is established that in the national scale of Georgia the populations slightly differ that is expressed in statistically processed material. The research has shown that U. glabra in Georgia is not characterized by broad ecological amplitude. With the purpose of species conservation, seeds are collected from different locations, then processed and stored in a Seed bank.

Key words: Ulmus glabra, Location, Leaf morphometry, Conservation.

INTRODUCTION

Scots elm in Georgia grows in the middle belt of mountains, mostly at the altitudes from 800 to 1700 m above sea level. It is a tree of height up to 30 m. It never creates independent cenoses. It is distributed phragmentarily, mostly in moist habitats, shaded areas of ravine edges, in mesophilic forest gaps etc. Basins of mountain rivers are favorable for its spread (Долуханов, 1958; Ketskhoveli, 1960; Kvachakidze, 2001; Akhalkatsi, Tarkhnishvili, 2012).
As a rule, it is the dominant species in formation of deciduous habitat type forest. The massive drying of this plant in 1970s in Georgia has been caused by fungal disease *Ophiostoma ulmi* (Buisman) Melin & Nannf., which later in Europe was named as Dutch Elm Disease (DED) (Gibbs et al, 1994; Jürisoo et al, 2019). As a result, the Scots elm were listed in Georgian Red list, as vulnerable (VU).

MATERIALS AND METHODS

The subject of the research is Scots elm -*Ulmus glabra* Huds (Ulmaceae). We have studied its spread, frequency in natural forests and morphology of a leaf. The goal of the study is to specify the area of *U. glabra* in Georgia, study the level of variability of morphological traits, taking into account the ecological peculiarities within the area of population of Scots elm and carrying out of conservation measures.
The field studies were conducted in 2016-2019 in various regions of Georgia in the areas of spread of *U. glabra*. The sample areas 100 m^2 have been taken, and inclination of slope, exposure, GPS coordinates, type of soil, type of forest, height, diameter and age of tree, density of stand, young, undergrowth and ground cover of the target species have been recorded (FAO, 1981; Kangas, Maltamo, 2009; Aptsiauri, Aptsiauri, 2012). The map depicting the area of spread of the species has been prepared with the use of GIS program (http://diva-gis.org; Borlea,1995; Gagnidze, 2005).
The flora of that habitat has been recorded. The districts distinguished by high fruit yield have been separated as temporary seed sections (seed stands and seed production areas). With the purpose of comparison of populations of the plant spread in various regions of Georgia the morphometric study of leaves has been conducted (INRA descriptors; Myking & Yakovlev, 2006).

324 samples of leaves have been taken. In each population sound mature leaves have been collected from each tree, each leaf has been digitalized and the morphometric parameters have been measured with the precision 0.01 cm by the program *ImageJ 1.47v (Image Processing and Analyses in Java).* The material collected in the field was also processed as herbarium samples.
The morphological traits of leaves have been processed in the program ***ImageJ***
The populations have been estimated by means of one-variable **ANOVA: Single Factor ANOVA** and the statistical hypothesis has been estimated by P-value. With the purpose of finding of differences between populations according to average meanings of each descriptor the **Tukey-Kramer Multiple Comparisons** test has been used.
Seed of elm has been collected and processed for storage in the Seed bank (Handbooks for Genebanks, 2006; ISTA, 2016).

RESULTS AND DISCUSSION

U. glabra has brevipetiolate tapering elliptical or obovate leaves of big size. The leaf blade near base is asymmetric, both surfaces are rough. The edge of leaf is double-serrated. The tree flowers in late March - April, the fruit matures in May-June.
Overall spread: the entire Caucasus, Black Sea coast, Middle and North Europe, sub Mediterranean region, Asia Minor (Stoyanov, 2004; Ruch et al, 2015; Hytteborn et.al, 2017).
The researches have been conducted in 7 regions of Georgia (Lagodekhi, Sagarejo, Mtskheta, Tetritskaro, Keda, Khevsureti and Borjomi), 4 locations (Bor.1, Bor.2, Bor.3 and Bakur.) have been considered in Borjomi. In total 10 locations of *U. glabra* have been considered.
In the area of Scots elm, are found mostly young trees, there is good young growth (70% of the studied locations are the good young generation) Rarely, e.g. in Tetritskaro district, dense planted stand of Scots elm is remained, with age specimens (older than 100 years); its reforestation is good.
The coordinates of the location: 44.505798 N, 41.618349 E; ALT 1394.

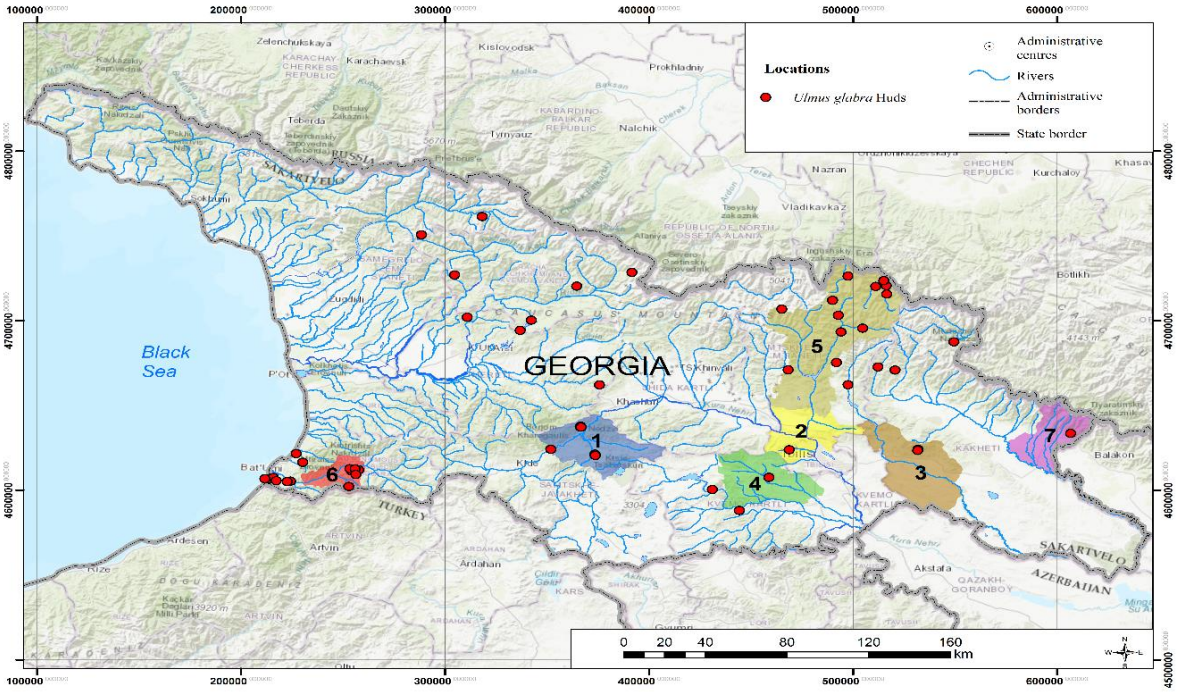


Fig. 1. Spread of *U. glabra* in Georgia.

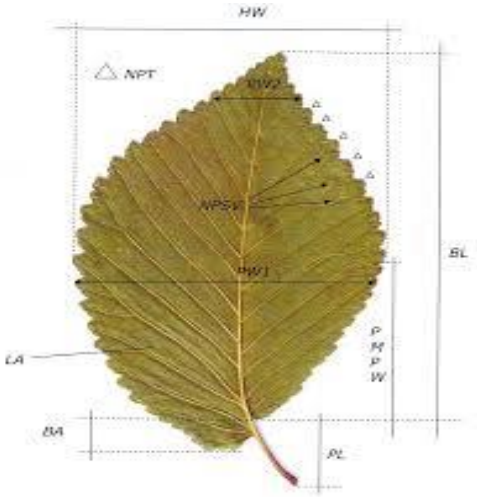
After estimation of the habitats it has been established that this species grows mainly in homogeneous habitats, above 800 m, in deciduous forest on moist half shaded slopes, together with other species (*Fagus orientalis*, *Acer laetum, Acer platanoides, Tilia caucasica*, *Fraxinus excelsior*, sometimes *Taxus baccata* L.). Ten locations, code of location, coordinates and altitude above sea level are presented in the Table 1.

Table 1. Locations of *U. glabra* with coordinates and leaf samples

#	Region	Lokation	Code	Semples of leaf	Longitude	latitude	Altitude (m)
1	Borjomi	Daba Bakuriani, village Andeziti	BAK	34	43.481659	41.725965	1580
		Borjomi forestry district, Tadzrisi section	BOR-1	26	43.218157	41.755875	998
		Borjomi-Kharagauli National Park	BOR-2	32	43.391252	41.880651	988
		Borjomi forestry district, village Rveli	BOR-3	28	43.388797	41.877562	801
2	Mtskheta	village Bevrety (Tsodoreti)	MTSK	28	44.623888	41.766046	940
3	Sagarejo	Mariamjvari Nature Reserve	SAG	20	45.383845	41.767902	1466
4	Tetritskaro	village abukiani, amlevi, Qsovreti	TET	76	44.505671	41.618338	1442
5	Khevsureti	Shatili-Mutso road	KHEV	22	45.199000	42.638915	1390
6	Keda	Mount Koslitavi	KED	34	46.28562	41.84603	1417
7	Lagodekhi	Lagodekhi protected area	LAG	24	42.03739	41.53288	587

Eight morphometric descriptors characteristic for elm *U. glabra* have been described (Fig.2): area of leaf blade; maximum width of leaf blade; length of leaf blade, measured from short base of leaf blade up to maximal width of a leaf; width of leaf blade, on the 50% of length of leaf blade, taken from short part of base of leaf; leaf width in the top of leaf on 90% of the length of leaf blade, taken from short blade; length of leaf petiole; asymmetry of base of leaf and length of leaf blade.

#	Descriptor
Absolute measure	
1	**LA** leaf blade area
2	**HW -** leaf blade width at its widest point
3	**PMPW** Leaf blade length, measured along the shorter side of lamina, starting from the leaf base to the point of maximum leaf width
4	**PL -** petiole length;
5	**BA -** leaf base asymmetry;
6	**BL -** blade length
7	**PW1 -** leaf blade width at 50 % of leaf blade length, measured along the shorter side of lamina
8	**PW2 -** leaf blade width at 90 % of leaf blade length, measured along the shorter side of lamina



(Fig.2.) Descriptors of leaf of *U.glabra*

Table 2. Maximal and minimal meanings of 6 parameters of leaves in populations of *U. glabra*

N	Character	Index	BAK	MTSK	BOR-1	BOR-2	BOR-3	SAG	TET	XEV	AJAR	LAG
1	LA	min	8.2	16.6	23.8	16.1	22.7	43.2	8.6	10.0	31.2	15.4
		max	132.2	147.8	160.4	106.5	196.2	91.3	152.0	147.7	157.3	120.0
2	HW	min	2.9	4.1	4.5	4.0	4.4	5.7	3.0	3.1	5.0	3.9
		max	10.4	12.2	12.4	10.2	14.6	8.2	10.7	11.3	12.5	10.2
3	PMPW	min	1.7	2.4	3.9	2.9	2.7	5.2	1.6	2.1	3.6	2.4
		max	10.0	9.7	11.3	8.8	11.3	9.5	10.4	8.2	10.8	10.1
4	BA	min	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
		max	1.2	1.2	0.9	1.2	2.2	1.3	2.6	1.8	1.8	1.2
5	BL	min	4.1	6.3	7.9	8.1	8.1	10.9	3.8	4.4	8.6	6.2
		max	21.0	20.0	22.1	16.6	19.4	17.6	20.5	17.3	20.4	20.2
6	BL/HW	min	1.4	1.4	1.4	1.6	1.3	1.8	0.9	1.0	1.4	1.5
		max	2.2	2.0	2.1	1.9	2.5	2.2	2.9	2.1	2.1	2.1



A **B**

Fig. 3) *U. Glabra* leaf morphotype: (A) Ulmus glabra morphotype: long tapering leaves, acute lateral lobes (ALL) absent. (B) Ulmus glabra morphotype: short tapering leaves, with acute lateral lobes.

The ratio of both monotypes has been determined. In particular, the B morphotype amounts to 12% of leaf samples.

Table 4. Average area of leaf, estimated by means of Single Factor ANOVA

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	35799.7394	9	3977.7488	3.4414	0.0005	1.9097
Within Groups	364094.8319	315	1155.8566			
Total	399894.5712	324				
					Level of significance	0.05

As we see from the Table, based on the analysis of locations of elm, the ***P-value*** equals 0.0005; this means that we obtained certain differences in the studied locations according to area of leaf. These differences are seen in detail by **Tukey-Kramer Multiple Comparisons** test. More specifically we have differences between the Bor.1 - Xev, Bor.1 - Keda, and Keda - Xev, Keda - Lag. locations. In the remaining locations area of leaf blade is almost identical and varies from 56 sm^2 to 75 sm^2.

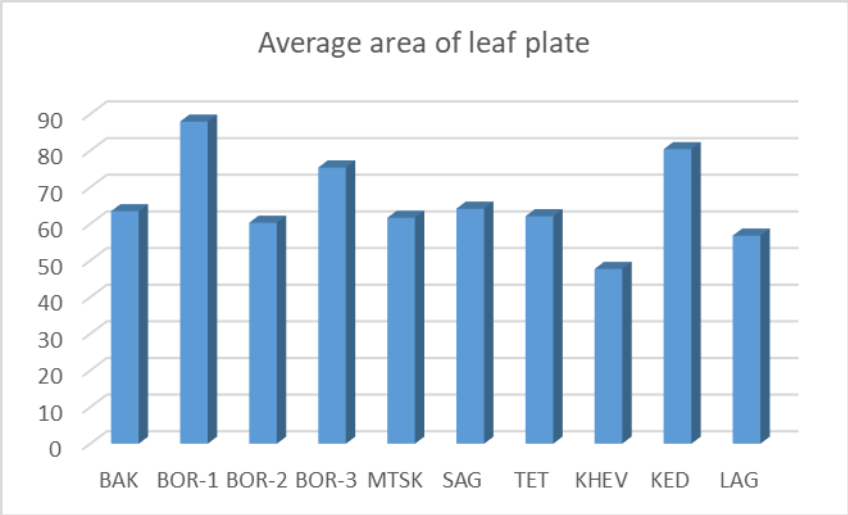


Fig. 4. Average area (**Tukey-Kramer Multiple Comparisons**) of *U.glabra* leaf plate at different locations

Graphical data processing using Boxplot was used to identify the center of data, dispersion, spread, skewness for each leaf descriptor.

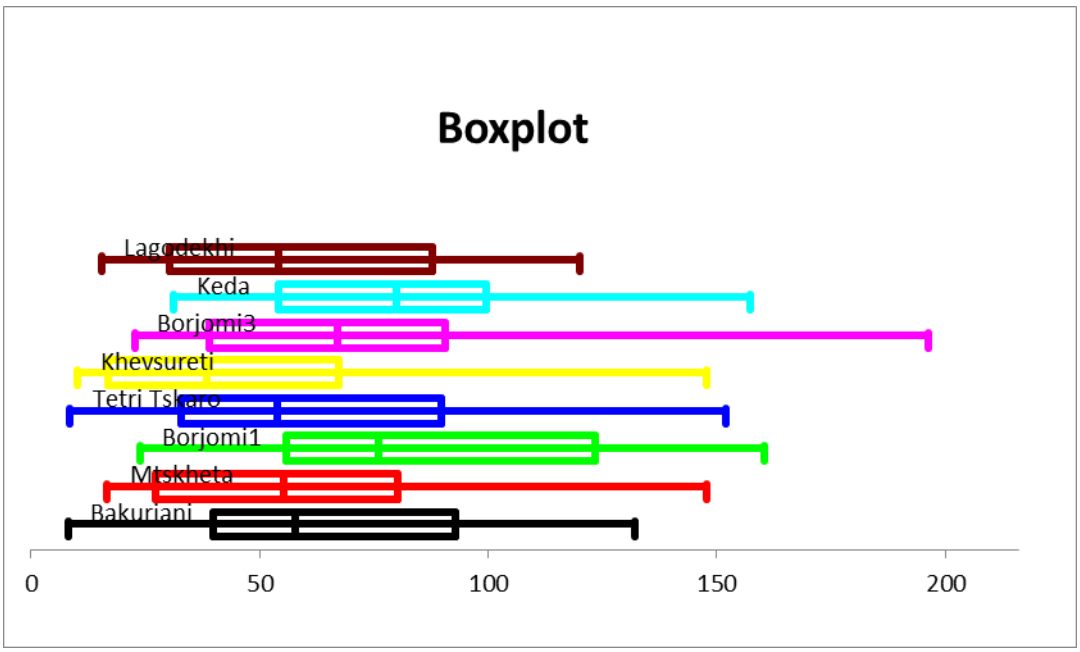


Fig. 5. Leaf blade area (LA) cm^2

Homogeneous data on leaf area in *U. glabra* populations are presented in the interval of 40–120 cm^2. A very different location was found in Borjomi 1, where we have the largest leaves. The location of Khevsureti shows small leaf size.

For the purpose of conservation of the species, seeds from the trees *U. glabra* in the phase of seed maturation were collected from three seedling sites (Keda, Tetritskaro and Lagodekhi), where the species is distinguished by high seed yielding. The collected seeds were processed according to standard rules and stored in the Seed bank.

CONCLUSIONS

The phytosanitary status of elm forests described in various regions of Georgia within the framework of the research is satisfactory. The age of trees *U. glabra* is mainly 25-35 years. It has been found that aged Scots elm specimens, like elms in general, are almost nonexistent due to Dutch Elm Disease. In Tetritskaro municipality there are relatively elderly survivors (100 years or more) that survived the conditions of high level of the epidemic.

In the locations with less anthropogenic load natural regeneration of elm forests is high. In 70% of the recorded locations young sprouts and young trees have been mentioned (or recorded).

The researches have resulted in preparation of the map describing spread of *U. glabra* in GIS program; data base has been made.

The research has shown that *U. glabra* in Georgia is not characterized by broad ecological amplitude, respectively, the eight descriptors of leaves of elm, described by us, are stable in the studied populations. Statistical studies revealed no strong differences in leaf shape between most locations; we found differences in leaf sizes of Bor.1 - Xev, Bor.1 - Keda, and Keda - Xev, Keda - Lag. All three of these locations (Bor-1, Keda, Xev) differ by ecological and climatic parameters.

Three samples of seed of *U.glabra* taken in 2018 are stored in the Seed bank.

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REFERENCES

Akhalkatsi M, Tarkhnishvili D. 2012. Habitats of Georgia, Natura 2000. Tbilisi, WWF. 118 p.

Aptsiauri Sh., Aptsiauri A. 2012. Basics of Forest Taxation, Tbilisi, 86 p.

Borlea, G. F.1995.The elm species in Rumania. Population genetics and genetic conservation of forest trees.Papers presented at an international symposium organized by IUFRO, held 24-28

Dolukhanov A. G. 2010. Forest vegetation of Georgia. Publish. House 'Universal', Tbilisi. 484.

Hytteborn, H., Svensson, B. M., Kempe, K., Press, A., Rydin, H., Nakashizuka, T. 2017. Century-long tree population dynamics in a deciduous forest stand in central Sweden. Journal of Vegetation Science 28(5), 1057-1069.

Gagnidze R. 2005. Vascular plants of Georgia a Nomenclatural checklist. Tbilisi.

Gibbs, J., Brasier, C., Webber, J. 1994.Dutch elm disease in Britain. Research Information Note - Forestry Authority Research Division(No. 252), 8 pp.

Jürisoo, L., Adamson, K., Padari, A., Drenkhan, R., 2019. Health of elms and Dutch elm disease in Estonia. European Journal of Plant Pathology 154(3), 823-841.

Kangas A., Maltamo M. 2006. Methodology and Applications Series: Managing Forest Ecosystems, Vol. 10

Ketskhoveli N. 1960. "Vegetation cover of Georgia",Tbilisi: Publishing house of Academy of Georgian SSSR, 441 p. (In Georgian).

Kvachakidze R. 2001. Georgian Forests. Tbilisi. 89 p.

Manual of Forest Inventory. 1981. Food and Agriculture Organization of The United Nations (FAO), Rome, 210 p.

Mykingi T., Yakovlev I. 2006. Variation in leaf morphology and chloroplast DNA in Ulmus glabra in the northern suture zone: Effects of distinct glacial refugia. Scandinavian Journal of Forest Research, 21: 99-107

Rao N.K., Hanson J., Dulloo M.E, Ghosh K., Nowell A., Larinde M. 2006. "Handbooks for Genebanks", No. 8:ISBN-13: 978-92-9043-740-6, 147 p.

Ruch, D. G., Badger, K. S., Taylor, J. E., Smith, M. E., Bell, S., Rothrock, P. E., 2015. The vascular flora and plant communities of Holthouse Woods Nature Preserve in Wayne County, Indiana. Proceedings of the Indiana Academy of Science 124(2), 106-123.

Rules Proposals. 2016. For the International Rules for Seed Testing. Edition, ISTA, 46 p.

Stoyanov, N. 2004. Elm forests in North Bulgaria and conservation strategies. Investigación Agraria, Sistemas y Recursos Forestales 13(1), 255-259.

(ORAL PRESENTATION)

HEAVY METAL HAZARDS TO THE PLANT, ENVIRONMENT AND PEOPLE AND MEASURES TO BE TAKEN

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Abstract
Nowadays, heavy metals that have become widespread in ecosystems such as soil, water and air have become actually an important environmental problem threatening the life of all organisms on Earth. Aluminum, vanadium, arsenic, mercury, lead, cadmium and selenium are toxic. Due to their toxic effects heavy metals cause deterioration of many physiological events in plants such as transpiration, stoma movements, water uptake, photosynthesis, enzyme activity, germination, protein synthesis, hormonal balance. Therefore, measures should be taken like; leaving the pollutant as it is, prohibiting the use of that area, immobilizing the pollutant in the region and keeping the area under control, keeping control of the transition to other areas, removing contaminated soil in a special disposal area, cleaning the soil in or outside the region and using pesticides more carefully.
Heavy metals cause significant disturbances in human health. These are, DNA damage, oxidative protein degradation, mitochondrial damage, autoimmune diseases (ulcerative colitis, rheumatism, etc.) organic diseases (kidney disease, allergy, eczema, asthma, etc.) and neurological disorders (depression, migraine, Alzheimer's and Parkinson's disease). As a result; with this research it is planned to increase the level of consciousness by discussing the damages of heavy metals to soil, plants, environment and human being. This study is thought to shed light on other related researches.

Key words: Heavy metals, environment, plant

INTRODUCTION

Nowadays, heavy metals, which have become widespread in ecosystems such as soil, water and air, have become an important environmental problem threatening the life of all organisms on Earth's surface. The main factors causing heavy metals to spread to the environment are industrial activities, exhausts of motor vehicles, mine deposits and enterprises, volcanic activities, fertilizers and drugs used in agriculture and urban wastes. (Stresty ve Madhava Rao, 1999; Öktüren, Asri ve Sönmez, 2006).
While zinc, manganese, cobalt, copper, nickel and molybdenum are the absolute essential elements for the development of plants, heavy metals that reach the ecosphere, aluminum, vanadium, arsenic, mercury, lead, cadmium and selenium are toxic. Excessive accumulation of heavy metals in tissues and organs, whether or not an absolute necessary element for plant development, adversely affects the development of vegetative and generative organs of plants (Gür and friends. 2004). Heavy metals cause many physiological disturbances such as transpiration, stoma movements, water uptake, photosynthesis, enzyme activity, germination, protein synthesis, membrane stability and hormonal balance (Kennedy and Gonsalves, 1987). Toxicity can vary from metal to metal as well as from organism to organism. Positive or negative (toxic) effects are not only related to the type and concentration of the element but also to the genetic behavior of different species. (Haktanır and Arcak, 1998; Öktüren, Asri ve Sönmez, 2006).

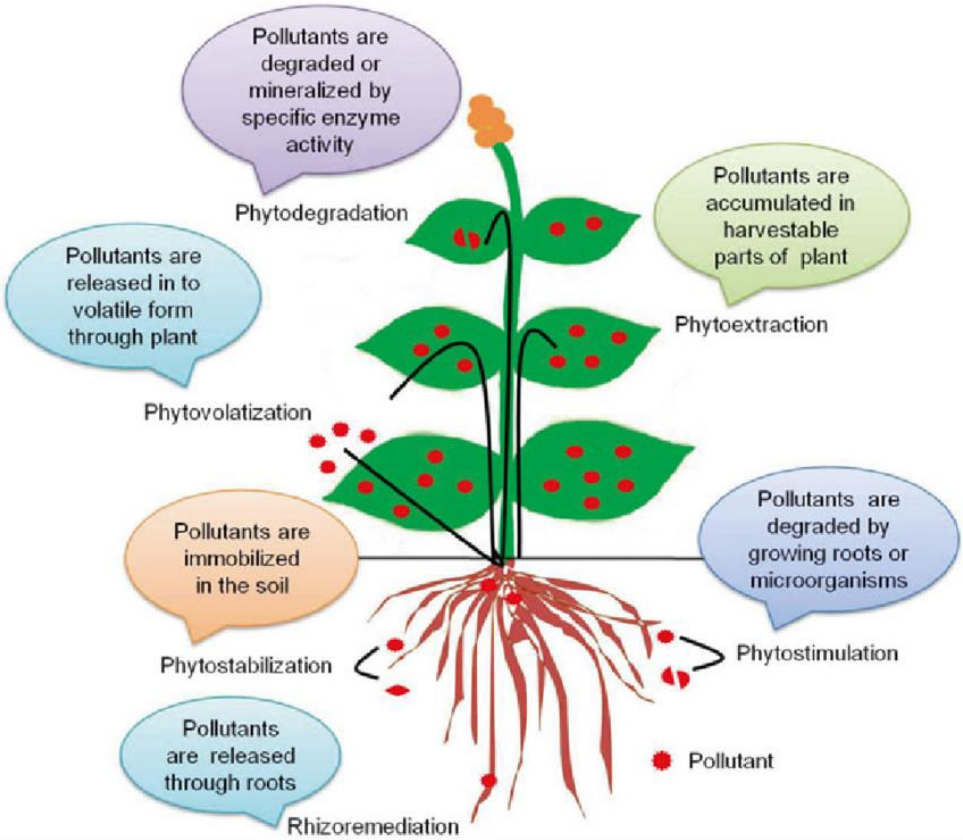


Figure 1. Schematic Representation Of Phytoremediation Types (Anonymous, 2018a).

Heavy metal activity, which is mostly increased by decreasing pH in soil, can be prevented by immobilization of organic compounds in soil. This can reduce the usefulness of Cd, Mn, Ni and Zn. Acidification increases in soils affected by acid rains and hence the increase of heavy metal mobility in soils increases the intake of heavy metals by plants except Mo. Heavy traffic on motorways significantly affect agricultural soils at the motorway in terms of heavy metal pollution and the pollution of Cd, Pb and Ni in this type of farmland has increased significantly (Sarı, T., 2009; Seven ve ark., 2018).

MATERIAL AND METHODS

The removal of pollutants in the soil can be an economical option, especially when it is considered important to reuse this area. There are many methods for physical, chemical, thermal and / or biological processes for the treatment of polluted soil. The choice of the appropriate soil treatment method depends on factors such as the characteristics of the region, the type of pollutant to be removed, the concentration and the subsequent use of contaminated land. Dirt removal is usually accomplished by refilling the contaminated area then by filling the isolated or cleaned soil again. However, researches on in-situ technologies have accelerated in recent years without digging the soil. (Kocaer, F. and Başkaya, H., 2003; Seven ve ark., 2018).

Soil, chromium, cadmium, nickel and lead pollution are also found in soils in many parts of the world. Cr, Cd, Ni and lead pollution creates environmental pollution problems, especially by mine digging and smelting activities, sewage water and other waste disposal or spreading after burning (Patterson, 1971). Cadmium and lead cause serious health problems in humans and animals as environmental pollutants (Lisk, 1972); chromium is an essential micro element and While high concentrations are a toxic element for mammals and other animals (Mertz, 1982), nickel is a possible carcinogenic element for the same group of organisms. (Lisk, 1972). However, nickel is considered to be an essential nutrient for higher plants (Brown and friends, 1987; Yıldız, 2001).

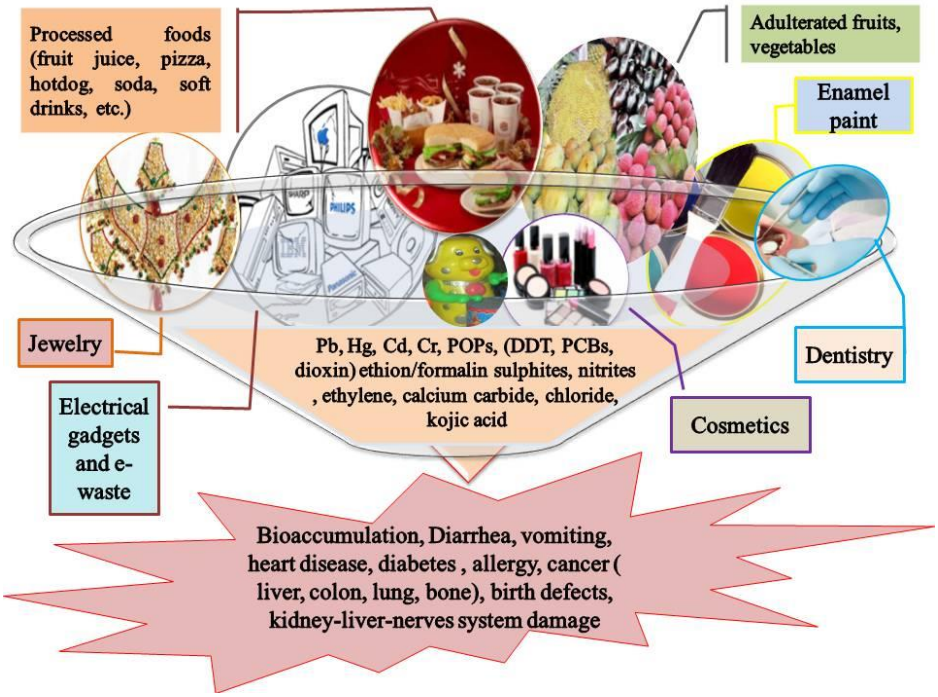


Figure 2. Chemicals in Consumer Products

DISCUSSION

Soil worms increase the metal mobility and the metal transfer to the plant in soils contaminated by metals, however, they are more resistant to metal toxicity than other members of the soil fauna, they can accumulate metals and increase the amount of metal that can be taken. Heavy metal accumulation in soil worm tissues, accumulation capacities of soil worms may vary depending on the toxicity of metals in earthworms, heavy metal species and ecological categories of soil worms. For example; While endogeic species accumulate higher amounts of Kadmium than epijeic and anecic species, anesic species accumulate Zn in higher amounts than the other two species. Lumbricus rubellus tolerates Cu pollution more than Aporrectodea caliginosa. It is found that the Eisenia fetidae showed the least toxicity in Pb (Hepşen Türkay, 2010; Taciroğlu. 2016).

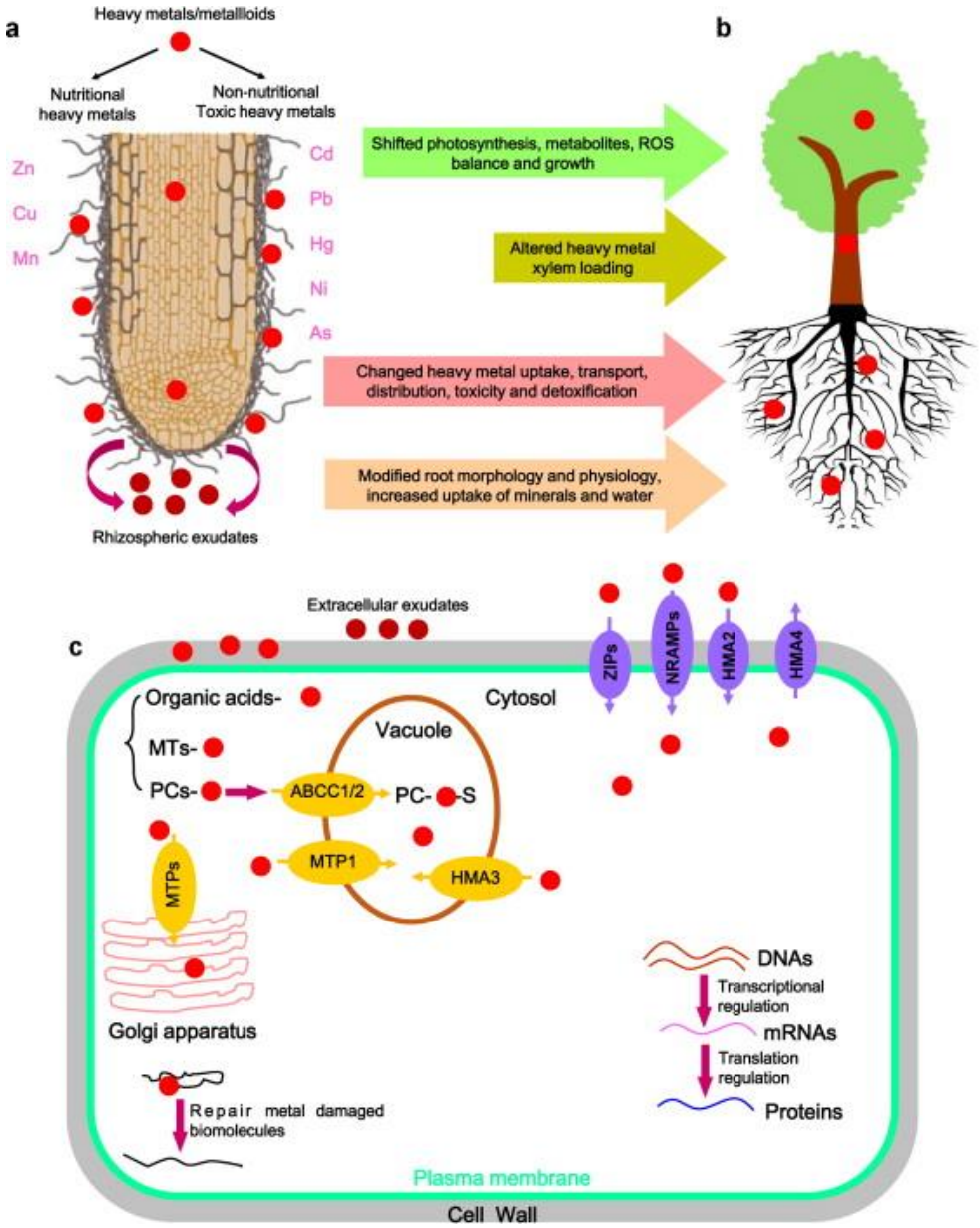


Figure 3. Intracellular Effects Of Heavy Metals (Anonymous, 2018c).

Hepşen Türkay (2010), as a result of 90 days incubation study to determine the effects of vermicompost -which is obtained by composting of hazelnut husk and treatment sludge with soil earthworms- on biological properties of soils in greenhouse and cropland conditions, it is found that Zn, which is caused by treatment sludge, has been increased in the soil worm tissues and decreased in vermicompost. In addition, it is stated that Zn can be removed by means of E. fetida earthworms (Taciroğlu. 2016).

Ünal ve ark., (2011), Cr, Pb, Zn, and Cu concentrations were determined by using olives (Olea europaea) leaf from 3 different regions selected in İzmir-Kemalpaşa industrial zone and on 3 different regions on highway and 7 km away from Kemalpaşa industry and highway side. It has been seen that; Cr, Zn, and Pb concentrations in the leaves of the olive plant are higher than the leaves in the control group, Cu concentrations were found to be low only at the cement plant and at the roadside point. The highest heavy metal pollution was detected at the cement plant and at the roadside point, while the lowest metal pollution was determined at the selected point as the control group. As a result, it is concluded that olive plant is a suitable bioindicator for monitoring all four metal elements studied since it can show short term changes of pollution in land ecosystems.

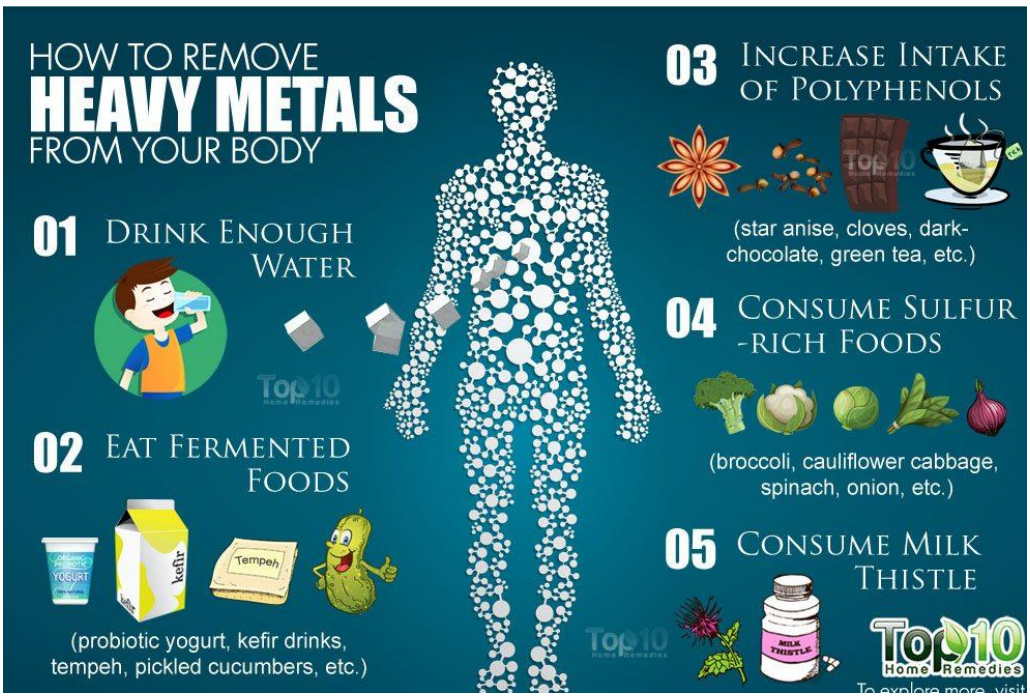


Figure 4. How To Remove Heavy Metal From Your Body (Anonymous, 2018d).

Fats usually contain small amounts of heavy metals. Micro metals are transmitted from muddy seeds or fruit to oil by natural means or during processing of raw materials from metallic equipment or from containers used during storage or transport (Gümüşkesen ve Yemişçioğlu, 2010). In a study, the comparison of the content of iron and copper in natural olive oil was made between two oil production systems. Iron and copper levels in the oils obtained from old processing systems (conventional press and super press) were found to be higher than those obtained from new systems (continuous decanter and sinolea) (Garrido ve ark., 1994; Büyükgök ve Ötleş, 2011).

Vegetable oils produced without natural refining, such as extra virgin olive oil and sesame oil, contain relatively high amounts of transition metals. (Choe ve Min, 2006). In extra virgin olive oil, the soil can be decontaminated by micro amount of Cu and Fe which can be transmitted from chemical fertilizers, storage containers and/or processing equipments (Erinç ve Kıralan, 2008). In olive oil, Fe is undoubtedly found in the highest amount (Leonardis ve Macciola, 2002). Fe and Cu amounts are found respectively to be between 0.5-3.0 and 0.001-0.2 mg / kg for extra virgin olive oil. The other metals in olive oil are Cr, Mn, Sn, Ni and Pb and their amounts do not exceed several µg / kg. (Erinç ve Kıralan, 2008). In refined olive oil, metal content is less than the metal content of natural olive oil due to refining process (Leonardis and Macciola, 2002; Büyükgök ve Ötleş, 2011).

Improvement of agricultural land can lead to significant changes in soil and soil crop composition (Notten, et al., 2005). Some fertilizers and chemicals used in agriculture contain high levels of toxic metals, which could lead to food pollution. In one study; copper fungicide used on grapes has been reported to cause pollution in wine (Melgar, et al.,2009). The level of heavy metals in wine and alcohols derived from fruits used in pesticides and fertilizers in Poland, Bulgaria and Italy is found to be higher than the legally permissible limits of the European Union. (Formicki, et al.,2012). Likewise; ıt has been found that pesticides used on Durum Wheat are causing cadmium, lead and arsenic pollution (Atafar, et al., 2010; Türközü ve Şanlıer, 2012).

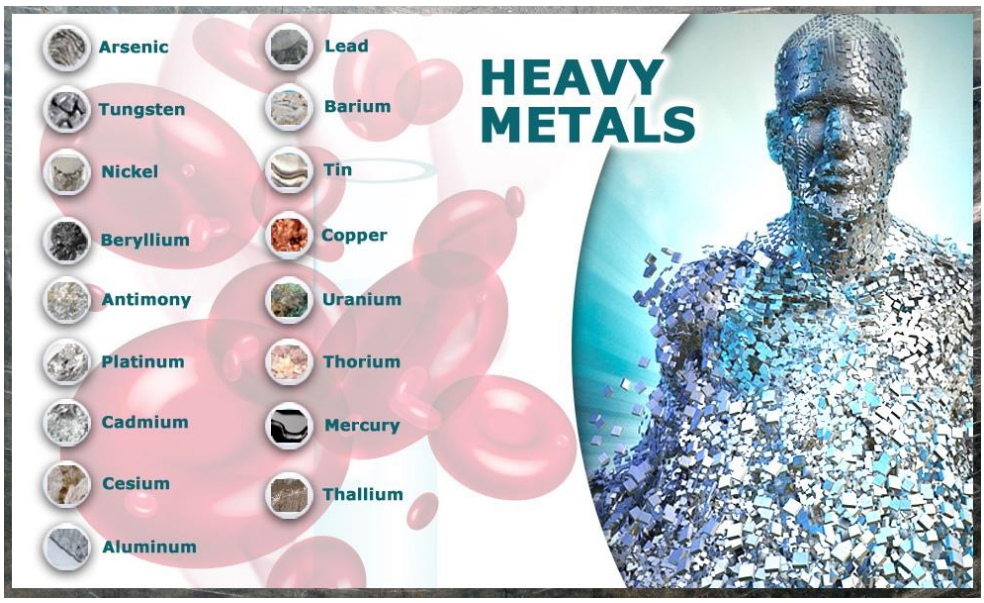


Figure 5. Common Sources of Heavy Metals (Anonymous, 2018e).

RESULTS

Heavy metals are known to infect food from fertilizers, tools and equipment in addition to environmental factors. Mercury compounds can pass into the atmosphere in the form of dust and gasses and then fall into the earth's waters and soil and into the plants. (Çağlarırmak, 2008). Çağlarırmak (2007) pointed out that heavy metals pollute the environment, it is reported that the regulation and discipline of ISO 14001 (implementation of environmental management standards) as well as prevention of all environmental pollution factors is necessary in this direction, first of all, it has been reported that it is absolutely necessary to mobilize community conscience and consciousness and to carry out environmental education (Çağlarırmak ve Hepçimen, 2010).

Soil pollution factors caused by heavy metals threaten food safety and pose a risk to distrupt soil flora and soil composition. Heavy metals damage both soil, plants and people. Motor vehicles, industry, mining enterprises, wastewater and unconscious use of chemical fertilizers causes the accumulation of heavy metals. The damage caused by heavy metals is a big risk due to long-term accumulation and causes death as a cause of many diseases. Urgent measures should be taken to minimize the soil pollution caused by the dangerous heavy metals. In this study; the information on; the activities causing the accumulation of heavy metals, the damage caused to the plants and people and how it can be prevented are aimed to be given.

REFERENCES

Anonymous, 2018a. https://www.researchgate.net/figure/Schematic-diagram-of-different-approaches-of-phytoremediation_fig3_268148634

Anonymous, 2018b. https://esdo.org/chemicals-heavy-metals/

Anonymous, 2018c. https://www.sciencedirect.com/science/article/abs/pii/S0098847213001731

Anonymous, 2018d. https://www.top10homeremedies.com/how-to/how-to-remove-heavy-metals-from-your-body.html

Anonymous, 2018e. https://barerootsnaturalhealth.com/hair-element-analysis/

Atafar, Z., Mesdaghinia, A., Nouri, J., Homaee, M., Yunesian, M., Ahmadimoghaddam M., et al.2010. Effect of fertilizer application on soil heavy metal concentration. Environmental Monitoring and Assessment. 60 (1-4):83-89, 2010.

Brown, P. H., Welch. R. M. and Carry, E. E., 1987. Nickel a micro nutrients essential for higher plants. Plant Physlol. 85: 801-803.

Büyükgök, E. B. ve Ötleş, S., 2011. Metaller ve Zeytinyağının Etkileşimi. Zeytin Bilimi 2 (2) 2011, 75-82.

Choe, E., Min, D.B. 2006. Mechanisms and factors for edible oil oxidation. Comprehensive Reviews inFood Science and Food Safety. .5: 169-186.

Çağlarırmak, N., 2007. Gıda güvenliğinin çevre kirliliği yönünden incelenmesi. 7. Ulusal Çevre Mühendisliği Kongresi, 24-27 Ekim, İzmir.

Çağlarırmak, N., 2008. Endüstrileşmenin gıda üretimleri ve gıda güvenliğine etkileri. 10. Ulusal Gıda Kongresi, 28-30 Mayıs 2008, Erzurum.

Çağlarırmak, N. ve Hepçimen, A. Z., 2010. Ağır Metal Toprak Kirliliğinin Gıda Zinciri Ve İnsan Sağlığına Etkisi. Akademik Gıda 8 (2) (2010) 31-35.

Erinç, H., Kıralan, M. 2008. Zeytinyağı Bileşiminin Oksidatif Stabiliteye Etkisi. I. Ulusal Zeytin Öğrenci Kongresi. 168-173. Edremit-Balıkesir.

Formicki, G., Stawarz, R., Gren, A. Muchacka, R., 2012. Cadmium, Copper, Lead and Zinc Concentrations in Low Qualıty Wines and Alcohol Containing Drinks from İtaly, Bulgaria and Poland. Journal of Microbiology, Biotechnology and Food Sciences.1 (February Special issue):753-757.

Garrido, M.D., Frias, I., Diaz, C., Hardisson, A. 1994. Concentrations of Metals in Vegetable Edible Oils. Food Chemistry.50: 237-243.

Gümüşkesen, A.S., Yemişçioğlu, F. 2010. Bitkisel Sıvı ve Katı Yağ Üretim Teknolojisi. Meta Basım Matbaacılık Hizmetleri. ISBN: 975-94208-0-5, İzmir, 216 s.

Gür, N., Topdemir, A., Munzuroğlu, Ö ve Çobanoğlu, D., 2004. Ağır Metal İyonlarının (Cu+2, Pb+2, Hg+2, Cd+2) Clivia sp. Bitkisi Polenlerinin Çimlenmesi ve Tüp Büyümesi Üzerine Etkileri. F.Ü. Fen ve Matematik Bilimleri Dergisi, 16(2), 177-182.

Haktanır, K ve Arcak, S., 1998. Çevre Kirliliği. Ankara Üni. Ziraat Fak. Toprak Bölümü, Ankara Üni. Yayın No: 1503, Ders Kitabı:457, Ankara.

Hepşen Türkay, F.Ş. 2010. Fındık Zurufu Ve Arıtma Çamurunun Solucanlarla Kompostlanması ve Elde Edilen Vermikompostun Sera ve Tarla Koşullarında Toprakların Biyolojik Özelliklerinde Meydana Getirdiği Etkilerin Belirlenmesi. OMÜ Fen Bilimleri Enstitüsü, Toprak Anabilim Dalı, Doktora Tezi, Samsun, 166s.

Kennedy, C.D. and Gonsalves, F.A.N., 1987. The action of divalent zinc, cadmium, mercury, copper and lead on the trans-root potential and efflux of excised roots, J.Exp. Bot., 38, 800-817.

Kocaer F., Başkaya H., 2003, Metallerle Kirlenmiş Toprakların Temizlenmesinde Uygulanan Teknolojiler, Uludağ Üniversitesi Mühendislik-Mimarlık Fakültesi Dergisi, Cilt 8, Sayı 1.

Leonardis, A.D., Macciola, V., 2002. Catalytic effect of the Cu(II)- and Fe(III)-cyclohexanebutyrates on olive oil oxidation measured by Rancimat. Eur. J. Lipid Sci. Technol.104: 156-160.

Lisk, D. J., 1972. Trace metals in soils, plants and animals. Adv. Agron. 24: 267-325.

Melgar, M.J., Alonso, J., García, M. A., 2009. Mercury in edible mushrooms and underlying soil: Bioconcentration factors and toxicological risk. Science of The Total Environment. 407(20):5328-5334.

Mertz, W., 1982. Introduction. Pages 1-4 in S. Langard, Ed. Biological and Environmental aspects of chromium. Elsevier Biomedical Press. Amsterdam.

Notten, M.J.M., Oosthoek, A.J.P., Rozema, J., Aerts, R., 2005. Heavy metal concentrations in a soil–plant–snail food chain along a terrestrial soil pollution gradient. Environmental Pollution.138(1):178–190.

Öktüren, Asri, F. ve Sönmez, S., 2006. Ağır Metal Toksisitesinin Bitki Metabolizması Üzerine Etkileri. Derim, 23 (2), 36-45.

Patterson, J. B. E., 1971. Metal torfcitles arising from industry. Pages 193-207 in Traceelements in soils and crops. MAFF technical Bull. No. 21. Her Majesty's Stationery office, London.

Sarı T., 2009, Edirne Ve Çevresinde Otoban Kenarlarındaki Topraklarda Bazı Ağır Metal Kirliliğinin Araştırılması, Yüksek Lisans Tezi, Namık Kemal Üniversitesi Fen Bilimleri Enstitüsü, Tekirdağ, 6-7.

Seven, T., Can, B., Darende, B. N. ve Ocak, S., 2018. Hava Ve Toprakta Ağır Metal Kirliliği. Ulusal Çevre Bilimleri Araştırma Dergisi, Sayı 1(2): 91-103 (2018) (Derleme Makale).

Stresty, T.V.S. and Madhava Rao, K.V., 1999. Ultrastructural alterations in response to zinc and nickel stress in the root cell of pigeonpea, Environ Exp Bot., 41, 3-13.

Taciroğlu, B., Kara, E. E. ve Sak. T., 2016. Toprakta Ağır Metal Gideriminde Solucanların Kullanımı. KSÜ Doğa Bil. Derg., 19(2), 201-207, 2016.

Türközü, D. ve Şanlıer, N., 2012. Gıdalardaki Ağır Metal Kontaminasyonları: Güncel Bakış. Selçuk Tarım ve Gıda Bilimleri Dergisi 26 (4): (2012) 73-80 ISSN:1309-0550.

Ünal, D., Sert, Ş., Işık, N. O. ve Kaya, Ü., 2011. İzmir-Kemalpaşa Sanayi Bölgesinde Ağır Metal Kirliliğinin Biyoindikatör Olarak Zeytin (Olea Europaea) Bitkisi Kullanılarak Belirlenmesi. Zeytin Bilimi 2 (2) 2011, 59-64.

Yıldız, N., 2001. Toprak Kirletici Bazı Ağır Metallerin (Zn, Cu, Cd ,Cr, Pb, Co Ve Ni) Belirlenmesinde Kullanılan Yöntemler. Atatürk Univ. Ziraat Fak. Derg. 32 (2). 207-213, 2001.

(ORAL PRESENTATION)

DETERMINATION OF EFFECTS OF FERTILIZATION ON VEGETATIVE AND GENERATIVE PROPERTIES IN OLIVE GROWING

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Abstract
Nitrogen is a nutrient that culture crops need a lot. Nitrogen is important for the development of fruit eyes in olives, fruit attitude and development of shoots (Sibbett and Ferguson, 2002). Nitrogen, which is deposited on the leaves during the development period, is mobilized to woody textures and adjacent fruit eye before the leaf dump. In plants like evergreen olive, the situation is different. Nitrogenous compounds are stored in leaves, because the life cycle of the leaves lasts more than one year (Klein and Weinbaum, 1984). It is stated that, in the olive business, fertilization done in the empty or full year and the amount of N applied in these years can affect the yield significantly. In this context, it is shown that supplemental N fertilization during the low yield year promotes shoot growth and increased yield probability in the following year, In contrast, insufficient nitrogen fertilization in the year of the product also decreased the potential for developing exile in the next empty year and it is reported that the yield of the product year may be affected (Sibett and Ferguson, 2002; İrget ve ark., 2007). The purpose of this study; is to emphasize the importance of plant nutrition and fertilization in order to protect both soil properties and to increase vegetative and generative development in olive cultivation.

Key words: Fertilization, olive, growing, effect

INTRODUCTION

The capacity of the plant to produce sufficient quantity and quality of farina is important in obtaining the product (Cuevas and Polito, 2004). Macro and micro nutrients play an important role in the fruiting process .In this context, the importance of potassium in the development of farina grass pipe is highlighted (Terena and Hepler, 2003). Potassium is an important element in flowering and fruit formation. Foliar application of KNO_3 has a positive effect on yield in olive. On the other hand boron is considered to be one of the important micronutrients due to its effect on plant growth (Khayyat and friends, 2007). In fact, the effects of boron application on the germination of farina and germination have been demonstrated. Leaf boron applications in olive cultivation are widely used because of its efficiency on phenology, yield, oil quality, shoot growth, crown volume, fruit attitude and hence efficiency (Larbi and friends, 2008; El Khawaga, 2003). Product losses occur due to lack of nutrients in aquaculture in sandy soils. In the studies carried out in the leaves of olive trees, nitrogen, potassium, phosphorus and boron deficiency were determined (Desoukaye and friends, 2009; El Khawaga, 2007; Acarsoy ve ark., 2011).



Figure 1. Olive Trees, Leaf, Flower, Pollen, Fruit and Seed (Anonymous, 2018a).

In fruit trees and woody plants, there is a significant accumulation of nitrogen metabolism (uptake, transport, distribution and storage) (Titus and Kang ,1982; Kato,1986; Roubelakis-Angelakis and Kliewer, 1992). In the preparation of fertilization programs, remobilization of nitrogen (re-transport) is an important issue to be considered. In this context, in woody plants, nitrogen is remobilized and stored in roots and shoot shells at the end of the season (Titus and Kang, 1982; İrget ve ark., 2007).



Figure 2. Plant Nutrient Requirements (Anonymous, 2018b).

MATERIAL AND METHODS

It is stated that the periodicity may affect the nutrient content and the annual nutrient consumption of the olive tree (Fernandez-Escobar and friends, 1999 and 2004). In this context, nitrogen is stored in young leaves in the empty year and is mobilized to support development over the full year. It is stated that a significant portion of nitrogen (> 60%) is stored in fruit at the end of the year and fruits are in the most powerful attractive force for the N in the shoots (Fernandez Escobar and friends, 2004; İrget ve ark., 2007).

Inglese and friends, (1999) indicate that the fat content, the composition and stability of the oil which is considered as the important quality criteria in olives, can change significantly if the yield is high or the number of fruits per tree increases (İrget ve ark., 2007).

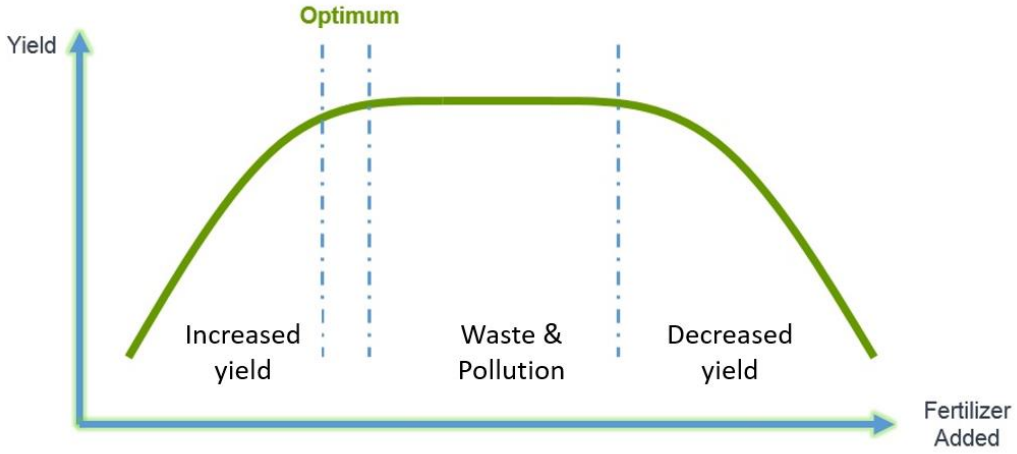


Figure 3. Growing Grain Yields (Anonymous, 2018c).

When the studies on the nutrition and fertilization of olives are examined in our country; a limited number of fertilization application studies have been seen such as the soil fertilization (Güner, 1969; Özelbaykal, 1995) folial fertilization (Çetin and Mendilcioğlu 1992) and soil + foliar fertilization (Canözer and Çolakoğlu, 1985; Dikmelik et al., 1999). The studies on the subject are generally aimed at examining the relationship between; the determination of nutritional status of olives grown in different regions (Canözer, 1978; Zabunoğlu et al., 1977; Akıllıoğlu, 1995; Toplu, 2000, Soyergin et al., 2002), the seasonal changes of nutrients (Eryüce, 1980; Püskülcü, 1981; Soyergin, 1993; Sarıfakıoğlu, 1995), the product and pruning, the amount of nutrients removed (Dikmelik, 1984), the nutrition status and yield (Fox et al., 1964) and quality (Seferoğlu, 1997; İrget ve ark., 2007).

High productivity in cultivation ranks first among production targets. Fertilization is essential for fruit formation in hard-core fruit species. The capacity of the plant to produce sufficient quantity and quality of flower powder is important in obtaining the product. The quality of flower powder is characterized by the vigor of the flower powder and the germination power (Cuevas and Polito, 2004). As indicated by Zeng-Yu Wang and friends, (2004), flower powder physiology, especially germination and viability, is important for plant breeding and adaptation (Khan and Perveen, 2006; Pinillos and Cuevas, 2008; Acarsoy ve ark., 2011).

In the fruit trees, leaf boron applications are effective in terms of yield increase and it is accepted as a valid method in terms of boron supply to flowers (Brown, 2001). Furthermore, these applications are preferred due to homogeneous distribution of material and low application concentration (Khayyat and friends, 2007; Acarsoy ve ark., 2011).

Acarsoy ve ark., (2011) In the study carried out for two years in Domat olive , two different boron fertilizers, one boric acid and the other liquid, were applied to the leaves in different combinations with urea and potassium nitrate (KNO_3), the effects of this process on the viability of farina, germination and fruit formation were investigated. While only "liquid boron + urea + KNO_3" en application gave the highest value in the year of full product in terms of farina viability, high values were determined in all applications compared to control group in empty product year. The highest values in terms of the germination power of farina in both years were obtained with the same application. Generally, the single application of urea and boric acid or boron liquid fertilizer has been found to be effective on the fruit formation. On the other hand, in the empty product year, it is generally determined that the applications have a positive effect on all three parameters.

Product losses occur due to lack of nutrients in aquaculture in sandy soils (Desoukaye and friends, 2009; El Khawaga, 2007). In this context, 5, 50 and 100 ppm boric acid (33.5% B) applications in 12 aged Arbequina, Bouteillan and Koroneiki olives are stated to increase fruit behaviors (Desoukaye and friends, 2009; Acarsoy ve ark., 2011).

DISCUSSION

According to Kamal (2000), Manzanillo and Picual olive varieties showed an increase in fruit yield with 0.3% and 0.5% borax application (Desoukaye and friends. 2009). When Manzanillo olive trees are applied with 0.5% urea containing macro and 0.05% boric acid containing micro nutrient mixtures flower, yield and average fruit weight increased in both nutrients compared to control application (El Khawaga, 2007). It has been observed that the application of leaf boron applications before flowering in the same variety increases the fruit behavior, but the application on the germination of farina has no effect (Perica and friends, 2001). In Gemlik olive varieties; applications done in three weeks before flowering It is stated that (250 ppm, 500 ppm and 750 ppm) 250 ppm and 500 ppm boron concentrations increase fruit attitude by 50% according to the control application (Gündeşli, 2005; Acarsoy ve ark., 2011).

Özkaya (2014), In the studies, generally nitrogen, potassium, phosphorus and boron deficiency were determined in the leaves of olive trees. However, applications to young leaves significantly increase the risk of damaging the tissue and the delay in administration of nutrients before flowering. No effective method for foliar fertilization of olives has been found. With multi-mineral leaf fertilizers prepared with olives at concentrations specific to N, P, K and / or B [(10-33-21+1,8B) and (8-16-40)] containing a completely organic fertilizer called Fertivant, positive effects have been obtained to increase fruit quality and yield especially in table olives. As a result of this work; especially, before flowering mainly P, B and K; while in the small fruit period mainly K type fertilization application recommended to be applied together.

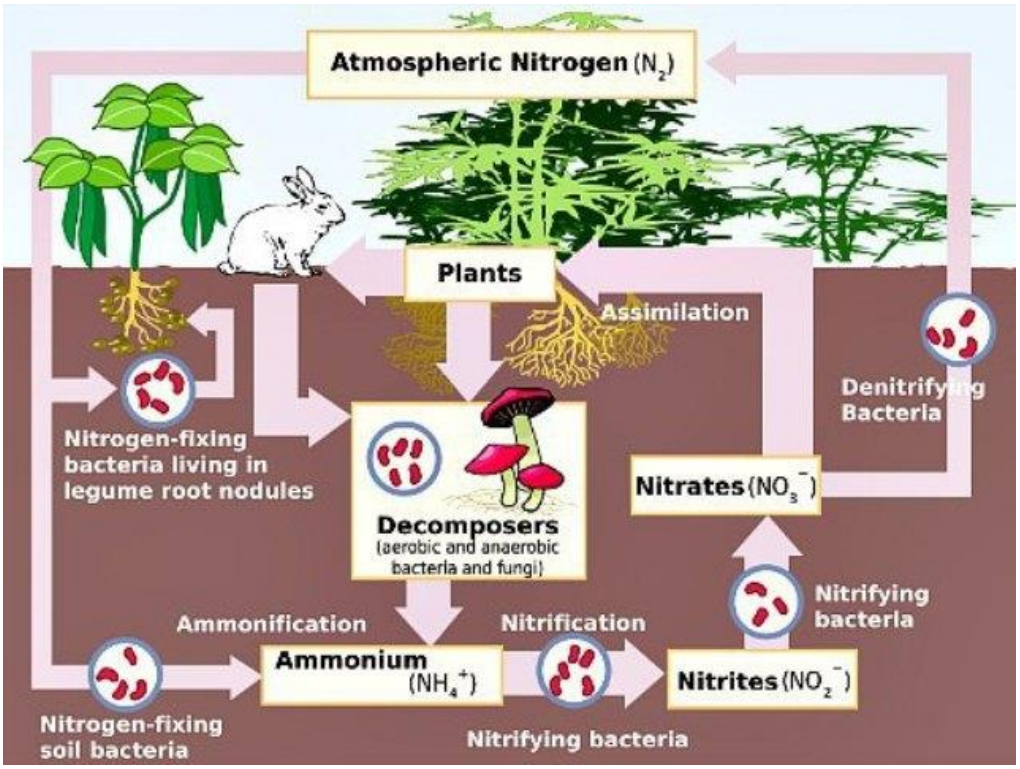


Figure 4. Nutrients Required By Plants For Best Growth (Anonymous, 2018d).

Mordoğan and friends (2013) have examined the effect of 0, 75, 150 and 225 kg / tree doses of organic fertilizer (bovine fertilizer) on the nutrient element content of olive soils. They have noticed that these applications have significantly affected the content of N, K, Ca, Mg, Cu, Na at 0-20 cm depth; P, K, Ca, Mn, Cu, Na at 20-40 cm depth. Applications did not affect the Fe and Zn content of soils. 225 kg / tree dose of organic fertilizer has significantly increased the K and Mg content of soils. According to the organic fertilizer applications, only the Fe and Na contents of the soil showed significant change over the years.

Magnesium and zinc have been shown to be effective in reducing the periodicity. Fertility and fertilization are negatively affected by zinc deficiency in trees and yield and quality decrease. Zinc sulphate application of 0.3% -0.5% of the leaves to remove zinc deficiency is recommended in the period when the flower attitude and the fruits get hazelnut size (Gezerel, 1998; Kalenderoğlu, 2010).

Effects of animal fertilizers on olive development, fruit yield, quality and nutrition were investigated by different researchers (Hegazi et al., 2007; Steve, 2009; Fayed, 2010; Hassan et al., 2015). Organic fertilizers increase the content of chlorophyll, b and nutrient element content in olive (Maksoud, 2000; Hegazi et al., 2007; Fayed, 2010). It also improves fruit formation and fat properties (Hegazi et al., 2007; Fayed, 2010; Ceylan ve ark., 2016).

Jasrotia and friends, (1999), have studied the effect of changing N and K fertilization in olive trees. Frantoio variety used in this research. 4 N application done of 250, 500, 750 and 1000 g per tree, K application was applied as 250, 500 and 750 g K_2O together with 500 g P_2O_5 per tree which is the basic dose of P_2O_5. Fruit formation, yield and fat content at N level of 750 g applied per tree were high. The highest yield was taken from 500 g K_2O per tree. Researchers have also observed that increased N levels result in a significant increase in growth and production. Thus, in order to achieve higher fruit formation, yield and fat content in olive trees, 750 g N and 500 g K_2O application per tree were found to be optimal (Kalenderoğlu, 2010).

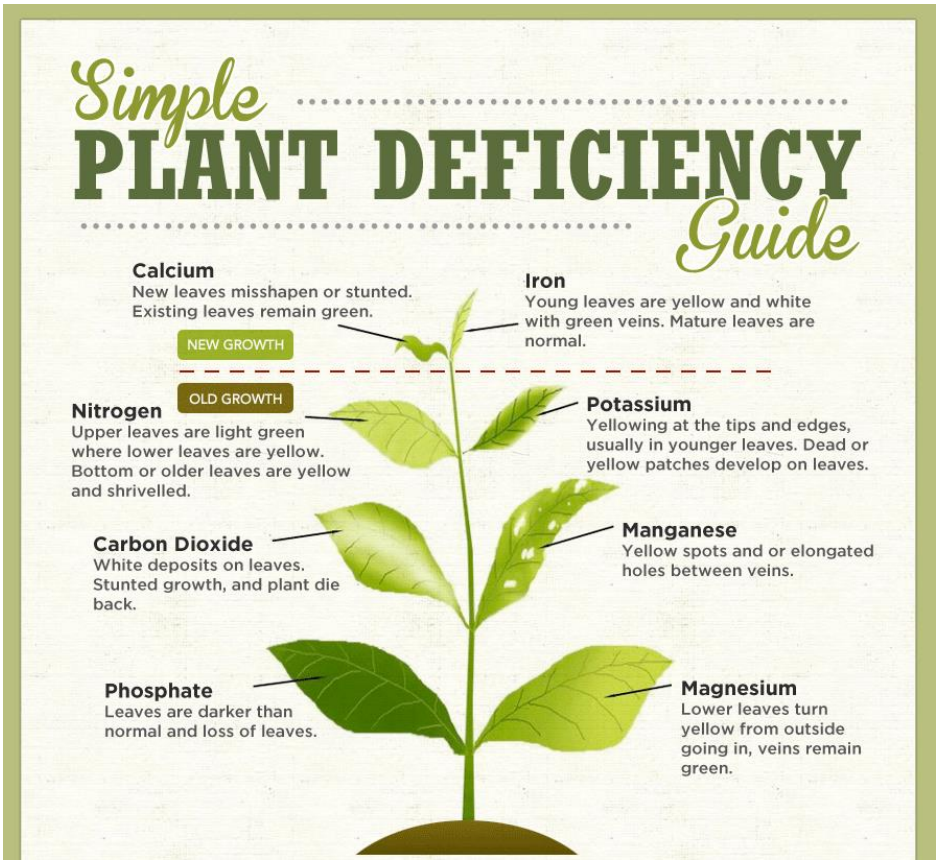


Figure 5. Simple Plant Deficiency Guide (Anonymous, 2018e).

RESULTS

Low fruit formation in olive varieties is a common problem. Therefore, studies on the development and morphology of generative organs are concentrated and the importance of criteria such as farina

viability, germination, grass pipe development and fruit attitude are emphasized (Ateyyeh and friends, 2000).

Soil properties and plant nutrition are very important in plant cultivation. Cultivation can never be considered without fertilization. By fertilization, the physical, chemical and biological properties of soils are improved and more efficient. At the same time, it provides more balanced growth, durability, high product and quality increase in trees. The purpose of this study; is to emphasize the importance of plant nutrition and fertilization in order to protect both soil properties and to increase vegetative and generative development in olive cultivation.

REFERENCES

Acarsoy, N., Eryüce N., Mısırlı, A., Kılıç, Ö. G., Kılıç, H. ve Arda, E., 2011. Farklı Bileşimlerde Bor, Azot Ve Potasyumlu Yaprak Gübrelerinin Domat Zeytin Çeşidinde Çiçek Tozu Canlılığı, Çimlenmesi ve Meyve Tutumu Üzerine Etkileri. Zeytin Bilimi 2 (2) 2011, 49-57.

Akıllıoğlu, A., 1995. Aydın Yöresi Zeytinliklerinin Beslenme Durumu. Türkiye II. Ulusal Bahçe Bit. Kong.3-6 Ekim 1995, Cilt I:741-745, Adana.

Anonymous, 2018a. http://www.garden-grower.com/tree-care/olive-trees.shtml

Anonymous, 2018b. http://fertsmart.dairyingfortomorrow.com.au/dairy-soils-and-fertiliser-manual/chapter-3-plant-nutrient-requirements/3-3-the-essential-plant-nutrients/

Anonymous, 2018c. https://www.smart-fertilizer.com/es/articles/growing-grain-yields

Anonymous, 2018d. https://krishijagran.com/featured/explained-14-nutrients-required-by-plants-for-best-growth-development/

Anonymous, 2018e. https://www.growrealfood.com/identifying-plant-nutrient-deficiencies/

Ateyyeh, A.F., Stösser, R., Qrunfleh, M., 2000. Reproductive biology of the olive (Olea europaea L.) cultivar 'Nabali baladi. Journal of Applied Botany. 74: (5-6) 255-270.

Brown, P., 2001. Can boron correct transient nutrient deficienciens. Fluid Journal, S: 3.

Canözer, Ö., 1978. Ege Bölgesi Önemli Zeytin Çeşitlerinin Besin Element Statüleri ve Toprak-Bitki İlişkileri Zeytincilik Araştırma Enstitüsü, Bornova, İzmir. (Uzmanlık Tezi)

Canözer, Ö., Çolakoğlu, H., 1985.Memecik Zeytin Çeşidinde Yapraktan ve Topraktan Uygulanan Gübrelemenin Verim ve Kaliteye Etkilerinin Araştırılması. Zeytincilik Araş. Ens. Proje Sonuç raporu, Bornova-İzmir.

Cuevas, L., Polıto, V.S., 2004. The Role of Staminate Flowers in the Breeding System of Olea europaea(Oleaceae): an Andromonoecious, Wind-pollinated Taxon JU. Annals of Botany 93: 547-553.

Çetin, A., Mendilcioğlu, K., 1992. Ayvalık Yağlık Zeytin Çeşidinde Verim ve Bazı Kalite Özelliklerine Yapraktan Gübre Uygulamasının Etkisi Üzerine Bir Araştırma. Türkiye I. Ulusal Bahçe Kong 13-16 Ekim 1992, Cilt 1:155-158, İzmir.

Desoukaye I.M., Haggag, L.F., Abd El –Migeed, M.M.M., Kishk, Y.F.M., El- Hady, E.S., 2009. Effect of Boron and Calsium Nutrients Sprays on Fruit Set, Oil Content and Oil Quality of Some Olive Oil Cultivars. World Journal of Agriculture Sciences, 5(2): 180-185.

Dikmelik, U., G. Püskülcü, M. Altuğand M. E. İrget, 1999. The Effect of KNO Application on Yield and Fruit Quality of Olive in Improved Crop Quality by Nutrient Management (Editors: D. Anaç and P. Martin-Prével), Kluwer Academic Publishers, 77-80.

El Khawaga, A.S., 2003. Effect of Girdling and Foliar Application of Some Nutrients on Growth, Flowering,Yield and Fruit Quality of Manzanillo Olive Trees Grown in Sandy Soil. Journal of Agricultural of Science, Mansoura University. 28 (3): 2124-2124.

El Khawaga, A.S., 2007. Improving growth and productivity of Manzanillo olive trees with foliar application of some nutrients girdling under sandy soil. Journal of Applied Sciences Research. 3(9): 818-822.

Eryüce, N., 1980.Ayvalık Bölgesi yağlık Zeytin Çeşidi Yapraklarında Bazı Besin Elementlerinde Bir Vegetasyon Periyodu İçindeki Değişmeler. E. Ü. Zir. Fak. Dergisi 17 (2):209-222.

Fayed, T.A. 2010. Response of four olive cultivars to common organic manures in Libya. American-Eurasian J. Agric. & Environ. Science, 8 (3): 275-291.

Fernández-Escobar, R. and L. Marín, 1999. Nitrogen Fertilization in Olive Orchards. Acta Hort. 474, 333-335.
Fernández-Escobar, R., R. Moreno and M.A. Sánchez-Zamora, 2004. Nitrogen Dynamics in the Olive Bearing Shoot. Hort Sci. 39(6):1406-1411.
Fox, R.L., A. Aydeniz, B. Kacar, 1964. Soil and Tissue Tests for Predicting Olive Yields in Turkey. Empire Jour. Of Exp. Hort. 32(125): 84-91.
Gündesli, M., 2005. İlkbaharda Yapraktan Bor Uygulamasının Gemlik Zeytin Çeşidinde Meyve Tutumu Üzerinde Etkisi. Kahramanmaraş Sütçü İmam Üniversitesi Fen Bilimleri Enstitüsü. Doktora tezi. (yayınlanmamış).
Gezerel, Ö. 1998. Meyve Ağaçlarının Gübrelenmesi ve Sorunları. T.C. Başbakanlık Devlet Planlama Teşkilatı Müsteşarlığı, Çukurova Üniversitesi Pozantı Tarımsal Araştırma ve Uygulama Merkezi, Ülke Ölçeğinde Meyvecilik Geliştirme Entegre Projesi Eğitim Programı II, Adana.
Güner, H., 1969. Zeytinin Kimyasal Yaprak Yapısı ile Ürün Verimi Arasındaki İlişkilere Dair Bir Araştırma. Ege Üniv. Zir. Fak. Yayın No:155, Bornova, İzmir.
Hassan, A.M., N. Abd-Alhamid, B.M.A. Rawheya, H.S.A. Aly Hassan, A.A. Abdelhafez and L.F. Haggag. 2015. Effect of organic and bio-fertilization on yield and quality of "Manzanillo" olives. Middle East J. Agric. Res., ISSN 2077-4605. 4(3): 485-493.
Hegazi, E.S., M.R. El-Sonbaty, M.A.Eissa, M.A. and T.F.A. ElSharony. 2007. Effect of organic and bio-fertilization on vegetative and flowering of picual olive trees. World J. Agric. Sci., 3: 210-217.
Inglese, P., G. Gullo, L.S. Pace, G. Ronzello, 1999. Fruit Growth, Oil Accumulation and Ripening of the Olive Cultivar 'Carolea' in Relation to Fruit Density, Acta Hort. 474: 265-268.
Inglese, P., Gullo, G., Pace, L.S., 2002. Fruit Growth and Olive Oil Quality in Relation to Foliar Nutrition and Time of Application. Acta Hort. 586: 507-509.
Irget, M. E., Kılıç, C. C., Bayaz, M. ve Özer, K., 2007. Azotlu Gübrelemenin Zeytinde Verim ve Kaliteye Etkisi. ADÜ Ziraat Fakültesi Dergisi 2007; 4(1-2) : 27 – 33.
Jasrotia, A., Singh, R.P., Singh, J.M. and Bhutan, V.P. 1999. Response of OliveTrees to Varing Levels of N and K Fertilisers. Acta Horticulturae 474: 337–340.
Kalenderoğlu, H., 2010. Gemlik Zeytin Çeşidinde Dal Eğme İle Birlikte Yapraktan Azot, Potasyum Ve Magnezyum Uygulamalarının Meyve Verimi Ve Kalite Üzerine Etkisi. Çukurova Üniversitesi Fen Bilimleri Enstitüsü Yüksek Lisans Tezi, 2010.
Khan S.A., Perveen, A., 2006. Germination capacity of storaged polen of Abelmoschus esculenthusL.(Malvaceae) and their maintenance. Pak. J. Bot., 38 (2): 233-236.
Khayyat M., Tafazoli, E., Eshghi, S., Rajaee, S., 2007. Effect of nitrogen, boron, potassium and zinc sprays on yield and fruit quality of date palm. American EurasianJ. Agric & Environ. Sci. 3: 289-296.
Klein, I., and S.A. Weinbaum 1984. Foliar Application of Urea to Olive.Translocation of Urea Nitrogen as Influenced by Sink Demand and Nitrogen Deficiency. J.Amer.Soc.Hort Sci.109:356-360.
Larbi, A., Gargouri, K., Ayadi, M., Dhiab, A., Msallem, M., 2011. Effect Of Foliar Boron Applıcation On Growth, Reproduction, And Oil Quality Of Olive Trees Conducted Under A High Density Planting System. Journal of Plant Nutrition, 34:2083–2094.
Maksoud, M.A. 2000. Response of growth and flowering of “Mazanillo” olive trees to different sort of nutrient. Egyptian Journal Horticulture. 27: 4, 5/3-523.
Mordoğan, N., Ceylan, Ş., Delibacak, S., Çakıcı, H., GÜNEN, E., Pekcan, T. ve Çolak, B., 2013. Organik Gübrelemenin Zeytin Yetiştirilen Kumlu-Tınlı Topraktaki Besin Elementi İçeriğine Etkisi. Adnan Menderes Üniversitesi Ziraat Fakültesi Dergisi. 10(1) : 7 - 13 2013.
Nyomora, A.M.S., Brown, P.H., Pinney, K., Polito, V.S., 2000. Foliar application of boron to almond trees affects pollen quality. J. Am. Soc. Hort. Sci. 125: 265–270.

Özelbaykal, S., 1995. Çukurova Bölgesinde Yetiştiriciliği Yapılan Zeytinlerde Azotlu Gübrelerin Verim, Kalite ve Bitki Besin Maddeleri İçerikleri Üzerine Etkileri Ç.Ü. Fen Bil. Ens. Bahçe Bitkileri Anabilim Dalı, Adana (Doktora Tezi).

Özkaya, M. T., 2014. Gemlik Zeytin (Olea Europaea L.) Çeşidinde Farklı Dönemlerde Uygulanan Bazı Yaprak Gübrelerinin Meyve Verim ve Kalitesi Üzerine Etkileri. Tarım Bilimleri Dergisi 2004, 10 (3) 353-357.

Perica, S., Brown, P.H., Connell, J.H., Nyomora, A.M.S., Dordas, C., Hu, H., Stangoulis James, C.R., 2001.Foliar boron application improves flower fertility and fruit set of olive. HortScience, 36: 714-716.

Pinillos, V., Cuevas, J., 2008. Standardization of the Fluorochromatic Reaction Test to Assess Pollen Viability. Biotechnic & Histochemistry 83(1):15-21.

Püskülcü, G., 1981. Memecik Zeytin Çeşidinde Makro ve Mikro Besin Elementlerinin Mevsimsel Değişimlerinin İncelenmesi. Zeytincilik Araş. Enst.; Bornova, İzmir. (Uzmanlık Tezi).

Sarıfakıoğlu, M. C., 1995. Bazı Zeytin Çeşitlerinde Yaprak ve Meyvede Mineral Besin Maddelerinin Mevsimsel Değişimi ve Ürün İle Kaldırılan Besin Maddelerinin Belirlenmesi, Ege Üniv. Fen Bilimleri Enst. Toprak Anabilim Dalı, Bornova, İzmir (Doktora Tezi).

Seferoğlu, S., 1997. Ayvalık ve Edremit Yöresinde Yetiştirilen Ayvalık Zeytin Çeşidinin Beslenme Statüsü ile Kimi Kalite Öğeleri Arasındaki İlişkiler. Ege Üniv. Fen Bilimleri Ens. Toprak Anabilim Dalı, Bornova, İzmir (Doktora Tezi).

Sibbett, G.S. and L. Ferguson, 2002. Nitrogen, Boron and Potassium Dynamic in “On” vs “Off” Cropped Manzanillo Olive Trees in California, USA. Acta Hort. 586: 369-373.

Soyergin, S. 1993. Bursa Yöresi Gemlik Çeşidi Zeytinlerin Bazı Besin Elementleri İçeriği ve Bu Elementlerin Mevsimsel Değişimleri. Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü. Doktora Tezi, Yalova.

Soyergin, S., I. Moltay, Ç. Genç, A.E. Fidan and A.R. Sutçu, 2002. Nutrient Status of Olives Grown in the Marmara Region. Acta Hort. 586:375-379.

Steve, D. 2009. Sustainable farming compost tea. Cited in http://www. compost-tea-notes%20(4).pdf. Erişim: Aralık 2015.

Terena, L., Holdaway-Clarke and Peter Hepler, K., 2003. Control of polen tube growth: role of ion gradients and fluxes. New Phytologist 159: 539-563.

Toplu, C., 2000. Hatay İli Değişik Üretim Merkezlerindeki Zeytinliklerin Verimlilik Durumları, Fenolojik, Morfolojik ve Pomolojik Özellikleri ile Beslenme Durumları Üzerinde Araştırmalar. Çukurova Üniv. Fen Bilimleri Enst. Bahçe Bitkileri Anabilim Dalı, Adana (Doktora Tezi).

Zabunoğlu, S., Hatipoğlu, F., Yenicesu, İ., 1977.Bursa İlinde Yetiştirilen Sofralık Gemlik Çeşidi Zeytin Ağaçlarının Makro ve Mikro Besin Maddeleri Durumu. Tübitak, VI. Bilim Kong. Tebliğleri, Ankara.

(ORAL PRESENTATION)

THE EVALUATION OF THE CONSUMERS' PREFERENCES ON APPLE VARIETIES: A CASE OF ANTALYA PROVINCE

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Abstract

In this study, it was aimed to determine the apple varieties preferences and apple consumption of the households living in the city center of Antalya. In this regard, consumers' decision to buy apples, purchasing frequency, supply channel preference, consumption level, attitudes to chemical drug residues were examined. Data were collected from 300 households by face-to-face interviews. The data were cross-sectional data for the period February 2017. Consumers were classified as low, medium-low, medium-high and high-income groups according to their income, and according to these groups, other variables were interpreted by cross-tabulation. Consumers opinions and behaviours towards food were scored by a five-point Likert scale.

Consumers gave importance such as being price, quality, appearance, diversity, taste, organic criteria in the purchase of apples. Consumers' choice of apples differed in parallel with the income level. As income increased, consumers were also more likely to know about apple varieties. It was observed that consumers generally know the traditional varieties (Golden delicious, Starking delicious, Granny Smith, Amasya) and buy it. When the reasons for choosing apple varieties were examined the taste of Golden and Starking varieties; crisp and hardness of Granny Smith and Amasya variety were preferred regarding being watery. The most important criteria for buying apples were factors such as price, appearance, quality, taste and flavour were at the forefront, and it was determined that the varieties came after these factors.

The most preferred channel for apple purchases was the street market. The most known and most consumed apple varieties were classic varieties (Starking delicious, Golden delicious, Granny Smith and Amasya). Developments in the production front, which can convince the consumer, especially for reliable food (such as organic, good agricultural production), may increase the consumption of apples.

Keywords: Apple, variety, consumption, preference, Antalya

INTRODUCTION

Today, the issue of nutrition is becoming more and more important. On the one hand, rapid population growth and urbanisation, on the other hand, there are some differences in the food consumption habits of the society due to the differences in the social life of the people. In this respect, fruit and vegetable can be the forefront products that tend to increase consumption (Gül et al., 2008). Apple is one of the most popular fruits that are grown and traded economically after citrus fruit and banana. Turkey is the homeland of apple species with a wealth of variety. However, this diversity of Turkey’s has not been developed to meet the needs of the food industry (Gül and Erkan, 2001). Approximately 60% of apple production is covered by Isparta, Karaman, Niğde, Antalya, Denizli and Konya.

The current food consumption and the consumer's income level are important in the decisions of the public on food supply (Koç, 1995). It is known that apple consumed fresh in Turkey. However, fresh consumption, as well as vinegar making, juices, pastries and desserts, are processed and cooked by consumption. In recent years, the pesticide residues in fruit and vegetable species and the use of hormones have been affecting consumer behaviour to a great extent. The awareness of consumers, along with the increasing income and knowledge level, has also caused some differences in the production techniques. GLOBALGAP protocol was prepared to protect EU consumers; this protocol was applied in Turkey (Gül et al., 2008). Golden delicious is the most grown apple in the world. Instead of these traditional varieties, the market share of new varieties is increasing, and this trend is expected to continue.

One of the important factors affecting the fruit production and trade is new varieties, and the other is production systems (such as Integrated Fruit Production-IFP) (Gül and Erkan, 2001). In Turkey, Golden delicious, Starking delicous, Granny smith, Starkrimson and Amasya is more widely grown, these varieties are classified as varieties traditionally grown in world trade (Gül and Erkan 2001). This study aimed to examine the perspectives of consumers the apple of Turkey's one of the major agricultural products. It was observed that the preferences of consumers change over time. Therefore, it is aimed to determine the consumer's judgment on apple varieties, preferences of consumers, purchasing channels, consumption structure.

MATERIALS AND METHODS

The material of the study consists of the data obtained from the surveys of the households living in Antalya. The questionnaire used in the study was prepared based on previous studies. The primary data obtained through face-to-face interviews. In the study, the sampling volume was determined to be 300 households. The study was applied to 300 households living in the urban area of Antalya. The survey was conducted in February 2017. Cross-tabulation was performed in the evaluation of the data. The questions were prepared according to the Likert scale to measure consumer satisfaction and preference. According to the average income of the households were divided into four groups. Households with income groups less than 1500 TRY was identified as I. group, households with income between 1501-3000 TRY was II. group, households with income between 3001-5000 TRY was III. group, households with an income of 5001 TRY and more was IV. group.

RESULTS AND DISCUSSION

Demographic Characteristics of Households

Consumer-related variables affect the demand for agriculture and food. Socio-demographic characteristics of consumers are influential on consumption and buying behaviour (Akpınar et al., 2015). In this study, consumers' demands for apple varieties were determined. Demographic characteristics of the sample consumer population surveyed such as gender, age, occupation, marital status, education, household size and lifestyle was analysed.

Accordingly, 45.3% of the 300 interviewees surveyed were male, and 54.7% were female consumers. Also, according to TUIK 2017 General Population Data, the female population ratio was 50.4% in Antalya province. Household size was 3-4 people in Turkey and Antalya. Akpınar et al. (2015) determined that the household size was 3.2 persons in the Antalya. In this study, the average household size was 3.7 persons. Interviewees were mostly students, civil servants, tradesmen and merchants. Their educational levels were majority high school.

There are many factors affecting consumption activity. The most critical factor affecting consumption is income level. There is a direct relationship between income and consumption. (Tarı and Pehlivanoglu, 2007). Therefore, the income level was accepted as an essential factor in the study.

13% of the households interviewed had Group I income level, 28% had Group II income level, 36% had Group III income level, and 23% had Group IV income level. The household interviewed was predominantly Group III (Table 1).

Table 1: Demographic characteristics of households (%)

Income Groups					
Variables	I	II	III	IV	Total/Average
Number of people (n)	39	84	108	69	300
Number of people (%)	13	28	36	23	100.0
Gender of interviews (%)					
Woman	76.9	58.3	46.3	44.9	54.3
Man	23.1	41.7	53.8	55.0	45.7
Households by income groups (%)					
0-1500	100	0.0	0.0	0.0	3.0
1501-3000	0.0	100	0.0	0.0	28.0
3001-5000	0.0	0.0	0.0	100,0	36.0
5001-8000	0.0	0.0	0.0	76.8	17.7
8001-1300	0.0	0.0	0.0	18.8	4.3
13000-20000	0.0	0.0	0.0	2.9	0.7
20000+	0.0	0.0	0.0	1.4	0.3
Education (%)					
Literate	0.6	0.0	1.9	0.0	1.0
Primary education	0.0	7.1	10.2	5.8	7.0
High school	59.0	51.2	49.1	55.1	52.3
College	10.3	9.5	9.3	7.2	9.0
University	25.6	31.0	22.2	17.4	24.0
MSc	2.6	1.2	7.4	10.1	5.7
PhD	0.0	0.0	0.0	4.3	1.1

Consumers' Fruit-Vegetable Purchasing Behaviours

Consumer behaviour is defined as the process of purchasing and exchanging goods (Moven and Minor, 2001). Individual and non-individual factors affect consumer behaviours. Individual factors include needs, motives, perceptions, attitudes and experiences (Cömert and Durmaz, 2006). Nowadays, consumers' expectation for product variety related to consumption is increasing. Numerous goods and services are produced to meet the expectations of consumers. Therefore, products should be produced by the expectations of consumers. The state, retailers and marketers should act together to meet consumers' expectations (Oral et al., 2017).

Apple is usually consumed fresh in Turkey. In the world, most of the total apple consumed type is fresh (68.2%) and processed in various ways (20.9%). In countries such as China, England, Brazil, Japan and Taiwan, the vast majority (85-95%) were consumed fresh (Gül and Akpınar, 2006). There are many different climate types in Turkey. Turkey's quince, fig, apricot, cherry, cherry pistachio, walnut, carob, grape, chestnut, strawberry, lemon and apple are received a significant share in world production (Gül and Akpınar, 2006). Apple has an important place among soft stone fruits. Isparta, Karaman, Antalya and Konya constitute a large part of the production in terms of apple production and variety.

The frequency of consumption type of apple in the interviewees was given in Table 2. The frequency of apple consumption was determined to be between two and three days and daily consumption.

Table 2: Frequency of apple consumption (%)

Income Groups					
Frequency	I	II	III	IV	Total/Average
Regularly daily	17.9	25.0	23.1	27.5	24.0
Irregularly per day	7.7	11.9	22.2	8.7	14.3
Two to three days	23.1	23.8	23.1	33.3	25.7
Two to three times a week	25.6	19.0	15.7	5.9	18.0
Once a week	10.3	11.9	8.3	10.1	10.0
Every fifteen days	12.8	7.1	4.6	4.3	6.3
Once in a month	2.6	1.2	2.8	0.0	1.7
Total	100.0	100.0	100.0	100.0	100.0

The demand for food products is increasing, and in recent years, many studies have been carried out on food safety for consumers. Consumers' thoughts on the reliability of fresh fruit and vegetables vary over time. The opinions of the interviewees in the field of research about the reliability of the fresh fruits and vegetables in terms of health were given Table 3. Accordingly, 8.3% of interviewees did not find it reliable, and 39.3% found it quite reliable. Interviewees generally found fresh fruit and vegetables as very reliable in terms of health (Table 3).

Table 3. Determination of the safety of fresh fruits and vegetables in terms of health (%)

Income Groups					
	I	II	III	IV	Total/Average
Not reliable at all	5.1	7.1	11.1	7.2	8.3
A little reliable	7.7	22.6	14.8	20.3	17.3
Moderately reliable	28.2	28.6	38.9	37.7	34.3
Quite reliable	43.6	35.7	20.4	21.7	28.0
Very reliable	15.4	6.0	14.8	13.0	12.0
Total	100.0	100.0	100.0	100.0	100.0

Apple types preferred by consumers

Turkey is known as the classic varieties such varieties of Starking delicious, Golden delicious, Granny Smith, Starkrimson and Amasya cultivation is done more. In the world, new varieties such as Fuji, Braeburn, Gala and Jonagold were prominent (Gündüz, 1997). In the research area, it was observed that consumers did not have enough information about new apple varieties.

The level of knowledge about the apple varieties of the interviewees was given in Table 4. The 75.3% of the interviewees declared that they knew Amasya apple variety, 64.7% of them knew Golden delicious, 55.3% of them knew Starking delicious, 52.7% of them knew Granny Smith, 18.7% of them knew Red Delicious, 6.7% of them knew Gala, 6.3% of them knew Pink Lady, and 5.7% of them knew Fuji apple varieties. Interviewees responded more than once answers to the apple variety. In general, interviewees had ideas about the classic varieties (Amasya, Golden delicious, Starking delicious and Granny Smith). As the level of income increases, interviewees' knowledge of new apple varieties increases (Table 4).

Table 4: Consumers' Level of Knowing Apple Varieties (%)

Income Groups					
Variety	I	II	III	IV	Total/Average
Amasya	71.8	73.8	77.8	75.4	75.3
Golden delicious	48.7	60.7	65.7	76.8	64.7
Starking delicious	38.5	50.0	61.1	62.3	55.3
Granny smith	30.8	51.2	59.3	56.5	52.7
Red delicious	12.8	21.4	17.6	20.3	18.7
Gala	5.13	6.0	6.5	11.6	6.7
Pink lady	7.7	6.0	7.4	4.3	6.3
Fuji	7.7	7.1	3.7	5.8	5.7

It was found that the most preferred consumer varieties were predominantly classic varieties. Starking delicious was the first with 27%, and Golden delicious was the second with 18%. Fuji was not preferred with 96.3% (Table 5)

Table 5: Prefer apple varieties (%)

Variety	Ever	Less	Sometimes	Continuous	Always
Amasya	47.0	6.7	15.3	21.3	9.7
Golden delicious	37.3	6.0	14.3	24.7	18.0
Starking delicious	48.0	2.7	6.3	16.0	27.0
Granny smith	48.3	3.0	19.0	22.7	7.0
Red delicious	86.0	1.3	4.0	6.0	2.7
Gala	94.3	0.3	1.7	1.7	2.0
Pink lady	95.7	0.7	2.3	1.3	0.0
Fuji	96.3	0.7	0.3	2.0	0.7

Reasons for Consumers to Prefer Apple Varieties

The reasons why consumers prefer apple varieties were given in Table 6. Accordingly, individuals often preferred Golden delicious with habit, taste, smell, organoleptic quality and durability. Granny Smith was preferred in terms of hardness and brittleness. The new varieties were not included in the ranking because they were not statistically significant.

Table 6: Reasons for choosing apple varieties

Variables	I	II	III	IV
Taste	Starking d.	Golden d.	Golden d.	Golden d.
Durability	Amasya	Amasya	Amasya	Golden d.
Habit	Starking d.	Golden d.	Golden d.	Golden d.
Organoleptic quality	Granny s.	Amasya	Golden d.	Starking d.
Hardness	Amasya	Granny s.	Granny s.	Granny s.
Juiciness	Amasya	Amasya	Amasya	Amasya
Brittleness	Granny s.	Granny s.	Granny s.	Granny s.
Smell	Amasya	Golden d.	Golden d.	Golden d.

Good agricultural practices, agricultural production system socially liveable, economically profitable and efficient, human, animal and environmental health care is the generic name of a series of applications (Ekmekçi et al., 2012). The aim of good agricultural practices is the sustainability of agricultural production without harm to the environment, human and animal health, protection of natural resources, traceability in agriculture, ensuring food safety .

Interviewees declared that their consumption could be 78.7% increased with the good agricultural practices in apple production (Table 7).

Table 7. The effect of Good Agricultural Practice on apple consumption (%)

Status	I	II	III	IV	Average
Decreases	5.1	4.8	6.5	1.4	4.7
Constant	17.9	15.5	19.4	13.0	16.7
Increases	76.9	79.8	74.1	85.5	78.7
Total	100.0	100.0	100.0	100.0	100.0

Effective Criteria for Apple Consumption and Purchase

In a study conducted on fresh fruits and vegetables in Adana, the most effective criteria for fresh fruit and vegetable purchases were freshness, health, flavour, quality, hygiene, medicine, and hormone (Gül et al., 2008). In a different study carried out in İzmir, Ankara and İstanbul, nutritional value, drug, hormone and additive, flavour and price were the most striking features (Akgüngör et al., 1999).

Table 8 showed that which criteria were considered in apple consumption. In this regard, consumer rating was determined by using the 5-point Likert scale. The quality, flavour, taste, health benefits, be organic, be eligible for the palate, water loss, cleaning, sweet, sour, astringent taste, vitamin and mineral content found important for the interviewees. Price was also an important factor. Quality, taste, delicate taste, health benefits, be organic, appeal to the taste buds, water loss, cleaning, sweet, sour, astringent taste, vitamin and mineral content, price, to be cheap, smell, appearance, insect damage, having pleasant texture, woolliness, useful for body, cracking, physiological demage, sunburn that is important for consumers.

Table 8: The criteria are taken into account in apple consumption

Variables	I	II	III	IV	Average
Quality	4.5	4.5	4.5	4.5	4.5
Taste	4.5	4.5	4.5	4.3	4.4
Nice taste	4.5	4.5	4.2	4.3	4.3
Health benefits	4.4	4.1	4.2	4.3	4.3
Be organic	4.2	4.2	4.2	4.3	4.3
Appeal to the taste buds	4.2	4.2	4.3	4.3	4.2
Water loss	4.0	4.3	4.3	4.3	4.2
Cleaning	4.4	4.1	4.3	4.2	4.2
Sweet, sour, astringent taste	4.3	4.1	4.2	4.2	4.2
Vitamin and mineral content	4.0	4.1	4.2	4.2	4.2
Price	4.0	4.2	4.0	4.1	4.1
To be cheap	4.3	4.0	4.1	4.0	4.1
Smell	4.0	4.1	4.1	4.1	4.1
Appearance	4.4	3.8	4.1	3.9	4.0
Insect damage	4.0	3.9	4.0	4.2	4.0
Having pleasant texture	4.2	3.8	4.1	3.9	4.0
Woolliness	3.9	3.8	4.1	4.1	4.0
Useful for body	4.3	3.7	3.7	4.2	4.0
Cracking	3.8	3.9	4.0	4.1	4.0
Physiological demage	3.9	3.8	3.9	4.2	4.0
Sunburn	3.9	3.8	4.0	4.1	4.0
Variety	3.9	4.0	3.9	4.0	3.9
Mechanical demage	3.9	3.9	3.8	4.2	3.9

Residue problem	3.9	3.8	3.9	4.1	3.9
Nice smell	4.1	3.5	4.0	4.0	3.9
Helping to weaken	3.6	3.6	4.1	4.0	3.8
High fiber content	3.8	3.5	3.7	3.9	3.7
Keep awake	3.6	3.3	3.4	3.4	3.4

Businesses attract consumers with various communication and media. These tools are used to reach consumers. In addition to the environment and friends, television, newspapers, magazines and radio broadcasts are preferred. In this way, the companies can maintain their continuity and in this way, according to the demands of consumers are producing (Karaman et al., 2013). The sources of information on the reliability of fruit and vegetable in the last six months of interviewees were given in Table 9. 15% of the interviewees stated that they received information from newspapers and magazines, 41.7% from TV and radio, 46.3% from family and friends, 20.7% from product labels and 13.3% from doctors and experts. As a result, it was observed that the interviewees received most of the information from family and friends, the internet as well as TV and radio.

According to a survey conducted in Tokat province, it was revealed that consumers from radio and television programs had the most information about food safety and were mostly influenced by TV commercials in food purchases (Onurlubaş, 2011).

Table 9. Resources that consumers have been informed about fruit and vegetable trust in the last six months(%)

Income Groups					
Variables	I	II	III	IV	Total/Average
Newspaper and magazine	12,8	19,1	14,8	11,6	15,0
TV and radio	43,6	51,2	39,8	31,9	41,7
Family and friends	53,9	40,5	46,3	49,3	46,3
Product tags	2,6	13,1	25,9	31,9	20,7
Doctor and expert advice	5,1	6,0	13,9	26,1	13,3
Internet	43,6	36,9	38,0	53,6	42,0

Today, the remnants of pesticide used in agriculture and the use of and unnecessary agrochemicals have become an essential problem in terms of sustainability in agriculture. With this problem, consumers are cautious about food products. As the use of agrochemicals increases, fruits and vegetables are under threat to food safety.

The importance of the problem of pesticides residues in fruit vegetables was shown in Table 10 using the 5-point Likert scale presented to the consumers. Accordingly, pesticide residues in fruit vegetables were found to be important in 57.4% of consumers. Also, the majority of the interviewees stated that the use of agrochemicals should be reduced.

Table 10. The importance of chemical drug residues in vendor selection in fruit vegetable species (%)

Income Groups					
Variables	I	II	III	IV	Total/Average
Never important	7.7	6.0	8.3	4.3	6.7
Not important	25.6	13.1	13.0	13.0	14.7
Middle	30.8	20.2	21.3	20.3	22.0
Important	20.5	31.0	27.8	24.6	27.7
Very important	15.4	29.8	29.6	37.7	29.7
Total	100.0	100.0	100.0	100.0	100.0

In the production of sufficient and high-quality agricultural products, plant protection products are necessary. However, the use of high doses and unconscious pesticides can be dangerous for human and environmental health (Tiryaki et al., 2010). Therefore, the remnants of medicines are becoming more and more important in the consumption of fruits and vegetables for consumers. In recent years, people prefer organic products. The effect of organic production on fruit and vegetable consumption was investigated in Table 11.

Table 11. The effect of organic vegetables on consumption

Income Groups					
Variables	I	II	III	IV	Total/Average
Does not change	12.8	17.9	24.1	23.2	20.7
Increases	87.2	82.1	75.9	76.8	79.3
Total	100.0	100.0	100.0	100.0	100.0

There are many economic and social factors affecting the buying behaviour of individuals. These are income level, education level, family and friends, TV ads and price discounts. Based on this information, the factors affecting the buying behaviour of the fruits and vegetables of the consumers are examined in Table 12. Individuals interviewed stated that they were affected by their family and friends by 31.7% in the purchase of fruits and vegetables. 11.7% dietitians' advice, with 24% price cuts and doctor's advice.

Table 12. Factors affecting purchasing behaviour (%)

Income Groups					
Variables	I	II	III	IV	Total/Average
Circle of friends	41.0	27.4	30.6	33.3	31.7
Price discounts	15.4	28.6	23.1	24.6	24.0
Doctor's advice	33.3	23.8	25.0	17.4	24.0
Dietitian advice	5.1	10.7	15.7	10.1	11.7
TV ads	5.1	11.9	4.6	10.1	8.0
Total	100.0	100.0	100.0	100.0	100.0

The Effect of Purchasing Channels on Consumer

The level of income varies depending on many factors such as habits, demands, and state policies. Many factors affect consumers' buying behaviour. In this regard, many factors such as the income level of the family, number of children, life status in rural or urban areas and quality of goods to be purchased are taken into consideration (Güneş et al., 2002).

The level of income of consumers is an important criterion in purchasing. While families with low incomes tend towards relatively affordable products, families with high-income levels prefer products that are more suitable for organic and quality standards. The distance to the supply channels, customer satisfaction, product and price diversity, the price of the products are effective in the choice of consumers.

In the evaluation of consumers in the neighbourhood markets, they were satisfied that the price, product freshness, variety of products and prices, and pick-up function provided reasonable satisfaction and that the client's behaviour and interest, health conditions and cleanliness and weighing reliability provided moderate satisfaction. However, there was dissatisfaction with the packaging. Supermarkets, unlike neighbourhood markets, especially in terms of weighing reliability, health conditions and cleanliness, packaging and packaging in terms of providing consumers with high satisfaction. However, the client's behaviour and interest, product freshness, product and price diversity, choosing a satisfactory satisfaction in terms of receiving. The level of satisfaction with the price level was moderate, and there was no marketing activity for supermarkets with low levels of satisfaction. It can be said that consumers are generally dissatisfied with the

peddlers. Among the evaluations made for the peddlers, it was reported that only the price criterion provided a good satisfaction level, and the degree of satisfaction with other activities was found to be moderate and low. The most preferred purchasing channel in Antalya is the local market with 77%, supermarket 11%, grocery 7% and the other 2.3% (Table 13).

Table 13. Sorting of apple purchasing channels by importance level (%)

Purchasing channels	Income groups				Average/Total
	I	II	III	IV	
Bazaar	82.1	82.1	79.6	63.8	77.0
Greengrocer	7.7	8.3	4.6	8.7	7.0
Peddler	0.0	1.2	0.0	5.8	1.7
Supermarket	5.1	6.0	11.1	20.3	11.0
Other	5.1	2.4	1.9	1.4	2.3
Total	100.0	100.0	100.0	100.0	100.0

Purchasing channels are important for consumers. In this context, the factors affecting consumer preferences were examined, and the results were listed in order of importance for the consumers who prefer to purchase fruits and vegetables according to the results; cheapness, the freshness of the product, proximity, product variety and prices were found to be statistically significant for consumers. Credit card shopping for supermarkets, shopping opportunities, health conditions and cleaning, ease of purchase stands out. Greengrocers were found to be important for consumers due to reasons such as proximity, ease of purchase, the freshness of products, health conditions and cleanliness. In this respect, price appropriateness, proximity, product freshness, product and price diversity and selection are the most critical factors in determining the purchasing channels that consumers would prefer to buy fruits and vegetables (Gül et al., 2008).

In the study, the criteria to be considered in terms of consumers in the selection of retailers when buying fresh fruits and vegetables were examined, and findings were given in Table 14. The most important criteria for district bazaar was proximity, product freshness, cheapness, habit, variety of product price, and selecting. The most important features when buying groceries were product mainly by selecting, product freshness, product price variety. The most important factors that are taken into consideration when shopping by the peddler were the freshness of the product and the behaviour to the customer. Peddler seller was preferred because of the freshness of the product and customer behaviour. The supermarket was preferred for product freshness, health conditions, selection, credit card shopping and parking facilities (Table 14).

Table 14. Reasons for buying channels when buying fresh fruits and vegetables

Criteria	District Bazaar	Greengrocer	Peddler	Supermarket
Cheapness	4.4	4.2	4.0	4.1
Proximity	4.5	4.2	3.9	4.4
Habit	4.4	4.2	3.8	4.3
Product freshness	4.5	4.3	4.2	4.5
Product-price diversity	4.4	4.3	4.0	4.4
Packing	3.7	3.9	3.5	4.2
Health conditions	4.1	4.2	3.9	4.5
Selecting	4.4	4.4	4.0	4.5
Customer behaviour	4.1	4.2	4.1	4.3
Ease of purchase	4.1	4.1	3.9	4.3
Collective shopping opportunities	3.8	3.7	3.5	4.1
Shopping with credit card	1.9	3.3	2.9	4.0
Parking facilities	2.2	3.5	3.0	4.0
Weighing reliability	4.0	4.2	4.0	4.3

Price	4.3	4.1	4.0	4.2
Ease of payment	4.2	4.1	4.0	4.2
Product reliability	4.2	4.2	4.0	4.4

*1. Never important, 2. Not important, 3. Middle, 4. Important, 5. Very important

CONCLUSION

Consumers mainly consumed apples every two to three days (25.7%). Consumers knew and generally, bought the classic apple varieties. For the taste of Golden and Starking varieties, Granny Smith was preferred for crisp and hardness and juiciness Amasya. Price, appearance, quality, taste and taste are the most important criteria for buying apples. Variety comes after these factors.

In the study, it was observed that people did not have enough information about apple varieties. It was determined that colour was an important to factor in fruit consumption, and the reddest colour was preferred.

The most preferred channel for buying apples was the district bazaar. The district bazaar was preferred due to the reasons of cheapness, intimacy, habit, product freshness and product-price variety. Supermarkets were preferred in terms of product freshness, health conditions, selection, product-price diversity and product reliability. The most important feature to be developed in the varieties preferred by the consumers was found as agrochemicals residues. More than 20 different varieties of apples are produced in our country, but consumers have more information on classical varieties. Therefore, consumers should be informed by producers about new varieties. Businesses should produce goods and services by paying attention to consumer demand.

REFERENCES

Akgüngör, S., Miran, B., Abay, C., Olhan, E., Kızıldağ Nergis, N. (1999). Estimation of Potential Demand of Consumers for Environmentally Friendly Agricultural Products in Istanbul, Ankara and Izmir. *Tarimsal Ekonomi Araştirma Enstitüsü, Yayın No*, *15*.

Akpinar, M.G., Gül, M., Oral, M.A., Akay, A.Ş., Gülcan, S. (2015). 6. Evaluation of Packaging Factor in Fruit Juice Products Preference. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, (44).

Agency, M. K. (2015). Karaman Apple Sector Report. *MEVKA Yayınları*, Konya.

Cömert, Y., Durmaz, Y. (2006). An Integrated Approach to Factors Affecting Consumer Satisfaction and Purchasing Behaviors and a Field Study in Adıyaman. *Journal of Yasar University*, *1*(4), 351-375. https://doi.org/10.19168/jyu.31680

Çevik, O., Bay, M., Mortaş, M., Öz, M., Erdemir, N. K. (2015). he Situation of the Apple Industry in Karaman from the Perspective of Competition, Finance and Marketing. Sosyal ve Ekonomik Araştırmalar Dergisi, 17(29), 110.

Çemrek, F., Filiz, Z. (2008). Consumer Satisfaction Analysis and an Application in the Food Industry. Dokuz Eylul University *Sosyal Bilimler Enstitüsü Dergisi,* Volume 10, Number: 1, 2008.

Ekmekci, K., Acar, A. İ., Yurtlu, Y. B., Hasdemir, M. (2012). Evaluation of Good Agricultural Practices in Terms of Agricultural Mechanization. *Selçuk Tarım Bilimleri Dergisi*, *26*(1), 97-103.

Emeksiz, F., Albayrak, M., Güneş, E., Özçelik, A., Özer, O. O., Taşdan, K. (2005). Assessment of the Agricultural Products Marketing Channels and Tools in Turkey. *Türkiye Ziraat Mühendisleri Odası Teknik Kongresi, Bildiriler* (II), 1155-1172.

Gül, M., Akpinar, M. G. (2006). Investigation of Development in the World and Turkey Fruit Production. *Akdeniz Üniversitesi Ziraat Fakültesi Dergisi*, *19*(1), 15-27.

Gül, M., Yılmaz, H., Akpınar, M. G. (2008). Consumption And Expenditure Structure of Fresh Fruits And Vegetables: The Case of Adana Province. *VIII. Ulusal Tarım Ekonomisi Kongresi, Gıda Pazarlaması Sunulu Bildirileri, Bursa*, 133-144.

Gül, M., Erkan, O. (2001). Apples in the world and Turkey Developments in Production and Trade. Çukurova *Üniversitesi Ziraat Fakültes Dergisi*, 16(3), 1-10.

Güneş, E., Albayrak, M., Gülçubuk, B. (2002). Food Industry in Turkey, Tekgida-İş Sendikası Yayını, Ankara.
Gündüz M (1997). Pome Fruits Assessment in terms of the World Trade and Turkey. Yumuşak Çekirdekli Meyveler Sempozyumu. 2-5 Eylül 1997, Yalova. 295-304.
Karaman, S., Özsayın, D., Karagan, H. (2013). Consumer Satisfaction in Direct Marketing of Organic Fresh Fruits and Vegetables. *Tarım Bilimleri Araştırma Dergisi*, *6*(1), 83-87.
Koç, A. (1995). Red Meat Supply and Demand of Econometric Analysis and Investigation of the Red Meat Industry Structure functioning in Turkey. Cukurova University, *Çukurova Üniversitesi, Fen Bilimleri Enstitüsü, Tarım Ekonomisi Anabilim Dalı, Doktora Tezi, Adana*.
Moven John, C., Minor Michael, S. Consumer Behavior: A Framework, 2001.
Onurlubaş, E. (2011). Measurement of Consumer Awareness on Food Safety Tokat Province. Gaziosmanpaşa Üniversitesi, *Fen Bilimleri Enstitüsü, Tarım Ekonomisi Anabilim Dalı, Doktora Tezi, Tokat*.
Oral, M.A., Akay, A.Ş., Akpınar, M.G., Gül., M. (2017). The Relationship Between Socio-Demographic Characteristics of Consumers and Fruit Juice Consumption. , Uluslararasi Hakemli Pazarlama Ve Pazar Araştirmalari Dergisi, Ocak / Şubat / Mart / Nisan – Kış İlkbahar Dönemi, Volume: 10.
Özçatalbaş, O., Turhanoğulları, Z., Kutlar, İ. (2009). General Status and Developments of World Apple Production Sector. *Tarım Bilimleri Araştırma Dergisi*, *2*(1), 139-144.
Özguven, N. (2008). Customer Satisfaction in Service Marketing and an Application on Transportation Sector. *Ege Academic Review*, *8*(2), 652-682.
Tarı, R., Pehlivanoğlu, F. (2007). Analysis of Consumer Behaviors in Terms of Income-Expenditure Groups in Kocaeli (Profile of Consumption Expenditures). Kocaeli University *Sosyal Bilimler Dergisi*, (13), 192-210.
Tiryaki, O., Canhilal, R., Horuz, S. (2010). Use and Risks of Agricultural Drugs. Erciyes University *Fen Bilimleri Enstitüsü Fen Bilimleri Dergisi*, *26*(2), 154-169.

(ORAL PRESENTATION)

MALVACEAE SPP. LEAVES AS A NOVEL CROP FOR FOOD

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Abstract

Local wild plants are often used as a complementary food source for indigenous societies around the globe. However, domestication of such plants as new crops for food is facing serious challenges, so in fact only a handful of new crops were domesticated for commercial use in the last decades. Several *Malva* and *Lavatera* species (Family: Malvaceae) are ruderal, nitrophilic plants that very commonly dominate vegetation of field margins in Mediterranean agroecosystems. In Israel, those Malvaceae species - mainly *M. nicaeensis* All. and *L. cretica* L. - are commonly called "*Hubeza*" (Arabic: bread). *Hubeza* have an important role in the local cuisine. Traditionally, people are harvesting and eating the green leaves fresh, boiled or fried. The goal of this project is to test the potential of *M. nicaeensis* and *L.cretica* as a potential crop for human food. We hypothesize that the nutritional values of the *Hubeza* leaves, as well as biomass production, is competitive to spinach, as well as other green leaves which are available commercially, and used in similar fashion. To test our hypothesis we compared here nutritional values of wild *Hubeza* leaves to the nutritional values of other green leaves crops, in terms of, total N, P, K, Fe, Cu, and Na. We found that leaves of wild Malvaceae exhibited similar concentrations of nutrients as compared to commercial green leaves, cultivated in the field. Subsequently, we will examine agronomic aspects of *M. nicaeensis* and *L.cretica* cultivation, as well as additional nutritional aspects. The use of native plants for agriculture can increase biodiversity of agroecosystems, promote diversification of agriculture, and reduce agricultural inputs. The value of native plants, local production, and maintenance of agroecosystem biodiversity can reduce food millage, promote food diversity and agricultural resilience.

Key words: green leaves, *Malva*, *Lavatera*, nutritional value, traditional food, novel crops.

INTRODUCTION

Sustainable agriculture is the economically viable production of food, that is nonexploitative, socially responsible, and which serves as the foundation for future generations (Allen et al., 1991). Shelef et al. (2018) illustrated how the use of local food production is reflecting the challenges and potential of developing more sustainable practices in agriculture. Using local plants is likely to prefer varieties that were naturally selected to tolerate the local environment, thus saving inputs, food millage, and empower regenerative agriculture (Shelef et al., 2017). According to the most serious attempt to estimate the value of wild edible plants, we are familiar with a range of about 30,000 edible plants globally (Food Plant Solutions, Bruce French), out of which we are commercialising merely 150 as crops (Sethi, 2015). Diversifying local production will help to foster more sustainable agroecosystems, create more efficient supply chains, and ultimately increase food security. The Mediterranean area was the cradle to some of the most important agriculture crops and practices (Gupta, 2004). Hundreds of Mediterranean plant species are classified as Crop Wild Relatives (Barazani et al., 2017), and many others are considered as protein rich plants, e.g. oaks

(Ozcan, 2006), and legumes (Barazani et al., 2008) such as *Lathyrus aphaca*, *Lotus edulis*, and *Pisum fulvum* (Krispil, 1983–1989;Dafni, 1985;Mayer-Chissick and Lev, 2014). Additionally, many of the wild annual greens that grow wild during the rainy season are edible and have a cultural history of being used as food and medicine (Mayer-Chissick and Lev, 2014). This suggests that the study of local plant crops, specifically in Israel and in the Mediterranean region, has great potential to support sustainable agriculture. The Malvaceae family includes over 4000 species many of which are of economical and agricultural importance such as cotton (*Gossypium spp.),* kenaf (*Hibiscus cannabinus*), cacao (*Theobroma cacao)* and Okra (*Abelmoschus esculentus).* Of these, 32 species are found wild in Israel including several edible species. The generic term for these edible plants, "*Hubeza*," comes from the Arabic word "Hubez," meaning bread. It is not surprising that "Halamit" (*Malva spp.*) and "Maog" (*Lavatera spp.*) have a rich history in local culinary culture. Perhaps the earliest mention dates back to the third century in the Jewish oral law, the Mishnah (Mishnah Kil'ayim 1:8). *Malvaceae paviflora* (one of the wild species in Israel) exhibits anti-inflammatory and antioxidant activity (Bouriche et al., 2011). However, there is little research documenting the nutritional value *M. paviflora* and related *Hubeza.* Barros et al. (2010) examined the nutritional and pharmaceutical value of *M. sylvestris*, also found in Israel. Their findings supported reports on the benefits of *M. sylvestris* as a nutritious additive to the diet (Guarrera, 2003), using fresh or boiled leaves, and green fruits (Neves et al., 2009) without any apparent adverse effects, even when high levels of nitrates were a concern (Hanningtonkiff, 1984).

This study evaluates several nutritional aspects of *Hubeza spp.* focusing on minerals: N, P, K, Fe, Cu and Na. This was accomplished through the sampling, drying and analysing wild leaves of individual plants in several populations, and comparing it to commercially-grown green leaves. We seek to confirm if *Hubeza spp.* holds nutritional significance for it to be foraged commercially or grown as a food crop.

MATERIALS AND METHODS

Sample collection. We collected fresh *Hubeza* leaves (*M. nicaeensis* and *L.cretica*), at January - February 2019. For clarification – at this stage we could not differentiate between the two species, as the main distinguishable difference is the characteristics of the flowers and microscopic morphology of the leaf epidermis. A total of 51 *Hubeza* individuals were sampled from three locations in Israel: Moshav Bnei Re'em (31°46'N 34°47'E), Kibbutz Hagoen (32°21'N 34°55'E), and the Volcani Institute in central Israel (31°59'N 34°49'E). Additionally, a single sample of *M. nicaeensis* was harvested along with five other edible greens in a cultivated field at Sandala, North Israel (32°31'N 35°19'E). The list of focal species include therefore the following seven species: *Hubeza*, *M. nicaeensis, Spinacia oleracea, Cichorium endivia L., Tetragonia tetragonioides, Beta vulgaris L.,* and *Rumex sp.* We kept the leaves in a cooler to prevent fungal infestation.

Phytochemical analysis of elements in the leaves. Leaves were harvested at the base of the leaf, not including the petiole, massed for fresh weight (FW) and dried in an oven (60ºC for 72 hours). Dry samples were weighed again to determine dry weight (DW) and water content (WC) then ground into a powder using an electric grinder. 100mg of each sample dried powder was used for macro- and micro- element analysis. Macroelements (N, P, K) were analysed using protocol for digestion by sulfuric acid (H_2SO_4) in digestion glass tubes using a heat block (Bar-Tal et al., 2004). Digestion was completed at 250 ºC for 30 minutes, samples were stirred and digestion continued for another 30 minutes before addition of H_2O_2. The resulting extracts were diluted with 98 ml distilled water to make 100 ml solution. Nitrogen (as NH_4^+) and Phosphorus were analyzed in automated discrete photometric nutrient analyzer (Gallery^{TM} Plus, Thermo Fisher Scientific). The values for NH_4^+ were multiplied by 0.77 to get values for total N (National Center for Biotechnology Information). Protein was estimated by multiplying N concentrations by a factor of 6.25 (Mariotti et al., 2008). These extracts were also used to test Potassium and Na using a Flame Photometer (Model 410 Flame Photometer produced by Sherwood Scientific Ltd, Cambridge, UK). Additional elements were analyzed using protocol for digestion by nitric acid using a heat block (Zarcinas et

al., 1987). After digestion, the samples underwent specific elemental analysis using an atomic absorption spectrometer (Perkin-Elmer Analyst 400, Norwalk, Conn.).

Data analysis. The probability of fit to normal distribution was tested by overview of residuals plots and Shapiro–Wilk test. In the case of a Gaussian distribution, the means of the treatments were compared by a simple T-test. The datasets deviating from normal distribution were compared by a non-parametric multiple comparison tests after Wilcoxon to locate the differences. We refer to a *P* value ≤0.05 as statistically significant. All the statistical analysis performed by R open source (Team, 2019).

RESULTS AND DISCUSSION

First, we present here typical images of the *Hubeza* plants - *M. nicaeensis*, and *L.cretica* (Fig. 1). The photos are illustrating how similar the species appear in the field before bloom, suggesting that when harvested wild – several species are highly likely to mix. This likelihood is justifying the generic use of "*Hubeza*" as the target of this study, rather than identified Malvaceae species in controlled conditions. At the time of sampling, specific *Hubeza* species could not be identified. Second, represented in photos are seven species that were studied in this research: we compared wild *Hubeza* plants to six species, used as a comparable resource for commercially grown green edible leaves (Fig. 2).

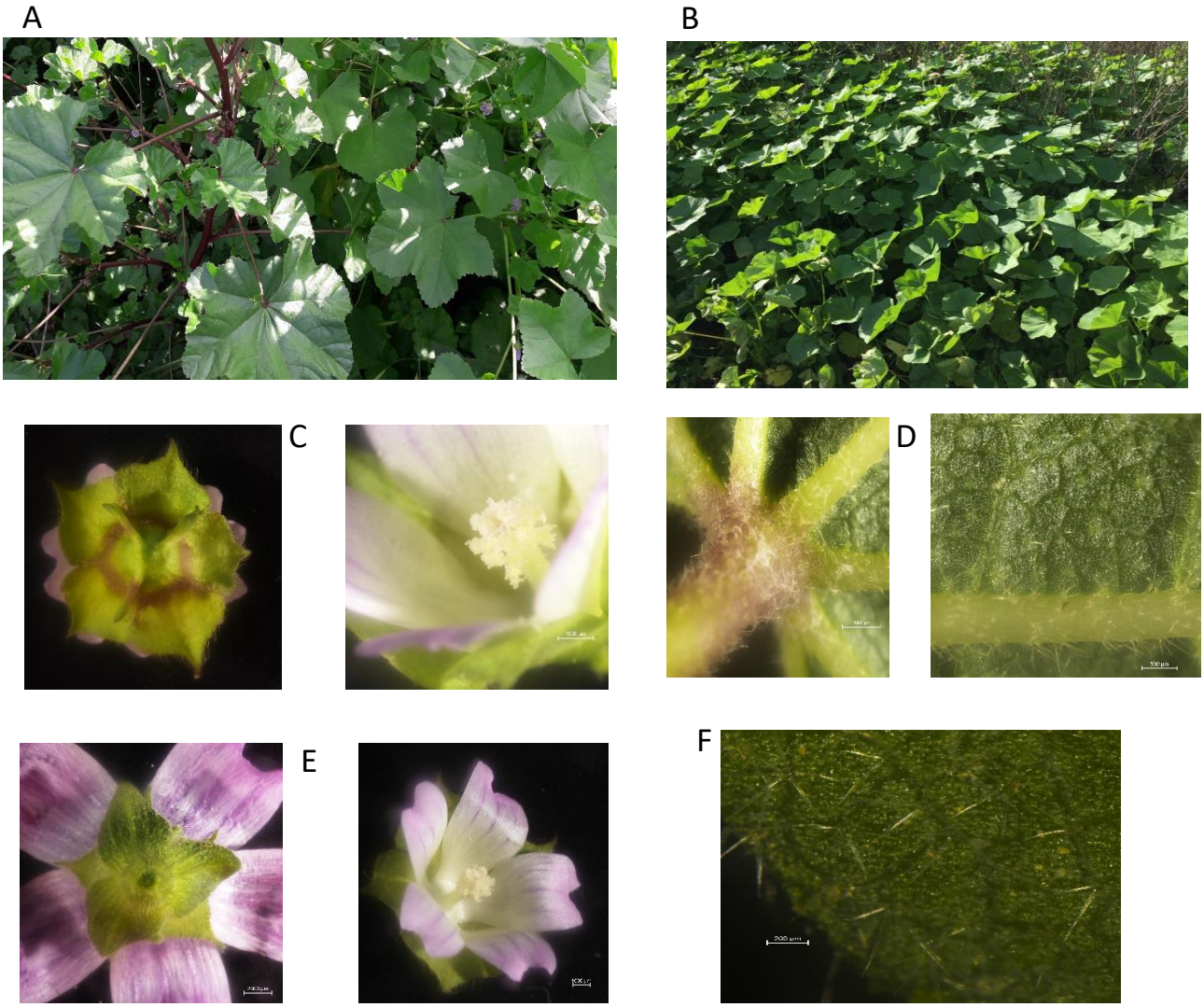
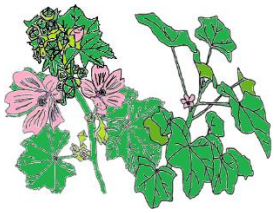


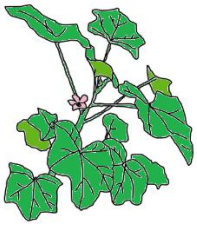
Figure 1. Green *Hubeza* leaves - *M. nicaeensis* and *L.cretica*. A) Mature blooming shoots of *M. nicaeensis* (left, redish stem) and *L.cretica* L. (right, green stem); B) Wild *Hubeza* patches, ruderal plantation; C) *M. nicaeensis* flowers (note the 3-part narrow epicalyx)*;* D) *M. nicaeensis* leaf surface; E) *L.cretica* flowers (note the 3-part wide joined epicalyx); F) *L.cretica* leaf surface.

Hubeza
(Malva nicaeensis and
Lavatera cretica)





Malva nicaeensis
cultivated in the field



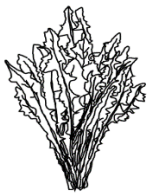


Beta vulgaris
(Wild beet)





Cichorium endivia





Rumex sp.
(Harvested wild, near
the cultivated field)





Spinacia oleracea
(Turkish spinach)





Tetragonia
tetragonioides
(New Zealand spinach)





Figure 2. Green edible leaves grown in a commercial small farm in Israel. Photos taken by Oren Shelef. The icons that we created illustrate each species as a visual morpho-type – we used these illustrations in figure 3.

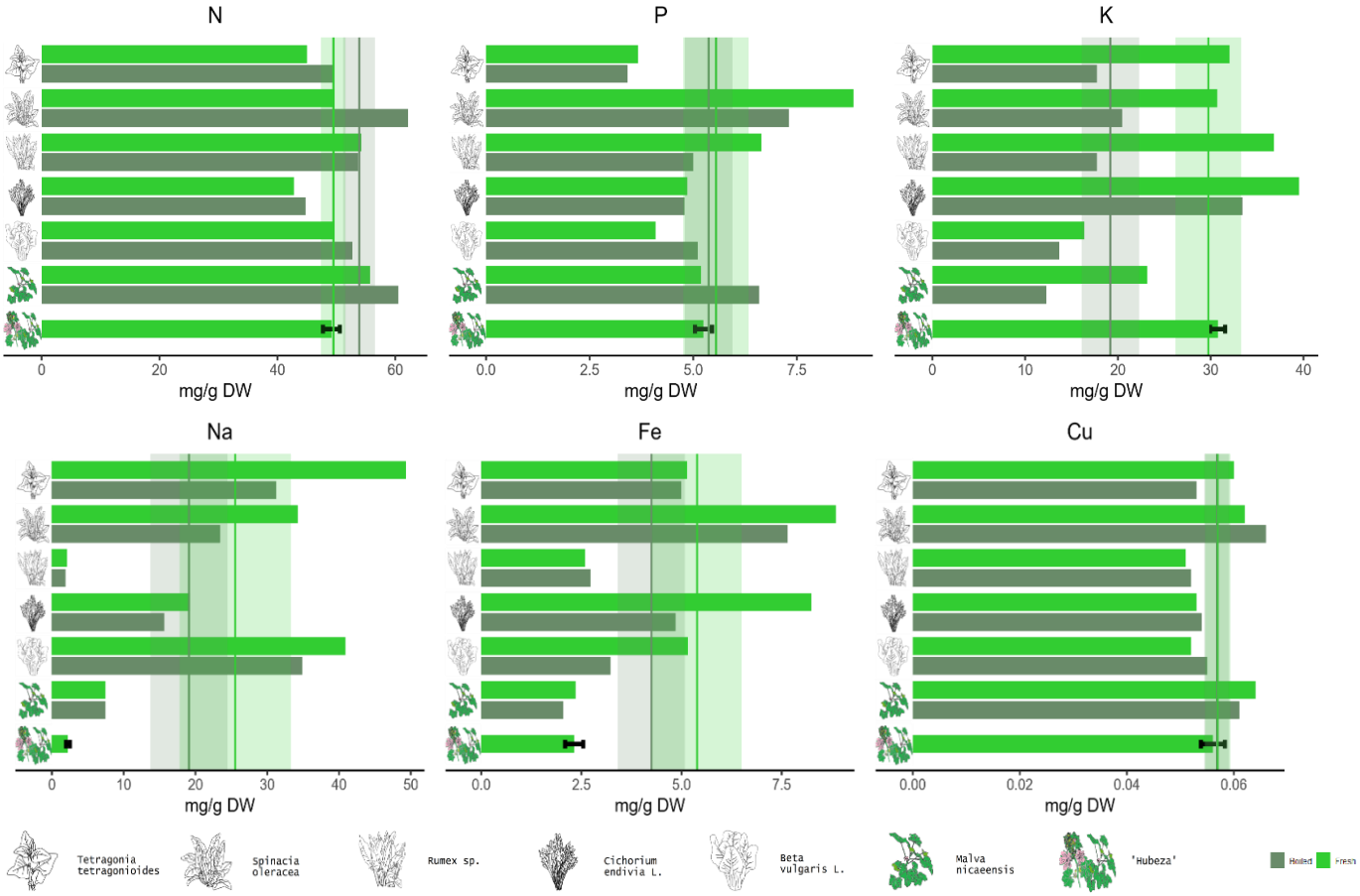


Figure 3. Concentrations of nutrients found in wild *Hubeza* are compared to those found in six species of cultivated green leaves. Horizontal bars represent the values per each species. Concentrations are all given in mg per gram dry weight (DW) of the sample. Green bars represent dried fresh leaves. Grey bars denote material dried from fresh leaves, which were soaked in boiled water for 10 minutes, to demonstrate the common practice for using green leaves in the kitchen. Vertical pale bars represent the average ± standard error of the 6 species of green cultivated greens (n=6, one sample per species). *Hubeza* leaves are represented with error sign, denoting ± standard error (n=51).

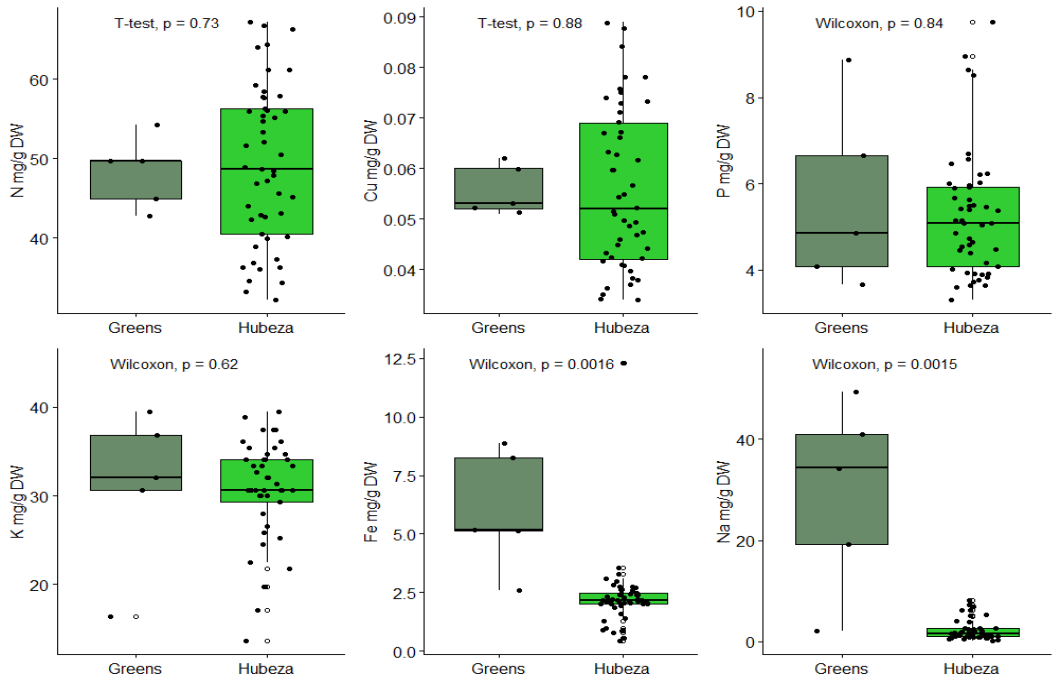


Figure 4. Difference between concentrations of nutrients (mg/g DW) found in *Hubeza* as compared to cultivated green leaves presented in a boxplot graph. Statistical tests and their *P* values, which were carried out based on the nativity of the residuals, mentioned at the top of each plot. "Greens" include 5 green leaves from the field, *M. nicaeensis* excluded. "Hubeza" include 51 accessions of wild populations of *M. nicaeensis* and *L. cretica*.

The average percentage of N, P, K, and Cu in the dry weight of *Hubeza* did not significantly differ from the averages of the cultivated greens (Fig. 3,4). Results show that the Na concentrations in *Hubeza* were significantly lower than all other greens, suggesting that Na is not accumulated extensively in *Hubeza* leaves. While this trait is advantageous for human nutrition, it may reveal that *Hubeza* are not tolerant to saline conditions, and this should be taken into account when planning for cultivation, irrigation, and fertilization. Na is desired in smaller amounts and *Hubeza* contains less than a fourth of the cultivated greens tested. The average Fe in *Hubeza* leaves was only half as much as the average among the other greens, 0.24% Fe by dry weight versus 0.54% Fe average. However, the percent by fresh weight was nearly the same (0.047% vs 0.042%). The results for the single known sample of *M. nicaeenis* was consistent with these averages for Fe in *Hubezah*. As the cultivated *Malva nicaeensis* showed a similar low level of Fe, this may suggest that *Hubeza* is not rich in Fe in comparison to other green leaves. This, however, should be measured in controlled conditions, with calculation of mass balance, and yield per area, to get a clearer conclusion. High levels of N in the leaves of a nitrophilic plant, may translate into high levels of nitrates, which are known as anti-nutritive to humans, and at some thresholds detrimental to herbivores (Vermunt and Visser, 1987;Barros et al., 2010). Multiplying the N levels of *Hubeza* by a 6.25 factor (Mariotti et al., 2008) results in high protein levels with an average of 60.8±2.0 mg/g FW, or 306.5±8.8 mg/g DW. These high levels of estimated total protein may be an overestimation driven by the high levels of non-protein N. however, if we consider the protein levels as reliable, *Hubeza*'s N content translates into 6 g Protein per 100 g of fresh leaves. This means that a large 50 g bunch (1-2 handfuls) of *Hubeza spp.* leaves would satisfy 6% of the 50 g recommended daily protein consumption (Protein, FDA Factsheet). *Hubeza* had about 25% more P than *Spinacia oleracea*, the leader in P among the culitvated greens. The average K was similar to the other greens tested, and 30g serving of leaves would still supply 78% of an adults recommended daily consumption (FDA vitamin and mineral chart). The concentration of Cu in *Hubeza*, which is an antioxident and helps metabolize the Iron, also surpasses or equals to the other greens in

concentration (FDA vitamin and mineral chart). According to the recommended daily intake values provided by the FDA, 100 g fresh *Hubeza* provides 12% protein, 10% P, 260% K, 264% Fe, 55% Cu, and 1.7% Na (FDA vitamin and mineral chart). This supports *Hubeza*'s nutritional importance. *M. nicaeenis* showed higher levels for N, protein, and Cu than the other greens. A bunch of *M. nicaeenis* boasted 41 mg Protein per g of fresh weight, higher than the others but lower than the 60.8 mg average for *Hubeza*. *M. nicaeenis* was also among the highest in other nutrients: second to *Spinach* in Phosphorus, third to *Cichorium endiva* and *Rumex sp.* in Potassium. It was second to last in Iron and Sodium. The inconsistent variance in *Hubeza* values could be explained by the manner of sampling wild populations. The sample size for the cultivated greens was much smaller than that of *Hubeza*. Additionally the *Hubeza* leaves were harvested individually from wild plants and the cultivated greens were tested as received from the farmer in bunches including stems. As such, the fresh water weight of the stem was included for the greens but not in the *Hubeza* leaves. However, since most nutrients are concentrated in the leaves, the dry weight needs to be considered as well. Our results for fresh *Hubeza* and Spinach (*Spinacia oleracea*) were higher in all aspects than the results recorded for fresh raw spinach from the USDA National Nutrient Database for Standard Reference. Our results show that in comparison to other commercially grown green leaves *Hubeza* have sufficient nutritional potential to be considered as a food crop.

CONCLUSIONS AND FUTURE ASPECTS

The nutrient results observed for *Hubeza* were comparable to similar greens grown for culinary uses making it a very good candidate for a food crop. Additionally, the nutrient analysis of the dried *Hubeza* leaf may support its use as a health supplement (leaf powder). To complete the examination of Malvaceae leaves as a novel food crop, it's important to add more nutrition factors analysis, including other minerals as Ca and Mg as well as vitamins, anti-oxidants, polyphenols, and amino-acids. It is also important to examine for anti-nutrients such as oxalate and nitrate. High concentrations of nitrates could have detrimental effect on cattle, so the impact of nitrophilic plants should be taken into account. In the future we will conduct open field experiments to test its viability to be grown in classical agricultural settings. Based on preliminary experiment, we suspect that Malvaceae has dormant seeds, hence the first agronomic aspect which we are planning to test is the propagation barrier. We will test for the optimal conditions for seed sprouting temperature, and dormancy removal techniques. Finally, we will grow the plants in a open field experiment to test the plausibility of growing green leaves of specific Malvaceae sp. for commercial use.

ACKNOWLEDGEMENTS

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REFERENCES

Allen, P., Van Dusen, D., Lundy, J., and Gliessman, S. (1991). Integrating social, environmental, and economic issues in sustainable agriculture. *American Journal of Alternative Agriculture***,** 34–39.

Bar-Tal, A., Yermiyahu, U., Beraud, J., Keinan, M., Rosenberg, R., Zohar, D., Rosen, V., and Fine, P. (2004). Nitrogen, phosphorus, and potassium uptake by wheat and their distribution in soil following successive, annual compost applications. *Journal of Environmental Quality* 33**,** 1855-1865.

Barazani, O., Mayzlish-Gati, E., Lifshitz, D., Hadas, R., Keren-Keiserman, A., Golan, S., Faraj, T., Singer, A., Beerman, A., and Perevolotsky, A. (2017). Strategies and priorities in field collections for ex situ conservation: the case of the Israel Plant Gene Bank. *Genetic Resources and Crop Evolution* 64**,** 1-5.

Barazani, O., Perevolotsky, A., and Hadas, R. (2008). A problem of the rich: Prioritizing local plant genetic resources for ex situ conservation in Israel. *Biological Conservation* 141**,** 596-600.

Barros, L., Carvalho, A.M., and Ferreira, I.C.F.R. (2010). Leaves, flowers, immature fruits and leafy flowered stems of Malva sylvestris: A comparative study of the nutraceutical potential and composition. *Food and Chemical Toxicology* 48**,** 1466-1472.

Bouriche, H., Meziti, H., Senator, A., and Arnhold, J. (2011). Anti-inflammatory, free radical-scavenging, and metal-chelating activities of Malva parviflora. *Pharmaceutical Biology* 49**,** 942-946.

Dafni, A. (1985). *Edible plants of the land of Israel.* Tel-Aviv (Hebrew): The Society for the Protection of Nature in Israel.

Guarrera, P.M. (2003). Food medicine and minor nourishment in the folk traditions of Central Italy (Marche, Abruzzo and Latium). *Fitoterapia* 74**,** 515-544.

Gupta, A.K. (2004). Origin of agriculture and domestication of plants and animals linked to early Holocene climate amelioration. *Current Science* 87**,** 54-59.

Hanningtonkiff, J.G. (1984). Poisonous Plants in Britain - and Their Effects on Animals and Man - Cooper,Mr, Johnson,Aw. *Lancet* 2**,** 556-556.

Krispil, N. (1983–1989). *Bag of plants (Hebrew).* Jerusalem: Yerid Hasefarim.

Mariotti, F., Tome, D., and Mirand, P.P. (2008). Converting nitrogen into Protein - Beyond 6.25 and Jones' factors. *Critical Reviews in Food Science and Nutrition* 48**,** 177-184.

Mayer-Chissick, U., and Lev, E. (2014). " Wild edible plants in Israel tradition versus cultivation. ," in *Medicinal and Aromatic Plants of the Middle-East,* eds. Z. Yaniv & N. Dudai. (Dordrecht: Springer), 9-26.

Neves, J.M., Matos, C., Moutinho, C., Queiroz, G., and Gomes, L.R. (2009). Ethnopharmacological notes about ancient uses of medicinal plants in Tras-os-Montes (northern of Portugal). *Journal of Ethnopharmacology* 124**,** 270-283.

Ozcan, T. (2006). Total protein and amino acid compositions in the acorns of Turkish Quercus L. taxa. *Genetic Resources and Crop Evolution* 53**,** 419-429.

Sethi, S. (2015). *Bread, Wine, Chocolate: The Slow Loss of Foods We Love.* New York: HarperCollins.

Shelef, O., Fernández-Bayo, J. D., Sher, Y., Ancona, V., Slinn, H., & Achmon, Y. (2018). "Elucidating Local Food Production to Identify the Principles and Challenges of Sustainable Agriculture," in *Sustainable Food Systems from Agriculture to Industry* ed. C.M. Galanakis. 1st ed (London, United Kingdom: Elsevier Inc.), 47-81.

Shelef, O., Weisberg, P.J., and Provenza, F.D. (2017). The Value of Native Plants and Local Production in an Era of Global Agriculture. *Frontiers in Plant Science* 8.

Team, R.C. (2019). R: A language and environment for statistical computing.

Vermunt, J., and Visser, R. (1987). Nitrate Toxicity in Cattle. *New Zealand Veterinary Journal* 35**,** 136-137.

Zarcinas, B.A., Cartwright, B., and Spouncer, L.R. (1987). Nitric-Acid Digestion and Multielement Analysis of Plant-Material by Inductively Coupled Plasma Spectrometry. *Communications in Soil Science and Plant Analysis* 18**,** 131-146.

(ORAL PRESENTATION)

An Assessment of Livestock Breeding and Livestock Production in Turkey

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Abstract
Human nutrition should be composed of a balanced daily intake of glutens, vitamins and proteins. In contrast to gluten and vitamins, proteins can be retrieved only from animal based products. Accordingly, bovine breeding and poultry are important to secure protein requirements of societies. With changing climatic conditions and declining interest to maintain livestock breeding, the supply has been in declination recently which corresponded to rising consumer prices in Turkey. Within this study, it was aimed to measure the impact of prices of animals per head and changing milked or slaughtered animal stocks on the supply of main outputs of animal breeding, milk and meat. The findings of supply response analyses of meat and milk supplies for the years between 2001 and 2017 indicated that price mostly affects supply in the long term as the breeder can change the aim of keeping animals. Yet, short term impact is also visible, despite being lower. However, the analyses showed us that most of the fluctuation in supplies is related with non-price factors. Analysis interrelated with sector supports and international trade is essential for proper inferences specifically for milk supplies. This is related with the input characteristics of milk for the food industry.

Keywords: livestock breeding, milk, meat, producer, supply response, Nerlove, Turkey

1. INTRODUCTION AND OBJECTIVE OF THE STUDY

Turkey has geographical advantages in animal breeding and production of animal-based products. Especially, the meat and milk products are both essential for daily nutrition of the society and economic wealth of animal breeders, which affects sustainability of animal breeding. So, breeding and slaughter of animals and producing animal based products are important for health of the society and economic sustainability. Livestock breeding is essential in balanced diet of livelihoods, increasing national income via meat, milk, textiles and pharmaceutical sectors. Providing inputs to these sectors is important for agriculture based industrialisation and assisting economic growth and development via reducing imports and increasing exports. Besides, with its high value added, livestock breeding is important to keep rural population in the rural areas and reducing unemployment both in urban and the rural area as well (Simsek, 2018; Saygin and Demirbas, 2017; Karagoz, 2009).

Adequate and balanced diet maintenance is important as mentioned and people need to consume protein-based products to maintain a good diet. Animal-based products are the only source of proteins. To consider the situation of Turkish consumers, protein intake of livelihoods in comparison with other parts of the world should be noted. As demonstrated in Table 1 with reference to 2013 figures (Anonymous, 2019a), share of animal based protein intake in Turkey is lower than the world average and only higher than the African countries. However, the total amount

of protein intake is almost 30 % more of the world average in grams. Yet, this is a sign of vegetative protein intake, which does not promise a balanced diet.

Table 1. Per capita protein consumption per person per day – 2013 averages

Country	Vegetative	Animal Based	Total	Share of Animal Based (%)
The EU	43	60	104	58
The USA	40	70	110	64
African Countries	53	16	69	23
The World	49	32	81	40
Turkey	72	36	108	34

Source: FAO (Food and Agriculture Organization) – Anonymous, 2019a

Considering the climatic effects and lack of intention to deal with livestock breeding, there appeared declination in number of animals, which brought reduction in production and consumption of animal based products in Turkey (Semerci and Celik, 2018). This mainly affected the sector from 1994 to 2009. The lack of public interest in rural activities and limited supports leaded to reduction in livestock breeding. With rising supports number animals bred had reached the level of 1994 by 2013. However, this did not reflect to supplies of animal products directly (Semerci and Celik, 2018).

Besides, unorganised structure of the sector, considering producers, wholesalers and marketers, is similar for animal production as vegetative production. In addition, high dispersion in milk production facilities, low quality, instability of prices corresponding to increasing costs, lack of registered production and animal diseases are the other factors affecting sustainability and improvement of animal breeding (Anonymous, 2019b).

Mainly, there are many reasons affecting rising food prices. The most important cause can be considered as climatic changes and resulting supply losses. Besides, cost accounts as input prices (energy, human power, feeds, etc.), transportation and sheltering results in sector-leaving breeders. Limited vaccination and animal care deficiencies especially in regions where livestock breeding is an essential activity, leads to reduction in animal and animal based product supplies (Turan et. al, 2017; Kiymaz and Sacli, 2008). In a study conducted to measure profitability of dairy farms in TRA1 region (Erzurum, Erzincan and Bayburt), it was understood that profitability had declined due to rising costs, especially the feeding costs (Askan and Dagdemir, 2016).

Departing from these facts, it was intended to evaluate the factors affecting meat and milk supplies in Turkey. Meat and milk, being the main outputs of animal breeding, get affected from stocks, prices, supporting systems and periodic impacts. Therefore, it was aimed to measure the effect of price and non-price factors on main outputs, meat and milk, of livestock breeding in Turkey between 2001 and 2017.

The objectives:

- To search inter-period effects of price on meat and milk supplies with a macroeconomic perspective,
- To analyse and interpret supply response of meat and milk to own prices and measure short and long term elasticities.

2. ANIMAL BREEDING AND MEAT AND MILK SUPPLIES IN TURKEY

With its environmental and cultural advantages, Turkey resides on cattle, sheep and goat breeding in terms of animal breeding. These animals are the main source of meat, milk and milk products' supplies. There exists pig and camel breeding interrelated with meat production as well, but number of animals bred and amount of meat supplied are limited. Yet, buffalo ranks the fourth in bovine availability. Considering the share of cattle, sheep and goat, it is important to observe the change in stocks as demonstrated below.

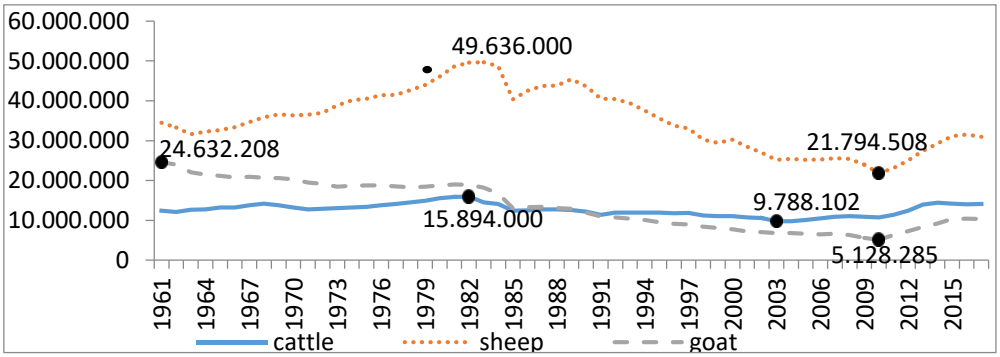


Figure 1 Animal presence of Turkey (1961-2017) - Anonymous, 2019a

There observed a relatively less fluctuation in absence of cattle, when compared with sheep and goat due to FAO data. The highest number of cattle was reached in 1982 with 15,981 million, while there were 49,636 million sheep in 1983. The steady declination was drastic for goat presence that 24,632 millions of goats declined to 5,128 million in 2010. By 2010 for sheep and goat and by 2004 for cattle, a rising trend had appeared again.

When the share of slaughtered number or animals with reference to animal stock was considered, around one out of five sheep and goats and one out of four cattle were slaughtered in Turkey from 2001 to 2017, with a steady trend. In addition, the change in the amount of meat produced is another frame to be considered.

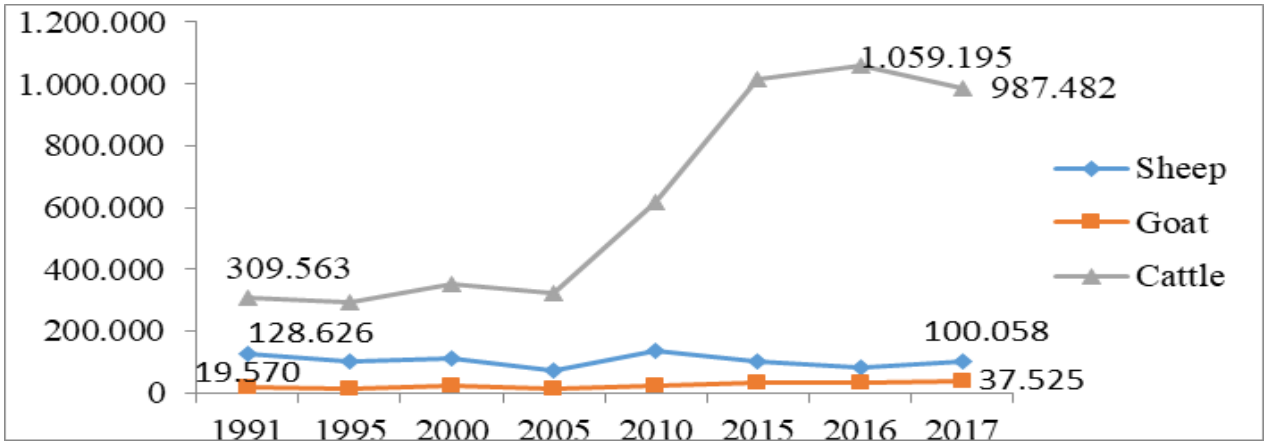


Figure 2 Amount of meat supplied in Turkey for selected years (in tonnes) - Anonymous, 2019a

Checking out these figures, it can be noted that, the meat supplied out of cattle has been rising, while sheep and goat meat was steady from 1991 to 2017. When the number of slaughtered animals and meat supplies was cross compared, the parallel movement can be observed. However, while the maximum number of sheep was slaughtered in 1991, the amount of meat was highest in 1998. Besides, 2009 was the year when minimum number of cattle was slaughtered while amount meat production was rising. These figures correspond to the rising yield per animal accordingly.

In addition, when the meat and milk supplies were overviewed since 2001, irrespective of the variety of animal, it was understood that the amount of meat produced had risen by 79 % from 2001 to 2010, while there was a declination in the speed from 2010 to 2017 with 44 %. On the other hand, milk supplies had risen by 43 % in the first ten years, which was followed by a rise with 53 %. This can be noted as the rising milk yield in opposition to declining meat yield. Or else, the food industries using milk as an ingredient can be considered as developing with a higher speed (Anonymous, 2019a).

Table 2. Development of meat and milk supplies (2001-2017)

YEARS	Meat (Tonnes)	Milk (Tonnes)
2001	435.778	9.495.550
2010 - Q	780.718	13.543.674
2010 - %	79 %	43 %
2017 - Q	1.126.403	20.699.894
2017 - %	44 %	53 %

Source: FAO (Food and Agriculture Organization) – Anonymous, 2019a

Following the production and supplies, reviewing the international trade of bovines is also essential. With respect to data retrieved from TURKSTAT (Anonymous, 2019c) ratio of exports to imports were calculated for different varieties between 2002 and 2019. In order to meet import demand for a country, the ratio is expected to be more than 100 %, referring to a positive Terms of Trade. Both for stud and non-stud cattle, Turkey's imports were considerably higher in Dollars. As an instance export revenue for stud and non-stud cattle was almost 2 million Dollars, while imports were 110 million Dollars in 2014. Even though the situation is better for sheep, export revenue exceeded import expenditures only in 2015. In 2018, exports were 2,68 million Dollars, corresponding to 62,54 million Dollars of imports. The situation is the same for goat trade. This data demonstrates that Turkey is not a self-sufficient country in terms of animal and animal products trade. In other words, domestic demand is much higher than the supplies.

Departing from this brief background information, it is essential to consider which factors influence breeding of animals and production of animal products. Or else, can price affect production supplies considerably, or are there different indicators. Considering these, the factors affecting meat and milk supplies, irrespective of the animal variety, was assessed for Turkey.

3. MATERIAL AND METHODOLOGY

Main methodological framework to evaluate the impact of price and non-price factors on product supplies can be acknowledged as the Nerlovian supply response mechanism (Nerlove, 1958). This method refers to measuring responsiveness of amount of production to various factors with utilisation of time series data and this method is eligible for competitive market settings. The onset of the methodological equation is as following (Nerlove 1958; Ozkan et al. 2011).

$$Q_t^* = a + bP_t^* + cZ_t \quad (1)$$

$Q_t^* = level\ of\ output\ for\ time\ t$

$P_t^* = expected\ real\ price\ for\ time\ t$

$Z_t = non - price\ exogenous\ variables$

Before proceeding, it is essential to consider specific characteristics of agricultural production. Irrespective of animal or vegetable production, it is easy to note that reacting against changing market conditions requires more time than other sectors. There is a time gap between production decision and production and marketing of the products. Accordingly, we do not expect a supply reaction to change in market prices immediately. Accordingly, planning for animal breeding and producing meat and/or milk out of the bred animals require time-based follow up of the market challenges. In other words, animal breeding decisions cannot be given for short term. However, slaughtering or milking decisions can be changed due to price and non-price fluctuations. Yet, in any terms, the breeder, as well as the vegetable producer, should plan for market expectations and should be well acknowledged on past prices (Ozkan et al. 2011, Tripathi and Prasad 2009).

Besides, not a lot of producers decide to shift between products year after year as every crop needs different approaches and knowledge. Therefore, the decision is also related with the amount produced in the recent periods. Our main question is 'by how much?' This query refers to the elasticity interpretation of the production with respect to price and previous stocks. Therefore, the following final form of the supply equation needs to be estimated and analysed with respect to

adaptive expectations. The estimation output would provide us with the ability to comment on short term and long term elasticities of supply (Tripathi and Prasad 2009).

$$Q_t = a_0 + a_1 P_{t-n} + a_2 Q_{t-n} + a_3 Z_t \quad (2)$$

At this phase, it is also essential to comment over the data characteristics and required methodological adjustment for time series data. For time series estimation, using the data on level would lead to inappropriate elasticity estimates due to afore mentioned data characteristics of agricultural supplies. Accordingly, the data needs to be adjusted with implementation of Error Correction Model (ECM) (Granger 1981; Engle and Granger 1987). ECM would lead proper interpretation of short term supply response for consecutive data (Granger 1981). This is achieved with determination of a lag length explaining time dependence of the data and estimating lagged equation which is called as autoregressive distributed lag model augmented and it is a modified version of a stable long-run relationship of the variables (Ceylan et al., 2018; Mohammed et al. 2007; Banerjee et al. 1998). Therefore, the linear adjustment of the equation with addition of the error terms, including information on time characteristics of the data was demonstrated below.

$$Q_t = a + bP_t + u_t \quad (3)$$

$$\Delta Q_t = a + b\Delta P_t + cu_{t-n} + u_t \quad (4)$$

$$\Delta Q_t = a_0 + b\Delta P_t - c(Q_{t-n} - a - bP_{t-n}) + u_t \quad (5)$$

$$Q_t = (a_0 + ca) + bP_t - bP_{t-n} + (1-c)Q_{t-n} + cbP_{t-n} + u_t \quad (6)$$

$$Q_t = (a_0 + ca) + bP_t + (1-c)Q_{t-n} + (cb - b)P_{t-n} + u_t \quad (7)$$

Here t is the year t and t-n refers to the time differenced price and quantity data. Also, n mainly refers to the time lag determined due to the linear relationship. However, considering agricultural and food products and the total data, it was decided to take time lag as 1. Accordingly, the supply functions estimated had taken the following form for both meat and milk supplies for Turkey between 2001 and 2017. The quantity supplied in tonnes for meat and milk were estimated against price and, previous supplies and changing number of animals bred as the main supply source of meat and milk. The final form of estimation was decided due to findings of normality tests and adjusted independent variables and inclusion of a trend variable was considered separately. Therefore, Q-stat and Jarque-Bera testing for normality assessment and ADF (Augmented Dickey Fuller) and LLC (Levin Lin Chu) testing for determining existence of time based unit roots were made prior to final estimation (Dickey and Fuller 1981; Levin–Lin–Chu 2002). In addition, the error terms of the long term supplies equation were checked with Johansen Cointegration test to determine potential of linear correction in the short term (Griffiths, 2008) and all procedures were made with E-Views 5 statistical program.

4. RESULTS AND DISCUSSION

4.1. Supply Response for Meat

To consider the relationship between amount of meat supplied and number of animals (bovines) slaughtered in addition to price per head, the data characteristics were overviewed. The data was understood not to be normally distributed due to findings of Jarque-Bera test applied for level and logarithmic transformation of the dependent and independent variables as demonstrated in Table 3.

Table 3. Normality of data for meat supplies (2001-2017)

	Q_{me}	P_{me}	Q_a
Jarque-Bera (ρ)	2,01 (0,37)	1,19 (0,55)	1,73 (0,42)
	$LogQ_{me}$	**$LogP_{me}$**	**$LogQ_a$**
Jarque-Bera (ρ)	2,04 (0,36)	1,68 (0,43)	0,89 (0,64)

The autocorrelation characteristics of data were measured via Q statistics following correlation coefficients that indicated non-stationarity. The test was made both for level and log transformed variables and first lag differenced form of the variables and findings were

demonstrated in Table 4. It was understood that, while the data is not stationary on level or after it is normalised by log transformation, the differenced data both on level and logged are stationary and can be used for analysis.

Table 4. Stationarity testing for meat supplies (2001-2017)

Q_{me}	$LogQ_{me}$	$D(Q_{me})$	$D(LogQ_{me})$
14,140 (0,00)	13,363 (0,00)	1,5180 (0,22)	2,0389 (0,16)
Q_a	$LogQ_a$	$D(Q_a)$	$D(LogQ_a)$
12,537 (0,00)	13,303 (0,00)	1,2841 (0,26)	1,6598 (0,2)
P_{me}	$LogP_{me}$	$D(P_{me})$	$D(LogP_{me})$
10,453 (0,00)	11,220 (0,00)	3,5440 (0,06)	1,8827 (0,17)

Afterwards, the existence of a unit root was checked with LLC and ADF tests. Test results for static equation demonstrated existence of common unit root for meat supplies and time effect seemed to be purified after taking the first difference of both dependent and independent variables.

Table 5. Individual and Common Unit Root Existence for Milk Supplies (2001-2017)

Level		Log		Difference on Level		Logged Difference	
LLC	4,31 (0,99)	**LLC**	1,80 (0,96)	**LLC**	-3,13 (0,00)	**LLC**	-3,11 (0,00)
ADF	3,42 (0,99)	**ADF**	2,21 (0,99)	**ADF**	-3,55 (0,00)	**ADF**	-3,53 (0,00)

Therefore, the long term and short term estimation of meat supplies were maintained with log transformation and via taking the difference of logged data. The long term estimates and main indicators were provided in Table 6.

Table 6. Long Term Estimates for Meat Supplies in Logged form (2001-2017)

Variable	Coefficient	t- stat (p value)	R^2	0,89
Constant	-10,511	16,93 (0,54)	**Mean Dependent Variable**	
$LogQ_{me}(-1)$	-0,095	-0,27 (0,78)	13,39	
$LogQ_a(-1)$	1,48	1,27 (0,22)	**F (p value)**	24,62 (0,00)
$LogP_{me}(-1)$	0,099	0,41 (0,69)	**Durbin-Watson Statistic**	
Time trend	0,039	0,78 (0,44)	1,98	

When the findings are interpreted, the variation in meat supplies explained with the relevant parameters was appeared as 90 %. It was understood from parameter estimate of time trend that 4 % of current meat supplies was determined by time. Long term price elasticity of the meat supplied in tonnes is 10 %. So, the price variation affects produced and sold amount of meat by 10 %. The short term price elasticity calculated was 9,1 %. Therefore, there is no significant difference between short and long term price elasticity of meat supply. However, the price dependency can be understood from the negative estimate of previous year's meat supply. If the amount of meat was high enough in the previous year, it can be noted that current meat supply is inversely affected due to declining prices. Previous year's number of bovines leads to rising amount of meat supplied. The negative sign of the constant refers to negative meat supplies or enforcement of imports without consideration of animal existence or price attributed to meat. Yet, short term supplies were expected to be estimated and Johansen cointegration test was conducted accordingly. The test statistic was -1,02 indicating the time dependence on 1 %. Accordingly, the impact of unexplained errors in the short term was confirmed and these error terms were included in the short term estimation results. The short term estimation results were demonstrated in Table 7.

Table 7. Short Term Estimates for Meat Supplies in Logged form (2001-2017)

Variable	Coefficient	t- stat (p value)	R^2	0,24
Constant	-0,007	-0,65 (0,95)	**Mean Dependent Variable**	
D(LogQ$_{me(-1)}$)	-0,42	-1,39 (0,19)	0,065	
D(LogQ$_a$)	2,15	1,21(0,26)	**F (p value)**	24,62 (0,00)
D(LogP$_{me}$)	0,23	0,58 (0,57)	**Durbin-Watson Statistic**	
D(error terms)	1,96-e7	0,58 (0,57	1,99	

The short term impact of the price is around 23 %. If the positive impact of estimated short-term price fluctuation was considered, it can be said that a rising price would lead more meat supplies. Yet, the unexplained spill-over is very low as understood from the low value of difference of errors. In opposition of 9-10 % impact of meat price per ton determined in the long run, the 23 % of short term effect can be read due to breeders' market view. In reality, bovines can be slaughtered in a few months watching the prices. Besides, short term positive price variation of sales per head would lead slaughtering decision easily. However, negative sign of the constant should be read as the producers' short term indifference between animal breeding objective as in slaughtering or keeping for the consecutive season. The determinative statistics enable us to conclude that the findings are reasonable for this short term evaluation.
Following interpretation of meat supplies, the milk supplies were overviewed as well.

4.2. Supply Response for Milk

The same methodological framework was watched up for meat supplie, for 2001 and 2017. The normality, stationarity and cointegration level of variables were tested and results are demonstrated below consecutively.

Table 8. Normality of variables for milk supplies (2001-2017)

	Q$_{mi}$	**P$_{mi}$**	**Q$_a$**
Jarque-Bera (ρ)	1,42 (0,49)	1,16 (0,56)	1,74 (0,42)
	LogQ$_{mi}$	**LogP$_{mi}$**	**LogQ$_a$**
Jarque-Bera (ρ)	1,02 (0,60)	0,69 (0,71)	1,68 (0,43)

Jarque-Bera test results indicated that neither dependent nor the independent variables were distributed normally. Following this non-normality detection, autocorrelation characteristics of the data was measured with Q-stats as demonstrated below.

Table 9. Stationarity testing for milk supplies (2001-2017)

Q$_{mi}$	**LogQ$_{mi}$**	**D(Q$_{mi}$)**	**D(LogQ$_{mi}$)**
13,40 (0,00)	13,47 (0,00)	0,35 (0,55)	2,06 (0,15)
Q$_a$	**LogQ$_a$**	**D(Q$_a$)**	**D(LogQ$_a$)**
12,54 (0,00)	13,30 (0,00)	1,28 (0,26)	1,66 (0,19)
P$_{mi}$	**LogP$_{mi}$**	**D(P$_{mi}$)**	**D(LogP$_{mi}$)**
10,43 (0,00)	11,16 (0,00)	3,06 (0,08)	1,69 (0,19)

As understood from the table, while the non-normal data on level and log were non-stationary, the data achieved stationarity characteristics after its one year lag was taken. Therefore, the differenced data on level and logged forms can be used for the rest of the analysis. Accordingly, the autocorrelation characteristics were measured and demonstrated in the below table with reference to LLC and ADF tests.

Table 10. Individual and Common Unit Root Existence for Milk Supplies (2001-2017)

Level		Log		Difference on Level		Logged Difference	
LLC	4,37 (0,99)	**LLC**	1,97 (0,97)	**LLC**	-3,25 (0,00)	**LLC**	-4,94 (0,00)
ADF	0,09 (0,99)	**ADF**	1,29 (0,99)	**ADF**	21,61 (0,00)	**ADF**	-29,01 (0,00)

Accordingly, first order autocorrelation was confirmed for milk supplies. Therefore, the static estimation was conducted with reference to logarithmic transformation of the data as it was the case for meat supplies. The coefficients were evaluated departing from these figures and the error terms of this relationship were assessed for cointegration relationship.

Table 11. Long Term Estimates for Milk Supplies in Logged form (2001-2017)

Variable	**Coefficient**	**t- stat (p value)**	**R^2**	0,98
Constant	12,22	3,65 (0,004)***	**Mean Dependent Variable**	
$LogQ_{mi}(-1)$	-0,37	-1,18 (0,26)	16,45	
$LogQ_a(-1)$	0,86	2,38 (0,04)**	**F (p value)**	109,25 (0,00)
$LogP_{mi}(-1)$	0,28	3,18 (0,004)***	**Durbin-Watson Statistic**	
Time trend	0,02	1,20 (0,26)	1,75	

** significant at 5 %; *** significant at 1 %

Looking at the figures, it was understood that 98 % of the variation was explained by the existing variables in the long term. However, the constant of the regression explains 75 % of the variation. So there should be other factors affecting milk supply, in addition to these indicators. Considering the worth of the industry using milk as an input, this is an expected situation. Yet, long term price elasticity of the milk supplied in tonnes is 29 %. So, the price variation affects produced and sold amount of milk by 29 % in the long term. It was understood that the previous year's number of bovines leads to rising amount of milk supplied. The short term price elasticity is 39 % and 2 % of current milk production was determined by time which may be interpreted as the impact of rising population. The higher short term response is interrelated with changing intermediaries and fluctuation in raw milk sales. Therefore, there appeared a different term related price response in milk supplies, which is in opposition with meat supplies.

In order to infer about short term relationship, the cointegration potential was checked via the error terms. The Johansen cointegration test indicated that unexplained effect of the previous year was significant at 1 % with -1,05 parameter estimate of the lagged error terms. So, the short term relationship could be estimated with regards to VEC methodology as well. The short term supply dynamics were demonstrated in Table 12.

Table 12. Short Term Estimates for Milk Supplies in Logged form (2001-2017)

Variable	**Coefficient**	**t- stat (p value)**	**R^2**	0,81
Constant	0,04	2,40 (0,04)	**Mean Dependent Variable**	
$D(LogQ_{mi(-1)})$	-0,19	-1,18 (0,26)	0,06	
$D(LogQ_a)$	0,73	3,63 (0,04)	**F (p value)**	10,97 (0,01)
$D(LogP_{mi(-1)})$	-0,014	-0,19 (0,85)	**Durbin-Watson Statistic**	
D(error terms)	0,76	4,17 (0,00)	1,92	

The unexplained spill-over seemed to be very high as the estimate indicated 76 % of timely impact. The short term impact of the price is below 1 %, with -0,014 parameter estimate, when time effect and non-classified impacts were considered additionally. Therefore, short term impact of prices was negative and low. This can be read as the breeders' preference on slaughtering animals rather than maintaining milking even if the price rises. This can be related with ageing of the animals and need for reproduction of the animal on this sense. This is also confirmed with the negative parameter estimate of milking animal supplies, while rise in number of animals lead to

rising milk supplies. The estimated variation is considerable with 81 %. However, most of the variation in milk supplies was not related with previous supplies, milk prices and changing animal stock. Accordingly, while the time effect in the long run is low with 2 %, the unexplained variation is high in the short term. And the short term price elasticity is considerably lower than that of long term. This is also related with the nature of animal breeding and purpose of breeding.

5. CONCLUSION

Before concluding, it is essential to note that the time series data used for the analysis is limited. However, the analysis was maintained in order to reach some insights on the sector. Mainly, the positive price elasticity of meat supplies per head of slaughtered animals is an awaited situation. There is no obvious difference between short term and long term elasticities. This is due to the fact that breeding decision especially for slaughtering is mostly a long-term decision. On the other hand, even if the long term price response for amount of milk produced is positive and similar with that of meat supplies, there appeared a negative elasticity for the short term even if the impact was very low. This outcome is mainly related with easy shift between milking or slaughtering and changing demand of the industry that use milk as an ingredient.

The negative effect of previous animal stocks on both milk and meat supplies also is in conformity with the characteristics of animal breeding sector. Even though there observed a rising trend in supports since the last 10 years, the supports seemed not to affect animal products supply in opposition to number of animals bred. Departing from these findings it was understood that the sector, especially milk production, should be analysed in depth with inferences on the sectors using milk and meat. Besides, the yield of error correction estimation for short term supplies indicated that there are other factors affecting the supplies besides price, previous stocks and timely changes. This is mostly valid for milk supplies with 76 % of variation explained by error terms. Considering the changing supporting schemes and status of interrelated industries as well as the fluctuating foreign trade balances for bovines and milk and meat, this non-price impact is understandable. This outcome also leaded us to consider in-depth analysis of the sector once more.

Consequently, the findings of the analyses residing on a short time frame indicated the need to increase data based knowledge on the sector both for Turkey and comparable countries. Mostly, field level studies measuring the changing conditions of the sector would lead more proper policy indications. However, existing analyses findings emphasized the role of prices for the long term especially in increasing the supply of milk and meat.

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REFERENCES

Anonymous, 2019a. FAO (Food and Agriculture Organization), http://www.fao.org/faostat/en/#data, retrieved on 10.07.2019.

Anonymous, 2019b. Milk Report 2018, Chamber of Agricultural Engineers, http://www.zmo.org.tr/genel/bizden_detay.php?kod=31590&tipi=17&sube=0, retrieved on 10.07.2019

Anonymous, 2019c. TUIK (Turkish Statistical Institute), https://biruni.tuik.gov.tr/disticaretapp/disticaret.zul?param1=21&param2=0&sitcrev=0&isicrev=0&sayac=5802, retrieved on 10.07.2019.

Askan, E., Dagdemir, V. (2016). TRA1 Düzey 2 Bölgesinde Destek ve Teşvik Alan Süt Sığırcılığı İşletmelerinde Süt Üretim Maliyeti ve Karlılık Durumu (Milk Production Cost and Profitability in Dairy Cattle Farms Supported and Encouraged in TRA1 Level 2 Region). Tarım Ekonomisi Araştırmaları Dergisi, 2(1), 1-12 (Journal of Agricultural Economics Research, 2 (1): 1-12). retrieved from http://dergipark.org.tr/tead/issue/22253/238850

Banerjee, A., Dolado, J.J., Mestre, R. (1998). Error-Correction Mechanism tests for cointegration in a single equation framework. Journal of Time Series Analysis 19(3), 267-283.

Ceylan, R.F., Ilbasmis, E., Ozkan. B., (2018). Is price significant in planning for sugar beet production? An example from Turkey. Mediterranean Agricultural Sciences, 31(2), 117-122. Retrieved from https://doi.org/10.29136/mediterranean.396526

Dickey, D.A., Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49(4), 1057-1072.

Engle, R.F., Granger, C.W.J. (1987). Cointegration and error correction: representation, estimation and testing. Econometrica, 55(2), 251-276.

Granger, C.W.J. (1981). Some properties of time series data and their use in econometric model specification. Journal of Econometrics, 16(1), 121-130.

Griffiths, W.E., Hill, R.C., Lim, G.C. (2008). Using EViews for Principles of Econometrics. Wiley Int. 5th ed. pp.878.

Johansen, S. (1988). Statistical analysis of cointegrating vectors. Journal of Economic Dynamics and Control, 12(2-3), 231-254.

Karagoz, H. (2009). Türkiye'de ve Konya'da hayvancılık sektörü, sektörün sorunları ve çözüm önerileri. (Animal Breeding Sector in Turkey and Konya, Problems of the Sector and Solution Recommendations) Konya Ticaret Odası, Etüd Araştırma Servisi, Konya.

Kiymaz, T. Sacli, Y. (2008). Tarım ve Gıda Ürünleri Fiyatlarında Yaşanan Sorunlar ve Öneriler (Problems and Solution Recommendations in Prices of Food and Agricultural Products). Devlet Planlama Teşkilatı Yayın ve Temsil Dairesi Başkanlığı Basım Şube Müdürlüğü Yayınları. Ankara, 5.

Levin, A., Lin, C.-F., Chu, C.-S.J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. Journal of Econometrics 108(1), 1–24

Mohammad, S., Javed, M.S., Bashir, A., Mushtaq, K. (2007). Price and non-price factors affecting acreage response of wheat in different agro-ecological zones in Punjab: A co-integration analysis Park J. Agri Science 44(2), 370-377.

Nerlove, M. (1958). The Dynamic of Supply: Estimation of Farmers Response to Prices. The Johns Hopkins University press, 41(2), 452-455.

Ozkan, B., Ceylan, F., Kızılay, H. (2011). Supply response for wheat in Turkey: A vector error correction approach. Mediterranean Journal of Economics: Agriculture and Environment, 10(3), 34-38.

Saygin, O., Demirbas, N., (2017). Türkiye'de Kırmızı Et Sektörünün Mevcut Durumu ve Çözüm Önerileri. (The Current Situation of Red Meat Sector in Turkey and Solution Recommendations) Hayvansal Uretim, Cilt: 58(1), 74-80.

Semerci, A., Celik, A. (2016). Türkiye'de Küçükbaş Hayvan Yetiştiriciliğinin Genel Durumu (General Situation of Small Ruminant Breeding in Turkey). Mustafa Kemal Üniversitesi Ziraat Fakültesi Dergisi, 21(2), 182-196 (Mustafa Kemal University Journal of Agriculture, 21 (2), 182-196).

Simsek, E., (2018). Türkiye ve AB Ülkelerinde Kırmızı Et Üretiminde İşgücü Verimliliğinin Karşılaştırılması (Comparison of Labor Productivity in Red Meat Production in Turkey And EU Countries). Tarım Ekonomisi Dergisi, 24(1), 85-97 (Turkish Journal of Agricultural Economics, 24 (1) ,85-97).

Tripathi, A., Prasad, A.R. (2009). Estimation of agricultural supply response by cointegration approach. The Indian Economic Journal, 57(1), 106-131. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/0019466220090106.

Turan, Z., Sanver, D. Ozturk, K. (2017). The Importance of Dairy Cattle Breeding in the Livestock Sector in Turkey, Contribution to Domestic Output and Comparison wıth Foreign Countries. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi Yıl: Temmuz 2017 Cilt-Sayı: 10(3) ss: 60-74. DOI: 10.25287/ohuiibf.309212.

(ORAL PRESENTATION)

The Change of the Production and Producers' Price of Dry-Onion in The World and Turkey

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Abstract

The changes in the world's and Turkish dry onion production and prices were discussed in this study. The data used in this study were gathered from FAO (Food and Agricultural Organisation) and TURKSTAT (Turkish Statistical Service) for the 1980-2017 periods. The production of dry onion has increased 4.37 times, due to an expansion of harvested area and yield over the period in the world. Turkey was ranked 7th of the world's dry onion production. The dry onion's trade has seen significant development in the world. Thus, dry onion's export quantity and value increased by 3.94 and 6.73 times, respectively. Over the period, Turkey's dry onion production has increased 2.22 times due to the increase of the yield. Turkey's production and export share has decreased in the world. Dry onion's producer price has immensely fluctuated in Turkey. Marketing margin was also increased in the 1991-2017 period. Mainly the increased exchange rate increased producers' price.

Key words: Dry onion, production, producers' price, Turkey

INTRODUCTION

An edible onion is known as the genus Allium and belong to the Alliaceae family. *Allium cepa* L. is the most common and economically important species among edible onions (Günay, 2005).

Onions can be grown in almost every region of Turkey. The homeland of onions is Central Asia. In time, it became widespread towards East Asia and Central Europe (Der, 2007).

Dry onion is used in almost all meals in Turkish food culture. It is a product with high consumer demand and high table value.

In recent years, especially in 2018-2019, yields were low due to various reasons, causing prices to rise. There are many reasons why the price fluctuations in dry onions are high. Onion products in Turkey do not have a support policy in particular. Farmers generally take into account the prices that occurred a year ago in the decision to produce onions. There was no producer association/cooperative based on a dry onion. Prices are formed under free-market conditions. In Turkey, especially in recent years, the rise in onion prices has sparked public debate. The government tried to put pressure on prices by taking various importance. Dry onion is a product frequently mentioned in cobweb theorem in economic literature. Besides, the structure of the farmers, market conditions, the characteristics of agriculture (multiplicity of risks and uncertainties, climatic conditions, diseases and pests, regional differences) may exacerbate the fluctuations in product supply and thus the fluctuations in prices.

This study aimed to examine changes in dry onion production and prices in the world and Turkey.

MATERIALS AND METHOD

The material of the study was obtained from FAO and TurkStat statistical data. Between 1980 and 2017, dry onion planting area, yield, production, price, import and export data were evaluated in major dry onion producer countries.

These data were analysed using percentage and index ratios.

The current dry onion prices were converted to real prices with 2018 prices using the Producer Price Index (UFE 2003 = 100; converted to 2018 = 100) calculated by TURKSTAT. The changes in prices by years and their reasons were tried to be revealed.

We used multiple regression analysis to determine the factors affecting Turkey's dry onion supply. Regression analysis is defined as an estimate of the linear relationship between the dependent variable and one or more independent variables or variables. The main purpose of regression analysis is the modelling of various factors that cause variations in the dependent variable (Greene, 2008; Gujarati, 2006). The closed regression model was given as follows = F (X_1, X_2, U) (Greene, 2008; Gujarati, 2006)

Y = Dry onion supply (tonnes)

X_1 = The price of dry onion a year ago ($)

X_2 = The share of Turkey in world onion export amount (%)

U = Error term.

Logarithmic function was used to calculate the model. The logarithmic regression model was: $LnY = \beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + U$

RESULTS AND DISCUSSIONS

World dry onion production was realised as 22.40 million tons according to 1980 data, while it reached 97.86 million tons in 2017. According to 2017 data, China ranked first in the world onion production with 24.28 million tons. India followed China with 22.43 million tons of production. India was followed by the USA with 3.73 million tons' productions. Turkey is located seventh place with 2.13 million tonnes in the world dry onion production (Table 1).

Table 1. Onions, dry production (million tonnes)

Countries	1980	1985	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
China	3,24	4,50	5,00	8,18	14,07	19,00	21,69	22,00	22,20	22,30	22,52	23,49	23,89	24,28
India	2,50	2,86	3,23	4,08	4,72	9,43	15,12	17,51	16,81	19,30	19,40	18,93	20,93	22,43
USA	1,52	2,04	2,39	2,97	3,25	3,33	3,34	3,36	3,24	3,16	3,17	3,41	3,73	3,73
Iran	0,63	0,72	1,21	1,13	1,34	1,69	1,93	2,17	1,94	2,05	2,07	2,43	2,40	2,38
Egypt	0,71	0,78	0,58	0,39	0,76	1,30	2,21	2,30	2,02	1,09	2,51	3,05	2,46	2,38
Russian Federation	1,91	1,96	2,27	0,88	1,13	1,23	1,54	2,12	2,08	1,98	1,99	2,10	2,02	2,14
Turkey	0,96	1,27	1,55	2,85	2,20	2,07	1,90	2,14	1,74	1,90	1,79	1,88	2,12	2,13
Bangladesh	0,14	0,14	0,15	0,14	0,13	0,59	0,87	1,05	1,16	1,17	1,39	1,70	1,74	1,87
Pakistan	0,43	0,51	0,71	1,01	1,65	1,76	1,70	1,94	1,69	1,66	1,74	1,67	1,74	1,83
Netherlands	0,43	0,44	0,50	0,48	0,82	1,08	1,30	1,54	1,35	1,31	1,38	1,50	1,45	1,78
Sudan	0,02	0,04	0,04	0,05	0,17	1,22	1,12	1,12	1,04	1,04	1,43	1,58	1,58	1,78
Brazil	0,69	0,64	0,87	0,94	1,16	1,14	1,75	1,52	1,52	1,54	1,65	1,45	1,66	1,62
Mexico	0,38	0,57	0,77	0,66	0,91	1,23	1,27	1,40	1,24	1,27	1,37	1,52	1,64	1,62
Others	8,82	10,72	11,33	16,09	17,82	20,68	23,45	25,08	24,53	24,89	26,86	26,76	27,60	27,90
World	22,40	27,20	30,60	39,85	50,14	65,75	79,18	85,26	82,56	84,66	89,25	91,48	94,94	97,86

Source: FAOSTAT, 2019

In 2017, 24.81% of the world dry onion production was realised by China. India follows China with 22.92%. These two countries realise approximately half (47.73%) of the world dry onion production. The first 13 countries realised 71.49% of the world dry onion production. Turkey meets 2.18% of world dry onion production. According to 1980 data, world dry onion production increased by 4.37 times in 2017. Compared to 1990, it had increased 3.20 times. It had increased 1.95 times compared to 2000. Compared to 2010, it had increased by 1.24 times. According to 1980 data, the highest increase was in Sudan with 98 times. Among the top 13 countries; Brazil was the only country with a decrease compared to 2010 (7%). However, world dry onion production has generally increased in the related years. Dry onion production in Turkey; Compared to 1980, 1990 and 2010, it increased by 2.22, 1.38 and 1.12 times, respectively. However, it has decreased by 3% compared to 2000. Turkey remained below the overall rate of increase in world onion production (Table 2).

Table 2. Changes in dry onion production in 2017 (%)

Countries	2017				
	Share (%)	1980=100	1990=100	2000=100	2010=100
China	24,81	749	486	173	112
India	22,92	896	695	475	148
USA	3,81	245	156	115	112
Iran	2,43	377	196	177	123
Egypt	2,43	335	412	312	108
Russian F.	2,18	112	94	188	139
Turkey	2,18	222	138	97	112
Bangladesh	1,91	1318	1262	1393	214
Pakistan	1,87	422	257	111	108
Netherlands	1,82	411	358	217	137
Sudan	1,81	9866	4036	1057	159
Brazil	1,66	234	187	140	93
Mexico	1,66	428	210	179	128
Others	28,51	316	246	157	119
World	100,00	437	320	195	124

Source: FAOSTAT, 2019

World dry onion cultivation area was 1616802 hectares according to 1980 data. According to 2017 data, it has reached 5201591 hectares. According to 2017 data, India ranked first with 1306000 ha production area. China followed India with an area of 1101238 ha. Turkey was the twelfth with 68136 ha in the world in term of dry onion production area (Table 3).

Table 3. Onions, dry harvested area (hectare)

Countries	1980	1985	1990	1995	2000	2005	2010	2015	2016	2017
India	251400	280600	301900	384600	450000	703600	1064000	1173000	1320000	1306000
China	185000	230000	247000	375000	665000	900000	979000	1070992	1085971	1101238
Bangladesh	32051	34058	35235	34165	33994	86429	117560	169609	177492	185735
Pakistan	41858	48156	58600	74834	109760	127800	124700	130532	135884	137900
Sudan	2500	5500	6200	7000	14000	53760	58590	85974	87696	96590
Russian Federation	171500	170000	162000	95300	93417	86334	88017	87949	88563	83343
Turkey	70000	84457	82925	142964	99836	77280	62688	60459	67570	68136
Egypt	21439	16920	10500	17167	28601	42599	61535	83042	69425	68053
Iran	40000	39345	60501	47997	43994	49950	55858	63685	62297	61661
USA	45794	49680	55980	67500	67250	66860	60410	54070	54920	55850
Brazil	67044	58005	74646	74676	66505	58388	70429	56677	57464	51957
Mexico	25563	32063	44468	33741	40935	46446	44843	50693	51504	51666
Netherlands	10900	11400	12800	11658	13244	22500	28866	32157	32723	34356
Others	651753	703215	732945	1065741	1192526	1377301	1394843	1715952	1794458	1899106
World	1616802	1763399	1885700	2432343	2919062	3699247	4211339	4834791	5085967	5201591

Source: FAOSTAT, 2019

In 2017, 25.11% of the world dry onion cultivation area was realised by India. China follows India with 21.17%. Turkey, according to 2017 data, constitutes 1.60% of the word dry onion production area. According to the 1980 data, the world dry onion production area increased by 3.22 times in 2017. It increased by 2.76 times compared to 1990. It increased by 1.78 times compared to 2000. It increased by 1.24 times compared to 2010. According to 1980 data, the highest increase was in Sudan with 38.63 times. Dry onion production area in Turkey decreased by 3% in 2017 compared to 1980. It has decreased by 18% and 32%, respectively compared to 1990 and 2000 and increased by 9% compared to 2010. Turkey has remained below the increase in the world (Table 4).

Table 4. Changes in harvesting area in 2017 (%)

Countries	2017				
	Share (%)	1980=100	1990=100	2000=100	2010=100
India	25,11	519	433	290	123
China	21,17	595	446	166	112
Bangladesh	3,57	579	527	546	158
Pakistan	2,65	329	235	126	111
Sudan	1,86	3864	1558	690	162
Russian Federation	1,60	49	51	89	95
Turkey	1,31	97	82	68	109
Egypt	1,31	317	648	238	111
Iran	1,19	154	102	140	110
USA	1,07	122	100	83	92
Brazil	1,00	77	70	78	74
Mexico	0,99	202	116	126	115
Netherlands	0,66	315	268	259	119
Other	36,51	291	259	159	136
World	100,00	322	276	178	124

Source: FAOSTAT, 2019

According to 1980 data, world dry onion yield was 13855 kg per hectare while according to 2017 data, 18814 kg per hectare. According to 2017 data, the USA ranked first in the world onion yield (66821 kg/ha). The USAwas followed by the Netherlands with 51799 kg/ha. According to data from 2017, Turkey was the sixth with 31 283 kg per hectare in the world in term of dry onion yield. Turkey was above the world average yield of onions (Table 5).

Table 5. Onions, dry yield (kg per hectare)

Countries	1980	1985	1990	1995	2000	2005	2010	2015	2016	2017
USA	33262	41140	42767	43926	48375	49866	55262	63124	67889	66821
Netherlands	39725	38298	38859	41100	61992	48089	45105	46774	44293	51799
Iran	15775	18281	20045	23553	30540	33743	34534	38095	38535	38584
Egypt	33117	46336	54952	22505	26677	30567	35883	36724	35414	34958
Mexico	14794	17761	17330	19625	22119	26502	28236	29964	31746	31361
Turkey	13714	15037	18692	19935	22036	26786	30309	31082	31383	31283
Brazil	10360	11026	11643	12595	17387	19485	24895	25513	28843	31220
Russian Federation	11149	11529	14006	9249	12137	14264	17455	23895	22846	25629
China	17514	19565	20243	21800	21158	21111	22155	21937	21995	22051

Sudan	7200	7273	7097	7429	12000	22619	19048	18417	18061	18386
India	9961	10202	10686	10608	10491	13406	14209	16136	15857	17172
Pakistan	10370	10687	12166	13538	15015	13809	13642	12802	12778	13294
Bangladesh	4420	4131	4196	4215	3942	6820	7418	10049	9777	10049
Others	13533	15246	15458	15099	14946	15012	16811	15594	15378	14690
World	13855	15426	16228	16384	17177	17775	18801	18921	18667	18814

Source: FAOSTAT, 2019

According to 1980 data, the yield of onion per hectare increased by 1.36 times in the world in 2017. It has increased by 1.16 and 1.10 times, respectively compared to 1990 and 2000. There was no change compared to 2010. According to 1980 data, the highest increase was realised in Brazil with 3.01 times. According to 1980, the yield of dry onion per hectare was increased by 2.28 times in 2017 in Turkey. It has increased by 1.67, 1.42 and 1.03 times, respectively compared to 1990, 2000 and 2010 (Table 6).

Table 6. Changes in the yield in 2017 (%)

Countries	2017			
	1980=100	1990=100	2000=100	2010=100
USA	201	156	138	121
Netherlands	130	133	84	115
Iran	245	192	126	112
Egypt	106	64	131	97
Mexico	212	181	142	111
Turkey	228	167	142	103
Brazil	301	268	180	125
Russian Federation	230	183	211	147
China	126	109	104	100
Sudan	255	259	153	97
India	172	161	164	107
Pakistan	128	109	89	97
Bangladesh	227	239	255	135
Others	109	95	98	87
World	136	116	110	100

Source: FAOSTAT, 2019

According to 2016 data, 7.69% of the dry onion production in the world was subject to export. According to 2016 data; the country with the highest rate of production to exports was the Netherlands (84.94%). It was understood that the Netherlands mainly produces for the foreign market. The Netherlands was followed by Mexico with 25.25%. Although China was the most important dry onion producer, the rate of exported dry onion was quite low. This means that dry onion production in China was mainly directed towards the domestic market. Mexico was a significant onion exporter. Especially since the late 1980s, it has increased the export rate. In 2016, 1 kg of every 4 kg dry onion produced in this country was subject to export. In Turkey, 4.99% of total dry onions production was subject to export in 2016. Turkey has not reached the world average, especially after the 1990s (Table 7).

Table 7. Export amount/production share (%)

Years	World	India	China	Netherlands	Mexico	Egypt	Turkey	USA
1980	6,79	5,28	0,86	96,82	15,14	5,91	3,39	7,67
1981	7,92	7,22	0,59	87,03	14,48	3,02	9,06	12,01

1982	6,85	8,16	0,83	81,13	13,66	2,01	17,22	3,42
1983	6,82	5,64	0,58	109,62	13,32	4,53	13,39	4,74
1984	7,33	8,14	0,50	93,47	18,02	2,52	9,95	6,44
1985	6,93	8,53	0,12	97,75	16,50	2,81	10,34	2,80
1986	6,91	9,36	0,05	82,45	17,63	2,52	12,65	3,91
1987	7,00	4,83	0,11	94,89	27,58	4,22	10,21	4,59
1988	7,25	6,40	0,09	95,37	22,66	7,57	12,19	5,51
1989	7,04	10,35	0,09	93,64	24,21	11,35	10,89	5,08
1990	7,26	7,45	0,05	100,73	20,76	10,37	5,50	7,37
1991	8,30	10,36	0,03	110,89	23,57	11,04	12,61	7,08
1992	7,32	7,80	0,21	96,55	27,45	9,40	12,07	6,76
1993	7,35	8,91	0,49	87,63	31,05	18,54	6,82	7,51
1994	9,43	9,95	0,77	101,75	30,38	27,19	3,43	12,49
1995	8,25	8,61	0,53	100,41	32,77	29,92	3,86	10,39
1996	8,39	10,24	0,88	69,75	32,72	23,23	10,28	9,33
1997	7,76	10,42	0,45	93,59	29,68	26,24	5,47	8,90
1998	7,82	4,05	1,19	72,75	34,63	20,83	6,35	9,48
1999	7,33	5,32	1,63	68,02	21,19	11,91	5,29	9,21
2000	6,78	7,27	1,18	69,89	26,10	19,30	3,90	10,89
2001	6,92	8,41	1,94	81,05	23,42	26,47	7,50	10,91
2002	8,07	13,99	1,57	83,40	21,64	38,87	6,77	9,68
2003	8,96	13,73	2,59	98,77	24,33	46,66	7,85	9,88
2004	8,13	10,74	2,32	63,48	23,80	39,15	3,64	8,01
2005	7,90	10,20	3,00	78,31	22,19	23,12	3,08	9,83
2006	8,60	12,74	2,91	103,34	23,89	18,27	7,29	9,19
2007	7,75	7,26	3,15	81,14	20,92	13,54	9,67	8,08
2008	8,37	12,32	2,63	89,00	22,36	5,30	10,51	9,41
2009	8,51	13,79	2,50	95,65	26,05	11,05	7,30	8,26
2010	8,71	9,02	2,97	96,58	25,86	18,47	5,03	10,81
2011	8,01	6,34	3,37	86,09	26,46	21,31	5,60	10,60
2012	7,91	9,09	2,79	90,67	30,25	15,77	8,11	10,24
2013	8,28	7,65	3,33	93,30	29,76	30,16	8,30	11,33
2014	7,77	6,53	3,25	90,69	28,37	16,63	12,57	10,70
2015	7,53	5,53	3,70	79,37	25,43	19,40	4,97	8,92
2016	7,69	8,78	2,98	84,94	25,25	18,60	4,99	8,73

Source: FAOSTAT, 2019

According to 2016 data; India accounts for 25.17% of world onion exports. India was followed by Netherlands and China with 16.87% and 9.74%, respectively. Turkey was providing 1.45% of the onions that were subject to export around the world. Turkey, especially after the 2000s, has a low share of world exports of dry onion (Table 8).

Table 8. Countries' export amount share in the World (%)

	India	Netherlands	China	Egypt	Mexico	Spain	USA	Turkey
1980	8,69	27,58	1,84	2,76	3,77	13,00	7,69	2,14
1981	10,32	23,38	1,19	1,07	2,64	16,22	10,35	5,33
1982	11,55	26,70	1,92	0,74	3,76	12,71	3,79	10,29
1983	9,00	26,59	1,36	2,09	3,71	15,18	4,99	7,93
1984	13,19	22,36	1,05	0,92	4,73	14,31	6,58	5,73
1985	12,96	22,65	0,30	1,17	4,99	15,23	3,04	6,97
1986	12,27	21,22	0,12	1,08	4,88	17,35	4,01	8,52

1987	6,45	22,44	0,25	1,62	6,89	14,19	4,64	6,56
1988	10,05	20,22	0,20	2,35	7,56	12,85	5,48	7,69
1989	15,35	19,87	0,22	2,44	7,99	11,26	5,34	7,17
1990	10,82	22,56	0,11	2,69	7,20	8,50	7,94	3,84
1991	14,01	19,35	0,06	2,32	7,20	9,05	6,14	7,61
1992	10,94	22,07	0,45	2,29	7,44	7,94	6,75	8,25
1993	13,98	20,65	1,25	5,39	8,05	8,58	8,02	4,41
1994	11,74	18,15	1,72	3,82	5,92	7,07	10,81	1,80
1995	10,68	14,63	1,31	3,51	6,60	7,82	9,37	3,34
1996	12,42	12,61	2,45	3,02	6,67	7,29	7,87	5,67
1997	10,50	16,92	1,43	3,27	7,62	6,71	8,74	3,62
1998	6,04	13,28	3,59	4,21	8,58	6,71	8,10	4,04
1999	7,27	14,32	5,32	2,96	7,25	6,15	8,57	3,69
2000	10,10	16,88	4,88	4,33	6,95	6,08	10,42	2,52
2001	12,26	17,22	8,08	4,62	6,69	5,49	9,29	4,48
2002	13,83	15,99	6,08	6,89	5,74	5,49	7,20	3,26
2003	17,03	15,81	8,98	6,34	5,50	4,47	6,51	2,72
2004	16,42	15,32	8,24	6,91	5,82	3,91	5,95	1,46
2005	18,51	16,30	10,97	5,79	5,26	3,92	6,31	1,23
2006	23,58	16,61	9,72	3,49	5,05	4,06	5,10	2,20
2007	17,66	15,41	11,29	3,52	5,08	4,07	5,11	3,15
2008	26,61	17,52	8,68	1,65	4,46	4,06	5,11	3,36
2009	26,49	19,17	8,30	3,71	4,92	4,13	4,47	2,13
2010	19,78	18,23	9,34	5,91	4,75	3,24	5,23	1,39
2011	16,25	19,42	10,86	7,19	5,42	3,71	5,21	1,75
2012	23,38	18,77	9,49	4,89	5,73	3,92	5,08	2,15
2013	21,07	17,44	10,60	4,71	5,39	4,11	5,11	2,26
2014	18,27	18,03	10,57	6,01	5,60	5,08	4,88	3,24
2015	15,20	17,33	12,62	8,59	5,61	5,12	4,42	1,36
2016	25,17	16,87	9,74	6,27	5,66	4,88	4,46	1,45

Source: FAOSTAT, 2019

From 1991 to 2017, the onion prices ($ / tonne) of producers in major onion producer countries was examined. Producer countries have the lowest prices of dry onions; Egypt and India (around $ 100) were the highest, respectively; Brazil, Turkey, USA, Bangladesh, China, Russia and Sudan ($ 220 tons and over).

From 1991 through 2017, the producer experienced fluctuations in the prices of all the onion producers. Price fluctuations were at least changed in the USA, the highest in Sudan, Iran, Egypt, the Netherlands and Turkey.

According to the average producers'onion price, prices increased by 92% in Sudan, 44% in Bangladesh, 77% in Iran, 45% in Pakistan, 20% in Egypt, 14% in Brazil, and 6% in the USA. Prices showed the declining trend in the Netherlands, China, Russia and Turkey.

There was an increase in unit export prices of major dry onion producer countries during the period of 1991-2017.

Dry onion producers' prices were compared between 1991-2017 in major producers USA, Netherlands, Spain and Turkey. In 2017, the lowest dry onion producers' price was 71 USD in the Netherlands. Turkey with 154 USD, Spain with 222 USD and USA with 298 USD, followed the Netherlands. The highest price was held in Turkey in 2010 with 590 USD. Dry onion producers' price until 2012 remained far above Spain and the USA in Turkey (Figure 1).

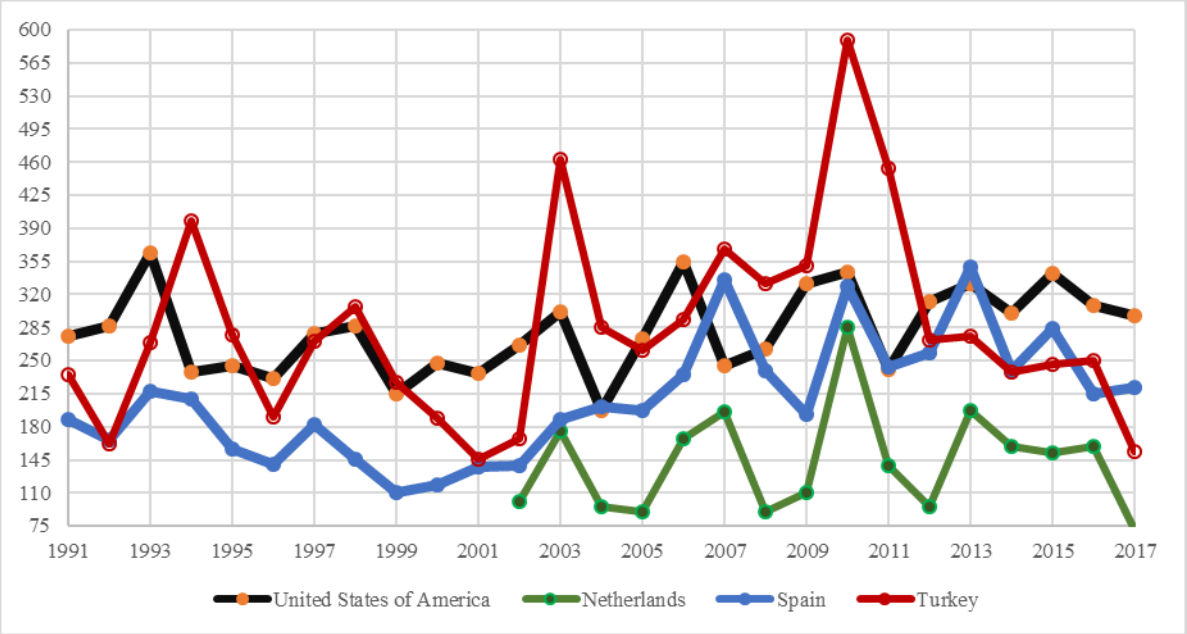


Figure 1. Dry onions' producer price in USA, Netherland, Spain and Turkey ($ per tonne)
Source: FAOSTAT, 2019

With neighbouring countries, Turkey, Iran and Russia onion producer prices were compared with the period 1991-2017. Onion producer prices in Turkey followed up above the price of Russia and Iran between 1995-2011. The highest price per tons among these three countries stood at 590 USD in Turkey in 2010 (Figure 2).

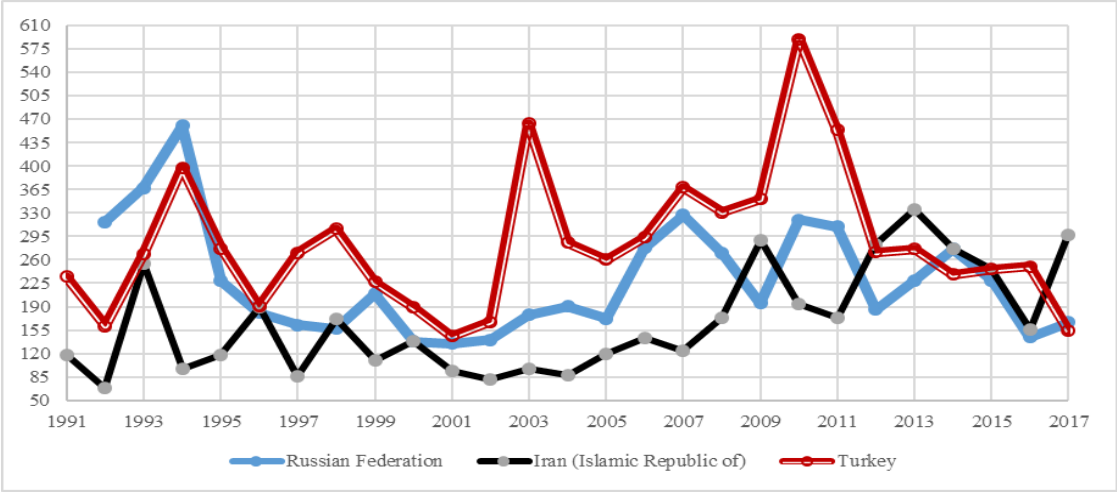


Figure 2. Dry onions' producer price in Russia, Iran and Turkey ($ per tonne)
Source: FAOSTAT, 2019

1980-2016 period, Turkey's share in the world dry onion production and export share in the World were investigated related changes in Figure 3. Turkey's export share in the World has kept above from share in the world dry onion production until 1993. Although fluctuations occurred in the following years, after 1996, it has remained close to each other. Turkey's share showed a declining trend and fell to a 2% level, and below.

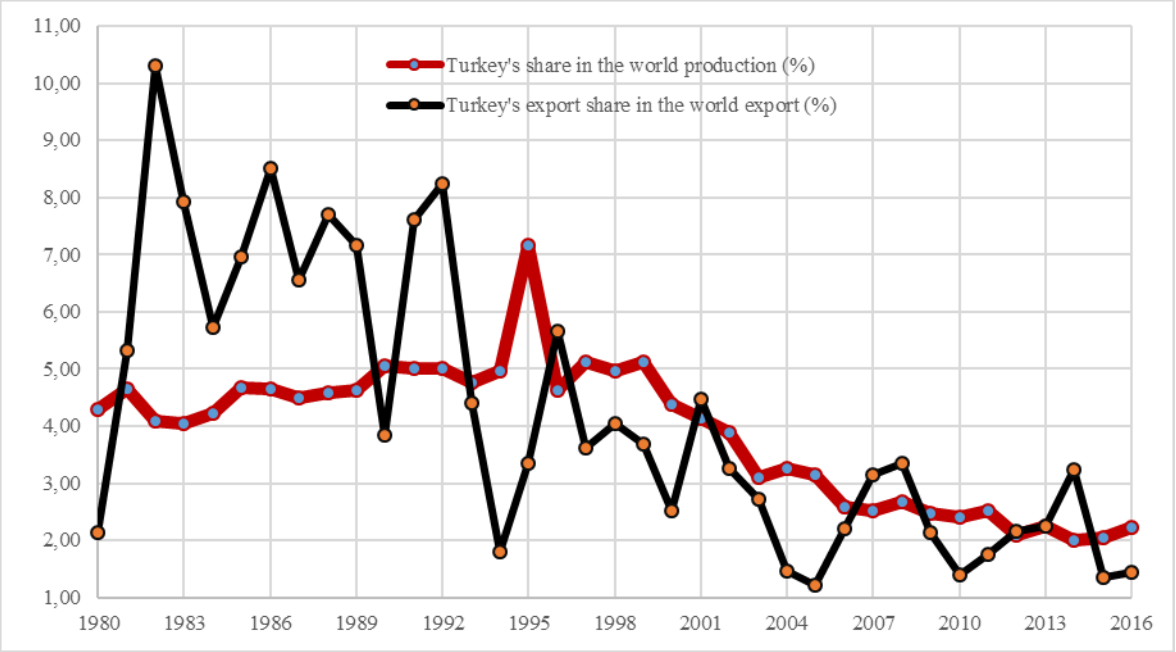


Figure 3. Turkey's dry onion production and export share in the world (%)
Source: FAOSTAT, 2019

Period 1980-2017 were examined relations between onion production and price in Turkey. There were fluctuations in the prices depending on the production. In 1980, the production was the lowest, the price of dry onion was 588 TRY per ton, and in 1995, when production was highest, the price of dry onion was 501 TRY. In 2017, the production was reached 2,132 million tons and the price was 188 TRY per ton. Onion production in 2006 and after was around 1.7 to 2.2 million tons. During this period, prices fluctuated between 188 TRY and 512 TRY. However, as of 2012, prices tended to decrease (Figure 4).

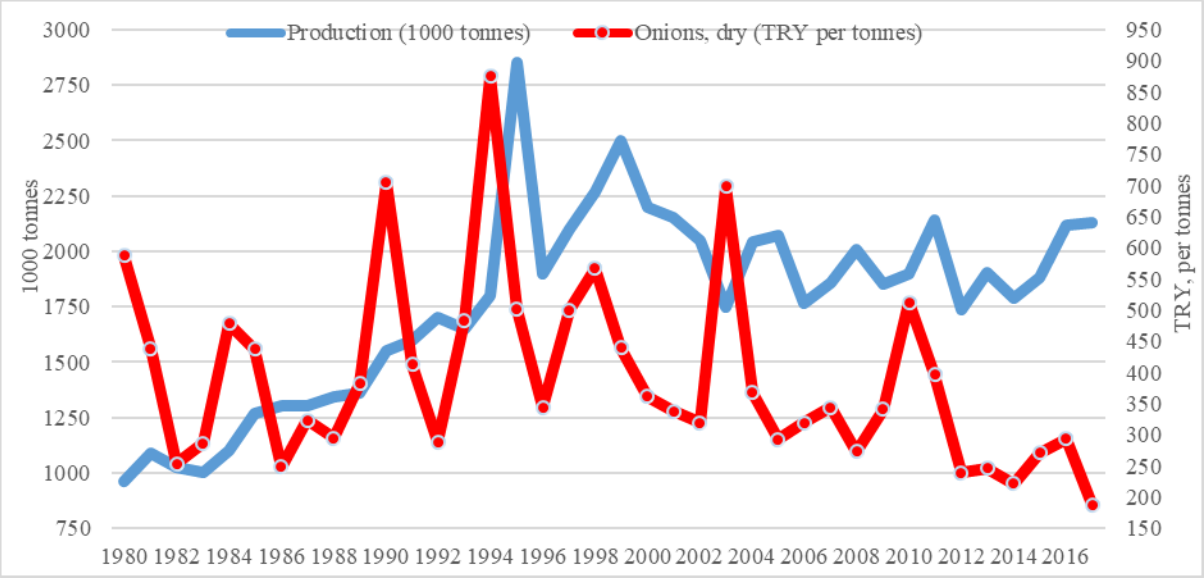


Figure 4. Turkey' dry onion production (1000 tonne) and reel producer price (TRY per tonne)
Source: FAOSTAT, 2019

The producers' real price of onions, and onion production in Turkey was analysed using a chain index. There were serious fluctuations in the production of onion and real prices in the 1980-2017 period. However, the changes in real prices compared to the previous year were more severe than the changes in production. The highest increase in production compared to the previous year was in 1995 (54%) and the highest decrease was in 1996 (33%). The highest increase in prices

compared to the previous year was in 2003 (119%) and the highest decrease was in 1982 (42%). However, both production and price changes were less severe in 2004 and beyond (Figure 5).

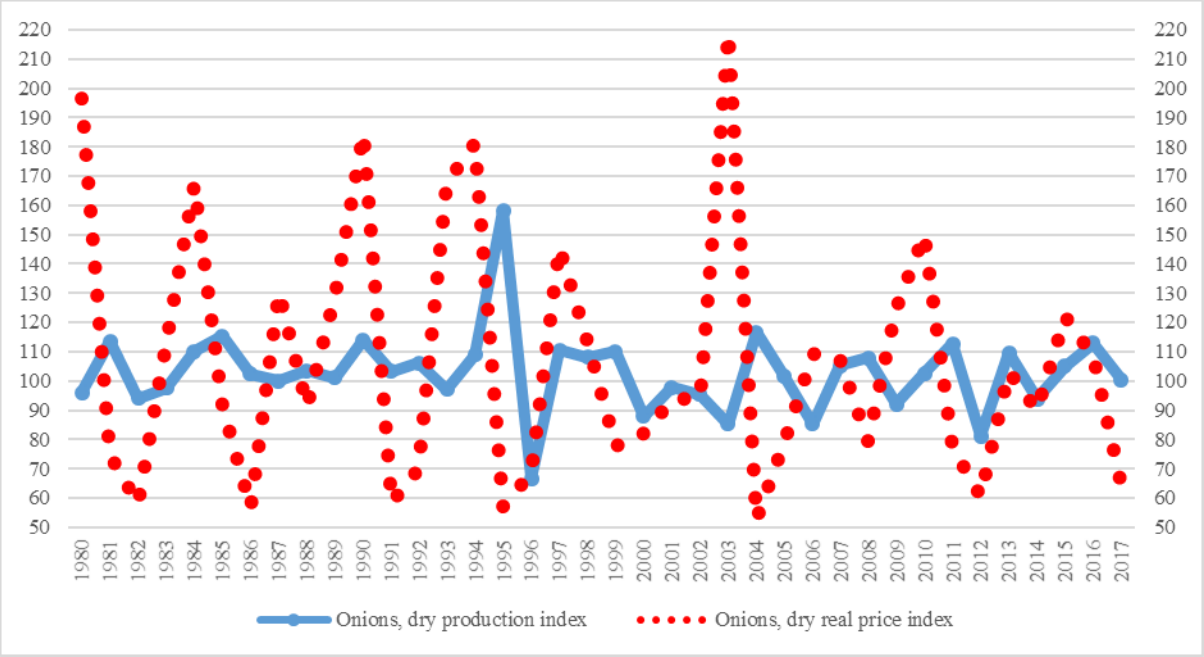


Figure 5. Turkey' dry onion production and reel producer price index (%)
Source: FAOSTAT, 2019

Onion production, with producer prices denominated in dollars that year in Turkey, were analysed using a chain index. The highest increase in onion prices was realised in 2003 (177%), and the highest decrease was in 1982 (49%). After 2010 there was a downward trend in prices (Figure 6). The fluctuations in prices expressed in foreign currencies were higher than in the Turkish currency.

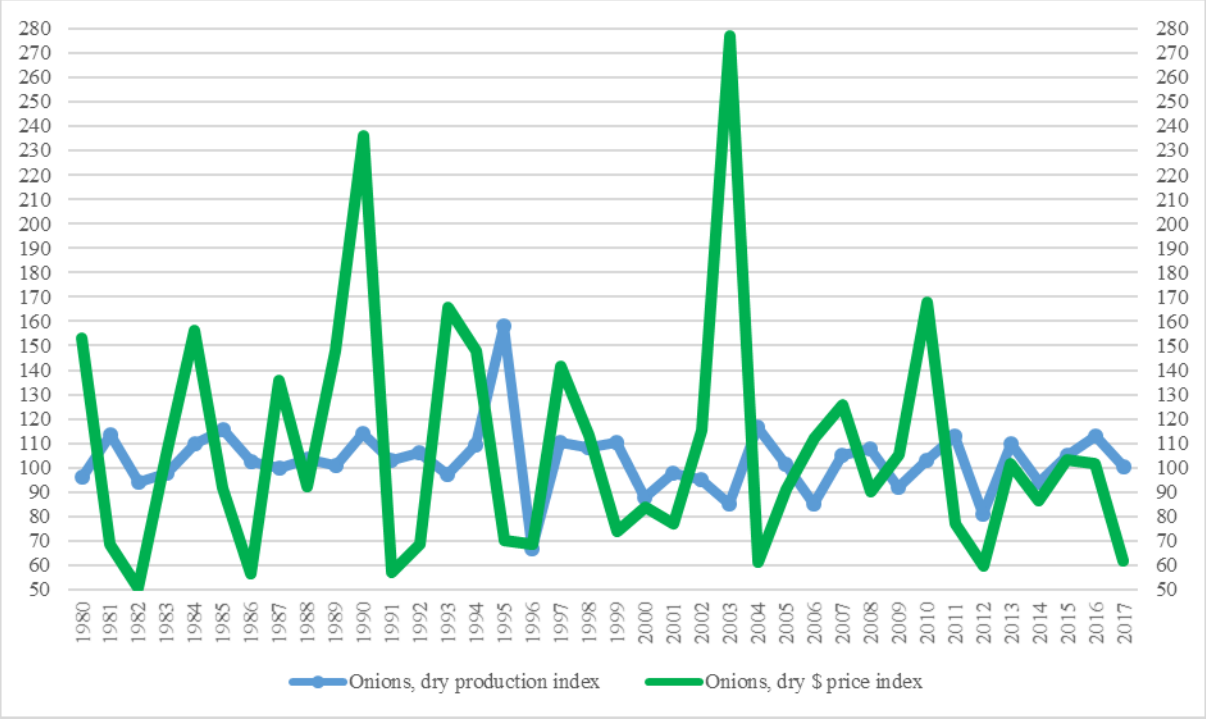


Figure 6. Turkey' dry onion production and producer price ($) index (%)
Source: FAOSTAT, 2019

Turkey's dry onion price and USA dry onion producer price was compared by using the chain index. The comparison was in the 1980-2017 period. The figure showed that the producers' onion price was fluctuated in Turkey and USA. Among the significant dry onion producer countries, America was the country with the lowest price fluctuations. In Turkey, these fluctuations were much more severe.

The lowest producers' onion prices occurred in Turkey in 1986 (94 $ per tonne), while the highest producers onion prices occurred in 2010 (588 $ per tonne). This year the highest difference was realised with the USA. The difference was 244 $. The highest producers price difference occurred with the United States and Turkey in 1983 as per tonne 158 $. Onion prices in Turkey (in the relevant period; 1980-2017) was higher than the USA in 1980, 1990, 1994, 1995, 1998, 1999, 2003, 2004, 2007, 2008 2009, 2010, and 2011. Dry onion price in 2017, Turkey's was 154 USD per tonne, while USA at 298 USD per tonne (Figure 7). The pearson correlation between real onion prices and the price in dollars was 0.433 in Turkey. Similarly, the pearson correlation between USA and Turkish onion prices was 0.495. This reported a similar relationship between USA and Turkish onion prices.

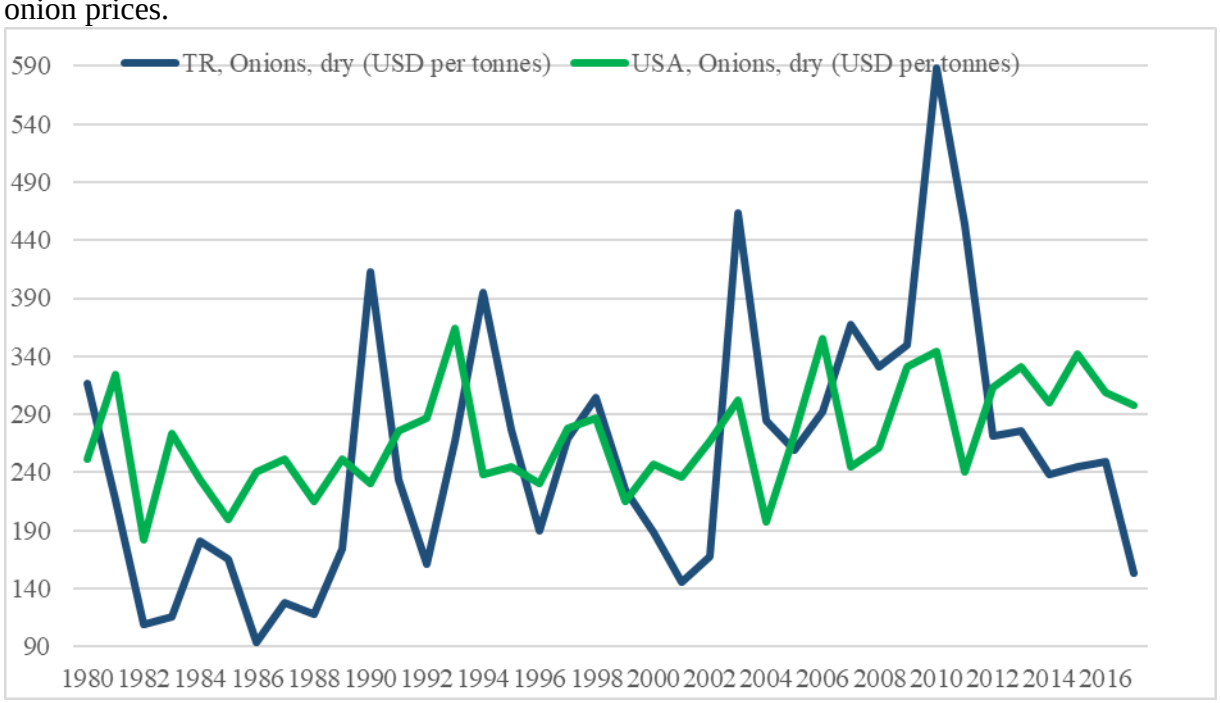


Figure 7. Dry onion producer price in the USA and Turkey
Source: FAOSTAT, 2019

Turkey's and USA dry onion producer's price index was compared by using the chain index. The highest increase compared to the previous year in dry onion producer prices in Turkey occurred in 2003 (177%), while the highest decrease occurred in 1982 (49%). The highest increase of dry onions producer prices occurred increased in the USA in 1980 with 63%, while the highest decrease occurred in 1982 (44%) (Figure 8).

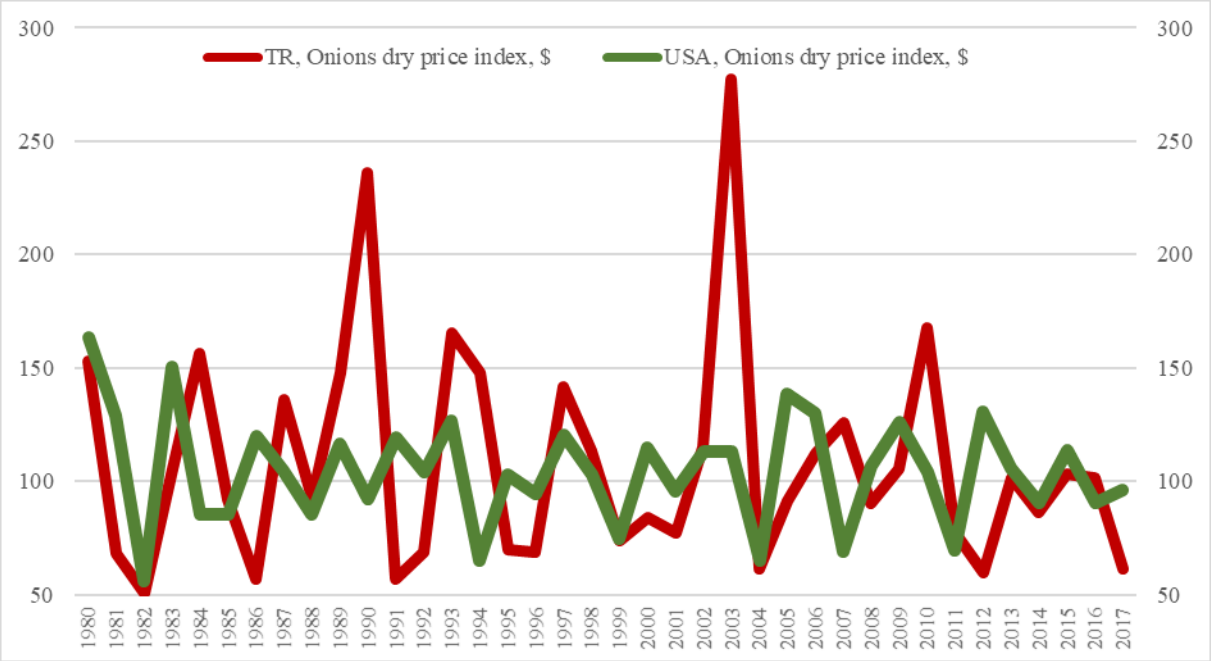


Figure 8. Dry onion producer price index in the USA and Turkey (%)
Source: FAOSTAT, 2019

Turkey's and USA dry onion producer real price was compared by using the chain index. The highest increase compared to the previous year at real producer price onion prices occurred in Turkey in 2003 (119%), while the highest decrease occurred in 2004 (47%). Turkey's dry onion producer real price was more severe than the United States (Figure 9).

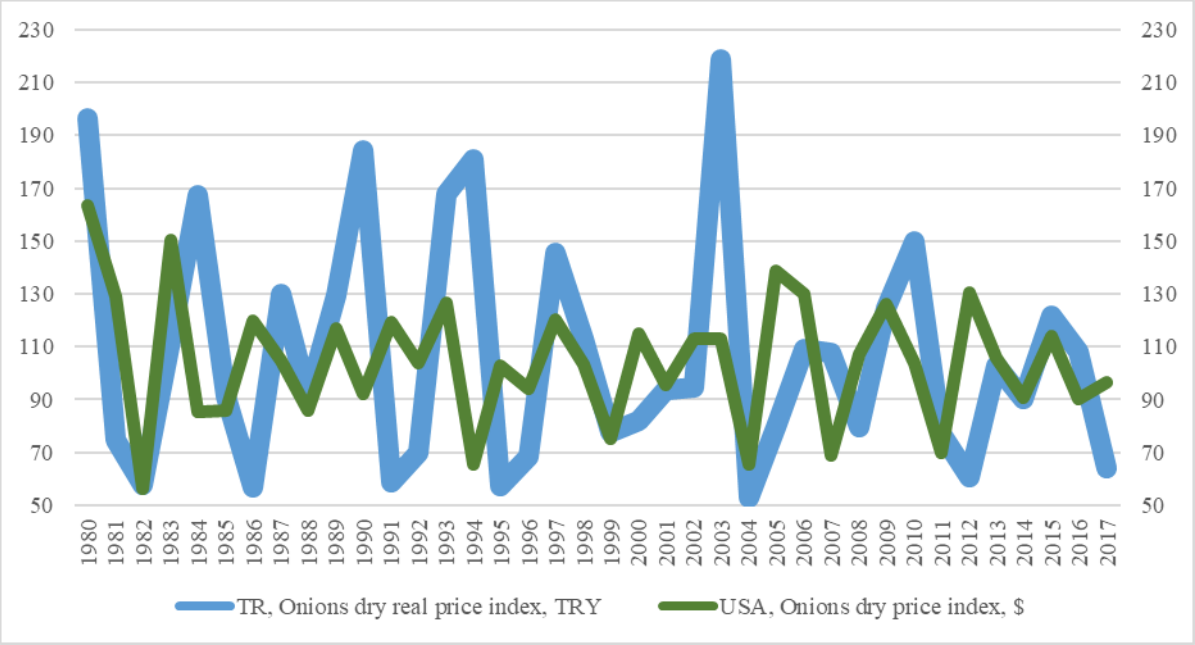


Figure 9. Dry onion producer real price index in the Turkey and USA (%)
Source: FAOSTAT, 2019

Dry onion producer prices have fluctuated in the 1980-2017 period. This was because the producers make a production decision by taking into consideration the prices a year ago. Dry onion prices in Turkey were free-market conditions. In the years of overproduction, the prices obtained by the producers also decrease more. The disruption of production in the agricultural sector and the lack of product-specific producer co-operatives make this decline or rise more severe. The highest value of the producer's dry onions price occurred in Turkey in 1994 as 875 TRY. This year was also the year when the price difference between dry onion and potatoes was highest. The highest

value of potatoes in 1995 was 553 TRY per tonne. Between 2000 and 2009, potato-dry onion prices fluctuated in parallel (Figure 10). There was a high correlation between potato prices and onion prices. Pearson correlation was 0,729. This indicated a strong correlation between the two variables.

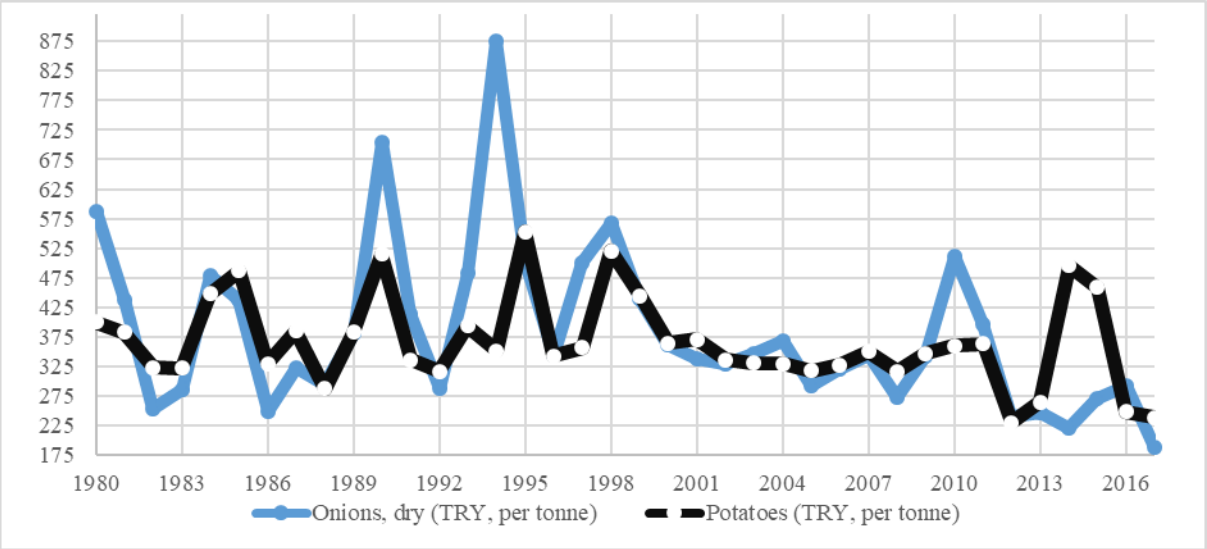


Figure 10. Dry onion and potatoes reel producer price in Turkey (TRY)
Source: FAOSTAT, 2019

The marketing margin was defined as the difference between the price that consumers will pay for the final product they purchase and the price they obtain for the products they produce (the first product price) (Rehber and Çetin, 1998). Accordingly, during the period 1994-2017, marketing margin was calculated from producer prices and consumer prices. In parallel with the price of onion obtained from the producer and consumer prices, the marketing margin fluctuated in the related period but showed an upward trend in general. In 1999, the lowest value was 39.5 USD per tonne, the highest value was reached in 2013, and it was 330.8 USD per tonne (Figure 11).

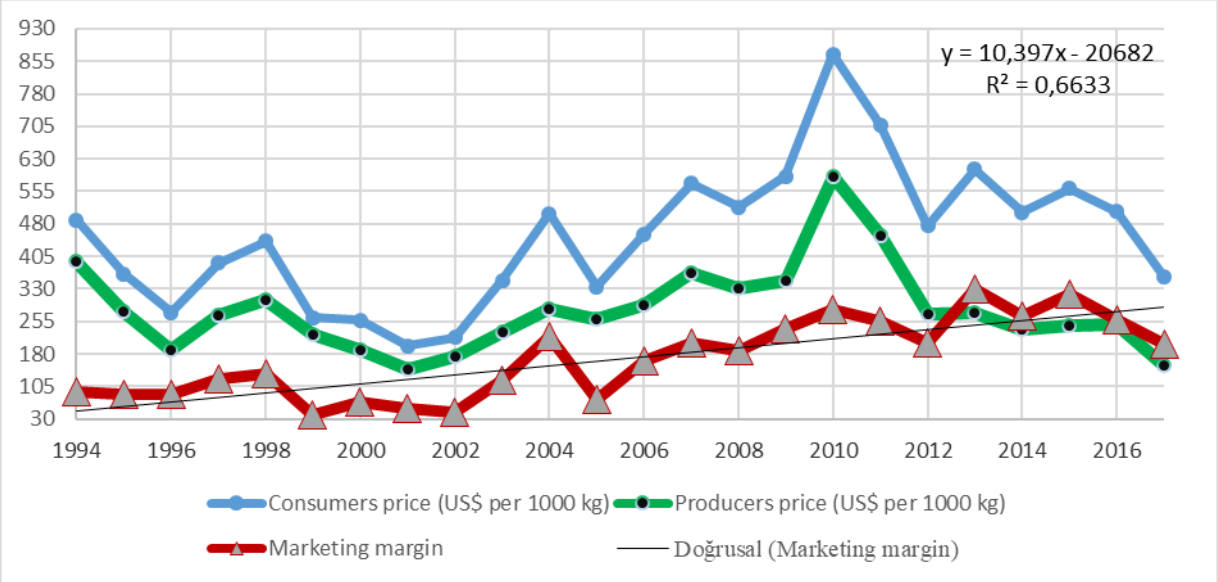


Figure 11. Dry onion's consumer and producer price, and marketing margin in Turkey ($)
Source: FAOSTAT, 2019

The regression analysis was used to determine the factors that affect dry onion supply in Turkey. The dependent variable was the quantity of dry onion's supply (Y, tonne). The independent

variables were dry onion price a year ago (X_1) and Turkey's dry onion export amount share in the World (X_2). The model result was given in Table 9.

The logarithmic model could be expressed as; $LnY = 13.445 + 0.265LnX_1 – 0.313\ LnX2$

The adjusts R^2 (determination value of the coefficient) was calculated as 0.457 (45.7%), and adjusts R^2 was indicated that the independent variables in the model could explain about 45.7 percent of the variation in Y (supply). The F-test was statistically significant at the 1% level ($F_{calculated}>F_{table}$, 16.177>3.32). F-test indicated that the calculated model could be used for the prediction purpose.

Dry onion price a year ago and Turkey's dry onion export amount share in the World were identifying as the significant factors affecting the dry onion supply in Turkey. The dry onion price a year ago (X_1) had a positive coefficient. The increase in this parameter would result in an increase of 0.265 units in the dry onion supply in Turkey. However, Turkey's dry onion export amount share in the World (X_2) had a negative coefficient. The value of the coefficient was calculated to be -0.313. This score showed that a unit increase in Turkey's dry onion export amount share in the world would lead to a decrease of 0.313 units in the dry onion supply in Turkey.

Table 9. Regression model summary

	Constant	X_1	X_2	F test	R_A^2
Coefficient	13,445	0,265	-0,313		
Standard error	0,551	0,089	0,082		
t-values	24,387	2,984	-3,828	16,177	0,457

CONCLUSIONS

In the world, dry onion production, unit area yields and cultivation areas increased significantly compared to 1980.

Onion production volume and unit area yield compared to 1980 showed an increase in Turkey. The amount of product to the unit area below the world average was above the world average. Onion cultivation area in Turkey has decreased compared to 1980. It has increased 3.22 times in the world. An increase in production in Turkey said that due to the efficiency of the rigging. However, the amount of supply available was not sufficient to meet the high demand. For this purpose, it was necessary to increase the sowing areas.

Both the onion production in essential countries and severe fluctuations in the price of onions in Turkey was concerned. Price instability affects the production decision, and the amount of production triggers price instability. This imbalance in the markets causes damage to producer-consumer parties. Market models should be developed for the sustainability of production. For this, production planning can be a tool. Price strategies can also be developed.

REFERENCES

Der, B., 2007. Tekirdağ İli Soğan Üretim Alanlarında Görülen Siyah Küf Hastalığı Yönünden Toprak Fungistasisinin Belirlenmesi, Yüksek Lisans Tezi, Namık Kemal Üniversitesi, Fen Bilimleri Enstitüsü, Tekirdağ.

FAOSTAT, 2019. The Food and Agriculture Organization. (web page: http://www.fao.org.tr, Accessed on 01.03.2019.)

Greene, W.H., 2008, Econometric Analysis. Department of Economics at the Stern School of Business, New York University.

Gujarati, D.N., 2006, Essentials of Econometrics. Basic Econometrics. Aravaca, Madrid: Mac Graw- Hill interamericana, Spain.

Günay, A., 2005. Sebze Yetiştiriciliği, cilt I, ISBN.975-00725-2-9, İzmir,403-417.

Rehber, E., Çetin, B., 1998. Tarım Ekonomisi. Uludağ Üniversitesi Ziraat Fakültesi Yayınları Yayın No: 134, 317s, Bursa.

TURKSTAT, 2019. Turkish Statistical Institute. (web page: Http://www.tuik.org.tr, Accessed on 09.03.2019)

(ORAL PRESENTATION)

Analysis of Red Pepper Cost and Profitability in Kahramanmaraş Province

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Abstract:
In this study, production costs and profitability development in red pepper, which is important in Kahramanmaraş province, which is focused on cost calculation in red pepper, has been analysed. The data were obtained from Kahramanmaraş Provincial Directorate of Agriculture and Forestry. The data set covers the period 2004-2018.
Gross, absolute (net) and relative profit for the developments in the profitability of red pepper were calculated. Proportional shares of product cost elements in total cost are calculated. Thus, weights were determined in total cost. Also, the cost of production and profitability of the products were determined by the simple index.
The most important cost elements in the period covered were land rent, harvesting and hoeing. Production costs of 2018 increased by 21%, depending on 2004. Relative and absolute profit decreased compared to the beginning of the period.

Key words: Red pepper, cost, profit, Kahramanmaraş, Turkey

INTRODUCTION

Red pepper is a spice that is obtained by drying and grinding the vegetables of *Capsicum annuum* L. which belongs to the Solanaceae family, and it is used to give flavour and bitterness to food (Akgül, 1993).

In 2018, according to TURKSTAT data, red pepper in Kahramanmaraş was realised as 24625 tons in 13050 decares area. Red pepper production area in Kahramanmaraş generates %10.89 of Turkey's area of red pepper, and it generates %10.83 of Turkey's red pepper production.

Kahramanmaraş has a prominent place in Turkey based on red pepper production. Besides, red pepper, registered as a geographical sign, is economically essential for the city. In this respect, it is critical to analyse the cost and profitability of Kahramanmaraş pepper.

It is necessary to know the actual cost and profitability of each product produced in terms of business. According to this, continuous production branches can be identified and abandoned, and profitable production branches can be given more space (Kiral et al., 1999).

Cost is essential for the economic evaluation of the annual results of the enterprise. In this respect, it is relevant to the economic conditions of the enterprises that they are suitable, measured and productive (Güneş et al., 1988).

Cost calculation in agricultural products is depends on the type of product, the purpose of calculating the cost, the method of calculating the value, the purpose of the calculation person or institutions (Cakir, 2005).

Costs and profitability indicators calculated from the sales price are the most critical factors for the enterprises to continue production. For this reason, this study aims to reveal the developments in cost and profitability of red pepper in 2004-2018 from Kahramanmaraş provincial directorate of the Ministry of Agriculture and Forestry.

MATERIALS AND METHODS

The primary material of the study was the statistical records of the Kahramanmaraş Provincial Directorate of Agriculture and Forestry. The product costs and production data set of the province cover the period of 2004-2018. TURKSTAT statistical data and related national and international research findings were also used.

Below formulas were used in the calculation of gross, absolute and relative profits related to the developments in profitability. Gross Profit = Gross Production Value (GPV) - Variable Costs, Absolute Profit = GPV – Total Production Costs (TPC) and Relative Profit = GPV / TPC (Açıl and Demirci, 1984; Kiral et al., 1999).

The proportional share of the cost elements in the total cost of red pepper was calculated. The ratios of the margin elements in the total cost were determined. Besides, the change in the production cost and profitability of the products was demonstrated by a simple index. Cost and profitability indicators were converted into real values by using the Producer Price Index (PPI; 2018 = 100) calculated by TURKSTAT. Thus, changes and developments in profits, costs, and components were determined by years.

RESULTS AND DISCUSSION

Turkey's red pepper production was 227 380 tonnes in 2018. The province of Şanlurfa comes first with a 43% share. This is followed by Gaziantep with 26% and Kilis with 13.9%. Kahramanmaraş production is 24625 tonnes and ranks 4th with a 10.8% share (Table 1).

Table 1. Important province in the red pepper production in Turkey in 2018

Provinces	Tonne	%
Şanlıurfa	98250	43,2
Gaziantep	59100	26,0
Kilis	31500	13,9
Kahramanmaraş	24625	10,8
Bursa	5880	2,6
Aydın	3601	1,6
Hatay	2690	1,2
Adıyaman	1710	0,8
Muğla	24	0,0
Turkey	227380	100,0

Source: TURKSTAT, 2019

Developments in red pepper production and harvested area in Kahramanmaraş province were given in Table 2. Accordingly, the harvested area of Kahramanmaraş was 13050 decares in 2018, which constitutes 10.89% of the total red pepper harvested area of Turkey. The red pepper production meets 10.83% of Turkey's production. Red pepper harvested areas decreased by 21.39% in 2018 compared to 2001 production year. Red pepper production, based on 2001, increased by 5.43 times in 2018 to reach 24625 tons. Red pepper yield in 2018 in Kahramanmaraş province was 1887 kg per decares. Between the years 2001-2018, the highest harvested area was in 2003 and the production in 2014. Even though the cultivation areas were generally reduced, the production increased. It is seen that this reason in the increase in production is due to the increase in the yield obtained from the unit area.

Table 2. Developments in red pepper acreage and production in Kahramanmaras

Years	Harvested area (da)	Index (2001=100)	Share in Turkey (%)	Production (tonne)	Index (2001=100)	Share in Turkey (%)	Yield - K.Maraş (kg/da)	Yield - Turkey (kg/da)
2001	16600	100,00	18.44	4530	100,00	22.65	273	222
2002	12700	76,51	18.14	3695	81,57	12.32	291	429
2003	17910	107,89	17.91	3839	84,75	9.60	214	400
2004	8910	53,67	12.44	3418	75,45	11.39	384	419
2005	11010	66,33	14.12	3750	82,78	8.33	341	577
2006	9400	56,63	14.04	2773	61,21	6.05	295	685
2007	10740	64,70	15.07	7430	164,02	11.05	692	943
2008	12384	74,60	15.93	7706	170,11	12.84	622	772
2009	12720	76,63	13.92	25030	552,54	12.71	1968	2155
2010	13720	82,65	13.19	27030	596,69	14.51	1970	1790
2011	4100	24,70	4.48	7850	173,29	4.84	1915	1771
2012	6337	38,17	5.62	9951	219,67	6.01	1570	1469
2013	14000	84,34	12.42	25400	560,71	12.79	1814	1762
2014	16100	96,99	14,84	29290	646,58	15,72	1819	1717
2015	15100	90,96	13,38	28200	622,52	13,81	1868	1808
2016	13022	78,45	10,64	27283	602,27	11,94	2095	1867
2017	9269	55,84	9,11	17620	388,96	9,83	1901	1763
2018	13050	78,61	10,89	24625	543,60	10,83	1887	1897

Source: TURKSTAT, 2019

Cost elements in red pepper production in Kahramanmaras province between 2004 and 2018 were given in Table 3. Red pepper production cost per decare was 1468 TL for 2018. For the year 2018, the highest value was the land rent with 250 TL. Within the costs of producing red pepper, harvest (220 TL), hoeing (165 TL), water and irrigation cost (110 TL) was followed by the land tenure (Table 3).

Table 3. Development of red pepper production cost with real prices

Production cost items	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	TRY per decares														
Land tenure	206	190	173	163	169	178	175	158	167	196	194	184	177	191	250
First ploughing	58	54	49	46	60	59	66	59	47	45	40	46	47	57	70
Second ploughing	51	48	43	41	43	43	44	39	37	36	32	46	47	57	60
Fertiliser price and labour	75	70	72	60	84	83	88	79	112	116	105	107	96	95	90
Seed sowing and labour	46	52	48	37	40	39	43	38	40	42	37	54	56	76	70
Guard	12	11	10	10	8	8	8	7	7	11	10	11	10	10	8
Weeding	151	139	150	119	145	155	140	126	130	139	107	123	132	184	165
Agrichemical labour	34	32	29	27	24	24	22	20	20	27	16	38	41	38	40

Water rate and labour	159	147	139	126	120	150	138	124	117	112	92	138	140	127	110
Harvest	189	174	289	149	265	286	263	237	251	285	226	276	265	254	220
Drying	26	24	29	20	24	36	33	30	37	36	32	54	51	51	50
Shipping	17	16	17	14	19	19	22	20	22	27	16	38	37	32	30
Interest cost	154	96	103	102	99	98	69	62	124	131	107	140	138	147	137
General administrative expenses	25	23	26	19	25	27	26	23	25	26	25	32	32	34	31
Variable cost	820	767	875	649	834	902	866	780	822	874	821	1071	1061	1129	1050
Fixed cost	384	309	302	284	293	303	270	243	317	354	326	356	347	372	418
Total cost	1204	1076	1177	933	1126	1205	1137	1023	1138	1227	1147	1427	1407	1501	1468

Source: TOBKİM, 2018

Table 4 showed the developments in the production costs of the cost elements covering the years 2004-2018 in the province of Kahramanmaraş. For the 2018 production period, 28% of the total production costs are fixed expense items and 72% is the changing cost elements. The share of changing and fixed costs in production costs has increased by the related years. According to 2018 data, the share of farm rent, which has the highest share in production costs is 17%, and the share of harvest fee is 15%.

Table 4. Developments in share in the total production cost of red pepper production cost factors (%)

Production cost items	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Land tenure	17	18	15	17	15	15	15	15	15	16	17	13	13	13	17
First ploughing	5	5	4	5	5	5	6	6	4	4	4	3	3	4	5
Second ploughing	4	4	4	4	4	4	4	4	3	3	3	3	3	4	4
Fertiliser and labour	6	6	6	6	7	7	8	8	10	9	9	8	7	6	6
Seed sowing and labour	4	5	4	4	4	3	4	4	4	3	3	4	4	5	5
Guard	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hoeing	13	13	13	13	13	13	12	12	11	11	9	9	9	12	11
Agrichemical and labour	3	3	2	3	2	2	2	2	2	2	1	3	3	3	3
Water rate and labour	13	14	12	14	11	12	12	12	10	9	8	10	10	8	7
Harvest	16	16	25	16	24	24	23	23	22	23	20	19	19	17	15
Drying	2	2	2	2	2	3	3	3	3	3	3	4	4	3	3
Transpotation	1	1	1	1	2	2	2	2	2	2	1	3	3	2	2

Interest cost	13	9	9	11	9	8	6	6	11	11	9	10	10	10	9
General administrative expenses	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Variable cost	68	71	74	70	74	75	76	76	72	71	72	75	75	75	72
Fixed cost	32	29	26	30	26	25	24	24	28	29	28	25	25	25	28
Total cost	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

The changes in the cost of red pepper production in the province of Kahramanmaras for 2004-2018 were examined in Table 5. Accordingly, the highest increase was observed in the harvest cost with 94% compared to 2004. The highest decreasing tendency was the seed and seed sowing labour costs (33%). Among the cost elements in the years covered, land tenure, first- second ploughing, fertiliser and labour cost, guard, hoeing, water and irrigation labour, harvesting, drying expenses were increased items, while seed and planting, agrochemicals and labour cost, transportation expenses decreased according to the beginning of the period.

Table 5. Developments in red pepper production cost and elements compared to 2004

Cost items	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Land tenure	100	92	84	79	82	87	85	77	81	95	94	89	86	93	121
First ploughing	100	92	84	79	103	102	113	102	80	76	69	79	81	98	120
Second ploughing	100	92	84	79	84	83	85	77	72	69	63	89	92	111	117
Fertiliser and labour	100	113	103	79	86	85	92	83	86	90	80	116	121	165	151
Seed sowing and labour	100	92	84	79	70	69	64	58	62	89	81	89	86	85	67
Guard	100	92	99	79	96	102	93	84	86	92	71	81	88	122	109
Hoeing	100	92	84	79	70	69	64	58	60	78	47	112	120	111	117
Agrichemical and labour	100	92	87	79	76	94	87	78	74	70	58	87	88	80	69
Water rate and labour	100	92	153	79	140	151	140	126	133	151	120	146	140	135	117
Harvest	100	92	112	79	94	139	128	115	145	138	126	209	200	198	194
Drying	100	92	101	79	112	111	128	115	130	156	94	224	214	185	175
Transpotation	100	62	67	66	65	63	45	40	81	85	70	91	90	96	89
Interest cost	100	94	107	79	102	110	106	95	100	107	100	131	129	138	128
General administrative expenses	100	94	107	79	102	110	106	95	100	107	100	131	129	138	128
Variable	100	80	79	74	76	79	70	63	82	92	85	93	90	97	109

cost															
Fixed cost	100	89	98	77	94	100	94	85	95	102	95	119	117	125	122
Total cost	100	92	84	79	82	87	85	77	81	95	94	89	86	93	121

Developments in the profitability of red pepper production in the province between 2004 and 2018 were given in Table 5.

For the year 2018, the Gross Production Value (GPV) was calculated as 1900 TRY per decares. The lowest production value for the year was 887 TRY per decares in 2011. The absolute profit, which shows the difference between the gross production value and production costs, was 432 TRY per decare for 2018. Gross profit, which shows the difference between total production value and changing expenses, was calculated as 850 TRY per decares in 2018. (Table 5).

The relative profit represents the GPV obtained for each production cost. The comparable profit was calculated as 1.29 for 2018. In other words, the 1.29 TRY income (GPV) was obtained for the cost of 1 TRY for red pepper production. In 2004, 1.40 TRY income was obtained against 1 TRY of the cost. The highest relative profit belongs to 2005. The lowest relative profit belongs to 2012 (0.83) (Table 5).

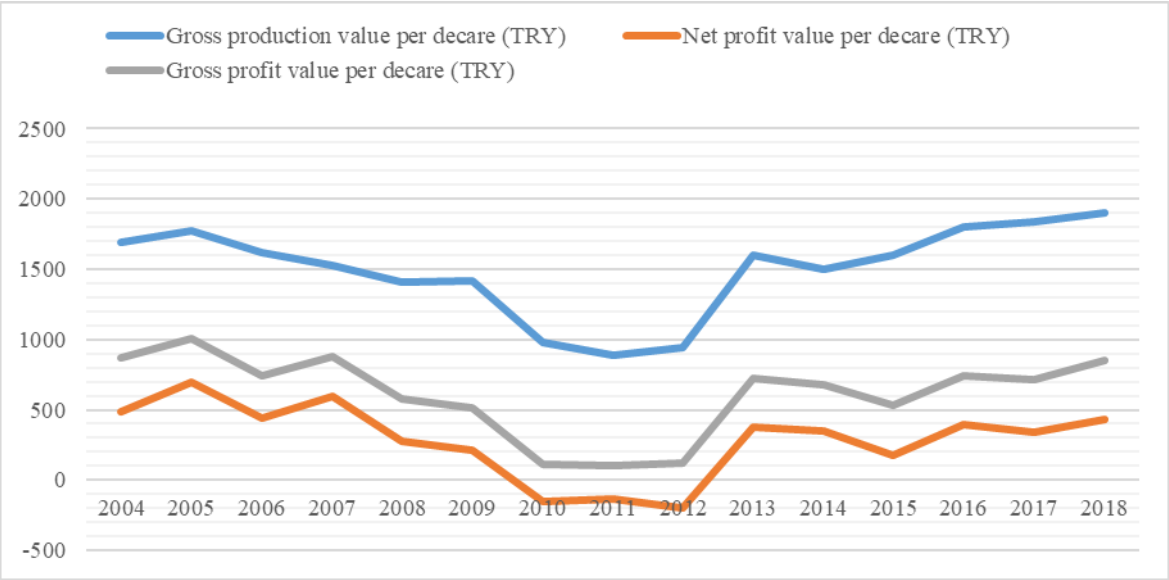


Figure 1. Developments in profitability in red pepper production

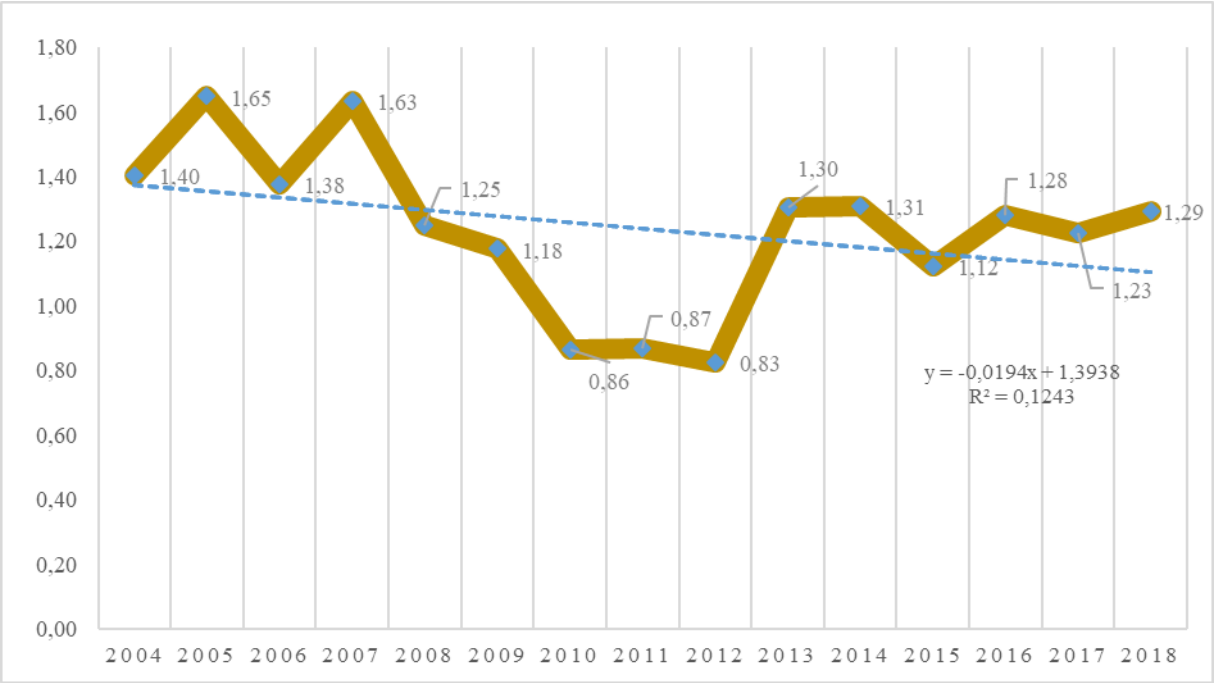


Figure 2. Developments in the relative profitability of red pepper production

The change in the GPV and profitability ratios of red pepper production was given in Table 6 in Kahramanmaraş province. Compared to 2004, GPV increased by 12% in 2018, the lowest in 2011 (47% decrease). Compared to 2004, the absolute profit for the decade decreased by 11%, the gross profit by 2% and the relative profit by 8%. The highest year of the corresponding increase was in 2005 (17%). The lowest value was obtained in 2011, with a decrease of 41% (Table 6). Gross profit decreased by 88% in 2011. Therefore, 2011 is the year in which the changing costs had the highest value. Absolute profit decreased by 72% in the same year compared to 2004. In general, profitability indicators showed a downward trend between 2004 and 2018.

Table 6. Developments in red pepper profitability compared to 2004

Indicators	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GPV	100	105	96	90	83	84	58	53	56	95	89	95	107	109	112
Net profit	100	144	91	122	58	44	32	28	41	77	73	36	81	70	89
Gross profit	100	116	86	101	66	59	13	12	14	84	78	61	85	82	98
Relative profit	100	117	98	116	89	84	62	62	59	93	93	80	91	87	92

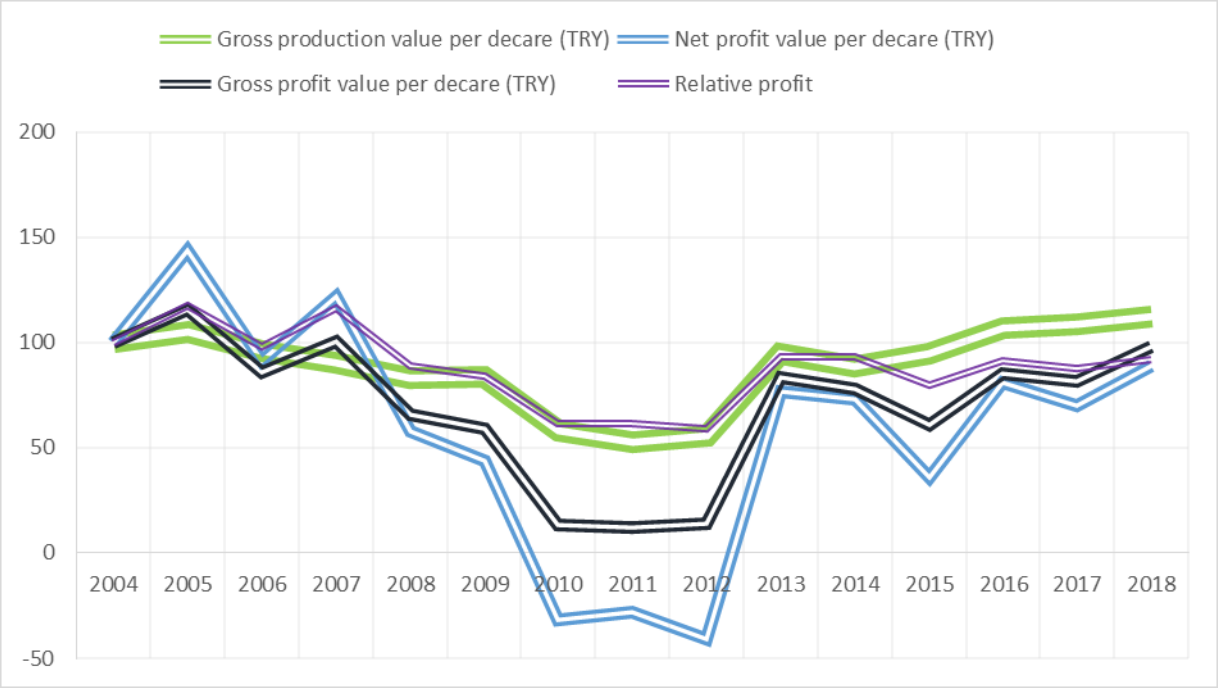


Figure 3. Developments in red pepper profitability compared to 2004

CONCLUSIONS

In this study, the cost calculation methodology was discussed in red pepper costs and determined the production costs and profitability developments in red pepper in Kahramanmaraş province. In the years covered, a significant portion of the production costs were variable costs. Production costs increased by the beginning of the year (21%) in Kahramanmaraş province. While there was an increase of 12% in GPV, absolute profit (11%), gross profit (2%) and relative profit (8%) decreased.

Cost elements in particular increases in harvesting, drying, fertiliser and labour costs increased the total production costs. Therefore, the profitability indicators decreased in general terms. Farmers could continue their production with the agricultural supports such as diesel, fertiliser, soil analysis, certified seed or seedling use provided by the Ministry of Agriculture and Forestry.

REFERENCES

Açıl, A.F., Demirci, R., 1984. Agricultural Economics Courses (in Turkish). T. C. Ankara University Faculty of Agriculture Publications: 880, Textbook: 245, 372 p., Ankara.

Akgül, A., 1993. Spice Science and Technology (in Turkish). Food Technology Association, No: 15, 451p., Ankara.

Çakır, S., 2005. Evaluation of production cost accounting methods of agricultural institutes in Adana (in Turkish). MSc. Thesis, Cukurova University, 129p, Adana.

Kıral, T., Kasnakoğlu, H., Tatlıdil, F.F., Fidan, H., ve Gündoğmuş, E., 1999. Cost Calculation Methodology and Database Guide for Agricultural Products (in Turkish). Agricultural Economics Research Institute Publications, Project Report No: 1999-13, 143p., Ankara.

TOBKİM, 2018. T. C. Ministry of Agriculture and Forestry Kahramanmaras Provincial Directorate Records, Kahramanmaraş.

TURKSTAT, 2019. Crop production statistics. Access date: 15.02.2018 web page: http://www.tuik.gov.tr//bitkiselapp

Şeniz, V., 1992. Tomato, Pepper and Eggplant Cultivation (in Turkish). Foundation for Support and Development of Agricultural Research (TAV) Publications, No: 26, 174p., Yalova.

(ORAL PRESENTATION)

The Effects of Grape Seed Flour and Glucose Oxidase Supplementation on the Some Quality Attributes of Bread

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Abstract

Grape seed flour, obtained from grape pomace, the by-product of the wine industry was supplemented into bread wheat flour to determine its effect on bread characteristics. Bread was prepared using different levels (0, 5, and 10%) of Öküzgözü (red grape variety) seed flour (ÖSF) and Narince (white grape variety) seed flour (NSF) replacement with bread wheat flour. At the same time, different amounts (0, 50, 100 mg/kg) of glucose oxidase (GO) were added to each formulation to improve bread properties. It was observed that addition of NSF or ÖSF showed an important effect on physical and textural properties of wheat bread. Loaf volume, width, length and height values decreased accurately depending on increasing ÖSF and NSF levels. The addition of GO, mainly when it was used at 100 mg/kg provided a significant improvement in all these values. Brightness (L value) and yellowness (b value) of crumb and crust of bread were gone down while redness (a value) went up as the ratio of NSF or ÖSF in the bread formulation were increased. Usage of GO was made the bread brighter. It was determined that there was a significant increase in bread hardness by the addition of NSF or ÖSF depend on the increase of percentage. When compared with control sample hardness of bread were risen from 264.9 g to 1207.8 g and 1458.0 g by the addition of 10% of ÖSF or 10% NSF, respectively. 100 mg/kg of using GO was found to be to improve considerably bread firmness. Overall results indicate that the by-products of the wine industry can be evaluated in bread making up to 5% level and the addition of GO can restore quality characteristics of their bread.

Key words: Bread, grape pomace, grape seed, Narince, Öküzgözü, texture

INTRODUCTION

Based on data from the Food and Agriculture Organization Statistical Database the total world production for grapes in 2017 is 74,276,583 metric tonnes and Turkey is the sixth highest producer of grapes in the world with its 4,200,000 metric tonnes (FAO, 2019). Grapes are used as fresh or after processed to various products such as wine, juice, raisins, boiled grape juice. Wine takes the seventh place among most produced commodities of the world with 29,105,845 metric tonnes (FAO, 2019).

During wine processing by-products called as grape pomace including skins, seeds, and stalks of grapes are occurred (Beres et al., 2016). Usage of these by products in food including breads may provide enrichment with bioactive compounds and additional health benefits (Hoye and Ross, 2011). Although grape seeds give potential health benefits to bread, the usage of grape seed flour in bread production brings some problems on technological and sensorial quality parameters of breads. Hoye and Ross (2011) reported a decrease on the loaf volume and brightness, an increase in the hardness and porosity of bread with the replacement of grape seed flour above 5 g in 100 g hard red spring wheat flour. They also reported a lower consumer acceptance of breads when the replacement level of grape seed flour was increased to ≥ 7.5 g.

Gül et al. (2017) also found a highest acceptability of breads containing up to 5 g of grape seed flour in 100 g bread wheat flour. If the replacement level of grape seed flour in bread formulations is increased, its potential benefits will also increase. However this increcement may cause some deterioration effects on quality of breads. This deterioration effects may be limited by adding some bread improvers beside grape seed flour. Glucose oxidase (GO) may be considered one of these bread improvers. Because GO has the potential to improve dough and bread properties (Bonet et al., 2006; Gül et al., 2009; Decamps et al., 2012). Therefore, in the present study it was aimed to investigate changes in the physical and instrumental texture properties of breads containing various amounts of both GSF and GO.

MATERIAL AND METHODS

Materials

Bread wheat flour was purchased from Berberoğlu Flour Co., Burdur, Turkey. Moisture (13.23±0.07 %), ash (0.61±0.01%), crude protein (10.44±0.13 %), wet-dry gluten-gluten index (30.65±0.03%, 10.29±0.26 %, 93.74±1.28 %) sedimentation (32.3±0.58 ml), falling number (305±7 .00 s) and farinogram values (water absorbtion capacity: 62.0±0.1%, dough development time: 1.7± 0.14 min, stability: 12.3±0.54 min, softening 12. minute: 35.0 ± 8.00 B.U.) of wheat flour were measured according to the approved methods 44-01.01, 08-01.01, 46–12.01, 38-12.02, 56-60.01, 56-81.03, 54-21.02 of AACC, respectively (AACC International, 2010). Glucose oxidase: Gluzyme Mono 10000BG (GOX, 10000 GODUF/g) was supplied by Novozymes (Novozymes, İstanbul, Turkey). All other chemicals used were of analytical grade.

Preperation of grape seed flours

Preperation of grape seed flours were made as in explained in our previous study (Gül et al., 2013). To put it briefly; grape pomaces by-product of white (from Narince grape variety) and red (from Öküzgözü grape variety) wine processing factory (Küp wines Denizli, Turkey) were taken as soon as the pressing and maceration processes were completed. Both types of grape pomaces were dried (8-9 hours at 55ºC untill moisture level decreased to 7-8%). After drying seeds were seperated, and floured to a particle size of under 300 µm. Grape seed flours of narince (NSF) and Öküzgözü (ÖSF) were vacuumed packed and stored at -18ºC until usage at further analysis.

Experimental design

The effect of three levels (0, 5 and 10%) for ÖSF and NSF, and the effect of three levels (0, 50, and 100 mg/kg) for the dose of GOX added in wheat flour by the replacement with wheat flour on the quality parameters of bread were investigated. Breads prepeared with 100% wheat flour was evaluated as control sample. The measurements were conducted three times.

Bread making

Bread was prepared in accordance with a method described by AACC Method 10-10.03 (AACC, 2010), with slight modifications. 1 kg wheat flour or wheat flour-GSF blends (with or without GOX), 30 g baker's yeast, water (according to water absorbtion capacity of each formula) and 15 g salt were mixed in a dough mixer (Günsa, Industrial Kitchen Equipment, İzmir, Turkey) until for 15 min, followed by proofing at 25°C and 75% relative humidity for 30 min in a proofer (Enkomak, Turkey). After mass proofing dough was cut into pieces according to 100 g flour weight basis, molded and placed into baking pans for the last fermentation at 25°C for 90 min in a proofer with relative humidity at 75%. Breads were baked at 275 °C for 15 min in a stone flour electrical oven (Enkomak, Turkey), followed by being cooled at room temperature for at least 30 min and packed in plastic bags prior to any subsequent analysis.

Determination of Bread Quality

Physical evaluation of breads

Loaf volume of breads prepared in triplicate was measured by rapeseed displacement method (AACC Method 10-05.01) 6 h later after baking. The bread weight measurement was made after the breads were baked and allowed to cool at room temperature for 1 hour (Elgün et al., 2002). Specific volume of breads was calculated by dividing the bread volume by bread weight. Width, length and height of breads from each batch were measured by a dijital calliper.

Crumb and crust colour evaluation of breads

Crumb and crust colour values of breads with or without the addition of different concentrations of ÖSF, NSF or GOX were measured with colourimeter (Minolta CR-410 Chroma Meter, Konica Minolta, Tokyo, Japan). Colour components L^*, a^* and b^* values, where L^* indicates brightness [(0) Black - (100) White], a^* redness [(+) red, (-) green], b^* indicates yellowness [(+) yellow, (-) blue].

Texture profile analysis (TPA) of breads

Texture profile analysis (TPA) of bread was performed following a method described in our previous study (Gül and Şen, 2017). In brief, after cooling 4h at room temperature, breads were sliced in width with an electric bread knife into uniform slices of 25 mm thick which were used for TPA. TPA was conducted in a texture analyzer (TAXTPlus; Stable Micro System Ltd., Godalming, UK) using a 36 mm diameter probe, with, pretest speed, test speed, posttest speed, and strain as 1 mm/s, 1.7 mm/s, 10 mm/s and 40% respectively. The TPA was replicated four times. Hardness, springiness, cohesiveness, gumminess and chewiness were measured.

Statistical analysis

Data were presented in the form of mean analysed by one-way ANOVA and the calculated mean values were compared using Duncan's multiple range test with significance defined at $P < 0.01$. All of the statistical analyses were carried out using a SPSS 16.0 software (SPSS Inc., Chicago, IL, USA).

RESULTS AND DISCUSSION

Effects of ÖSF, NSF and GOX on physical properties of bread

Physical (weight, loaf volume, specific volume, width, length and height) properties of breads containing different amounts of ÖSF, NSF and GOX are presented on Table 1.

Table 1. Effects of ÖSF, NSF and GOX on physical (weight, loaf volume, specific volume, width, length an height) properties of bread

GSF (%)	GO (ppm)	Loaf Weight (g)	Loaf volume (cm^3)	Specific volume (cm^3/g)	Width (mm)	Length (mm)	Height (mm)
0 (Control)	0	140.85^{de}	650.00^{d}	4.60^{d}	71.79^{b}	128.85^{ef}	77.38^{c}
	50	141.42^{cd}	680.00^{c}	4.79^{c}	72.71^{b}	132.54^{cd}	82.36^{b}
	100	144.24^{b}	750.00^{a}	4.91^{b}	74.87^{a}	134.47^{a}	85.60^{a}
5 % ÖSF[2]	0	137.42^{fg}	613.33^{e}	4.46^{e}	64.56^{f}	122.20^{j}	60.53^{g}
	50	136.71^{g}	666.67^{d}	4.88^{bc}	65.06^{f}	125.29^{i}	57.84^{h}
	100	138.92^{defg}	730.00^{b}	5.25^{a}	69.62^{c}	127.84^{fgh}	61.77^{fg}

	0	137.68^{fg}	386.67^{i}	2.81^{i}	56.35^{g}	134.23^{ab}	34.27^{n}
10 % ÖSF	50	138.41^{efg}	400.00^{i}	2.89^{i}	55.63^{g}	132.34^{d}	40.91^{m}
	100	139.42^{def}	413.33^{i}	2.96^{i}	55.41^{g}	133.39^{bc}	43.75^{l}
	0	140.69^{de}	446.67^{h}	3.17^{h}	69.60^{c}	129.66^{e}	62.56^{f}
5 % NSF[3]	50	143.66^{bc}	496.67^{g}	3.46^{g}	68.50^{cd}	127.15^{h}	68.33^{e}
	100	144.71^{b}	546.67^{f}	3.78^{f}	69.67^{c}	129.45^{e}	71.13^{d}
	0	145.20^{b}	356.67^{j}	2.46^{j}	66.75^{e}	128.34^{fg}	47.36^{k}
10 % NSF	50	145.46^{b}	360.00^{j}	2.47^{j}	67.64^{de}	127.55^{gh}	51.44^{i}
	100	148.22^{a}	366.67^{j}	2.47^{j}	67.66^{de}	127.73^{gh}	49.09^{j}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).
(2): ÖSF: Öküzgözü seed flour
(3): NSF: Narince seed flour

Loaf weight of breads were found between 136.71 g to 148.22 g. Highest loaf weight values were measured at 10 % NSF containing breads. This probably occurred as result of the higher water absorption capacity of NSF (Table 1).

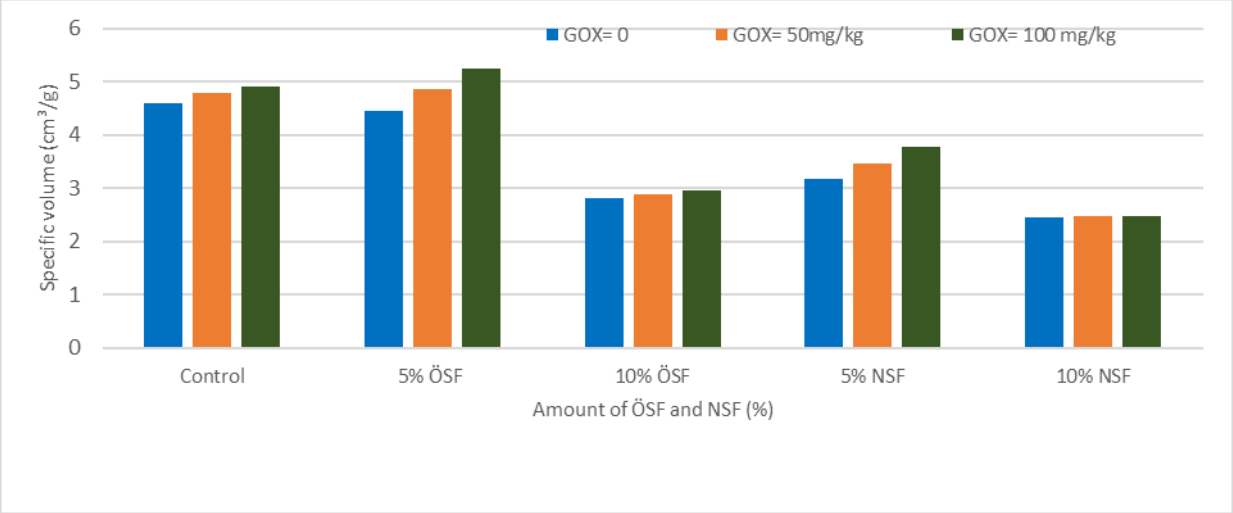


Figure 1. Specific volume of bread with the addition of different amounts of ÖSF, NSF (0,10,100 g/100g) and GOX (0,50,100 mg/kg).

The effect of GSF and GOX on loaf volume and specific volume of breads are shown in Table 1 and Figure 1, respectively. There were significant differences ($P < 0.01$) in loaf volume and consequently the specific volume between the control bread (no GSF) and the bread groups with added ÖSF and NSF. There was a general trend indicating a decline in bread specific volume with increasing GSF levels. When the specific volumes of control bread and 5% ÖSF, 10% ÖSF, 5% NSF and 10% ÖSF added breads were compared, significant reduce ($P < 0.01$) was recorded as from 4.60 to 4.463, 2.808, 3.174, 2.456 cm^3/g respectively. Compared with the effects of ÖSF and NSF on the specific volume of bread; ÖSF had a more positive effect on the specific volume. As can be seen clearly from Figure 1 as NSF was increased to 10% addition level in to wheat flour, breads had a significantly smaller specific volume ($P < 0.01$) than the control bread and the other breads prepared with 5% ÖSF, 10% ÖSF or 5% NSF.
The replacement of wheat flour with GSF negatively impacted bread volume, however addition of GOX in to bread formulation had a significant ($P < 0.01$) improving effect on this value (Table 1, Figure 1). Improving effect of GOX was became more evident by increasing its supplementation

amount from 50 mg/kg to 100 mg/kg. Most pronounced benefit of GOX addition was seen on 5% ÖSF breads. Highest specific volume was observed with the addition of 100 mg/kg GOX in to 5% ÖSF containing doughs. Although GOX had a positive impact on loaf volume of 5% GSF containing breads, this effect was seen in a limited extent when the incorporation level of GSF was increased over 5% to 10%. However, there were no significant differences amongthe three addition levels of GOX on specific volumes of 10% NSF breads.

It was observed that incorporation of GSF in to wheat flour resulted a significant decrease on loaf width, length and height as similarly loaf volumes. The increasing levels of GOX caused very clear increase on bread physical characteristics (width, length, height, loaf volume and specific volume) when the GSF was used up to 5% replacement level.

Crumb and crust color of breads

The crust and crumb color values of bread with different amounts of added GSF and GOX are given in Table 2. The results show that the color of bread crust and crumb were affected by GSF addition. In general, L* and b* values decreased, whereas a* values increased, with increasing GSF levels. As an expected, with the addition GOX, breads were become a few lighter than breads contain no GOX. However, when the GOX was used more than 50 mm/kg and depend on increase of percentage, L* and b* values showed significant changes on ÖSF added breads while a* values were not affected. Increasing levels of GOX also was not cause any change on crust a* and crust b* values of NSF breads.

Table 2. Effects of ÖSF, NSF and GOX on crust and crumb colour of bread

GSF (%)	GO (ppm)	Crust L*	Crust a*	Crust b*	Crumb L*	Crumb a*	Crumb b*
0 (Control)	0	65.24$^{b(1)}$	2.25^{g}	16.04^{cd}	63.60$^{c(1)}$	1.08^{h}	10.20^{a}
	50	69.28^{a}	2.33^{g}	14.36^{fg}	68.02^{b}	0.93^{hı}	10.11^{a}
	100	62.85^{c}	5.22^{f}	17.40^{b}	70.61^{a}	0.56^{ı}	8.90^{b}
5 % ÖSF[2]	0	47.93^{h}	9.79^{cd}	17.94^{ab}	53.21^{e}	2.82^{g}	7.69^{d}
	50	48.31^{gh}	10.40^{bc}	18.56^{a}	54.55^{e}	3.16^{fg}	7.41^{d}
	100	47.56^{h}	10.66^{b}	18.16^{a}	56.58^{f}	3.29^{ef}	5.64^{g}
10 % ÖSF	0	45.57^{ı}	9.32^{d}	15.37^{de}	44.44^{h}	4.29^{c}	5.93^{fg}
	50	39.74^{j}	12.23^{a}	14.62^{ef}	46.14^{gh}	4.37^{c}	7.41^{d}
	100	44.60^{ı}	9.45^{d}	16.16^{c}	50.03^{f}	4.66^{bc}	5.64^{g}
5 % NSF[3]	0	49.57^{fg}	10.36^{bc}	13.45^{h}	51.14^{f}	3.80^{d}	7.59^{d}
	50	56.07^{d}	8.52^{e}	14.66^{ef}	53.54^{e}	3.60^{de}	8.28^{c}
	100	55.43^{d}	9.36^{d}	13.75^{gh}	57.50^{d}	3.83^{d}	8.28^{c}
10 % NSF	0	50.36^{f}	7.95^{e}	10.88^{ı}	44.42^{h}	4.91^{ab}	6.87^{e}
	50	51.90^{e}	8.38^{e}	11.58^{ı}	45.16^{h}	5.26^{a}	7.69^{d}
	100	55.42^{d}	8.41^{e}	13.08^{h}	43.33^{g}	5.06^{a}	7.41^{d}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).

(2): ÖSF: Öküzgözü seed flour

(3): NSF: Narince seed flour

Texturel properties of breads

Texture profile analysis (TPA) was performed 6 hours after the bread left the oven and the results are given in Table 3.

Table 3. Effects of ÖSF, NSF and GOX on TPA of bread

GSF (%)	GO (ppm)	Hardness (g)	Springiness	Cohesiveness	Gumminess	Chewiness
0 (Control)	0	264.9^{k}	1.42^{cd}	0.84^{ab}	231.88^{j}	714.52^{i}
	50	235.50^{l}	0.96^{d}	0.68^{d}	243.50^{i}	553.00^{j}
	100	154.40^{m}	0.93^{d}	0.66^{d}	230.20^{j}	576.8^{j}
5 % ÖSF[2]	0	476.24^{i}	1.89^{bc}	0.83^{ab}	397.56^{i}	738.55^{i}
	50	297.27^{j}	2.81^{a}	0.86^{a}	261.65^{i}	731.30^{i}
	100	273.53^{k}	1.61^{cd}	0.85^{a}	239.14^{j}	325.51^{k}
10 % ÖSF	0	1207.80^{e}	1.00^{d}	0.77^{c}	898.97^{e}	898.06^{f}
	50	1313.90^{d}	0.98^{d}	0.84^{ab}	1029.30^{d}	1014.60^{e}
	100	996.41^{g}	0.99^{d}	0.76^{c}	766.67^{f}	764.19^{h}
5 % NSF[3]	0	1004.30^{f}	1.74^{cd}	0.84^{ab}	791.32^{f}	847.49^{f}
	50	686.24^{h}	1.27^{cd}	0.85^{a}	631.91^{g}	1252.90^{c}
	100	565.34^{i}	2.65^{ab}	0.84^{ab}	490.64^{h}	804.93^{g}
10 % NSF	0	1458.00^{c}	0.96^{d}	0.75^{c}	1165.40^{c}	1174.60^{d}
	50	2170.40^{a}	0.96^{d}	0.76^{c}	1652.70^{a}	1594.50^{a}
	100	1867.30^{b}	0.97^{d}	0.72^{cd}	1443.80^{b}	1404.2^{b}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).
(2): ÖSF: Öküzgözü seed flour
(3): NSF: Narince seed flour

As can be seen from Table 3 and Figure 2 replacement of wheat flour with GSF negatively impacted bread firmness. Addition of GSF increased hardness with the increasing level of GSF. When ÖSF and NSF compared each other, ÖSF provides more softer breads than NSF at all replacement levels. After the addition of GO hardness were decreased and breads became more softer. However usage of GO at 10% NSF breads did not provide any benefit and even made the bread harder. Usage of GO at 100 ppm provide more firmness

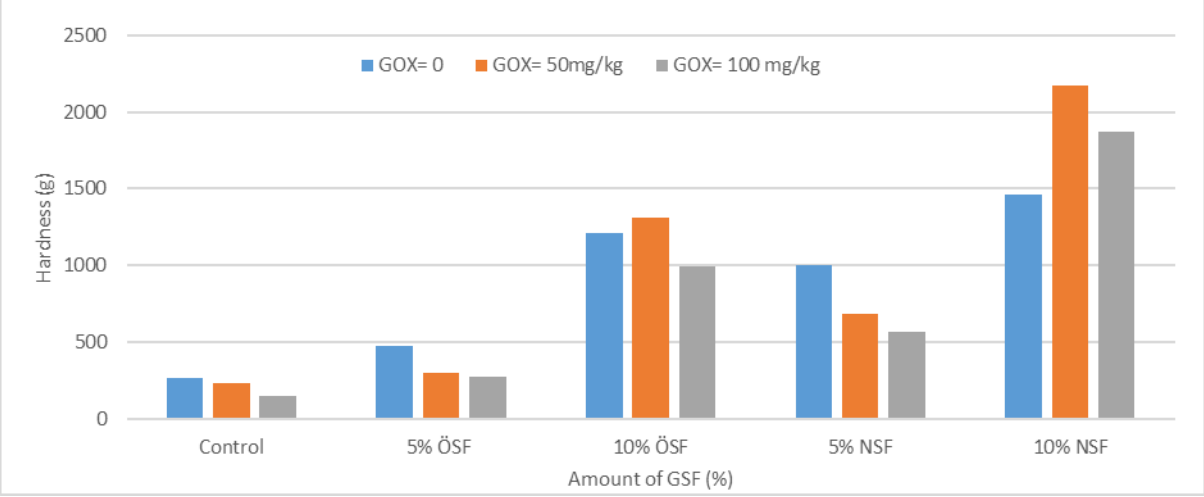


Figure 2. Crumb hardness (g) of bread with the addition of different amounts of ÖSF, NSF (0,10,100 g/100g) and GOX (0,50,100 mg/kg).

There was no significant difference was determined between the springeness values of control and GSF added breads. While addition of 5% NSF and ÖSF did not led to any change on the springeness values of breads. Cohesiveness of control and 5% ÖSF and NSF containing breads were showed similar values. But lower cohesiveness were determined when the addition level of ÖSF and NSF were rised to %10. However addition of GOX did not cause important changes on the cohesiveness of experimented breads. Significant increase on the gumminess and chewiness of breads were determined by the increasing levels of ÖSF and NSF as compared with control breads. When the chewiness values of breads containing ÖSF and NSF in the same proportions were examined, it was found that the chewiness values of ÖSF-added breads were lower. But in breads containing 10% NSF, the improving effect of 100 ppm GOX was found insufficient in terms of chewiness.

CONCLUSION

Results of the present study indicated thet the addition of grape seed flour was caused to decrease the quality characteristics of bread. Loaf volume, width, length and height values decreased while hardness of breads increased with addition of ÖSF and NSF in the bread formulation. Improving effect of GOX on these properties were determined when it was used at 100 mg/kg. 100 mg/kg of using GO was found to be to improve considerably bread firmness. Overall results indicate that the by-products of the wine industry can be evaluated in bread making up to 5% level and the addition of GO can restore quality characteristics of their bread.

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REFERENCES

AACC International (2010). Approved Methods of Analysis of American Association- St. Paul, MN: AACCI

Beres, C., Simas-Tosin F.F., Cabezudo I., Freitas S.P., Iacomini M., Mellinger-Silva C., Cabral M.C.L. (2016). Antioxidant dietary fibre recovery from Brazilian Pinot noir grape pomace. Food Chemistry, 201, 145-152. DOI: 10.1016/j.foodchem.2016.01.039

Bonet, A., Rosell, C.M., Caballero, P.A., Gómez, M., Pérez-Munuera, I., Lluch, M.A. (2006). Glucose oxidase effect on dough rheology and bread quality: A study from macroscopic to molecular level. Food Chemistry, 99 (2), 408-415. DOI: 10.1016/j.foodchem.2005.07.043.

Decamps, K., Joye, I.J., Courtin C.M., Delcour, J.A. (2012). Glucose and pyranose oxidase improve bread dough stability. Journal of Cereal Science, 55 (3), 380-384. DOI: 10.1016/j.jcs.2012.01.007.

Elgün, A., Ertugay, Z., Certel, M. and Kotancılar, H.G. (2002). Tahıl ve Ürünlerinde Analitik Kalite Kontrolü ve Laboratuvar Uygulama Kılavuzu. Atatürk Üniversitesi Ziraat Fakültesi Ofset Tesisleri, 245s, Erzurum.

FAO. (2019). Food and Agriculture Organization of the United Nations, Statistics.

Gül, H., Acun, S., Şen, H., Nayır N., Türk, S. (2013). Antioxidant activity, total phenolics and some chemical properties of Öküzgözü and Narince grape pomace and grape seed flours. Journal of Food, Agriculture and Environment Vol.11 (2), 28-34.

Gül, H., Gül, M., Aslan, S.T., Acun, S., Nayır, N., Şen H. (2017). Consumer acceptability of bread produced from by-products of wine industry. Fresenius Environmental Bulletin, 26 (11), 6924-6931.

Gül, H., Özer, M.S., Dizlek, H. (2009). Improvement of the wheat and corn bran bread quality by using glucose oxidase and hexose oxidase. Journal of Food Quality, 32, 209-223. DOI: 10.1111/j.1745-4557.2009.00246.x

Gül, H., Şen H. (2017). Effects of pomegranate seed flour on dough rheology and bread quality, CyTA - Journal of Food, 15:4, 622-628. DOI: 10.1080/19476337.2017.1327461.
Hoye, C., Ross, C.F. (2011). Total phenolic content, consumer acceptance, and instrumental analysis of bread made with grape seed flour. Journal of Food Science, 76 (7), 428-436. DOI: 10.1111/j.1750-3841.2011.02324.x.

(ORAL PRESENTATION)

THE EFFECT OF AGRICULTURAL CREDIT USAGE ON THE SOCIO-ECONOMIC INDICATORS OF APRICOT FARMERS: A CASE OF MUT DISTRICT OF MERSİN IN TURKEY

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Abstract

In this study, the relationship between the socio-economic characteristics of apricot growing farmers who used agriculture loan and non-use in the case of Mersin province Mut district was discussed. The stratified sampling Neyman method was used to determine the sample farmer volume in the Mut district. The farmer number was calculated to be 91 in the confidence interval with 5% of the average, the margin of error and 90%. Data from this number of farmers was obtained by face-to-face survey method. The data set included the 2016 production period. The rate of farmers who used credits in apricot production was 32.97%. Farmer age, farmer's level of education, household size, experience in apricot cultivation, total farmland, apricot land, unit production cost of apricot and apricot sale price are higher in farmers who use credit. However, the apricot yield per unit area is also lower.

***Keywords**: Apricot, agricultural credit, farmer, cost, Mut*

INTRODUCTION

Turkey has an important position based on the apricot production in the world and export and ranks first in the world in terms of these indicators (Gül and Akpınar, 2006; Akpınar et al., 2006). Mersin is located in the second position in term of the apricot production in Turkey. The share of Mersin in Turkey apricot planted area of the province ranged from a 6.32% to 4.34% between the years 2004-2018, was 5.72% in 2018. Its share in production varied between 6.17% and 41.38%. In 2018, the figure was 11.91%. The planting area has increased with each passing year. However, production varies depending on climate conditions. In 2018, apricot production reached to 89300 tons. Apricot production of Mersin distrits in 2018 is given in Table 1. In the district of Mut, 70246 tons of apricots were produced on an area of 55740 decares. Mut district is in the first place in terms of apricot planted area and production. Mut district's share in the apricot planted area of Mersin has changed between 76.57% and 86.90% between 2004-2018 and realised as 77.52% in 2018. Its share in production varied between 69.46% and 88.60% between 2004-2018. In 2018, it was 78.66%. Therefore, Mut is a district that meets almost all of Mersin apricot production. This district is followed by Tarsus with 9.85%, Gülnar with 3.19% and Akdeniz with 2.43%. At this point, Mut district was chosen as the sampling area.

Table 1. Apricot production in districts of Mersin province

District	Harvested area (decares)	Share in the harvested area (%)	Production (ton)	Share in the production (%)
Mut	55.740	77.52	70.246	78.66
Tarsus	7.081	9.85	9.295	9.85
Gülnar	3.050	4.24	2.846	3.19
Akdeniz	3.082	4.29	2.170	2.43

TURKSTAT, 2019

Developments in apricot production and planted area in Mut district in 1995-2018 were given in Table 2. About 14650 tons of apricot production was realised in 21640 decare area in 1995. In 2018 compared to this year, planted areas increased by 2.58 times and increased to 55740 decares, and production increased by 4.79 times and reached to 70246 tons. Fluctuations in the apricot production of district were involved, and one of the most important reasons is the frost event in spring period.

Table 2. Apricot production and planted areas in Mut district of Mersin

Years	Harvested area (decares)	Area index (1995=100)	Production (ton)	Production index (1995=100)
1995	21.640	100	14.650	100
2000	31.130	144	42.100	287
2005	46.750	216	48.739	333
2010	52.228	241	39.195	268
2011	55.240	255	40.166	274
2012	55.240	255	35.166	240
2013	55.684	257	80.646	550
2014	55.240	255	93.861	641
2015	55.240	255	90.280	616
2016	55.240	255	85.460	583
2017	54.456	252	70.621	482
2018	55.740	258	70.246	479

TURKSTAT, 2019

Agricultural credit was about 24.26 billion in 1988 increased by 181.6% and exceeded approximately 68.24 billion TRY in 2017 with real prices (2003 PPI = 100 were calculated based on prices of 2017) in Turkey. On the other hand, as a result of the need for credit in other sectors and the further development of other economic indicators (Gürbüz and Gül, 2016), the share of agriculture in total credits decreased from 16.2% to approximately 3.3%. A similar situation exists in Mersin. The amount of credits used by the agricultural sector in the province in 1988 was around 216 million TRY. In this year, 11.87% of total loans were in the agriculture sector in the province. This value decreased to 8.62% in 2017.

Agricultural credits have decreased proportionally in the last twenty-nine years in both Turkey and Mersin. However, the amount of agricultural credits in Turkey increased by 186% in 2017 compared to 1988, increased by more than ten times in Mersin. The proportional share of agricultural credits in Mersin was above the average of Turkey between 2007 and 2017 (Figure 1).

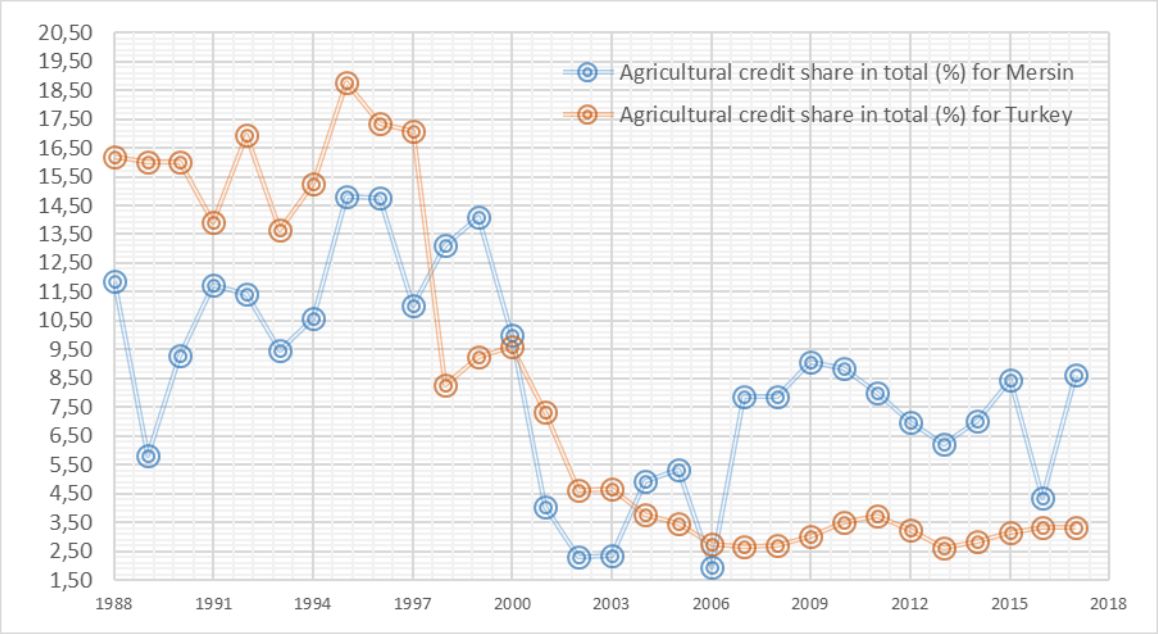


Fig. 1. Agricultural credit share in total credit (%)
Data is calculated depend on Anonymous, 2019

While the share of agricultural credits in Mersin province of Turkey was 0.89% in 1988, it increased to 3.31% in 2017. The share of agricultural credits in Mersin province of Turkey has been at the level of 3% in average between 2007and 2017 (Figure 2).

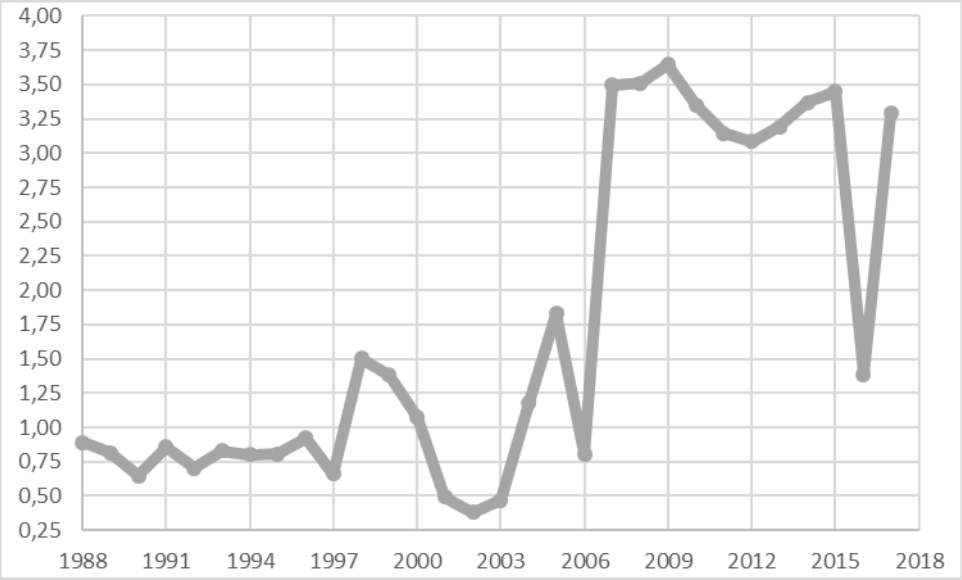


Fig. 2. Mersin's agricultural credit share in Turkey (%)
Data is calculated depend on Anonymous, 2019

Therefore, this study aimed to investigate the relationship between the credit usage of apricot farmers in the Mut district of Mersin and the socio-economic characteristics of farmers.

MATERIALS AND METHODS

The primary material of this study was obtained from the farmers who grow apricots in Mut. The stratified sampling Neyman method was used to determine the sample farmer volume in the Mut district. The farmer number was calculated to be 91 in the confidence interval with 5% of the average, the margin of error and 90%. Data from this number of farmers was obtained by face-to-face survey method. The data set included the 2016 production period.

A Single Product Budget Analysis method was used in the cost analysis of farmers. Gross production value includes the sales value of the agricultural products of the farmer, and increases in the productive value (Erkuş et al., 1995).

The determination of the debts of the enterprise was based on the declaration of the farm owner. In the calculation of the labour of the farm owner and family members, the daily wage paid to the local labour force was taken as a precedent. 3% of the total changed cost was taken as general administrative expenses (Kıral et al., 1999).

Gross profit was calculated by subtracting the variable cost from the gross value of production, and net profit was calculated by subtracting production costs (Aras, 1988). The relative profit was calculated by dividing the gross production value by the cost of production (Kıral et al., 1999).

Also, the Chi-square test was used to determine relationships between observed variables. For continuous variables, variance analysis was performed. Analysis of variance was used to test hypotheses about whether the difference between the means of two or more groups is significant (Özdamar, 1999).

RESULTS AND DISCUSSION

32.97% of the surveyed farmers used agricultural credits (Table 3). Demirtaş (2000) calculated the loan uses the ratio as 30,86% in the same region.

Table 3. Agricultural credit usage status

	N	%
Credit user	30	32,97
Non-user	61	67,03
Total	91	100,00

The age, educational level, experience of apricot production activities, household size, non-agricultural business ownership of the owners of apricot production activities were examined.

The average age of farmers using credit in the research area was 49 years, education level was 7,37 years, household size was 4,47 people, and experience in apricot production was 19 years (Table 4). It was determined that household size, experience and education level were higher in farmers using credit than non-credit farmers. However, these situations were not statistically significant.

Demirtaş (2000) calculated household size as 5,43 in the same region.

The rate of a non-agricultural job of farmers using credit is 36,67% and the rate was 29,51% for non-credit farmers (Table 4). Farmers using credit had a higher rate of non-agricultural job. The share of non-agricultural incomes in total revenues was 12,25% compared to those who do not use credit (7,69%). There was also a statistically significant difference between non-agricultural income level and credit usage status ($\alpha = 0,10$; Fcalculated> Ftable; 3,328> 2,748).

On average, it was calculated that the apricot land owned by the enterprise consisted of 2,80 parts, whereas the farmers who did not use credit was 1,97 pieces (Table 4). A statistically significant difference was found between the pieces of apricot fields and credit usage status ($\alpha = 0,05$; Fcalculated> Ftable; 5,89> 3,95).

The averages of agricultural land for farmers using and not using loans were 48,79 and 32,99 decares, respectively. 92,62% of the farmland was irrigated in farmers using credit and the rate of irrigated land was 86,24% for those who did not use credit. 94,81% of the farmland was own land of using credit farmers, and 81,34% of those who did not use credit were owned land (Table 4).

The average of the farmers using credit was 33,45 decare apricot land, and this value was 20,11 decare apricot land for non-credit farmers. 68,57% of the total farmland was apricot land for credit users and 60,97% for non-credit users. 4,98% of apricot land was renting land for farmers

using credit, and renting area was 18,22% for those who did not use credit. 95,02% of total apricot land was owned land in the farmers using credit, and this value was 81,05% for farmers who did not use credit. For those who did not use credit, 2,53% of the total apricot land was shared land (Table 4).

Demirtaş and Gül (2003) found that farmers had 15,19 decare apricot land in the same region.

Gross production value is calculated by adding annual productive value increases in crop and animal production to the value obtained by multiplying the production amounts of plant and animal products produced by agricultural enterprises within the year with the prices of the farmer (Açıl and Demirci, 1984; Erkuş et al., 1995).

Apricot gross production value was 69.31% of the total gross production value and 57,90% of the farmers who did not use credit (Table 4).

Those who use credit have a higher rate of record keeping in agricultural work (30%). Their participation in training on apricot (23,33%), computer ownership (40%), internet ownership (43,33%) and soil analysis rate (30%) were higher compared to non-credit users. There was a statistically significant difference between farmers using and not using credit in term of record keeping, computer ownership, internet presence, soil analysis, agricultural organisation rate and credit usage status (χ^2 p-values <0.05).

Table 4. Socio-demographic-economic factors with credit groups

	Credit user	Non-user
Farmers age (year)	49.00	48.49
Farmers education level (year)	7.37	7.10
Household size (head)	4.47	4.16
Farmers experience in apricot production (year)	19.00	18.39
Family education (%):		
Illiterate	0.79	1.30
Literate	2.36	2.60
Primary	43.31	49.35
Secondary	15.75	13.42
High school	22.83	17.32
Junior college	4.72	5.19
University	10.24	10.82
Total owned land (%)	94.81	81.34
Rented land (%)	5.19	16.47
Irrigated land (%)	92.62	86.24
Non-irrigated land (%)	7.38	9.99
Apricot land in total farmland (%)	68.57	60.97
Total apricot owned land (%)	95.02	81.05
Apricot rented land (%)	4.98	18.22
Apricot shared land (%)	0.00	2.53
The share of apricot production value in total gross production value (%)	69.31	57.90
Share of non-agricultural income in total income (%)	12.25	7.69
Parcel numbers of apricot area (per)**	2.80	1.97
Apricot area (decares)**	33.45	20.11
Record keeping in apricot growing (%)**	30.00	9.84
Participation in training activities for apricot cultivation (%)	23.33	14.75
Non-agricultural business (%)*	36.67	29.51
Computer ownership (%)*	40.00	22.95
Internet ownership (%)**	43.33	22.95

The number of the farmer who soil analysis (%)**	30.00	9.84
Membership of an agricultural organisation***	90.00	29.51

*, Significant at 90%; **, Significant at 95%; ***, Significant at 99%

Variable costs are costs that increase or decrease depending on the volume of production. These costs arise when production is made. Production varies depending on the amount (İnan, 2001). Total production cost in apricot cultivation was calculated as 1345,50 TRY/da on average for farmers using credit and 1287,92 TRY/da on average for non-credit farmers (Table 6). The share of the variable cost was 59,58% and 57,34% among those who used credit in apricot production (Table 5).

Among the variable cost items of the farmers in question, the highest rate of agrochemicals, fertiliser and labour costs were obtained (Table 5).

Fixed costs, on the other hand, are defined as the costs that do not change depending on the production volume, whether they are produced or not (İnan, 2006).

In this study, fixed cost components in apricot production; general administrative expenses, land tenure, family labour, depreciation of establishment costs and the interest of establishment capital. The share of fixed costs was calculated as 40,42% in the average of the farmers using credit interviewed in apricot production and 42,66% in the non-credit users (Table 5).

The highest share of fixed-cost items in apricot production of farmers using credit interviewed received land rent with 15,09%. The depreciation of establishment costs followed this at 10,32% and the interest of establishment capital at 9,03%. Those who did not use credit were the most important fixed cost elements, and their shares were 16%, 10,78% and 9,43% respectively (Table 5).

In the interviewed farmers, the most critical cost element in the apricot production process was a variable cost. The most important cost elements were agrochemicals with 20.35%, land rent with 15.09%, fertiliser with 13,12%, depreciation of establishment costs with 10.32% (Table 5).

In the non-credit farmers, the most critical apricot production cost elements were land rent with 16%, agrochemicals with 13,74%, fertiliser with 12,47%, paid labour with 12,37%, depreciation of establishment costs with 10,78% (Table 5).

There was statistically significant difference between paid labor and marketing cost and credit usage status ($\alpha = 0.05$; Fcalculated> Ftable; 10,553> 23.95). The rate of paid labour cost and marketing cost was lower among farmers using agricultural credit.

Demirtaş and Gül (2000) found that farmers' fixed cost share was 39,70% and variable cost share was 60,30% of the total apricot production cost in the same region.

Table 5. Production cost in apricot growing (%)

Cost items	User	Non-user
Machnirey rent	7,83	8,20
Labour***	8,55	12,37
Fertiliser	13,12	12,47
Irrigation	6,47	6,01
Agrochemicals	20,35	13,74
Marketing**	1,80	3,14
Revolving fund interest	1,45	1,40
Variable cost	59,58	57,34
General administrative expenses	1,79	1,72
Land tenure	15,09	16,00
Family labour	4,19	4,72
Depreciation of establishment costs	10,32	10,78
The interest of establishment capital	9,03	9,43
Fixed cost	40,42	42,66
Total producion cost	100,00	100,00

, Significant at 95%; *, Significant at 99%

The gross production value obtained by the usage the agricultural credit of farmers was 1877,25 TRY per decare in the production of apricot. The gross production value obtained by farmers who did not use agricultural credit in the production of apricot per decare was determined as TRY 1813,81 (Table 6).

Gross profit in apricot-grown farmers was calculated by subtracting varying costs from gross production value (Açıl and Demirci, 1984). Accordingly, gross profit per decare was calculated as 1075,55 TRY on average for farmers using credit. The average gross profit value per decare of farmers who did not use credit was 1075,31 TRY (Table 6). 10% of farmers using credit and 14,75% of non-users credit farmers received a negative value of gross profit from apricot production. In other words, 10% of farmers using agricultural credit and 14,75% of non-credit farmers could not meet the variable costs of apricot production.

Absolute (net) profit was found by subtracting the total production cost for apricot production from the gross production value (Kıral et al., 1999). One of the main objectives of the business is to make a profit, but also to find ways to make this profit the highest. The average absolute profit of farmers using agricultural credit in apricot production was calculated as 531,75 TRY per decare. For farmers who did not use agricultural loans, the absolute profit per decare was found to be 525,89 TRY (Table 6). The absolute profit value obtained from apricot production was negative in 26,67% of the farmers using agricultural credit. In 37,70% of farmers who do not use agricultural credit, the absolute profit value obtained from apricot production was negative. Thus, about 27% of farmers using agricultural credit and about 38% of farmers not-user were a loser from apricot production. There is a statistically significant difference between absolute profit per decare and credit utilization ($\alpha = 0.10$; Fcalculated> Ftable; 3,328> 2,748). Farmers using agricultural credit had high absolute profits.

The relative profit was found as the ratio of gross production value to production cost. Relative profit is proportional to how much one option is superior to the other. Relative profit measures the return on production activities better (Kıral et al., 1999). In apricot cultivation, the relative profit was calculated as 1.40 for credit-using farmers and 1.41 for non-credit farmers (Table 6).

The relative profit value calculated on the average of farmers in apricot production for 2016 production season shows that apricot production activity was profitable. As a matter of fact, in the apricot production of the farmers using agricultural credit during the survey period, the gross production value of 140 TRY was obtained for every 100 TRY production cost. Therefore, 40 TRY profit was generated for every 100 TRY production cost. In apricot production of farmers who do not use agricultural credit, gross production value of 141 TRY was obtained for every 100 TRY production cost. Therefore, a profit of 41 TRY was provided for each production cost of 100 TRY.

However, more than 30% of farms in the region had a loss. Also, high-profit was available on some farms.

Demirtaş (2000) calculated the relative profit as 1,39 in the same region. Gül and Demirtaş (1998) found that real apricot sale price fluctuates depending on the production in 1988-1997.

Farmers using agricultural credit for the 2016 production season had higher production costs per kg, kg sales price and kg profit margin in apricot production. However, these situations were not statistically significant.

In the 2016 production season, farmers using agricultural credit had lower yields per decare in apricot production. The production cost per decare and the gross production value in farmers using credit were higher than non-user. However, these situations were not statistically significant.

Table 6. Some economic indicators in apricot growing

	User	Non-user
Yield per decares (kg)	731,08	780,87
Production cost per decares (TRY)	1345,50	1287,92
Gross production value per decares (TRY)	1877,25	1813,81

Gross margin per decares (TRY)	1075,55	1075,31
Net profit per decares (TRY)	531,75	525,89
Relative profit	1,40	1,41
One kg cost (TRY)	1,84	1,65
One kg selling price (TRY)	2,57	2,32
Profit margin	0,73	0,67

1 USD equal 3.02 TRY for 2016 average

CONCLUSION

In this study, the effect of agricultural credit utilisation on the socio-economic indicators of the farmers in the Mut district of Mersin province was investigated.

Farmer age, farmer's level of education, household size, experience in apricot cultivation, total farmland, apricot land, unit production cost of apricot, and apricot sale price are higher in farmers who use credit. However, the apricot yield per unit area is also lower.

It is also essential to disseminate consultancy and agricultural extension services in the region. Thus, the yield of the unit area can be increased. Improvements in credit usage in the production can increase the farmer's income.

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REFERENCES

Açıl, A.F., Demirci, R., 1984. Agricultural Economics Courses (in Turkish). Ankara University Agricultural Faculty Publications, 372p, Ankara.

Akpınar, G., Gül, M., Dağıstan, E., 2006. Development and Structure of Fruit Trade in Turkey during EU Accession Process (in Turkish). 7th Turkish Agricultural Economics Congress, page: 836-848, Antalya.

Anonymous, 2019. The Banks Assocation of Turkey's Data, web page: https://www.tbb.org.tr, Access Date: 02.02.2019.

06.12.2015) Aras, A., 1988. Agricultural accounting (in Turkish). Ege University Faculty of Agriculture Publications No.486, 86p, İzmir.

Demirtaş, B., 2000. Apricot Production Economics in İçel province (in Turkish). Msc. Thesis, Çukurova University Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 107s., Adana.

Demirtaş, B., Gül, A., 2000. Socio-Economic Structure and Problems of Fresh Apricot Producers in Mersin Province (in Turkish). Çukurova University, Journal of Agriculture Faculty, 15 (2), 47-54.

Demirtaş, B., Gül, A., 2003. Socio-Economic Structure and Problems of Fresh Apricot Producers in Mersin Province(in Turkish). Journal of Aegean Agricultural Research Institute, 13(1), 158-175.

Erkuş A., Bülbül M., Kıral T., Açil A. F., Demirci R., 1995. Agricultural Economics (in Turkish). Ankara Univ. Faculty of Agriculture. Education, Research and Development Foundation Publications No: 5, 289p, Ankara.

Gül, A., Demirtaş, B., 1998. A Research on Economic of Apricot Production in İçel Province (in Turkish). Çukurova University, Journal of Agriculture Faculty, 13 (4), 147-156.

Gül, M., Akpınar, M.G., 2006. An Assessment of Developments in Fruit Production in the World and Turkey (in Turkish). Mediterranean Agricultural Sciences, 19(1), 15-27.

Gürbüz, D., Gül, M., 2016. Financial source of dairy farms: A case of Burdur province (in Turkish). Journal of Agricultural Faculty of Mustafa Kemal University, 21(1), 57-70.

İnan, İ.H., 2006. Agricultural Economy and Management (in Turkish). Hasad Publishing, Tekirdağ.

Kıral, T., Kasnakoğlu, H., Tatlıdil, F., Fidan, H., Gündoğmuş, E., 1999. Cost calculation methodology and database guide for agricultural products (in Turkish). Agricultural Economics Research Institute Publications, Publication No: 37, 143p, Ankara.

Özdamar, K., 1999. Statistical Data Analysis with Package Programs 1 (in Turkish). Kaan Kitabevi 2. Baskı, No: 1, ISBN 975- 6787-00-7, 535p. Eskişehir.
TURKSTAT, 2019. Turkey Statistical Institute, Fruit production statistical data. Access Date: 20.04.2019. https://biruni.tuik.gov.tr/medas3

(ORAL PRESENTATION)

MARKETING STRUCTURE OF APRICOT PRODUCTION AND ANALYSIS OF ITS PROBLEMS: A CASE OF MUT DISTRICT IN MERSIN PROVINCE

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Abstract

In this research, marketing structure and problems of apricot production at the level of producers and intermediaries in Mut district, which is an important apricot production region of Mersin, were examined. Data were obtained from 91 producers and 35 intermediaries in the region by face to face survey method. The data included the 2016 production period. The most used marketing channel in the region was “producer-commissioner-consumer". Apricot marketing margin ranged from 11% to 100%. Inefficiencies of producer unions in the region and price instabilities are the points to be developed for the improvement of apricot production.

Key words: Marketing margin, apricot, SWOT, channel, Mut

INTRODUCTION

Turkey ranks first in the world apricot production (Gül and Akpınar, 2006). It is an important country in world exports, especially dried apricots (Akpınar et al., 2006). Apricot cultivation in stone fruits in Turkey shows a significant increase in recent years. Apricots are cultivated in almost every region except the high parts of the Black Sea and Eastern Anatolia. Malatya apricots are grown in most provinces in Turkey. 90% of apricots grown in Malatya are considered to be dried (Demirtaş, 2000). Mersin ranks second in apricot production of Turkey. In 2018, 89300 tons of apricot production was realised in 71905 decares of land. There have been significant increases in harvested areas and production compared to 1995. As a result of the yield, the increases in production followed a fluctuating course (Table 1). This can be explained by the fact that agricultural activities are highly dependent on natural conditions.

Table 1. Apricot production, planted areas and yield in Mersin province

Years	Harvested area (decares)	Area index (1995=100)	Production (ton)	Production index (1995=100)	Yield (kg/tree)	Yield index (1995=100)
1991	-	-	10.822	59	35	66
1995	24.550	100	18.241	100	53	100
2000	35.790	146	45.678	250	92	174
2005	54.630	223	55.737	306	86	162
2010	62.313	254	56.430	309	47	89
2011	70.506	287	52.486	288	46	87
2012	72.140	294	46.865	257	38	72
2013	68.433	279	94.055	516	76	143
2014	67.684	276	111.738	613	84	158
2015	67.943	277	107.922	592	79	149
2016	68.694	280	104.310	572	73	138
2017	67.278	274	86.918	476	60	113
2018	71.905	293	89.300	490	58	109

Source: TÜİK, 2019

The share of the Mut district in the apricot-planted area of Mersin province is 77.52%, and its share in production is 78.66%. Therefore, Mut is a district that meets almost all of the apricot production of Mersin province. At this point, Mut district was chosen as a sample area.

The study aimed to analyse the marketing structure of the apricot cultivated in the Mut district, the marketing channels, the problems in these channels (both at the producer level and the intermediary, in the process of processing).

MATERIALS AND METHODS

The research material was gathered from the apricot producers in the Mut district and intermediaries in the marketing channel. The stratified sampling Neyman method was used, and the farmers' sample was calculated. It was found that the number of farmers in the sample was 91 with a margin of error of 5% and a confidence interval of 90%. Farmers were divided into four layers according to the apricot planted area widths. Farmers who grow apricots between the levels of 1.00-7.00 decares were named as the 1st group, the farmers having orchard between 7.01 and 14.00 decares were II. group, farmers having orchard between 14.01 and 25.00 decare was III. group and farmers with 25.01 decares and more orchards was named IV. group (Table 2).

Table 2. Sample size (Farmers)

Farm groups	Apricot planted area (da)	N	Standard deviation	Variance	Average	Sample size
I	1.00-7.00	1520	1.76	3.11	3.80	24
II	7.01-14.00	868	1.95	3.82	10.04	16
III	14.01-25.00	500	3.05	9.32	18.41	14
IV	25.01+	265	15.64	244.59	38.49	37
Toplam		3153	11.04	121.96	10.75	91

The 35 intermediaries in the region were interviewed. Data were obtained by survey method. At this point, marketing structures for each channel took place in the survey questions. Original data from farmers and related stakeholders were analysed and interpreted as appropriate tables. Also, SWOT analysis was performed for apricot cultivation.

RESULTS AND DISCUSSION

Apricot production is realised in 70 countries around the world. In 2017, world apricot production was about 4.27 million tons, and production increased by 145% compared to 1980. Apricot major producing countries in the world are Turkey, Iran, Uzbekistan, Algeria, Italy, Pakistan, Morocco, France, Ukraine and Japan (Table 1).

Apricot production in Turkey ranks first in the world. Turkey with 985 000 tonnes of production in 2017 is a 19.7% share of the world apricot production. Based on the 1980 Turkey apricot production has increased 5.1-fold (Table 1).

Table 3. Apricot production in the world

Country		1980	1990	2000	2010	2017	Share (%)	Index (1980=100)
Turkey	Harvested area (ha)	44075	49595	89800	108053	125049	11.9	137
	Yield (kg/ha)	3630	6049	5902	4165	7877	-	371
	Production (ton)	160000	300000	530000	450000	985000	19.7	507
Uzbekistan	Harvested	-	12400	17000	35500	41711	7.78	336

	area (ha)							
	Yield (kg/ha)	-	4145	4000	9155	12768	-	308
	Production (ton)	-	51400	68000	325000	532565	12.51	1036
İtaly	Harvested area (ha)	13000	14042	15340	19543	18993	3.54	146
	Yield (kg/ha)	7392	13154	13127	12940	14032	-	190
	Production (ton)	96100	184710	201372	252892	266372	6.26	277
Algeria	Harvested area (ha)	7700	14010	13390	49495	44307	8.27	535
	Yield (kg/ha)	3024	2497	4209	4010	5798	-	192
	Production (ton)	23285	34979	56354	198467	256890	6.03	1103
İran	Harvested area (ha)	14000	11877	28692	81290	11545	2.15	82
	Yield (kg/ha)	3929	7197	8703	4774	20760	-	528
	Production (ton)	55000	85474	249700	388049	239712	5.63	436
Pakistan	Harvested area (ha)	3218	6400	12909	29648	30877	5.76	960
	Yield (kg/ha)	11115	12656	9752	6414	5796	-	52
	Production (ton)	35768	81000	125889	190174	178957	4.20	500
Spain	Harvested area (ha)	19300	22800	23487	18333	21002	3.92	109
	Yield (kg/ha)	5896	5246	6067	4294	7755	-	132
	Production (ton)	113800	119600	142498	78715	162872	3.83	143
France	Harvested area (ha)	13000	13759	14992	13797	12768	2.38	98
	Yield (kg/ha)	6077	8026	8724	10380	11631	-	191
	Production (ton)	79000	110432	130787	143212	148500	3.49	188
Afghanistan	Harvested area (ha)	6820	5115	5754	8320	23890	4.46	350
	Yield (kg/ha)	6965	7044	7445	8000	5518	-	79
	Production (ton)	47500	36030	42840	66560	131816	3.10	278
Morocco	Harvested area (ha)	-	13500	13921	12244	11419	2.13	85
	Yield (kg/ha)	-	5459	8591	11020	9856	-	181

	Production (ton)	63000	73700	119600	134933	112538	2.64	179
Other coutries	Harvested area (ha)	172944	153033	200250	188440	194519	36.29	112
	Yield (kg/ha)	6136	7265	5972	5719	6385	-	104
	Production (ton)	1061103	1111785	1195970	1077639	1242019	29.17	117
World	Harvested area (ha)	294057	316531	435535	564663	536072	100.0	182
	Yield (kg/ha)	5899	6916	6574	5854	7942	-	135
	Production (ton)	1734556	2189110	2863010	3305641	4257241	100.00	245

Kaynak: FAOSTAT, 2019

Turkey's Mediterranean Coast region has great potential for the fresh and early apricot production. Turkey has more favourable geography than other Mediterranean countries such as Greece, Italy, France and Spain for the early apricot production. Early maturation can be achieved 10-20 days earlier than these countries (Durgaç and Kaşka, 1996).

As of 2018, the provinces of apricot production in Turkey were given Table 4. Malatya province is located in the first place in Turkey with 798366 decares of the planted area and 401363 tonnes of apricot production. The province of Mersin ranks second place in Turkey with 71905 decares of planted area and production of 89300 tons of apricot. Share in Mersin province of Turkey apricot planted area is 5.72%, while its share of production was 11.91%. The province of Mersin was followed by third place in Elazığ with a ratio of 6.90%, Iğdır was in the fourth place with 4.83%, Kahramanmaraş was in fifth place with 3.97% and Antalya was in the sixth place with 1.89%.

In 1995, a total of 18241 tons of apricot was produced in the apricot planting area in 24550 decares of land in Mersin. The planting area continued to increase with each passing year and total apricot production reached 52486 tons in 2011. The production decreased to 46862 tons, due to drought in 2012. In 2015, its production increased by ten times compared to 1991 and reached 107922 tons. In 2017 and 2018, adverse weather conditions decreased to 89300 tons.

Table 4. 2018 production in provinces that are important apricot production in Turkey

Province	Harvested area (decares)	Share in Turkey (%)	Production (ton)	Share in Turkey (%)
Malatya	798.366	63.49	401.363	53.52
Mersin	71.905	5.72	89.300	11.91
Elazığ	98.192	7.81	51.775	6.90
Iğdır	34.070	2.71	36.194	4.83
Kahramanmaraş	89.328	7.10	29.778	3.97
Antalya	18.044	1.43	14.201	1.89

Source: TÜİK, 2019

Farmer Level Findings

In the research area, the average household size was 4.26 person, the 7.74% was in the 0-6 age group, 16.75% was in the 7-14 age group, 54.90% in the 15-49 age group, and 20.62% was in 50 and over age group. The population of the family was at the first group of farmers with a maximum of 4.42 person. Demirtaş and Gül (2003) determined the average household size as 5.43 in 1998 in the same region. There has been a decrease in the average household width in the last 20

years. The decrease in the population growth rate and the migration from the village to the city were effective in this.

In the farmers interviewed in the region, apricot cultivar “Alyanak” was in the 1st rank with 32.27%. “Tyrinthe” cultivar was in second place with 22.32%, and “Bebeko” cultivar was in third place with 15.42%. “Şekerpare” cultivar was the least cultivated cultivars with 4.15% of the other cultivars. 96% of farmers regularly did pruning every year. Pruning was mostly done in January. Demirtaş and Gül (2003) found that 90% of farmers did pruning in their study in the same region. Over the past 20 years, the rate of pruning has increased. It can be said that the increase in the level of consciousness of farmers has been effective at the increased rate of prunning. In the apricot orchards, soil tillage was done by tractor and also done hoeing by hand. The majority of farmers were engaged in hoeing every year and two times.

Irrigation process starts in April and continues until November. Major diseases and pests in apricot orchards are monilia (*Monilia laxa*), sapling dip worm (*Capnodis spp.*), and freckle disease (*Coryneum beijerinckii*). In apricot production, agrochemicals application was 4.97 times. They were generally applied in February, March and April.

About 37.20 hours of labour was used in apricot production. 50.10% of this was for irrigation, 17.95% for fertilisation, 13.37% for spraying, 11.95% for pruning, 6.64% for soil processing. Demirtaş and Gül (2003) calculated that 49.20 hours of labour is used per decares according to 1998 data in the same region. There was a decrease in the labour force used in the unit area. With the development of technology, it can be said that the use of better quality tools and equipment is effective.

The 37.88% of the machine power used in the production of apricot was used in soil treatment, 40.28% in fertilisation and 21.85% in spraying. Demirtaş and Gül (2000) calculated that 6.01 hours of machine power is used per decares according to 1998 data in the same region.

The 79.12% of the farmers carried out the classification in harvested product. As the scale of business increased, the level of classification increased. Product classification was made in farmers' enterprises.

Apricot harvest begins in the second week of May and ends in the third week of June.

In the apricot harvest, 40.73% of the labour force was used for harvesting, 62.98% for packaging, 0.79% for transporting, 1.09% for storing.

Table 5. Product classification of farmers in apricot

Farm groups	Make product classification		Does not make product classification		Total	
	N	%	N	%	N	%
I	14	58.33	10	41.67	24	100
II	13	81.25	3	18.85	16	100
III	12	85.71	2	14.29	14	100
IV	33	89.19	4	10.81	37	100
Total	72	79.12	19	20.88	91	100

Of the farmers in the research area, 74.7% sold the apricot to the broker, 13.1% to the merchant, 5.4% to the merchant from outside the district, and 5.4% directly to the consumer. In all farmer groups, brokers were the most important actors in the product sales channel of producers. In small-scale farmers, direct sales to consumers were over 5%.

Demirtaş and Gül (2003) calculated that the majority of product sales were merchants (69.1%) according to 1998 data in the same region. This was followed by the broker with 28.4%. There was a decline in sales to the merchant.

Table 7. Apricot sales channels for farmers

	Broker		Merchant		A merchant from outside the district		Consumer		Total	
Farm groups	N	%	N	%	N	%	N	%	N	%
I	15	62.5	6	25.0	1	4.1	2	8.3	24	100
II	12	75.0	1	6.2	2	12.5	1	6.2	16	100
III	12	85.7	2	14.2	0	0	0	0.0	14	100
IV	29	78.3	3	8.1	2	5.4	3	5.4	37	100
Total	68	74.7	12	13.1	5	5.4	6	5.4	91	100

In the examined area, apricot sales are in the form of sale in bulk in the harvest time, sale in bulk in the flowering time and sales in the form of weight in harvest time.

About 97.8% of the farmers received the price of the product with forwarding sell and 2.2% received with cash. In the process of determining the product prices, 97.80% of the producers reported that the prices vary depending on the quantity, while 2.20% stated that the firms determined the prices.

The most important problem experienced by farmers in apricot cultivation was the high input prices. Also, lack of consultant, lack of laboratory and lack of scientific activity related to apricot was the other problems mentioned.

In the research area, “Alyanak” cultivar was the first of the cultivars with 34.1% of the farmers. 25.3% of the producers stated “Tyrinthe” cultivar and 24.2% of “Bebeko” cultivar.

One of the most critical problems experienced by farmers in marketing was sometimes the decrease in the number of apricot brokers/merchants periodically and the delay in product payments. They also stated that intermediaries and firms have an essential role in price setting. The production of dried apricots in the district was not very common. There is no industry to process the product. Therefore, depending on the season, apricots can be sold at a low price.

Findings from intermediaries

About 80% of the intermediaries (broker and merchant) interviewed in the research region were in Mut district of Mersin city, and 20% were in Iskenderun district of Hatay city.

About 40% of the apricot intermediaries interviewed were engaged in trading activities for more than ten years, 20% were trading in less than ten years. 20% of the intermediaries interviewed received apricot quantities from producers at 16,000 tons, and 80% received earlier apricots from producers at 16,000 tons and above. The period they bought the apricot was usually the end of May, and they started to sell the apricots in May-June with the storage service.

About 80% of the interviewed intermediaries reported that the apricot purchase price changed according to that season's yield, while 20% said that the market supply and demand balance had determined the purchase price of apricot.

The 60% of the intermediaries were active in Istanbul and Ankara, and 40% in the Mersin market.

All the brokers and traders interviewed in the region were selling the apricot to the processing company.

The purchasing period for intermediaries from the apricot producers was generally in June. The sales amount of 20% of the intermediaries was 10000 tons or less, 40% was between 15000 and 16000 tons, and 40% was sold at 20.000 tons or more.

The difference between the price paid to the first seller and the price paid by the last buyer in the market chain is called the marketing margin. The marketing margin at the level of apricot the intermediaries in the region was 50% on average. This value could vary between 11% and 100%.

About 60% of the intermediaries in the region were able to store the apricot, and 20% of them did not have storage facilities.

It was determined that 80% of the intermediaries conducted market research. About 40% of the intermediaries gave more importance to the colour in the purchase of apricots. About 40% of them reported that the size of a product is more important, and 20% said that fruit maturity is more important in the purchase of apricots.

The 60% of intermediaries in the region reported that they made a payment with time bargain on the purchase of apricots, 40% of them made a payment with cash.

About 80% of the intermediaries reported that with the support for apricot would improve the market.

In the research area, five apricot processors and marketers were also interviewed. It was determined that the firms interviewed had apricot purchase activities between 7 years and 15 years. 20% of the companies in the research area were family companies, 40% were private companies, and 40% were other companies. The level of education of the employees of the firms was generally at the high school level.

The executives of the firms stated that they have a university degree in education. Processor and marketing companies in the region had both a food engineer and an agricultural engineer.

It was determined that 80% of the firms interviewed in the region were exporters and domestic marketers and 20% were handlers and marketers.

The 20% of the exporter firms interviewed in the study obtained apricots from Isparta and Çanakkale, and 80% of them were obtained from the Mersin and Malatya.

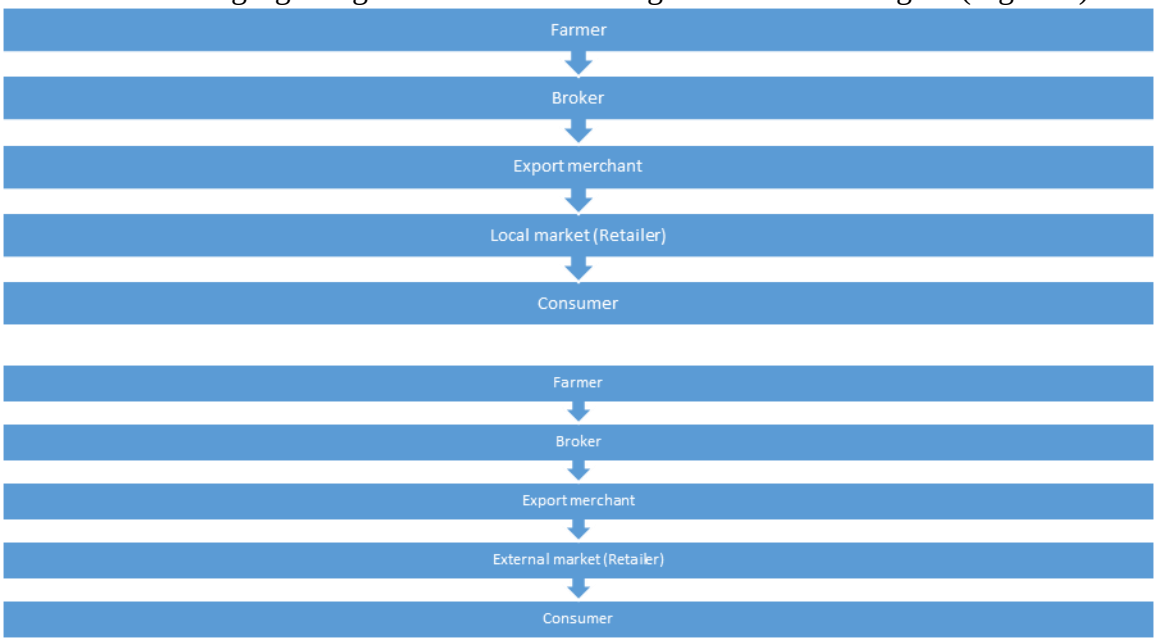
About 20% of the exporting firms interviewed exported apricots to the USA, 20% exported to Ukraine and 60% exported to Russia.

All of the exporters had an infrastructure for export. 60% of the companies interviewed in the region had a production facility, storage, packaging unit, transport vehicles. It was determined that 40% were only storage-packaging / packaging tools.

Apricot marketing channel

A significant portion of the apricots produced in Mut district of Mersin city is sold from producers to brokers, from brokers to the domestic market and from retail outlets to consumers (Figure 1).

Processors used to buy apricots were marketing channels of producers and brokers. The company was also sending the product abroad by the broker. Direct marketing of the product was low. The following figures give different marketing channels in the region (Figure 1).



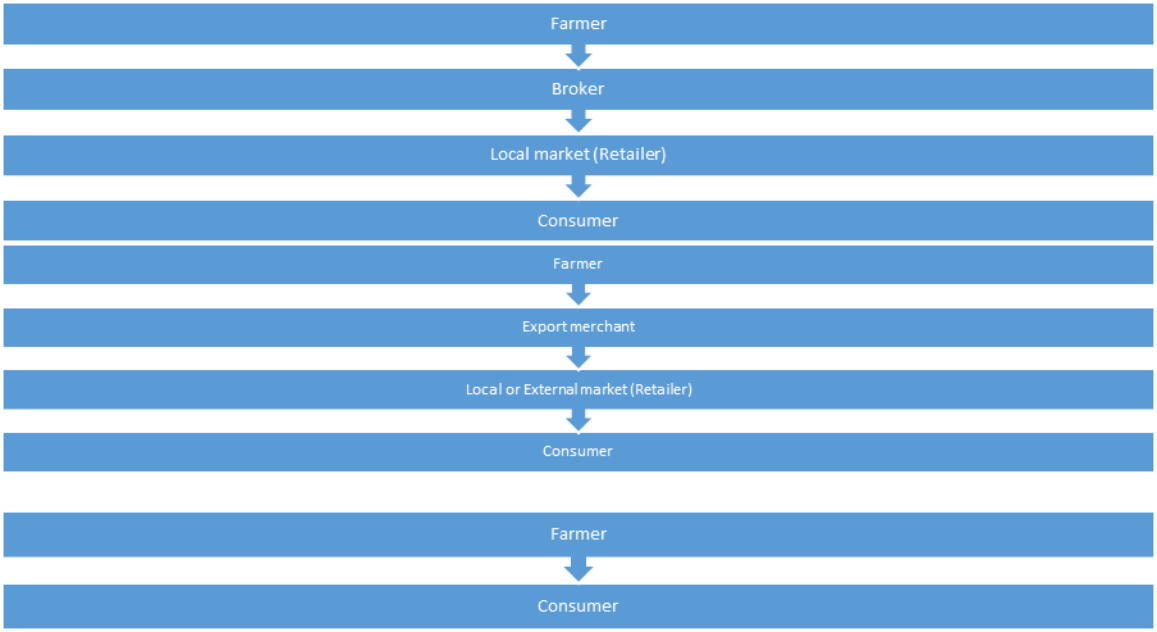


Figure 1. Apricot marketing channels in the region

About 80% of the firms were using the broker-consumer sales channel. 20% of the firms were using producer-collector-broker-exporter-foreign market retailer-consumer-sales channel.

All of the apricot processors and marketers interviewed were doing market research. It was found that they carried out market research with their staffs.

It was determined that firms used domestic packaging. It was declared that 40.00% of the packaging material was used as a mesh bag, 20.00% as bulk box and 40.00% as a wooden case.

Companies were implementing standardisation for apricot. Colour-size-shape is essential parameters in the standardisation process.

When the 1 kg apricot cost of the handler and apricot brokers were calculated, it was found that the average processing cost was 0.01 TRY, the labour cost was 0.25 TRY, the transportation cost was 0.01 TRY, and the packaging cost was 0.25 TRY, 10% commission and 10% withholding tax.

SWOT Analysis of Apricot Cultivation

SWOT analysis is one of the methods used to analyse the internal state of any organisation, public or private sector firm, and the external factors surrounding it (Houben et al., 1999; Yumuk ve Inan 2005; Aslan and Gul, 2017; Gül and Öktem, 2017; Gül and Parlak, 2017; Bayraklı and Gül, 2018). In this study, the opinions of the stakeholders about apricot were examined in SWOT analysis for apricot production. Within this framework, the strengths, weaknesses, opportunities and threats of apricot production were put forward in the framework of information obtained from producers, intermediaries and processors.

As the strengths of the apricot, the region is suitable in terms of environmental conditions of apricot sector, apricot quality, taste and odour are different from apricots produced other regions, the yield is above the country average, storage life is long, and the input used to be low, the income obtained was high.

The weaknesses in the field of research are that producers do not carry out soil analyses and the lack of organisation in the region in terms of production and marketing. It was determined that there was a few organisation based on producers in the region. Specific boards and organisations do not establish the price of the apricot market. It should be avoided by the trader/broker in the local market. With the increase in the organisation, it can be said that the producers will gain advantages in terms of input and product sales price. Inadequate input use by the operators in the researched area could decrease the yield and decrease the quality. In the region, there was also a lack of processing, sorting and packaging facilities. Since the apricot is a source of livelihood by the operators in the region, the capital allocated to apricots is high.

The opportunities in the apricot sector in the region may increase the possibility of insuring against the cold, thus reducing the product risk. Also, the growing diversity of apricot cultivation in the region also creates an opportunity for export.
Threats in the apricot sector of the region discussed in the study were the presence of climate change, the occurrence of frost in specific periods, the reduction of the quality and price of the diseases and pests of apricots, the difficulty in finding workers in the region, the lack of production planning and the price instabilities.
Demirtaş and Gül (2003) determined that more than 70% of the farmers in this region were exposed to frost damages in the spring. In the spring, especially in the flowering period of apricot cultivation frost events every year more or less affects this cultivation. Among the measures that can be taken to protect against the spring frosts, besides burning the different materials, the breeding of the varieties resistant to frosts is also essential (Gül and Demirtaş, 1998).

CONCLUSION

An essential part of the earlier apricots produced in the Mut district is evaluated in domestic markets. It is mostly consumed as fresh. In the region, the food industry did not develop.
Farmers in the region sell apricots most to brokers. Apricot price is a problem in years when the harvest is high.
Apricots are classified according to their size and quality and are offered for sale. In the market, medium size apricots, which are primarily difficult to sell, present to market firstly.
The hardness of climatic conditions in the region, weakness of exports, insufficient fruit attitude, lack of marketing opportunities, fluctuations in apricot prices were identified as essential problems.
There is no organised organisation in the area of production and marketing. In the years of production, the product price has increased, and in the case of production surplus in the next year, the product price decreases considerably, and this leads to significant price instabilities over the years. Therefore, enterprises will take a step towards price stability with the establishment of cooperatives/producer organisation for the marketing of apricots.

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REFERENCES

Akpınar, G., Gül, M., Dağıstan, E., 2006. Development and Structure of Fruit Trade in Turkey during the EU Accession Process (in Turkish). 7th Turkish Agricultural Economics Congress, page: 836-848, Antalya.

Aslan, O., Gül, M., 2017. Economic Structure and the Problems of Thyme Producer Farms in Denizli. International Journal of Social and Economic Sciences, 7 (1), 64-69.

Bayraklı, B., Gül, M., 2018. Analysis of Marketing Structure and Problems in Garlic Production: The Case of Kastamonu Province. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 18 (2), 21-28.

Bilen, G., Kabukçuoğlu, M.S., 2002. Principles of Project Process Management and Logical Framework Matrix Preparation (in Turkish). İstanbul Bilgi University Publication, İstanbul.

Demirtaş, B., 2000. Apricot production economics in İçel province (in Turkish). Msc. Thesis, Çukurova University Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, 107s., Adana.

Demirtaş, B., Gül, A., 2000. Socio-Economic Structure and Problems of Fresh Apricot Producers in Mersin Province (in Turkish). Çukurova University, Journal of Agriculture Faculty, 15 (2), 47-54.

Demirtaş, B., Gül, A., 2003. Socio-Economic Structure and Problems of Fresh Apricot Producers in Mersin Province(in Turkish). Journal of Aegean Agricultural Research Institute, 13(1), 158-175.

Durgac, C., Kaska, N., 1996. Comparison of Yield, Quality and Earliness of Apricot Varieties at Çukurova (in Turkish). V Temperate Zone Fruit in the Tropics and Subtropics 441, 93-100.

FAOSTAT, 2019. Food and Agriculture Organization of the United Nations statistical data. Web page, (http://www.fao.org), Access date: 10.02.2019.
Gül, A., Demirtaş, B., 1998. A Research on Economic of Apricot Production in İçel Province (in Turkish). Çukurova University, Journal of Agriculture Faculty, 13 (4), 147-156.
Gül, M., Akpınar, M.G., 2006. An Assessment of Developments in Fruit Production in the World and Turkey (in Turkish). Mediterranean Agricultural Sciences, 19(1), 15-27.
Gül, M., Öktem, H., 2017. Marketing Structure and Problems of Sour Cherry Farmers: Afyonkarahisar and Konya Province Example. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", 17 (2), 147-156.
Gül, M., Parlak, H., 2017. Input Usage and Problems in Green Bean Production: A case of Burdur Province, Turkey. AgroLife Scientific Journal, 6(1), 133-140.
Houben, G.K., Lenie, K., Vanhoof, K., 1999. A Knowledge-based SWOT Analysis as an Instrument for Strategic Planning in Small and Medium Sized Enterprises. Decision Support System, 26, 125-135.
TÜİK, 2019. Turkey Statistical Institute, Agricultural Statistics data. Web page, (www.tuik.gov.tr), Access date: 15.03.2019.
Yumuk, G., İnan, İ.H., 2005. An Evaluation of Quality Costs of Manufacturing Industry Firms in Trakya Region by SWOT Analysis (in Turkish). Journal of Tekirdag Agricultural Faculty, 2(2), 177-188.

(ORAL PRESENTATION)

MARKETING STRUCTURE OF GREENHOUSE CAPIA PEPPERS (CAPIA PIPERIS) PRODUCTION AND ANALYSIS OF ITS PROBLEMS: THE CASE OF KAŞ DISTRICT OF ANTALYA PROVINCE

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Abstract

This study was carried out in order to determine the marketing structure, problems and solution proposals of the greenhouse production of capia pepper at the level of producers and intermediaries in Kaş, which is an important location in the production of capia peppers in the province of Antalya. Data were collected from 77 producers, ten intermediaries, five merchants and two exporters from the region. The data were from 2016 production period. The most important sales channel of farmers were commissioners. Commissioners sell their products to the merchant and the traders. The marketing margin ranges from 22% to 25%. Issues such as farmer scales in the region, the ineffectiveness of producer unions, and logistics are the points required for the development of capia pepper production.

Key words: Marketing margin, SWOT, capia pepper, Kaş

INTRODUCTION

Pepper is consumed as fresh, but also paste, canned consumed as an important vegetable. In 2017, 36 million tons of pepper were produced in the world. Approximately 49.3% of that was in China, 9.13% in Mexico, the 7.23% in Turkey, 6.54% in Indonesia, 3.54% in Spain, 2.67's% in the USA, 2.07% in Nigeria and 1.73% in Egypt (FAOSTAT, 2019).

Turkey was produced about 2.61 million tons of pepper in 2017. Of this 42.47% was capia, 36.25% was green, 16.14% was a bell, 5.15% was banana pepper variety. The 78.74% of Turkey's pepper production was produced in the open field conditions, and 21.26% took place in greenhouse conditions. Greenhouse areas constitute 8.2% of pepper cultivated areas (TURKSTAT, 2019).

The vegetable is 305310 decares as of 2017 in the greenhouse areas in Antalya province. In the same year, vegetable production was about 3.61 million tons in the greenhouse. The greenhouse formed 37014 decares of vegetable fields is pepper areas. A total pepper production was 394874 tonnes. Thus, 12.12% of the vegetable area and 10.94% of the production, formed peppers in the province of Antalya in the greenhouse. The capia pepper variety, which is the subject of the study, was 79058 tons in 7436 decare area in the greenhouse area of Antalya. The capia pepper production areas accounted for 20.09% of the total pepper production areas and 20.02% of its production in the greenhouse (TURKSTAT, 2019).

In the Kaş district, capia pepper is 4194 decares in the greenhouse area, and is consist of 53.05% of the Antalya and 32.89% of Turkey’s capia pepper area in 2018. Capia pepper production of Kaş is 41940 tonnes in 2018, and this accounted for 49.71% of Antalya, and 30.78% of Turkey (Figure 1).

This study aimed to investigate the marketing structure of capia pepper in the greenhouse. It was aimed to analyse the marketing structure, marketing channels, problems in these channels and determine the factors that cause these problems and to offer solutions.

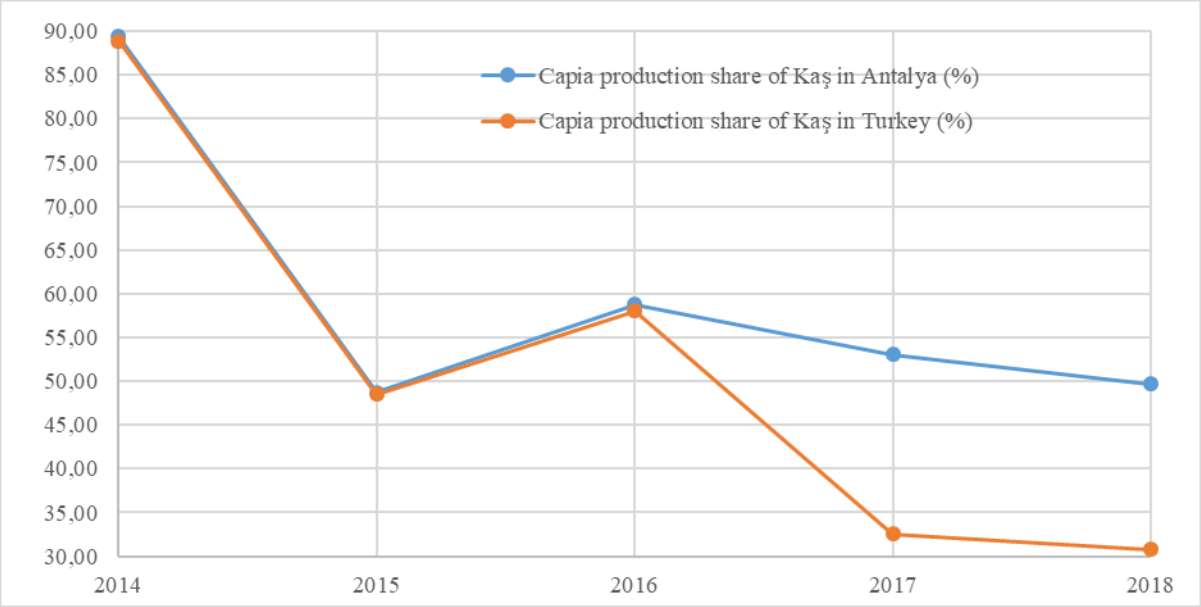


Figure 1. Kaş capia pepper production share in Antalya and Turkey

MATERIALS AND METHODS

The data were obtained from 77 farmers, ten brokers, five merchants and two exporters in Kaş, Antalya. The questionnaire forms used for collecting data from the units were arranged in accordance with the purpose of the research. Data belonged to 2016 production period.

Based on the data obtained from the relevant stakeholders from the producers, the capia pepper marketing structure and marketing margin of the region were calculated.

SWOT (strengths, weakness, opportunities, threats) analysis of capia pepper cultivation was also performed for the region. This analysis is a method of examining environmental factors, investigating opportunities, understanding threats, identifying strengths, admitting weaknesses (Yumuk and Inan, 2005; Aslan and Gül, 2017; Gül and Öktem, 2017; Bayraklı and Gül, 2018).

RESULTS AND DISCUSSION

Farmer Level Findings

The average age of the farmers interviewed in the region was 45 years, and the majority of them were primary school graduates.

Capia pepper yield was calculated to be 7756 kg per decare on average.

The capia pepper production experience of the interviewed farmers was 4.4 years on average. The most common problem in the region was the diseases and pests.

Farmers have mostly sold capia pepper to brokers in their area. The marketing cost was 523 TRY per decare. The share of this cost element in production costs was found to be 5.28% (Table 1).

Table 1. General characteristics of farmers

	Average
Education level	Primary school
Age (year)	45
Capia pepper farming activity period (years)	5
Capia pepper yield per unit area (decare) (kg)	7756
Marketing costs for capia pepper (decaras) in the unit field (TRY)	523
Share of marketing cost in total production cost (%)	5.28
Capia pepper sale price (kg, TRY)	1.99
Sales channel	Brokers

At the farmers level in the region, the selling price of capia pepper kg was determined as 1.99 TRY, and the cost of kg was 1.28 TRY.

Marketing margin was found as 55%. This value was 18% in the first group farmers, II. group was 34%, and III. group was calculated as 83% (Figure 2).

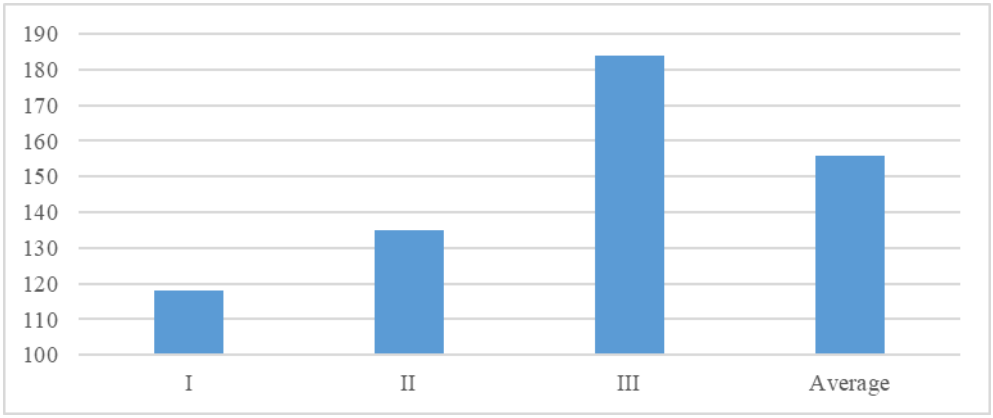


Figure 2. Capia pepper marketing margin in the farmers

Findings at Intermediate Level

A face-to-face interview was held with ten brokers. As a result of the data obtained, it was determined that all of the brokers received the products in their own name, they were immediately sold after receiving the product, and also the capia pepper variety that they purchased was a “diyar”.

None of the brokers in the area were identified as having a pepper processing facility and reported no storage facilities. They stated that they did not experience product loss because they bought the product and sold it immediately.

All of the agents reported that there is no unit for market research. They said they did market research themselves. During transport, it was found that the packaging used standard 30x50 plastic crates and the transportation was carried out on the highway.

The average period of activity of the brokers in the research area was 10.6 years. The education level of the brokers (managers) was at the high school level, and the education level of their employees was determined as secondary school.

The operating period of the brokers in season (month) was set as 9.6 months.

The number of permanent workers in the interviewed brokers was 6.4, and the number of temporary workers was 1.6.

In the season, the amount of purchased pepper was 3760 tons. The purchase price was 2.1 TRY. The marketing margin was 24% in brokers (Table 2).

Table 2. General characteristics of brokers

	Average
Broker education level	High school
The education level of employees	Secondary school
Activity duration (months)	9.6
Number of permanent workers (person)	6.4
Number of temporary workers (person)	1.6
Amount of purchase (ton)	3760
Purchase Price (TRY per kg)	2.1
Broker activity period (year)	10.6
Marketing margin (%)	124

Brokers were selling the capia pepper from the producer to the merchant or exporter merchant. Sales patterns were generally futures (Figure 3).

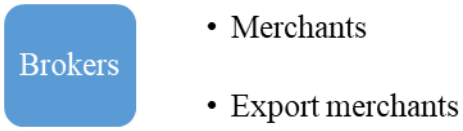


Figure 3. Capia pepper distribution channel at broker level

Interviewed export merchants were determined to have a mean duration of operation of 16 years.

The level of education of exporters (managers) was determined as high school and the employees' educational status as secondary school.

The trading time of exporters was 9.5 months. The number of workers working at exporters was 17.5, and the number of temporary workers was 76.5.

According to the data obtained from exporters, the purchase amounts in the season were 300000 tons. The marketing margin was 25% (Table 3).

Table 3. General characteristics of export merchant

	Average
The education level of export merchant	High school
The education level of employees	Secondary school
Activity duration (months)	9.5
Number of permanent workers (person)	17.5
Number of temporary workers (person)	76.5
Amount of purchase (ton)	300000
Activity period (year)	16
Marketing margin (%)	125

In the region, export merchants were able to buy capia pepper directly from farmers. Besides, capia was also provided by brokers and merchants. It was also found out that export merchants sold to local and domestic retailers (Figure 4).

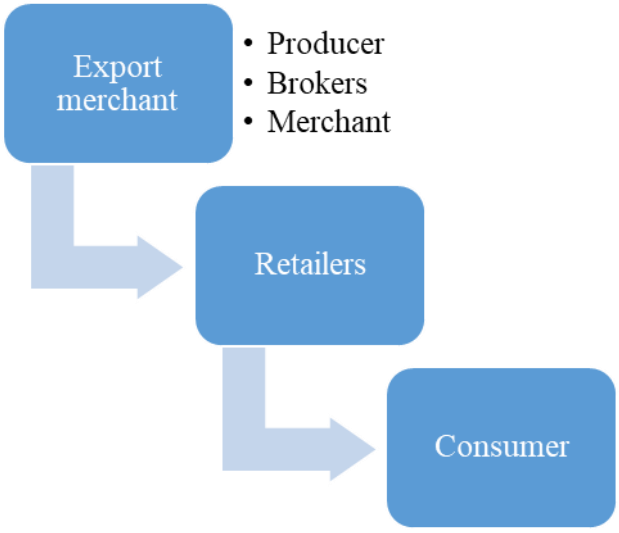


Figure 4. Capia pepper distribution channel in the export merchant level

It was determined that the education level of the traders who were interviewed was at the middle school level and that the education level of their employees was at the level of primary school.

Seasonal activity period of merchants was ten months. The number of permanent workers was 3-4 people, and the number of temporary workers was 4-5.

At the level of traders, the marketing margin in capia pepper is 22%. In the season, the purchase amounts were determined to be 150000 tons. Traders were found to be in this activity for 4.6 years (Table 4).

Table 4. General characteristics of merchants

	Average
The education level of merchants	Secondary school
The education level of employees	Primary school
Activity duration (months)	10
Number of permanent workers (person)	3.8
Number of temporary workers (person)	4.6
Amount of purchase (ton)	150000
Activity period of merchants (year)	4.6
Marketing margin (%)	122

Capia Pepper SWOT Analysis and Marketing Channel

SWOT analysis is one of the methods used to analyse the internal state of any organisation, organisation, public institution or private sector firm and the external factors surrounding it (Bilen and Kabukçuoğlu, 2002).

In this study, the opinions of stakeholders about capia pepper production were made in SWOT analysis of capia pepper production. In this context, the strengths, weaknesses, opportunities and threats of capia pepper production were presented in the context of information obtained from producers, intermediaries, traders, publishers and processors.

The strengths of the region were determined by the high-quality capia pepper production, the suitability of the region's soil structure and climatic conditions, the length of the production period in the region, and the fact that capia pepper production provided good income to farmers and intermediaries, and the potential for cheap rural labour.

The weaknesses in the region were determined as high input costs, production fluctuations over the years, insufficiency of struggle against diseases and pests, difficulties in adapting to quality and standards, insufficient capital and financial resources, marketing of district products and insufficiency of producer unions.

Opportunities in the region, marketing opportunities in place, capia pepper in cash, the opportunity to sell, as a result of high-quality capia pepper exports was determined as an increase in exports.

The threats in the region were determined as climatic changes, fluctuations in capia pepper price, low irrigation water and increased risk of disease.

When the marketing channels of the region were examined, it was determined that the farmers generally reached their products to the brokers, to the exporter companies in their brokers and the consumers by going to the exporters through the firms. It was found that the products reached the consumer from the producer directly and/or reached the consumer from the retail points through the merchant.

Capia pepper, marketing channel is generally used to farmers, brokers and export merchants. Brokers sell merchant and export merchant goods. The merchant and export merchants can deliver their goods to the consumer through the retailer (Figure 5).

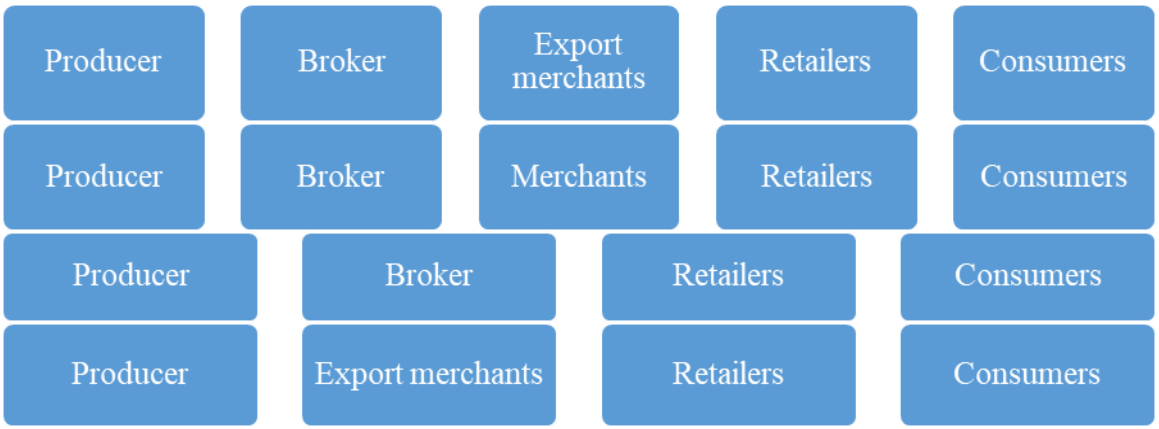


Figure 5. Capia pepper marketing structure

CONCLUSION

This study aims to improve the marketing system of capia pepper production in the greenhouse. Kaş district of Antalya province was included in the study. In this context, 77 farmers, ten brokers, five merchants and two export merchants were interviewed face-to-face with data from the survey. Environmental conditions are suitable for the production of capia pepper in the region.

At the farmers' level in the region, the marketing margin was at the level of 5.28%, brokers were at the level of 24%, traders were at the level of 22%, and export merchants were at the level of 25%. A significant portion of farmers was selling capia pepper to the broker. The most important factor for farmers in the region to go for capia pepper production was to provide a good income. For this reason, capia pepper production in the region increased very rapidly. The average duration of operations in intermediaries interviewed in the region was over ten years. Cooperatives/producer associations are essential for stability in input and product prices. There may be a success in the case of the effective operation of the cooperative / union to be established.

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REFERENCES

Aslan, O., Gül, M., 2017. Economic Structure and the Problems of Thyme Producer Farms in Denizli. International Journal of Social and Economic Sciences, 7 (1), 64-69.

Bayraklı, B., Gül, M., 2018. Analysis of marketing structure and problems in garlic production: The case of Kastamonu province. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 18 (2), 21-28.

Bilen, G., Kabukçuoğlu, M.S., 2002. Principles of Project Process Management and Logical Framework Matrix Preparation (in Turkish). İstanbul Bilgi University Publication, İstanbul.

FAOSTAT, 2019. Food and Agriculture Organization of the United Nations statistical data. Web page, (http://www.fao.org), Access date: 15.03.2019.

Gül, M., Öktem, H., 2017. Marketing Structure and Problems of Sour Cherry Farmers: Afyonkarahisar and Konya Province Example. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", 17 (2), 147-156.

Gül, M., Dağıstan, E., Demirtaş, B., Yılmaz, H., Karataş, A., Yılmaz, Y., 2009. Development and Seasonal Fluctuations in Some Vegetable Prices in Antalya Province (in Turkish). Mustafa Kemal Üniversitesi Ziraat Fakültesi Dergisi, 14(2), 57-68

TÜİK, 2019. Turkey Statistical Institute, Agricultural Statistics data. Web page, (www.tuik.gov.tr), Access date: 15.03.2019.

Yumuk, G., İnan, İ.H., 2005. An Evaluation of Quality Costs of Manufacturing Industry Firms in Trakya Region by SWOT Analysis (in Turkish). Journal of Tekirdag Agricultural Faculty, 2(2), 177-188.

(ORAL PRESENTATION)

THE PROFITABILITY AND CHARACTERISTICS OF CAPIA PEPPER'S FARMERS IN THE GREENHOUSE AREA: A CASE OF KAŞ DISTRICT IN ANTALYA PROVINCE

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Abstract

In this study, the socio-economic structure and profitability of the farmers producing capia pepper in Kaş district of Antalya were investigated. In the district of Kaş, surveys were conducted with 77 farmers producing capia pepper with face to face via questionnaire. The data belongs to the 2016 production period. As a result of the research; in the production of capia pepper, the relative profit was calculated as 1.56. However, 22.08% of the farmers had a negative profit. The most important reason for this was the low productivity of the unit area and sales price.

Key words: Capia pepper, profit, farmer, cost, Kaş

INTRODUCTION

Red pepper produced in the world belongs to the Capsicum of the Solanaceae family and grown in temperate climates zone (Beis, 1990; Yemiş, 2001).

Greenhouse activity is one of the important livelihoods in Kaş. Production units show a small family business. Greenhouse in the distinction is made of glass and plastic.

Due to the geographic location of Kas district, the production of capia pepper became important. There is a long period of foggy weather on a bowl-shaped plain on four sides. It is stated that this situation provides quality and yield increase in pepper production undercover. As a matter of fact, the production of capia pepper in the greenhouse has increased significantly in the region in the last five years.

Turkey was given 737177 hectares in the greenhouse to pepper production in 2017. The 46.36% of these greenhouse areas are plastic, 24.71% is a low tunnel, 14.50% is glass, and 14.43% is a high tunnel. In the same year, the vegetable production was approximately 7.38 million tons in the greenhouse. The 83926 decares of the vegetable fields created pepper areas in the greenhouse. Total pepper production was 704293 tons. Thus, pepper share is 11.38% in the greenhouse vegetable areas in Turkey, and 9.54% of the total production. The pepper capia subject to study in Turkey in 12282 decares area, totalled 128974 tonnes in the greenhouse. Capia pepper production areas accounted for 14.63% of total pepper production areas and 18.31% of production in the greenhouse. The distribution of the species in greenhouse pepper production in Turkey, green pepper comes in front with 56.05% share. This type is followed by capia pepper with 18.31%, bell pepper with 14.27% and banana pepper with 11.37% (TURKSTAT, 2019).

Kaş district of Antalya has a total of 25250 decares of vegetables in the greenhouse. In the same year, vegetable production in these areas was 385475 tons. The district realises 8.27% of the greenhouse vegetable areas and 10.68% of the vegetable production in Antalya.

Pepper in the greenhouse areas in the district covers 6995 decares of total vegetable areas and constitute 27.70% of the total area. In this district, pepper production is 68863 tons, and it meets 17.86% of total vegetable production. With these cultivation areas, the district covers 18.90% of the pepper in the greenhouse areas of Antalya and 17.44% of its production.

Capia pepper in the Kas district is 4194 decares. 41940 tons of capia pepper was obtained from this area (Table 1). Consequently, 16.61% of the greenhouse vegetable production areas in the

district constitute capia pepper with these values. 10.88% of the vegetable production is covered by capia pepper.

In the district, 6995 decares of pepper in the greenhouse area are 59.96% of the capia pepper. Of the 25444 tons of pepper production, 60.90% of them were made with capia pepper (Table 1).

In the greenhouse, capia pepper production in Kaş district constitutes 53.05% of Antalya capia pepper production. In this respect, the research area of the capia pepper sample area was determined as the Kaş district.

Table 1. Pepper production in a greenhouse in Kaş district (2017 year)

Cover type	Peppers	Harvested area (decare)	Production (tonnes)	Harvested area (%)	Production (%)
Greenhouse (Glass)	Banana	295	2655	4.22	3.86
	Green	792	7128	11.32	10.35
Greenhouse (Plastic)	Banana	837	8370	11.97	12.15
	Bell	106	1060	1.52	1.54
	Capia	**4194**	**41940**	**59.96**	**60.90**
	Green	771	7710	11.02	11.20
Total		6995	68863	100.0	100.0

Source: TÜİK, 2019

In this study, it was aimed to determine the farmers' profitability and the characteristics of the farmers.

MATERIALS AND METHODS

The data were obtained from 77 farmers who produced capia pepper in the greenhouse in Kaş, Antalya. Data gathered from farmers belonged to 2016 production period.

The number of capia pepper growers and capia pepper fields was obtained from the District Directorate of the Ministry of Agriculture and Forestry of Kaş, Antalya. Stratified sampling was applied to this main population. The number of pepper producers to be interviewed was calculated as 77 with a 10% margin of error and a 90% confidence interval. The distribution of the surveyed producers, according to the greenhouse areas, was given in Table 2. Farmers with capia pepper area less than 2.50 decares were identified group I, the producers with 2.51-5.00 decares area was II. group, producers with an area over 5.0 decares was III. group (Table 2).

Table 2. Sample size

Groups	Greenhouse area (capia pepper, decares)	Number of farmers interviewed (person)	Percentage (%)
I	<2.51	23	29.87
II	2.51-5.00	20	38.96
III	5.00<	34	31.17
Total		77	100.00

The data were obtained from the capia pepper growers by face-to-face survey method. The questionnaire included the following questions: (i) socio-economic characteristics of farmers, (ii) technical information about capia pepper production activity, (ii) economic information of farmers on capia pepper production activity.

A single budget method was used to calculate the cost items of farmers in the region. The costs of production activities were examined as variable and fixed costs.

Cost elements are divided into two in terms of their economic characteristics. These; (i) fixed costs (rent, insurance, depreciation, permanent employee wages, interest, etc.) and (ii) that are

not dependent on the capacity of production, decreasing and multiplying, i.e., variable, by production volume (Açıl, 1977).

The unit production cost was calculated by dividing the production costs into production. The relative profit was calculated by proportioning the gross production value to production costs (Kiral et al., 1999).

The primary data obtained from farmers were tabled and interpreted.

RESULTS AND DISCUSSION

The average of the interviewed producers' age was 44.5. The experiences of agricultural activity were 11.3 years on average and 4.4 years on the production of capia pepper (Table 3).

Table 3. Farmer characteristics

Groups	Farmers' age (years)	Experience in the farm activity (years)	Experience in the capias pepper production activity (years)	Household size (person)
I	46.00	13.22	4.48	3.87
II	44.30	8.37	3.67	4.33
III	43.25	13.21	5.25	4.54
Average	44.48	11.32	4.40	4.26

When the population structure of the farmers was examined, it was found that 58.4% of the total population was concentrated in the 15-49 age group. The 45.5% of the total population was female, and 54.5% was male. It was determined that the household size was 4.3 persons on farms.

It was determined that 11.7% of the pepper producers interviewed in the region were engaged in non-agricultural business. It was found that 11.7% had computers, 13.0% had internet, and 92.2% had automobiles. The 55.8% of the capia pepper producers in the region were using credit cards, and 90% had social security.

When the indebtedness of the farmers in the last five years was examined; 28.57% stated that the indebtedness decreased, 20.78% had the same debt, and 50.65% had increased the indebtedness. The reasons for the increase in the indebtedness of the producers of the region can be attributed to the increase in production cost and the addition of new ones to the greenhouse areas in recent years. The 69% of capia pepper producers used agricultural loans, and 87.0% were members of agricultural organisations.

About 51.95% of the farmers were only producing capia pepper. In addition to the capia pepper production, 44.16% of the farmers engaged in livestock production, capia pepper production as well as other plant production activities in the rate of 2.60%, pepper production, while other vegetative production and livestock activities in the rate of 1.30% (Table 4).

Table 4. Agricultural activity of farmers (%)

Groups	Only capia peppers	Capia peppers and livestock	Capia peppers and other crops	Capia peppers, livestock and other crops	Total
I	30.43	60.87	8.70	0.00	100.00
II	53.33	46.67	0.00	0.00	100.00
III	70.83	25.00	0.00	4.17	100.00
Total	51.95	44.16	2.60	1.30	100.00

It was determined that agrochemical dealers (4.9 points according to 5 points Likert scale) were very effective in deciding the inputs used by capia pepper producers in the region. Their own information, buyer requests and the agricultural organisation were determined to be moderately effective. It was determined that 43 (55.8%) of the capia pepper producers kept records in the enterprise.

Seedlings row spacing used by the producers interviewed in the region, varied between 110 cm and 160 cm. Farmers were mostly used 125-140 cm in-row spacing. The distance between seedlings ranged from 30 cm to 60 cm. Farmers preferred the most seedling distance of 40 cm.

Regional dealers were generally effective in a seedling supply channel.

It was determined that 27.3% of capia pepper farmers knew the integrated pest management, 64.9% knew good agricultural practices, 58.4% knew organic agriculture and 54.5% knew biological control.

In the decision-making on the product variety of farmers interviewed in the region, the most active role was the company recommendations. Consultant suggestions were also useful in these decisions.

Capia pepper yield in the study area was calculated as 7755.98 kg per decare. The harvest number of capia pepper was 23. Capia pepper area was determined as 4.79 decares. In pepper production, the irrigation system was realised by drip irrigation. The pepper production period in the region could exceed ten months, and the number of irrigation was 120. Farmers reported a 0.96% product loss in their production (Table 5).

Table 5. Capia pepper area, yield, product loss

Groups	Yield (kg per decares)	Number of Harvest (pcs)	Capia pepper field (decare)	Number of Irrigation (units)	Product loss (%)
I	7463.12	21	2.16	114.8	1
II	6965.10	23.5	4.09	117.7	0.9
III	8346.03	25.4	7.88	137.5	1
Average	7755.98	23.3	4.69	123.0	0.96

The average selling price of capia peppers was 1.99 TRY. As the greenhouse scale increased, the selling price of unit capia pepper increased. The average cost of capia pepper was 1.56 TRY. As the greenhouse scale increases, the unit capia pepper cost fell. The relative profit was found to be 1.56. As the greenhouse scale increased, the relative profit from pepper production increased. As a result, the greenhouse scale increases farmers' profitability (Table 6).

Table 6. Capia pepper cost and profitability

Groups	Sale price per kg (TL)	Production cost per kg (TL)	Relative profit
I	1.77	1.50	1.18
II	1.99	1.48	1.35
III	2.05	1.12	1.84
Average	1.99	1.28	1.56

The share of the factors that make up the capia pepper production cost of the farmers interviewed in the region was given in Table 7. The most crucial cost elements in Capia pepper production were seedling, fertiliser, pesticide, labour. The variable cost ranged from 69.27% to 79.24% in farmer groups. The fixed cost was calculated between 20.76% and 30.73%. As the greenhouse scale increases, the rate of variable cost increases and the fixed cost share decreases. Small-scale farmers benefited from more family workforce. The greenhouse facility interest rate and depreciation share were also high on a small-scale farm. As a result, greenhouse scale increases and fixed cost decreases (Table 7).

Table 7. Distribution of capia pepper production cost (%)

Cost items	**I**	**II**	**III**	**Average**
Seedling	17.71	19.51	20.73	19.83
Fertilisers	12.28	15.41	19.44	16.90
Pesticides	10.46	10.66	12.93	11.74
Labour temporary	10.24	9.01	9.98	9.68
Marketing	5.79	5.21	5.17	5.28
Irrigation	5.63	5.59	3.35	4.49
Machinery rent	2.81	2.94	1.83	2.37

Other variable cost	1.06	1.93	2.05	1.85
Revolving fund interest	3.30	3.51	3.77	3.61
Variable cost	***69.27***	***73.76***	***79.24***	***75.76***
Land tenure	6.51	8.10	8.43	8.02
Family labour	9.30	6.24	3.75	5.49
Greenhouse facility cost of interest	6.47	4.93	3.12	4.28
Greenhouse plant depreciation	6.36	4.75	3.09	4.18
General administrative expenses	2.08	2.21	2.38	2.27
Fixed cost	***30.73***	***26.24***	***20.76***	***24.24***
Production cost	**100.00**	**100.00**	**100.00**	**100.00**

With the positive findings in the economic indicators, it was determined that the farmers' tendency to continue the production of capia pepper and their satisfaction were high. In small-scale enterprises, these indicators were lower.

The level of knowledge about the capia pepper cultivation was moderate.

About 22.03% of the farmers lost in the capia pepper production in the investigated period. The greenhouse area, the number of households, the tendency to continue the production of capia pepper and their satisfaction were lower (statistically significant at 10% between the two groups (the profitable farmer; the loser farmer)). Capia pepper cultivation experience and knowledge levels were also low. Capia pepper is lower in yield per unit area (about 5000 kg). This was one of the reasons why unit production costs were higher than the other group (profitable).

The 68.83% of the farmers interviewed used agricultural credit for the production of pepper in the period examined. The productivity of the farmers who use credit to the unit area, the tendency to continue the production of capia pepper and their satisfaction were higher (statistically there is a significant difference between the two groups (the ones who use credits, the ones who do not use). Capia pepper cultivation has low experience but high levels of knowledge. The yield of capia pepper to the unit area was about 8007 kg and more than 1000 kg. This leads to lower production costs compared to the other group (non-user). Moreover, unit sales prices were 14% more than those who do not use loans.

CONCLUSION

In this study, characteristics and profitability of greenhouse capia pepper producers were investigated. The Kaş district of Antalya was taken to the scope of the study. In this context, 77 farmers were interviewed face-to-face with the questionnaire method. The average age of the capia pepper producers in the region was 44.5 years, and the majority of them were primary school graduates. More than half of the farmers kept records in their production. The rate of non-agricultural work was low. More than half of the farmers were growing only capia pepper. A significant portion of the producers (about 70%) was using agricultural credit. Farmers' indebtedness in the last five years has also increased. More than half of the producers knew the concepts such as organic agriculture, biological control and good agricultural practices.

The firm's recommendations were most effective in deciding the variety of product of the producers. Agrochemical dealer was also useful in deciding the inputs used of the farmers.

The essential cost items were fertiliser, seedlings, pesticide and labour cost.

The farmers' satisfaction with the production of capia pepper was high. The relative profit was calculated as 1.56, and this is also effective on satisfaction.

The most critical factor for the farmers in the region to go to the production of capia pepper is to provide a good income. Also, the incentives for producers to be more informed about the benefits of cooperatives can increase the profit rates of small-scale farms. Useful information/guidance on input use is also vital to sustainability.

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REFERENCES

Açıl, A.F., 1977. Calculation of Agricultural Product Costs and Developments in Agricultural Product Cost in Our Country (in Turkish). Ankara University Faculty of Agriculture Publications, 76p., Ankara.

Beis, S.H., 1990. Food Coloring from Red Pepper (in Turkish). MSc. Thesis, Anadolu University Health Sciences Institute, 27p., Eskişehir.

Kıral, T., Kasnakoğlu, H., Tatlıdil, F.F., Fidan, H., Gündoğmuş, E., 1999. Cost Calculation Methodology and Database Guide for Agricultural Products (in Turkish). Agricultural Economics and Research Institute, TEPGE Report No: 1999-13, 143p., Ankara.

TURKSTAT, 2019. Turkish Statistical Institute, Agricultural Statistics data. Web page, (www.tuik.gov.tr), Access date: 15.03.2019.

Yemiş, O., 2001. Research on Oleoresin Capsicum Production from Red Peppers (in Turkish). MSc. Thesis, Ankara University Institute of Science and Technology, 71p., Ankara.

(ORAL PRESENTATION)

AMES MUTAGENITY TEST

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Abstract

Technology, in addition to offering convenience, brings along a major challenge air pollution and adversely affect living things. All living things in nature face with natural or artificial chemicals in daily life. These chemicals may be natural chemicals in foods, pesticides, food additives, hair dyes, artificial chemicals such as cosmetics and medicines, cigarette smoke, water and complex compounds like the pollutants in the air. The most rational approach to reveal carcinogenic risk of chemicals is tumor induction in experimental animals. However, the results of these tests take a long time and the costs are high. Therefore, researchers have developed many short-time mutagenicity test systems that can result in a short time and cost low. Mutagenic effects of chemicals are intended to identify with mutagenicity tests developed. Most widely used short-time test systems are the bacterial tests and the most used one of these test is Ames test. Ames mutagenicity test, used to determine mutagenic effects of chemicals, in terms of test parameters is one of the best standardized method. This test system is based on reverse mutation measurements of a variety of specially configured mutants of Salmonella typhimurium. As a result, mutagenic dose of test substance used is determined. This study aims to explain the Ames test and method steps to the researchers who want to determine the mutagenicity of the chemical substances that they are exposed to continuously.

Key words: Ames test, Salmonella typhimirium, mutagenic effect

INTRODUCTION

Environmental mutagenic substances with a mechanism of action, mutagenic effect, can cause cancer in humans. This has always been the subject of discussion. The relationship between mutagenicity and carcinogenicity has also been suggested to be mutagenic. There is a 90% correlation between carcinogenicity and mutagenicity. *Mutagenicity:* Genes-related mutations or chromosomes to have the property to cause changes (Saleh, 1997). While the mutation is caused by the direct effect of genetic material, the cancer can occur as a result of multiple-step complex biological events. Therefore, it was revealed that every carcinogenic substance is mutagenic, but not every carcinogenic agent is a carcinogenic substance (Aydoğan ve Kutlu, (2004). The reason why mutagenicity is taken as the basis for screening carcinogens is that the genetic code is universal and the correlation between mutagenicity and carcinogenicity is high (Monarca ve ark., 2000).

Genotoxicity, cell genetic material (DNA, RNA) is a devastating effect on a word with a defined genetic and hereditary effectively. Genotoxins are mutagenic and cause mutations. Genotoxicity is known as genotoxin. Genotoxins may be carcinogen, cancer-causing agents, mutation-causing agents, teratogens or agents that cause birth defects. In most cases, genotoxicity causes mutation in various cells and other body systems (Shah, 2012).

Mutation: Hereditary changes that occur in the genetic information of living things and are transferred from generation to generation (Klug ve Cummings, 2000). The change in the structure of a gene without changing its number in the genome or its location on the chromosome is called the Gen Mutation. The basis of the gene mutation mechanism is the change in the AT / GC ratio or the formation of the bases during external effects. (Monarca ve ark., 2000; Watanabe ve ark., 1996; İstanbulluoğlu ve ark., 1981). Changes in genes can be as simple as the acquisition, loss or

replacement of a nucleotide. It may also be complex, such as the addition or removal of several nucleotides within the normal DNA sequence. A gene is a unit of thousands of base pairs. In a gene there may be mutations at each base, so there is at least one base pair of mutations in a gene. (Demirsoy, 1992).

Mutagenicity tests are intended to determine the mutagenic effects of chemical substances. Bacterial tests are the most commonly used method for short-term test systems. Because bacteria are preferred in simple breeding environments, they are preferred because they are simple, quick and cheap. Ames Test is the most commonly used bacterial test. (Maron ve Ames, 1982).

It is also a Salmonella / microsomal test called Ames mutagenicity test. It is the best standardized test method for determining the mutagenic effects of chemical substances. This test may perform a preliminary screening of the mutagenic and related suspected carcinogenic effects of a large number of chemicals. It can be determined whether a mutagen causes frame shift or base change mutations (Aydoğan ve Kutlu, 2004).

The Ames mutagenicity test is one of the most common methods used to determine the mutagenicity of chemicals used in industrial chemicals and drug screening (Porwollik ve ark., 2001). This test has been adopted to assess the various carcinogenic potential of substances and has a wide range of use (Chen ve ark., 2015).

The Ames test has been used to investigate the mutagenic and carcinogenic effects of more than 5000 chemicals since the year it was identified. In addition, in this test system, liver microsome enzymes (S9) can be used to determine whether the metabolites of the substance are mutagenic. When S9 is used, a positive result indicates that the substance itself is harmless, but that the metabolites that will appear when taken to the living body have a harmful effect (Mortelmans ve Zeiger, 2002).

Briefly, in this test system, the metabolic activation system including rat liver supernatant and cofactors was added to provide biotransformation events in mammals. In previous studies, many prokarsinogen, which did not show mutagen activity, were reported to be positive with the new application of the test system containing metabolic activation (Mortelmans ve Zeiger, 2002).

The Ames test system is based on the measurement of back mutations in several specifically constructed mutants of *Salmonella typhimurium* (Aydoğan ve Kutlu, 2004). TA and YG strains of *Salmonella typhimurium* are used. The most commonly used bacterial strains are TA 97, TA 98, TA 100, TA102, TA 1535, TA 1538 (İstanbulluoğlu ve ark., 1981). When a mutant strain is mutated in the form of a single base change, it has mutated in the form of a transmutation or transversion, when it is spontaneously or becomes wild with a mutagen warning (Wagner ve ark., 1996, Kusamran ve ark., 1994, Watanabe ve ark., 1996).

METHOD OF THE AMES TEST SYSTEM:

1. Genetic Controls: S. Thphimurium Test strains are checked whether they have original mutations.
2. Control of spontaneously reversing colony number
3. Preparation of Master Plates

1. Genetic Controls:

Genetic properties of Salmonella Typhimurium strains:

Histidine (his) mutation:

Each test strain contains various mutations in different regions of the histidine operon. These are frame shift mutations which manifest themselves by the alteration of the base resulting from the change of a single base in the DNA or by the addition or removal of a base. The principal mechanism of the compound-induced mutation can be demonstrated by these strains at the molecular level. It produces strains in the presence of histidine, does not reproduce in the absence of histidine, confirms his- character. Some of the following mutations have been added to these strains to increase the susceptibility of the initially developed his-mutants to various chemicals. These include:

1. Rfa mutation

2. UvrB mutation
3. R factor

Rfa mutation:

This mutation occurs in genes that encode the lipopolisaccharide layer of the bacterial cell wall. The result of the Rfa mutation, which makes the lipopolysaccharide layer of the cell wall partially destroyed, is facilitated by the introduction of large molecules that cannot normally pass through the cell wall.

uvrB mutation:

In the DNA repair system, it was formed as a result of the perforation in the uvrB gene, which encodes the enzyme, which is the role of cut removal (= excision repair). The UvrB mutation causes increased sensitivity in the emergence of many mutagen. However, during the removal of the uvrB gene for technical reasons, this evidence includes biotin (bio) gene. For this reason, bacteria need biotin as well as histidine to reproduce. It is observed that the strains carrying the UvrB deletion breed in the control plate and not in the UV-irradiated plaques.

R factor:

In order to better determine mutagenes, *S.thphimurium* TA1538 and TA1535 strains were obtained by adding the pkM 101 R factor plasmidine with ampicillin resistivity gene and *S.thphimurium* TA 98 and TA 100 strains.

The responses to plasmid-containing strains, which have been shown to be mutagenic, have increased considerably compared to plasmid-free strains. New strains containing plasmids have responded to a clear positive response against weak or non-mutagen agents with original strains. The PkM 101 Plasmidi contains gene products linked to the error-prone repair system, which is responsible for the more sensitive of these strains.

Strains containing R-Factor are observed to reproduce in ampicylic plaque and do not produce R-factor-free strains in the same plaque.

Control of the number of self-rotating colonies

Each test strain turns itself on itself with a unique frequency. *S.thphimurium* TA 98 for the strain of self-rotating colony number 20-40, TA 100 for the strain was found between 95-190.

1. Preparation of Master Plates

a) Determination of cytotoxic Effect: The test compounds used in the Salmonella/Microzom test system are added to the culture of the agar and the test compound in different quantities in order to detect non-lethal doses for bacteria. With the number of colonies in the control plate, the test compounds are compared to the colony numbers in the added plates and the cytotoxic dose is determined. In mutagenite experiments, non-cytotoxic doses of chemical compounds are used.

b) Detection of mutagenic effects of tested chemical compounds: In each experiment, positive mutagenic action checks are performed routinely using positive mutagenics.

c) Evaluation of results: In the Salmonella/Microzom test system, the number of histidine prototrophes must be at least twice the number of self-rotating colonies in order to be called mutagen in a substance. However, if this number is less than twice the number of self-rotating colonies and there is a dose-dependent increase, then this substance can be called mutagen (Maron ve Ames, 1982, Mortelmans ve Zeiger, 2002).

Du et al., in a 2019 study, the mutagenic effect of titanium dioxide nanopacinets, commonly used in the cosmetic, health and food industries, was investigated and a positive mutagenic action was not observed.

In another study using the Ames test, atraumatic Restorative treatment (ART) material showed poor mutagenic effects (Kumari ve ark., 2019).

For an agent who has positive results in the Ames method, human or other mammals are not mutagenic or carcinogenicity. The positive bacterial mutation means a preliminary warning about the potential damage of the agent. It is also an important marker that directs more extensive work to be done in higher organisms. The Ames test is therefore routinely implemented in many laboratories around the world (Korkmaz, 2005).

REFERENCES:

Aydoğan, G., ve Kutlu, M. (2004). Bazı İmidazol Türevi Bileşiklerin Mutajenik Aktivitelerinin Ames Salmonella/Mikrozom Testi ile Araştırılması. *Turkish Journal of Biochemistry*, 29 (1); 1-176.

Demirsoy, A., (1992). Yaşamın Temel Kuralları/Genel Biyoloji, Cilt 1, Kısım 1, Ankara.

Du, X., Gao, S., Hong, L., Zheng, X., Zhou, Q., Wu, J., 2019. Genotoxicity evaluation of titanium dioxide nanoparticles using the mouse lymphoma assay and the Ames test. *Mutat Res Gen Tox En* 838, 22–27.

İstanbulluoğlu, E., Pamukçu, T., ve Pamukçu, M. (1981). Eğrelti Otu ile Beslenen İneklerden Elde Edilen Sütün Mutajenik Aktivitesi Üzerinde Çalışmalar. *Ank, Üni, Vet. Fak. Derg.,* 28 (1-4): 137-143.

Korkmaz, B. (2005). Bazı 2-Sübstitüe Perimidin Bileşiklerinin Mutajenik Aktivitelerinin Ames Mutajenite Testi ile Belirlenmesi. Yüksek Lisans tezi, Anadolu Üniversitesi, Fen Bilimleri Enstitüsü, Biyoloji Anabilim Dalı.

Klug, W.S. and Cummings, M.R. (2000). Concept of Genetics, 6 th Edition, Pretince Hall 0-13-081626-4, (2000), Çev. ÖNER, C., Genetik Kavramlar, Palme Yayıncılık, 816.

Kumari, D.P., Shetty, A.V. Khijmatgar, S., Chowdhury, A., Lynch, E. Chowdhury, C.E., 2019. Mutagenicity potential (affect) of new atraumatic restorative treatment (ART) material incorporated with Azadirachta indica (Neem) against *Salmonella typhimurium*. *Journal of Oral Biology and Craniofacial Research.* Volume 9, Issue 1, January–March 2019, Pages 5-9.

Kusamran, W.R., Wakabayashi, K, Ogari, I., Tepsuwan, A., Nagao, M, and Sugimura, T. (1994). Mutagenicities of Bangkok and Tokyo River Waters, *Mutat, Res*, 325: 99-104.

Maron M. D., and Ames B. (1982). Revised methods for Salmonella mutagenicity test. Elsevier Biomedical, Press, *Mutation Research*, 113: 173-215.

Monarca, S., Feretti, D., Collivinarelli, C., Guzzella, L., Bertanza, G., and Dedrazzani, R. (2000). The Influence of different disinfectants on mutagenicity and toxicity of Urban Wastewater, *Water Research*, 34(17): 4261-4269.

Mortelmans K., Zeiger E. (2002). The Ames *Salmonella*/Microsome mutagenicity assay. Elsevier, Mutation Research, 455: 29-60.

Porwollik, S., Wong, M. R., Sims, S. H., Schaaper, R. M., DeMarini, D. M., McClellanda, M. 2001. The ΔuvrB mutations in the Ames strains of Salmonella span 15 to 119 genes. *Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis*, Volume 483, Issues 1–2, 1 November 2001, Pages 1-11. https://doi.org/10.1016/S0027-5107(01)00239-1

Saleh, K. (1997). Mikronükleus Testi ile bazı kimyasal maddelerin ve çevre kirletcilerin neden olduğu klastojenik etkilerin araştırılması, Yüksek Lisans Tezi, Eskişehir.

Shah, S.P. et al. The clonal and mutational evolution spectrum of primary triple-negative breast cancers. Nature published online doi:10.1038/nature10933 (4 April 2012).

Wagner, E.D., Wasilewska, A.C., Connoly, S., and Lewa, M.J. (1996). Mutagenic analysis of 2, 3-diaminophenazine in Salmonella strains expressing different Levels of o-acetyl transferase with and writhout plant and mamalian activation, *Mutat. Res*., 372: 65-74.

Watanabe, K., Sakamoto, K. and Sasaki, T. (1996). Comparisons Chemically-Induced mutagenicity among four bacterial strains, *Salmonella typhimurium* TA 102 and TA 2628 and E.Coli WP2/ PKM101 and WP2A/ pKM 101: Colloborative Study I., *Mutat. Res*., 361: 143-155.

(ORAL PRESENTATION)

Inclusion of *Rosa damascena Mill.* powder in to cookies: nutritional, antioxidant and quality characteristics

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Abstract

This study was investigated the quality characteristics, dietary fibre and antioxidant properties of cookies supplemented with 0-2.5-5-7.5-10% of Rosa damascena Mill. powder (RP). Antioxidant activity, total dietary fibre and total phenolic contents increased linearly ($p < 0.01$) by raising the substitution levels of RP whereas water activity, total lipid, total protein contents and fracturability remained almost constant. Cookies became darker and redder with the increasing rate of RP. The use of RP was caused a negligible decrease on spread ratio. Considerable decrease (from 5004. 2 kg to 4469.6 kg for control and 10 % RP containing cookies, respectively) on the hardness of cookies was observed after the 5 % addition level of RP. The sensory analysis indicated that addition of up to 7.5 % RP given acceptable cookies without affecting their technological quality compared with control cookies. Based on overall observations, RP addition to cookies can enhance the nutritional status, especially dietary fibre, total phenolic contents and antioxidant activity without sacrificing consumer acceptability. It was concluded that RF could be added to the formulae to improve the functionality of the cookies as well as other bakery products such as muffins, cakes, bread a few- of acceptable quality.

Key words: Antioxidant activity, cookie, dietary fibre, Rosa damascene, sensory acceptance.

Introduction

Rosa damascene Mill. belongs to Family *Rosaceae* and Genus *Rosa* (Gül et al., 2015). *Rosa Damascena Mill*, which is called Isparta Rose or Oil Rose, is the most important one in terms of economic value (Dilmen and Baydar, 2016). Turkey has an important place among the rose oil producing countries over the world (Gül, 2000). According to 2018 data, oil rose production quantity of Turkey is 14773 tons and Isparta takes the first place with its 12332 tons production quantity (TUİK, 2018).

Several studies have been performed on the pharmacological effects of *R. damascene*. Some of these effects can be listed as; good for disorders of the brain and the heart, anticonvulsant effect and could reduce frequency of seizures in children who were resistant to anti-epileptic drugs, used externally for eyes, mouth, foul breath, liver (as plaster), sores, and internally to treat the chest and stomach (Başer et al., 2012). Kart and Cağındı (2017) reported that; rose tea can be an alternative to other herbal teas with its antioxidant properties and also it's pleasant smell and comfortable drink.

Apart from pharmacological uses, rose and rose products are widely used also in cosmetic, perfumery and food industry. Fresh or dried rose flowers, rose flower buds, dry rose petals and rose water used as an ingredient for the production of various food products such as rose jam, rose syrup, rose water, herbal teas, traditional Turkish deserts and gluten free cookies (Gül et al., 2010; Başer et al., 2012; Kart and Çağındı, 2017; Gül and Tekeli, 2018).

Bakery products, used as staple foods from ancient times, are an important source of energy in human nutrition. Among bakery products bread takes first and cookies (biscuits) take second range. Production and consumption of cookies are quite high in many countries and also in Turkey, because of their ready-to-eat forms, long shelf life, reasonable prices and practical consumption opportunities (Gül et al., 2016; Gül et al., 2017).

There is an increasing demand for the various novel types of cookies that may provide a health benefits along with the good texture, appearance, flavour and acceptable sensory properties. Thus the lots of additives can be used effectively for producing novel functional cookie varieties. Usage of lauric acid-lean copra meal for designing functional antioxidant-rich cookies (Ghosh, et al., 2017), usage of mosambi peel powder to determine its effects on physiochemical and sensory properties of cookies (Younis et al., 2016), functional, physical and sensory properties of cookies prepared from okara, red teff and wheat flours (Ahmed et al., 2018) are just a few example of these studies done.

Biscuit manufacturers need for tried-and-true cookie recipes to offer innovative and healthier options and to meet increasing demand. However to the best of our knowledge this paper is the first study that investigate the usage of *Rosa damascena Mill* petals powder (RP) in the formulations of soft wheat flour (SWF) cookies. In an effort to increase the nutritional value of common cookies, RP at different substitution levels (0% as control, 2.5%, 5%, 7.5 and 10% w/w) to common SWF were added. Beside nutritional quality, knowledge of effects of different concentrations of RP supplementation on technological and textural quality of cookies is necessary to produce safe, high-quality and value-added cookies. Thus, the goal of the present study is to identify the effect of increasing levels of RP replacement on nutritional (such as dietay fiber, total phenolic content, antioxidant activity, protein, lipid, ash etc.), physical (diameter, thickness, spread ratio, lightness, redness, yellowness), textural (hardness and fracturability) and sensorial properties of SWF cookies.

MATERIALS AND METHODS

Materials

SWF; had 12.74% moisture, 0.64% ash, 8.5% protein, 20.89% wet gluten, %6.94 dried guten, 15.5 ml sedimentation value and 355 s falling number values measured by using American Association of Cereal Chemists (ACCC, 2000) methods obtained from Türkmenler Milling Factory (Gaziantep, Turkey). *Rosa damascena Mill*. Powder (RP) was purchased from Kurucum Gıda (Isparta Turkey) as vacuum packed after drying and grinding. Other ingredients sodium bicarbonate obtained from Şişecam Chemicals Group Soda Industry **(**Mersin, Turkey), 42% corn syrup kindly supplied from Sunar Corn Integrated Plant Inc. (Adana, Turkey), while hydrogenated vegetable oil, granulated sugar, and salt purchased from a local market were used in cookie making. All chemicals used were of analytical grade.

Cookie-Making Procedure

To examine the influence of RP on some nutritional and quality characteristics of cookies, SFW was replaced with RP with 2.5, 5, 7.5 and 10 % levels. Cookie doughs of 100 % wheat flour were prepared as control samples. 225 g wheat flour or wheat flour-RP mixtures (14% moisture basis), 64 g hydrogenated vegetable oil (cream shortening), 130.0 g fine granulated sugar, 2.1 g salt, 2.5 g sodium bicarbonate (NaHCO3), 33 g high fructose corn syrup (42%), and 16.0 g distilled water was used for preparation of cookies according to AACC method 10-50.05 (AACC, 2000) with slight modifications. Cookie dough was kneaded in Hobart mixer, (Hobart, N-50, Germany N-50) and sheeted to a thickness of 5 mm with the help of a rolling pin. Afterwards, the dough was shaped using a circular scone cutter (with a 60 mm diameter) and baked at 205ºC±2ºC for 10 min in a laboratory oven (Fimak FSET4, Turkey). The baked cookies were cooled for 3 h and stored in high-density polyethene bags with hermetic cover until further analysis.

Proximate analysis of cookies

Proximate analysis of cookies are important in terms of revealing their nutritional composition. For this purpose standard methods of AACC (AACC, 2000) were used to determine moisture, ash, protein, total lipid, total dietary fibre and pH (AACC Method 44-01.01, AACC Method 08-01.01, AACC Method 46-12.01, AACC Method 30-25.01, AACC Method 32-05.01 and AACC Method 02-52.01 respectively) of cookies. Water activity (Woody, 2003) with an aW - meter (Novasina, Lab Touch-aw, Lachen, Switzerland). Total phenolic content (TPC) and antiradical activity of RF and cookies were detected by using methods of Singleton and Rossi, (1965) and α-diphenyl-β-picrylhydrazyl DPPH method of Dorman et al. (2003).

Physical characteristics of cookies

Width (W), thickness (T), and spread ratio (W/T) parameters of cookies at the end of baking were measured by using digital calliper in mm at five different places in each cookie. For each batch measurements from 6 cookies were recorded and average was calculated. Spread ratio (W/T) was calculated by dividing average W to T for each sample. Surface color of the cookies were measured in three different zones of the crust using using colourimeter (Minolta CR-310, Minolta Co Ltd., Tokyo, Japan). Results were recorded using CIELAB $L*$ (lightness), $a*$ (+redness/−greenness), and $b*$ (+yellowness/−blueness) values.

Textural Properties of Cookies

Cookie break strength and the distance at the point of break "fracturability" values were measured by a TA.XT Plus Texture analyser (Stable Micro Systems, UK) using a 3-Point Bending Rig (HDP/3PB) and 5 kg load cell. Test parameters were performed as; pre-test speed: 1.0 mm/s, test speed: 3.0 mm/s, post-test speed; 10 mm/s, distance: 5.0 mm and data acquisition rate 500 pps. Textural analyses were conducted after 6 h, at 24 °C, in five replicates per batch.

Sensory analysis

Sensory analysis of cookies were carried out by ten untrained judges from food engineering department according to Gül et al. (2013) after 4 hours of baking. The samples were coded with three-digit numbers and were presented in a randomized order. The attributes were estimated on a hedonic scale from 1 to 5 point; 'dislike extremely' to 'like extremely' respectively. The sensory attributes evaluated were surface colour, surface structure, texture (hardness), taste, aroma, odour, overall acceptance and also purchasing intent was determined on a five-point scale (5: definitely would buy, 1: definitely would not buy).

Statistical analysis

Results were expressed as means of analysis performed in triplicate. One way analysis of variance (ANOVA) and Duncan's test was conducted to establish the significance of differences among mean values at $p \leq 0.01$ by using the software, statistical package for social science (SPSS 16.0) procedures.

RESULTS AND DISCUSSIONS

Proximate Composition

Data on the proximate composition of cookies are presented in Table 1. Moisture, protein, pH and aw values increased slightly with the level of substitution of RP while addition of RP was not changed total lipid content of cookies significantly. The ash content of cookies was began to decrease over 5% supplementation level of RP. There was a considerable increase was observed on the dietary fibre content of cookies with the increasing level of RP. A significant difference was found between the control sample and the 10% RP containing cookies in terms of dietary fibre content.

Table 1. Proximate composition of control and RP enriched cookies[1]

RP (%)	Moisture (%)	Ash (%)	Protein (%)	Total lipid (%)	Total dietary fibre (%)	pH	aw	TPC (g/kg GAE)	Antiradical activity (DPPH IC50 mg/ml)
0	6.14^{b}	1.53^{a}	9.65^{c}	15.16^{a}	1.90^{e}	5.90^{b}	0.42^{c}	0.9200^{e}	0.0000
2.5	6.34^{ab}	1.56^{a}	9.71^{bc}	15.38^{a}	3.64^{d}	7.13^{a}	0.44^{b}	59.6700^{d}	0.0000
5	6.91^{ab}	1.54^{a}	9.79^{abc}	15.12^{a}	4.49^{c}	7.10^{a}	0.45^{ab}	103.4138^{c}	7914.1100^{a}
7.5	6.66^{ab}	1.32^{b}	9.87^{ab}	15.29^{a}	5.08^{b}	7.00^{a}	0.45^{a}	126.0313^{b}	6917.9188^{b}
10	7.17^{a}	1.06^{c}	9.95^{a}	15.18^{a}	7.27^{a}	6.93^{a}	0.45^{a}	167.9075^{a}	5793.9075^{c}

[1]: There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).

According to the results summarised in Table 1 addition of RP was provided a significant rise on total phenolic content of cookies. While a little phenolic substances (0.92 g/kg GAE) were found in the control sample, this value was increased linearly to 59.6700, 103.4138, 126.0313, g/kg GAE for 2.5%, 5%, 7.5% and 10% RP containing cookies respectively.
Moreover, antiradical activity (DPPH IC50) of RP added cookies were also found higher than %100 wheat flour cookies (control samples). The results revealed that incorporation of RP exhibited higher antioxidant properties by rising the substitution levels of SWF with RP.

Physical and Textural Characteristics

Physical characteristics of cookies prepared with different RP contents are displayed in Table 2. An increase in RP content over the 5% significantly decreased the both W and spread ratio of the cookies whereas it was not caused any significant difference at T values of cookies.
Significant differences ($p<0.01$) were obtained on the colour values of cookies due to addition of RP in to cookie formulation. The higher the replacement of RP, the lower the lightness and yellowness. Cookies were became darker by the incorporation of RP. However, when comparing $a*$ value, statistically significant difference ($p<0.01$) were found between samples. A linear increase in the $a*$ values were detected with the replacement of RP.

Table 2. Physical and textural characteristics of control and RP enriched cookies[1]

RP (%)	W (mm)	T (mm)	W/T	L∗	a∗	b∗	Hardness (kg)	Fracturability (mm)
0	61.85^{a}	9.50^{a}	6.51^{a}	65.96^{a}	4.45^{d}	22.09^{a}	5004.2^{a}	40.07^{a}
2.5	62.56^{a}	9.59^{a}	6.52^{a}	47.38^{b}	8.22^{c}	11.73^{b}	5246.5^{a}	40.16^{a}
5	62.62^{a}	9.57^{a}	6.54^{a}	41.52^{c}	9.30^{b}	7.87^{c}	5284.5^{a}	40.30^{a}
7.5	61.10^{b}	9.57^{a}	6.38^{b}	38.63^{d}	9.59^{b}	6.81^{d}	4791.8^{b}	39.78^{a}
10	60.75^{c}	9.57^{a}	6.35^{b}	35.71^{e}	10.25^{a}	5.58^{e}	4469.6^{c}	40.07^{a}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$). W:Width, T: Thickness, W/T: Spread ratio, L:Lightness, a:redness, b:yellowness

Textural properties of cookies are the important criteria for the evaluation of cookie quality. Hardness and fracturability values of control and RP added cookies are presented in Table 2.
Hardness- peak force to break the cookie- was not showed any significant change up to 5% RP content whereas hardness of 7.5% and 10% containing cookies were decreased gradually. This decrease probably was arisen from both higher moisture and aw values of cookies, prepared from higher concentrations of RP. On the other hand the fracturability was generally not affected from the supplementation of RP.

Sensory Evaluation

Sensory scores of cookies prepared from different concentrations of RP can be seen from Figure 1. Surface colour of 10% RP containing cookies were approved the highest score while other RP containing cookies were scored less than control cookies. Darker colour of 10%RP cookies may be considered as the reason of higher scores them. Color of foods is an important quality characteristics and major factors affecting sensory perception and consumer acceptance of them. It is a powerful marketing tool that influences consumer purchases in many aspects (Kumar, 2017). There is a tendency among consumers to buy darker bakery products because they think that when the colour of a product is darker the healthier it is and also it has higher dietary fibre content. In recent decades with the recognition of the importance of dietary fiber there is an increase interest in bakery products with a high fiber content (Krolak et al., 2017). Along with the surface color surface structure of the cookies enriched with RP was scored higher compared with control cookies. This value of the investigated cookies was showed a significant ($P<0.01$) gradual increase up to 7.5 % addition level of RP.

The consumer acceptance test indicated that addition of RP had a favorable effect on hardness of cookies. The hardness values of cookies were decreased despite the increasing RP level as determined in the instrumental measurements. The addition of RP in the formulation had positive effects on the taste, aroma and odour as compared to the control samples. Among RP containing cookies 7.5% RP cookies were preferred most than other levels of RP in terms of overall acceptance, purchasing intent, taste, aroma, odour and surface structure (Figure 1).

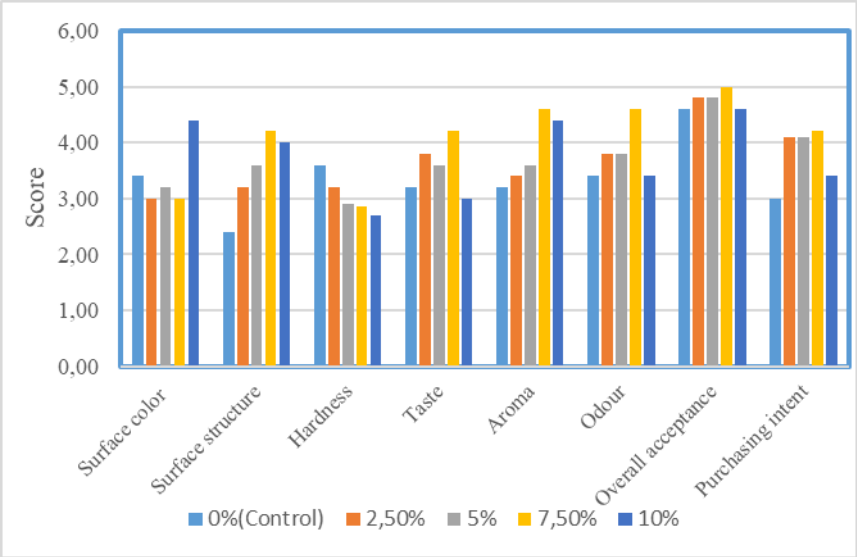


Figure 1. Sensory assestment of cookies

CONCLUSIONS

The purpose of this study was to formulate functional cookies had an acceptable sensorial and technological quality attributes by partial replacement of SWF with RP in different levels. According to the proximate compositions of cookies enriched with RP at different concentrations revealed that the addition of RP provide an important nutritional advantage to cookies with regard to high fiber, total phenolic content and also high antioxidant activity.

Based on physical properties, partial replacement of SWF with RP over to 5% level reduced the diameter and spread ratio of cookies but did not affect the thickness. Cookies became darker and softer linearly with the increasing level of RP in formulation. Regarding the sensory scores, the samples with RP exhibited acceptable sensory attributes. According overall acceptability and purchasing intent scores cookies containing up to 7.5% RP can be produced without sacrificing

consumer acceptability. However, the use of RP makes these cookies functional foods because of their good nutritional content.
The results indicate that Rosa damascena Mill powder (RP) can be used as a functional ingredient in bakery products such as cookies, muffins, cakes, bread a few- of acceptable quality.

References

AACC, (2000). International. Approved Methods of Analysis, 11th Ed. AACC International, St. Paul, MN, U.S.A.

Ahmed, H., Satheesh, N., Dibaba, K. (2018). Functional, physical and sensory properties of cookies prepared from okara, red teff and wheat flours, Croatian Journal of Food Science and Technology Croat, 10 (1) 23-32. DOI: 10.17508/CJFST.2018.10.1.05

Başer, K.H.C., Altintaş A., Kürkçüoglu, M. (2012). Turkish rose. A review of the history, ethnobotany, and modern uses of rose petals, rose oil, rose water, and other rose products. Issue 96. www.herbalgram.org, 40-53.

Dilmen, R., Baydar, N.G. (2016). Tissue Culture Applications on Oil –Bearing Rose (*Rosa damascena Mill*.) Süleyman Demirel Üniversitesi Ziraat Fakültesi Dergisi, 11 (2):134-141.

Dorman, H.J.D., Peltoketo, A., Hiyunen, R., Tikkanen, M.J. (2003). Characterization of antioxidant proeperties of de-odorised aqueous extracts from selected lamiaceae herbs. Food Chemistry, 83, 255-262. DOI: 10.1016/S0308-8146(03)00088-8

Ghosh, P.K., Bhattacharjee, P., Sarkar, P.M. (2017). Reduction of lauric acid in coconut copra by supercritical carbon dioxide extraction: Process optimization and design of functional cookies using the lauric acid-lean copra meal. Journal of Food Process Engineering, 2017; 40. DOI:10.1111/jfpe.12501

Gül, H., Acun, S., Bıçakcı, S. (2010). Rose dessert with rose delight, rose jam and rose leaves. Proceedings book of the I. International Symposium on Traditional Foods From Adriatic to Caucasus" Symposium, April, 15-17, Tekirdağ, Turkey, 802-803.

Gül, H., Kart, F.M., Gül, M., Akpınar, M.G. (2017). Bakery products consumption and consumers' awareness in urban areas of Isparta city, Turkey. Scientific Papers. Series "Management, Economic Engineering in Agriculture and Rural Development, 17 (2), 137-146.

Gül, H., Özmen, C., Metin, S., Gül, M. (2016). Biscuits consumption study: a case of Isparta, Procedding Books of the XII. National Congress of Agriculture Economics, Volume III. May 25-27, Isparta, Turkey, 1903-1912.

Gül, H., Tekeli, S.G. (2018). Evaluation of nutritional, physical, textural and sensorial properties of gluten free cookies supplemented with dried *Rosa Damascena Mill. petals*. Scientific bulletin. Series F. Biotechnologies, vol. xxii, ISSN. 2285-1364, 221-228.

Gül, H., Yanık, A., Acun, S. (2013). Effects of white cabbage powder on cookie quality. Journal of Food, Agriculture and Environment, 11 (1), 68-72.

Gül, M., 2000. Current status of rose oil production and problems in Isparta. Süleyman Demirel University Journal of Natural and Applied Sciences, 4 (1), 91-102.

Gül, M., Kazaz, S., Baydar, H., Sırıkcı, B.S. (2015). A study about technical, economical situation, problems and improvement of oil rose (*Rosa damascena Mill*.) in Turkey. Journal of Essential Oil Bearing Plants, 18 (3), 613 – 626. DOI: 10.1080/0972060X.2014.998723

Kart, D., Çağındı, Ö. (2017). Determination of antioxidant properties of dry rose tea. International Journal of Secondary Metabolite, Vol. 4: 3 (2017) pp. 384-390. DOI: 10.21448/ijsm.374630

Krolak, M., Zychowicz, MJ., Sajdakowska, M. (2017). Impact of consumer eating habits and fiber content on acceptance of plain wheat rolls. Cereal Foods World, 62 (2), 59-64.

Kumar, J.S. (2017). The psychology of colour influences consumers' buying behaviour – a diagnostic study. Ushus-Journal of Business Management, 16(4), 1-13. DOI: 10.12725/ujbm.41.1.

Singleton, V.L., Rossi, J.A. (1965). Colorimetry of total phenolics with phosphomolybdic-phosphoyungstic acid reagents. American Journal of Enology and Viticulture, 16, 144-58.

TUİK, 2018. Turkish Statistical Institute, http://www.turkstat.gov.tr

Woody, A.L. (2003). Probing and three-point bend methods compared to sensory scales as measurements for cookie texture. Master's Thesis, University of Tennessee, http:// trace.tennessee.edu/utk_gradthes/2332

Younis, K., Islam, R., Jahan, K., Kundu, M., Ray A. (2016). Investigating the effect of mosambi (*Citrus limetta*) peel powder on physicochemical and sensory properties of cookies. Quality Assurance and Safety of Crops & Foods: 8 (3), 393– 98. DOI: 10.3920/QAS2015.0706

(ORAL PRESENTATION)

MONITORING WORK THE NITRATE POLLUTION OF GROUNDWATER AND SURFACE WATERS IN ANKARA PROVINCE

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Abstract

On the way to prepare the accession to European Union, environment is regarded as one of the most important topics in Turkey. The Council Directive 91/676/EEC on the protection of waters against pollution caused by nitrates from agricultural sources was entered into force for the EU members in 1991. In the context of adopting and implementing this Directive, the Regulation on protection of the water against nitrate pollution caused by agricultural resources was put into force in Turkey in 18 February 2004. In this framework, applying GAP (Common Agricultural Policy) code/s in the determined sensitive areas, one of the aims was to improve water and soil quality as well as to prevent water and soil pollution caused by nitrates. Within the framework of the nitrate directive, various studies are carried out in the Directorate of Agricultural Environment and Natural Resources Presidency in General Directorate of Agricultural Reform in Ministry of Agriculture and Forestry in order to protect against pollution from surface and underground agricultural origin. Nitrate monitoring studies in Turkey are ongoing at around 3107 points (including river, groundwater and lake) throughout the country in 2016. In this context, Ankara Province in 2008 (15 locations), in 2009 (15 locations), in 2010 (15 locations), in 2011 (15 locations), in 2012 (17 locations), 2013 (18 locations), 2014 (31 locations), 2015 (62 locations), water analysis results only in 2015 were obtained. According to the nitrate analysis results of the water samples taken in 2015, values were found to be lesser than 50 mg / L for critical nitrate pollution except for three sampling locations.

Turkish river basins have an impact on establishment of rational water management plans. Moreover, Action Plans and Codes for Good Agricultural Practices have to be established, soon after the designation of the NVZs (Nitrate Vulnerable Zones).

Key words: nitrate, soil pollution, nitrate directive

INTRODUCTION

The desire to obtain high efficiency in modern agricultural techniques encourages the use of excessive fertilizers. In modern agriculture-based applications, a high rate of efficiency is achieved, while the cost and environmental pollution is getting increased. Besides, synthetic and chemical fertilizers cause deterioration of natural balance and residues in products. (Keeney, 1982; Schröder et al., 1998). A result of excessive use of nitrogen fertilizers in groundwater nitrate pollution affects human health, environment and farm animals in Turkey as well as whole world (Büyük et al., 2016).

World fertilizer consumption increased to 69 million tons in 1970 and 146 million tons in 1990 (Haktanır, 2010). World fertilizer consumption reached 143.5 million tons in 2003 as pure N, P, K. Around the world, 64% of this amount was used by developed countries while 35% of it was used by developing countries. Due to the negative impact of fertilizers on the environment, some developed countries, especially the European Union and the United States, have some limitations on fertilizer consumption. In EU countries, there has been a decrease in fertilizer consumption from 3% to 38% between 1992 and 2001 due to the requirements of the water and nitrate directive (FAO 2005).

As a result of nitrate analysis in drinking water samples taken from intensive agricultural regions, 125 ppm NO_3 (N: 28 ppm) was determined. This number becomes even more important for the damage caused to the environment by nitrogen fertilizers compared to the 45 ppm NO_3 which is the upper limit accepted by the World Health Organization (WHO 1993).

Due to the small amount of natural nitrogen resources in agricultural soils, very high yield increases are obtained due to nitrogen fertilizer applications and nitrogen fertilization is widely applied as a very profitable agricultural input. For this reason, nitrogen fertilizers are the most consumed fertilizers in our country and in the world. As a matter of fact, in the world, in 1930, 1975 and 1998, 1,3 million tons, 43,9 million tons and 80,2 million tons nitrogen (N) were consumed respectively. The amount of nitrogen fertilizer consumed per year between 2004-2013 years in Turkey have ranged from 1.133.068 to 1.431.946 tons, and the least usage of the nitrogenous fertilizer occurred at the year 2008 while the utmost consumption occurred in 2012. During the period 2004-2013, an average of 1.348.376 tons of nitrogen fertilizer (N) was consumed per year in our country (Anonymous, 2013). However, in recent years, it is stated that it is mandatory to use nitrogen in a controlled way due to environmental issues and economic reasons. Excessive nitrogen use brings significant financial burden to the producer. In addition, excess nitrogen can be washed with irrigation water and mixed with ground water and from there to the well and source water used as drinking water. This situation creates human and animal health issues (Keeney, 1982; Hatipoğlu et al., 1996).

It is known that only 50% of the fertilizers used in agriculture are beneficial to the plants and the other part reaches to other receiving environments by the ways of washing, surface flow and evaporation. The enrichment of nutrients in these environments, for example, the emergence of health problems due to eutrophication or excessive nitrate accumulation in the aquatic environment is very closely related to agriculture. While the world fertilizer consumption is currently at the level of 83.40 kg / hour (1993) , in most of Japan, the Netherlands, the USA and the EU, this value has exceeded 100, 200 and even 600 kg / hour until recently (Haktanır 2010).

According to Eraslan (2010), in Turkey, depending on the average policy, effective chemical fertilizer production plant nutrients was 1255 million tons in between the years 1985-2008 while the average consumption of chemical fertilizers have been takes place as 1861 million tones. Between 1985 and 2008, 65% of the average effective fertilizer used as plant nutrient is nitrogenous, 32% is phosphorus and 3,6 % is fertilizer with potassium.

The main causes of soil and water pollution from agricultural sources are excessive fertilizer consumption, erosion and pesticide consumption (ÇOB 2004). The average amount of pure nitrogen with various chemical fertilizers used for agricultural purposes in Turkey is 1,32522 million tons between 1998-2008 (TÜİK, 2009). World fertilizer consumption reached to 143,5 million tons in 2003 as pure N, P, K.

Agriculture is the largest source of nitrate pollution of waters (surface and groundwater) in EU countries, although households and industries also contribute to some extent. The nitrate pollution problem is addressed within the European Union mainly by the Nitrates Directive (91/676/EEC), regarding nitrate pollution caused by agricultural practices, supplemented by the provisions of the Urban Wastewaters Directive (91/271/EC), the Waterframe Directive (2000/60/EC) of the European Parliament and its daughter Groundwater Directive (2006/118/EC). One of the main tasks of the Nitrates Directive (NID) is monitoring, which accommodate the control and evaluation of agricultural activities impact on groundwater quality. Groundwater monitoring network has to be drafted to provide continual and comprehensive view about chemical and quantitative groundwater status in all vulnerable zones and to reveal the impact of fertilization, mainly the increasing trends in monitored indicators of nitrate substances content. Bressers and Huitema (2001), Driessen and Leory (2007) stressed the three main sources of reactive N compound emissions distinguished by current governmental policy. First one is combustion (mainly NOx by industry, power plants and traffic), second one is waste waters (mainly dissolved and particulate N in discharges by industry and households, the last one is agriculture (mainly NH3 and N2O to air, NO3 to groundwater and dissolved and particulate N to surface waters). In the context Nitrate Directive, it was designed

Nitrate Vulnerable Zones (NVZs) where the nitrate concentrations in the groundwater amount to 50 mg/lt or more. Moreover, kods of Good Agriculture Practices, valid on a countrywide basis and often consisting of voluntary-based measures, specific Action Programmes with mandatory measures have to be developed for the NVZs (Monteny, 2001).
In Turkey, the Nitrate Directive put into enforced publish in Offical Gazette in 2004 known as " Regulation on the Protection of Waters against Pollution Caused by Nitrates from Agricultural Sources. Yetiş et al. (2013), they stressed that Turkey being a candidate country to EU requires heavy cost investments in achieving approximation with EU Environmental Acquis. Moreover, they explained the technical measures and investment cost assessment related to the implementation of the ND in Turkey. As Turkey has not yet designated nitrate vulnerable zones (NVZs) according to requirements of the EU's ND, three scenarios were developed to estimate the capital investments needed for implementation of the ND. The aim of this study is to determine the change of nitrate content in sampled surface and groundwater in Ankara. It is thought that the obtained database can shed light on the future studies of nitrate pollution to be carried out along the whole basin.

MATERIAL AND METHODS

In this study, while determining water sampling points, the Ministry of Agriculture and Forestry, Agricultural Reform Directorate General of Agriculture Directorate of Agriculture Environmental and Natural Resources Preservation Directorate in the province of the nitrate directive studies were taken into account. In this study, while the water sampling points were determined, the activities of the nitrate directive of the Ministry of Agriculture and Forestry, Agricultural Reform Directorate General of Agriculture Directorate of Agriculture Environmental and Natural Resources Preservation Directorate in the province of Ankara were taken into consideration. The points where the water sampling was used in the study were selected taking into account the areas where agricultural production is intense, representing the nitrate pollution caused by agricultural activities. In this context, the results of nitrate analysis obtained in 2008 (15 points), 2009 (15 points), 2010 (15 points), 2011 (15 points), 2012 (17 points), 2013 (18 points), 2014 (31 points) and 2015 (62 points) from Ankara and its surroundings were investigated. In the water samples, a 220 nm reading was performed by taking into account the UV spectrophotometric method in nitrate analysis.

RESULT AND DISCUSSION

The amounts and classes of nitrates in water samples taken in the period of 2008-2015 in Ankara are given in Table 1. According to the results, the concentration of nitrate in 66% and 73% of samples taken in 2008 and 2009 respectively is less than 10 mg / lt. However, in 2010 and 2011, there was an increase in the amount of nitrate in the water samples from the same sampling points. Six of the sampling points taken between 2008-2013 consist of underground water wells. In 2014, the number of samples taken from groundwater increased to 10 and 9 samples was taken from the lake surface. However, there is also an increase in the sampling frequency taken from water sampling points during the year. The increase in the data obtained from the surface, sub-surface and lake surfaces in Ankara is evaluated within the framework of nitrate directive and it is considered that there will be a database for the monitoring system and for the studies to be done about pollution in the subsequent periods. Ensuring continuity of nitrate monitoring on surface, sub-surface and lake surfaces in our country and regular collection of data will directly affect the success of nitrate directive studies.

Table 1. Rivers and groundwater nitrate concentration classes (mg NO_3 / lt) and number and percentages of their monitoring point in Ankara province in each concentration classes in 2008-2015.

Years	≤ 10	%	10 < ≤ 25	%	25 < ≤ 50	%	50 <	%	Total
2008	10	66,67	1	6,67	0	0,00	4	26,67	15
2009	11	73,33	0	0,00	0	0,00	4	26,67	15
2010	6	40,00	4	26,67	0	0,00	5	33,33	15
2011	2	13,33	5	33,33	2	13,33	6	40,00	15
2012	6	37,50	5	31,25	2	12,50	3	18,75	16
2013	11	61,11	1	5,56	1	5,56	5	27,78	18
2014	20	64,52	4	12,90	1	3,23	6	19,35	31
2015	46	74,19	9	14,52	4	6,45	3	4,84	62

According to European Environmental Agency report (2005), agriculture in Europe contributes, on average, to about 80%-90% of the total emissions of NH3 into the atmosphere, to roughly 40%-60% of the Nr to surface waters, and to about 50%-70% of the emissions of N2O to the atmosphere (Oenema et. al., 2009). In Turkey, In the study conducted in order to determine the nitrate content of the wells of Antalya-Kumluca region by Kaplan et al., (1996), samples were collected from 20 wells around Kumluca region and EC, NO3 and NH_4 analyzes were performed. According to the results of the analysis, the NO_3 content of well water varies between 2.46-164,91 mg / l, NH_4 contents are 2.35-7.22 mg / l and EC values are between 548-1643 µm hour / cm. NO_3 contamination in the wells of the region has reached a very critical level, the sample and the ratio of NO_3 on the limit values of 45 mg / l was found to be 50%. In particular, it has demonstrated the necessity of taking measures to prevent drinking of these well waters.

On the other hand, in a study conducted by Orman et al., (2010), nitrate content was determined in irrigation waters taken from wells in greenhouse areas in Antalya-Kumluca region. For this purpose, EC and NO_3 concentrations were determined in samples taken from 20 wells through 1996 to 2008. When the results were evaluated, nitrate concentrations were 2.46-164.91 mg / l in 1996 and 0.15-66.04 mg / l in 2008. Average nitrate concentrations were determined as 52.15 mg / l in 1996 and 19.37 mg / l in 2008. When these data were evaluated, decreases in nitrate values were determined in 2008. In recent years, there has been a decrease in pollution factors as a result of the application of agricultural methods and techniques to protect ecological balance. As a result, the more controlled operation of nitrogen fertilizers and applications in our country will prevent contamination of surface and surface water. In the use of nitrogen fertilizers, land conditions, plant types and agricultural techniques should be taken into consideration. Regulations related to nitrate content determined in water should be continuously controlled by inspections, solution suggestions should be taken in problem areas and put into practice.

CONCLUSION

It was well known that the agriculture-related nitrogen pressure to the EU surface and ground water resources after the 2nd World War. Afterwards, nitrate concentrations in groundwater and surface water have drastically increased. The EU Nitrates Directive aims at a reduction of nitrate concentration in groundwaters to values below 50 mg/l. For this aim, Nitrate Vulnerable Zones were designed in all 15 member states. In addition, being a candidate country to EU, Turkey will be forced to implement action promes with mandatory measures to reduce nitrogen pressures.

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REFERENCES

Anonymous, 2013. Türkiye İstatistik Kurumu, Bitkisel Üretim Genel Müdürlüğü. İstatistikleri.

Bressers, H.T.A. and Huitema, D. 2001. What the doctor should know; politicians are special patients. The impact of the policy making process on the design of economic instruments. In: Market- Based Instruments for Environmental Management : Politics and Institutions, ed. M.S Anderson and R.U. Sprenger. Edward Elgar , Cheltenham, UK.

Büyük, G., Akça, E., Kume, T., Nagano, T. 2016. Investigation of Nitrate Pollution in Groundwater Used for Irrigation in Konya Karapinar Region, Central Anatolia. KSU J. Natural Sci. 19(2):168-173.

ÇOB., (2004). T.C. Çevre Ve Orman Bakanlığı, Çed Ve Planlama Genel Müdürlüğü, Çevre Envanteri Dairesi Başkanlığı, Türkiye Çevre Atlası.

Driessen, P. and Leory, P. 2007. Environmental Policy. Analysis and Perspectives. Coutinho, Bussum, N.L.

EEA. 2005. The European Environment, State and Outlook 2005. European Environment Agency, Copenhagen.

Eraslan, F., Inal, A., Güneş, A., Erdal, İ., Coşkan, A. 2010. Türkiye'de kimyasal gübre üretim ve tüketim durumu, sorunlar, çözüm önerileri ve yenilikler, TMMOB-ZMO, VII. Teknik Kongresi Bildiriler Kitabı-2, s.54-72, Ankara.

Hatipoğlu, F., Alpaslan, M., Güneş, A. 1996. Türkiyede gübre kullanımı ve çevre üzerine etkileri. Tr. J. of Agriculture and Foresty (20)1-5, 1996.

Haktanır, K. (2010).Erişim tarihi: 2010. http://www.tarimbilgibankasi.com/upload/dosyalar/GDO/Cevresel_Degisimlere_Tarimin Etkisi.pdf.

FAO. 2005. FAO statistics, www.fao.org/statistics.

Kaplan, M., Sönmez, S., Tokmak, S. 1996. Antalya- Kumluca yöresi kuyu sularının nitrat içerikleri. Tr. J. of Agriculture and Forestry, 23, 309-313.

Keeney, D.R. 1982. Nitrogen mnagement for maximum efficiency and minumum pollition. nitrogen in agricultural soils. Stevenson, F, J., 605-649.

Monteny, G.J. 2001. The EU Nitrate Directive: A European Approach to Combat Water Pollution from Agriculture. Optimizing Nitrogen Management in Food and Energy Production and Environmental Protection: Proceedings of the 2nd International Nitrogen Conference on Science and Policy, TheScientific World (1), S2, 927-935.

Oenema, O., Witzke, H.P., Klimont, Z., Lesschen, J.P., Velthof, G.L. 2009. Integrated assessment of promising measures to decrease nitrogen losses from agriculture in EU-27. Agriculture, Ecosystems and Environment, 133, 280-288.

Schroder, J.J., Neteson, J.J., Withhagen, J.C.M., Noij, I.G. 1998. Effect of applicationon agronomic and enviromental parameters in silage maize production on sandy soil. Field Crops Research, Vol.58 (1) (1998) pp.55-67.

TUİK, (2009). Türkiye İstatistik Kurumu.

WHO., (1993). World Health Orgaization, Summary of WHO guidelines for the assessment of herbal medines. Herbal Gram 28: 13-14.

Yetiş, Ü., Yukseler, H., Valatka, S., Girgin, S., Semeniene,., Keresteciogl u, M., Jacobsen, M. 2013. Implementation of the European Union's Nitrates Directives in Turkey. Desalination and Water Treatment, volume 51, Issue 19-21.

(ORAL PRESENTATION)

The Use of Goji Berry Leaves as An Additive in Sugar Beet Leaves Silages

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ABSTRACT

This study was carried out to determine the chemical content and some fermentation properties of sugar beet leaves silages by the addition of different levels of goji berry leaves. Goji berry leaves were dried and grounded in a diameter of 1 mm sieve and used in silages. Goji berry leaves were added to the sugar beet leaves at 0 (control) %, 0.5, 1.0, 1.5 and 2.0 levels. At the end of the research, The dry matter contents of the silages containing goji berry leaf at levels of 1, 1.50 and 2.0% were increased compared to the control group ($P<0.001$). The crude ash content of the silages decreased with the addition of goji berry leaf ($P<0.05$). In addition, there was no statistically significant difference in NDF, ADF, crude protein, pH, lactic acid, butyric acid and ammonia nitrogen content ($P>0.05$). Acetic acid contents decreased with the addition of goji berry leaf ($P <0.05$). As a result, the addition of 1% goji berry leaf to the sugar beet leaves positively affects the silages and improves the silage quality.

Keywords: Goji berry leaves, sugar beet leaves, silage, additive, volatile fatty acids.

INRODUCTION

Goji Berry is the common name of *Lycium barbarum, Lycium chinense* and *Lycium ruthenicum* species belonging to *Lycium* class and spreads in tropical and subtropical regions of the world and it belongs to *Solanacea* family (Levin and Miller, 2005). Goji berry is found in tropical and subtropical regions; however, it is also known to spread to Mongolia, Himalayas, Western China and Tibet (Bucheli et al., 2011). In addition, it spreads in arid, semi-arid and a little bit semi-saline areas (Fukuda et al., 2001).

In *Lycium barbarum* leaves are long and elliptical, pedicel is 1 or 2 cm, calyx is generally two-lobe and the lobes have 2 or 3 cloves at the tip, Corolla tube is 8-10 mm and longer than the lobes (Mi et al., 2015). It has been reported that the part with medicinal value is fruit; however, on the leaves there are flavonoids with biological activity (Koşar et al., 2003; Shahidi and Naczk, 2003; Lagow, 2004). As a results of the extraction studies of Li et al., (2011); Inbaraj et al., (2008); Wang et al., (2010); Amagase and Hsu., (2009); Cui et al., (2011) identified routine gentisic acid and quercetin on the leaves of *Lycium barbarum*.

The purpose of this study is to identify the effect of goji berry leaves supplementation to sugar beet leaves at different amounts on the chemical and some fermentational properties of the silages.

MATERIALS AND METHODS

Silage material and tratment: Sugar beet leaves used in the study were collected from the field of a producer who cultivates sugar beet in Usak province. Goji berry leaves used as the silage supplement were supplied from a producer of goji berry. Goji berry leaves were dried and grinded with 1 mm diameter of sieve and they were used in powdery form in experiment silages. As soon as sugar beet leaves were brought from the field, they were chopped to 1.5-2 cm of diameters and goji berry leaves at different levels were added and they were ensiled in 1 lt of anaerob jars in laboratory

conditions at room temperature as 4 parallels. The ensiling period lasted for 75 days. Goji berry laves were added to suger beet leaves at 0 % (control), 0.5 %, 1.0 % ve 1.5 % ve 2.0 % levels respectively and they were ensiled.

Chemical analyses: As soon as the silages were opened dry matter values were identified after the silage samples taken to represent the silages were dried in circulated oven for 48 hours at 65 ºC (AOAC, 1999). After the silages were dried, they were grinded at 1 mm of sieve diameter and the crude ash content of the samples were determined by burning in ash oven for 4 hours at 550 ºC as stated in AOAC (1999) and the crude protein content of the samples were determined by Kjeldahl method. ADF and NDF analyses were conducted as stated by Van Soest et al. (1991).

Analyses to Determine Fermentation Properties: When the silages were opened, pH of the liquid obtained after 100 ml of distilled water was added to 25 g of silage sample and mixed by a mixer was measured by a digital pH meter in order to determine the pH values of silage samples (Polan et al., 1998). Moreover, soon after the silages were opened 40 g of silage sample was taken and 360 ml of distilled water was added and shaken for at least 5 minutes. Following this shaking procedure the mixture was filtrated with Whatman no:1 paper and NH_3-N was determined by Kjeldahl distillation method by taking 100 ml from the obtained filtrate (Broderick and Kang, 1980). Lactic acid, acetic acid and butyric acid contents of the silages were determined on HPLC device by taking 1 ml from the same filtrate. (Device properties: Column: C18, 5 µm, 4.6 x 250-mm; Mobile PhaseA: socratic; 10-mM K-phosphate buffer; pH 2.0 with phosphoric acid; Mobil phaseB: Acetonitrile; Flow Rate: 1.5 mL/dak.; Column Temperature: 30 ºC; UV Deduction: Wavelength: 210 nm; Injection Volume: 20 µL).

Statistical Analyses*:* The data of the study were analyzed according to One-Way Anova procedure in SPSS 16.01 package programme and Duncan's Multiple Range Test was applied for the differences of the groups (SPSS, 2007).

RESULTS

The effect of dried and grinded goji berry leaves added to sugar beet leaves at different levels on the chemical compositions of the silages was presented in Table 1.

Table 1. Chemical composition of sugar beet leaves silages

Parameter	Goji berry leaves powder levels in sugar beet leaves silages, %					P
	Control	0.5	1.0	1.5	2.0	
DM, %	13.91^{c}	14.11^{bc}	15.06^{ab}	15.96^{a}	15.80^{a}	0.001
NDF, % DM	25.74	26.84	26.61	26.29	27.60	0.59
ADF, % DM	14.27	15.49	15.84	14.41	15.28	0.12
CA, % DM	20.54^{a}	18.68^{b}	17.76^{b}	17.56^{b}	17.53^{b}	0.02
CP, % DM	28.02	28.28	28.40	27.88	27.51	0.83

$^{a-c}$: The differences between the averages in the same line are significant (P<0.001).

$^{a-b}$: The differences between the averages in the same line are significant (P<0.05).

DM: Dry matter; NDF: Neutral detergent fiber; ADF: Acid detergent fiber; CA: Crude ash; CP: Crude protein.

It was found that dry matter contents of the silages containing goji berry leaves at 1.5 % and 2.0 % levels were higher than the control and the groups containing 0.5 % of goji berry leaves (P<0.001). Dry matter content of the silages increased with goji berry leaves supplementation and no loss of dry matter content was observed. However, the crude ash contents were decreased with goji berry supplementation (P<0.05). It was found that the differences in terms of NDF, ADF and crude protein contents were not significant (P>0.05).

The effect of Goji berry leaves on the fermentation properties of sugar beet leaves was presented in Table 2.

Table 2. Fermentation characteristics of sugar beet leaves silages

Parameter	Goji berry leaves powder levels in sugar beet leaves silages, %					P
	Control	0.5	1.0	1.5	2.0	
pH	4,69[a]	4.58[a]	4.23[b]	4.43[b]	4.30[b]	0.001
LA, %	1.74	1.72	1.17	1.66	0.94	0.10
AA, %	0.43[a]	0.27[ab]	0.18[b]	0.22[b]	0.18[b]	0.04
BA, %	0.04	0.05	0.03	0.03	0.01	0.78
NH_3-N	2.26	2.42	3.32	2.18	1.68	0.06

[a-b]: The differences between the averages in the same line are significant (P<0.05).
[a-b]: The differences between the averages in the same line are significant (P<0.001).
LA: Lactic acid; AA: Acetic acid; PA: Propyonic acid; BA: Butyric acid; NH_3-N: Ammonia nitrogen;

pH of the groups added goji berry leaves at 1.0%, 1.5% and 2.0% levels decreased compared to the groups added goji berry leaves at 0.% level (P<0.001). In supplementation, no statistically significant change was identified in terms of lactic acid, butyric acid and ammonia nitrogen contents of the silages with goji berry leaves supplementation (P>0.05). Goji berry leaves supplementation at 1.0 %, 1.5 % and 2.0 % levels also decreased the acetic acid content compared to control group (P<0.05).

DISCUSSION

Use of medicinal and aromatic plants as supplements in silages has recently become a current issue. To prevent the development of harmful microorganisms in silages and reduce the pH of silages in a very short time is the reason for this. No literature study could be found for the effect of goji berry supplementation in silages on the silage quality. It was reported that goji berry leaves used as silage supplementation in this study were strong antioxidants and antimicrobials (Mocan et al., 2014). Therefore, it can be said that goji berry leaves that were added especially to the silages more than 1 % by indicating the strong antimicrobial effect reduced the pH of the silages. In a study conducted with different herbal supplements Arslan Duru (2019) determined that lavender supplementation did not affect the pH of the silages and also Alhan and Can (2017) determined that inoculant supplementation to sugar beet leaves did not affect the pH of the silages.

Since the water soluble carbonhydrate content is effective in the lactic acid growth, it becomes difficult that pH of the silages is acetic when the fermentation conditions are not good (Bolsen et al., 1996). Although pH reduces with goji berry treatment, we understand in this study that it causes the lactic acid that is required to be in the silages to reduce besides the undesirable microorganisms. However, there are some reports that lower lactic acid content does not indicate bad fermentation development. Baytok et al. (2005) indicated that lower lactic acid content did not adversely affect silage fermentation and its nutritive values. Therefore, it can be said that it is necessary to provide minimum lactic acid content that would create the protective effect in order to provide a good quality of silage fermentation and lactic acid at the level to realize a good silage fermentation conditions was produced in experiment silages. The acetic acid that is desired to be in limited amount in silages significantly and statistically reduced. Moreover, the butyric acid production that occurs as a result of poor fermentation and is not wanted to be in silages was suppressed by goji berry leaves supplementation. Similarly, Aksu et al. (2017) reported that dried daphne pulp supplementation to alfaalfa reduced the lactic acid and butyric acid contents of the silages; however, increased the acedic acid content.

Higher acetic acid content leads the ammonia level of the silages to increase through the deamination of aminoacids (McDonald et al., 1991). Proteins were protected by the reduction of acetic acid amount with goji berry leaves supplementation and lactic acid production in silages and proteolisis was prevented to keep on for a long time, therefore ammonia nitrogen production did not increase in the silages. Alhan and Can (2017) stated that ammonia nitrogen amount of sugar beet leaves was 9.26 % and it reduced to 5.73 % with wheat straw and inoculant supplementation.

It was determined that dry matter contents of the silages increased and there was no loss of dry matter. Gürbüz and Kaplan (2008) pointed that dry matter content of sugar beet leaves was 11.90% and dry matter content of the silages increased with the whole corn supplementation at different levels. NDF and ADF contents among the cell wall compounds did not change with goji berry leaves treatment.

It can be said that degradability of the cell wall compounds in the silages reduced as a result of the fact that goji bery leaves slowed down the lactic acid bacteria activities. Arslan Duru (2018) concluded that NDF content of sugar beet leaves silages was 27.21% and ADF content of it was 16.02% and the alfalalfa supplementation at different levels did not have a significant effect.

Crude ash contents reduced with goji berry leaves supplementation to the silages. Lower crude ash content of goji berry leaves reduced the crude ash content as its amount in silages increased. Can et al. (2003) identified that crude ash contents of sugar beet leaves reduced with different supplements.

CONCLUSION

The effects of goji berry leaves with strong antimicrobial and antioxidant properties on sugar beet leaves silages were investigated in this study. No loss of dry matter was observed in silages, pH decreased, lactic acid production was provided to create protective effect in silages and unwanted butyric acid content was produced in very small quantities in silages. Therefore, it was concluded that goji berry leaves could be appreciated as supplements in silages and a good quality of silages could be obtained with 1 % of use.

REFERENCES

Aksu, T., Denek, N., Aydın, S.S., Doğan Daş, B., Savrunlu, M., Özkaya, S., 2017. Effect of Dried Thyme Pulp (*Tymbra Spicata* L. spicata) on Fermantation Quality and In Vitro Organic Matter Digestibility of Meadow Grass and Alfalfa Silages. Kafkas Univ Vet Fak Derg. 23 (2): 211-217.

Alhan, R., Can, A., 2017. Determining effect of straw and inoculant addition on silage quality of sugar beet leaves silage. Bulgarian Journal of Agricultural Science, 23 (4) 639–643.

Amagase, H., Hsu, C.H.P., 2009. Meta-analysis of the general effects of a standardized *Lycium barbarum* fruit juice shown in randomized, double-blind, placebo-controlled human clinical studies. FASEB Journal, 23, 716.1.

AOAC, 1999. Official Methods of Analysis. Association of Official Analytical Chemists, 16th Ed.,Arlington

Arslan Duru, A., 2019. Lavanta (*Lavandula angustifolia*) Katkısının Yonca Silajlarının Kalitesi Üzerine Etkisi. Uluslararası Mühendislik Araştırma ve Geliştirme Dergisi. UMAGD, 11 (2), 426-431.

Arslan Duru, A., 2018. Determination of Some Quality Properties of Sugar Beet Leaves Ensiling Alfaalfa with Different Levels. II. International Scientific and Vocational Studies Congress, (BILMES EN-NAT 2018)- Engineering and Natural Sciences.

Baytok, E., Aksu, T., Karslı, M.A., Muruz, H., 2005. The effects of formic acid molasses, and inoculant as silage additives on corn silage composition and ruminal fermentation characteristics in sheep. Turk J Vet Anim Sci, 29, 469-479.

Bolsen, K.K., Ashbell, G., Weinberg, Z.G., 1996. Silage fermentation and silage additives. Asian Austral J Anim Sci, 9 (5): 483-493, 1996.

Broderick, G.A., Kang, J.H., 1980. Automated simultaneous determination of ammonia and total amino acids in ruminal fluid and in vitro media. J. Dairy Sci., 63, 64-75.

Bucheli, P., Gao, Q., Redgwell, R., Vidal, K., Wang, J., Zhang, W., 2011. Biomolecular and clinical aspects of chinese wolfberry. In: Herbal Medicine: Biomolecular and Clinical Aspects. 2nd edition. (Eds: Benzie, I. F. F. and Wachtel-Galor, S.), CRC Press, Taylor & Francis, pp. 289–315.

Can, A., Denek, N., Yazgan, K., 2003. Şeker pancarı yaprağına değişik katkı maddeleri ilavesinin silaj kalitesi ile in vitro kuru madde sindirilebilirlik düzeylerine etkisi. YYÜ. Vet. Fak. Dergisi, 14(2): 26-29.

Cui, B., Liu, S., Lin, X., Wang, J., Li, S., Wang, Q., Li, S.,2011. Effects of Lycium barbarum aqueous and ethanol extracts on high-fat-diet induced oxidative stress in rat liver tissue. Molecules, 16: 9116-9128.

Fukuda, T., Yokoyama, J., Ohashi, H., 2001. Phylogeny and biogeography of the genus *Lycium* (Solanaceae): inferences from chloroplast DNA sequences. Molecular Phylogenetics and Evolution, 19(2): 246–58.

Gürbüz, Y., Kaplan, M., 2008. Chemical composition, organic matter digestibility, in vitro gas production characteristics and ensilling of sugar beet leaves as alternative feed resource. Journal of Animal and Veterinary Advances. 7 (12): 1568-1574, 2008.

Inbaraj, B.S., Lu, H., Hung, C.F., Wu, W.B., Lın, C.L., Chen, B.H., 2008. Determination of carotenoids and their esters in fruits of *Lycium barbarum* Linnaeus by HPLC-DAD-APCI-MS. J Pharm Biomed Anal., 47: 812-818.

Koşar, M., Altintaş, A., Kırımer, N., Başer, H.C., 2003. Determination of the free radical scavenging activity of Lycium extracts, Chem. Of Nat. Comp., 39 (6): 531-535.

Lagow, B., 2004. PDR for Herbal Medicines 3rd ed. Thomson PDR, Montvale, 530-531.

Levin, R.A., Miller, J.S., 2005. Relationships within tribe Lycieae (Solanaceae): paraphyly of *Lycium* and multiple origins of gender dimorphism. American Journal of Botany, 92(12): 2044– 2053.

Li, G., You, J., Sou, Y., Song, C., Sun, Z., Xia, L., Zhao, X., Shi, J., 2011. A developed pre-column derivizatin method for the determination of free fatty acids in edible oils by reversed –phase HPLC with fluorescence detection and its application to *Lycium barbarum* seed oil, Food Chem., 125: 1365-1372.

McDonald, P., Henderson, A. R., Herson, S. J. E., 1991. The Biochemistry of Silage. 16th ed., Chalcombe Publication, Marlow, UK.

Mi, X.S., Huang, R.J., Ding, Y., Chang, R.C.C., So, K.F., 2015. Effects of *Lycium barbarum* on modulation of blood vessel and hemodynamics. In: Lycium barbarum and Human Health, (Eds: Chang, R.C.C. and So, K.F.), Springer, pp. 65–79.

Mocan, A., Vlase, L., Vodnar, D.C., Bischin, C., Hanganu, D., Gheldiu, A., Oprean, R., R. Silaghi-Dumitrescu, G., Crișan, 2014. Polyphenolic content, antioxidant and antimicrobial activities of *Lycium barbarum* L. and *Lycium chinense Mill*. Leaves. Molecules 2014;19:10056–73.

Polan, C.E., Stive, D.E., Garrett, J.L., 1998. Protein preservation and ruminal degradation of ensiled forage treated with heat, formic acid, ammonia, or microbial inoculant, Journal of Dairy Science, 81, 765-776.

Shahidi, F., Naczk, M., 2003. Phenolics in Food and Nutraceuticals. CRC Press, New York, 131.

SPSS, 2007. SPSS for Windows Release 16.01. SPSS Incorporation. 2007.

Wang, C.C., Chang, S.C., Inbaraj, B.S., Chen, B.H., 2010. Isolation of carotenoids, flavonoids and polysaccharides from *Lycium barbarum* L. and evaluation of antioxidant activity. Food Chem., 120: 184-192.

Van Soest, P. J., 1982. Analytical systems for evaluation of feeds. In: P. J. Van Soest (Editor), Nutritional Ecology of the Ruminant. Cornell University Press. Chapter 6, pp. 75-94. Ithaca, NY.

(ORAL PRESENTATION)

DETERMINATION OF TOMATO LEAFMINER (*TUTA ABSOLUTA* (MEYRICK) (LEPIDOPTERA: GELECHIIDAE)) POPULATION IN OPEN FIELD AND GREENHOUSE TOMATO GROWING AREAS ON TURKISH REPUBLIC OF NORTHERN CYPRUS

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Abstract

Tomato is very important vegetable crop of the world. It is consumed as fresh table tomato and as raw material for food processing industries. The tomato leafminer, Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) is the most destructive pest attacking tomato plant, Lycopersicon esculentum. The tomato leafminer was recorded in Crete (Greece) for the first time in June 2009. Under heavy infestation yield loss in the range of 80-100% is common. During this research, a total of 10 (ten) different tomato growing areas (5 open fields in Güzelyurt and 5 greenhouses in Girne) have been visited. The 5 greenhouses are found in Girne region and related, distrinct villages [Tepebaşı 1(K1), Tepebaşı 2 (K2), Çamlıbel (K7), Geçitköy 1(K9) and Geçitköy 2 (K10)] and 5 open field areas are found in Güzelyurt region and related, distrinct villages [Yeşilırmak (K3), Çamlıköy (K5), Yeşilyurt (K6), Aydınköy (K11) and Yayla (K13)]. 5 (five) pheromone traps were used for each village and for each area. To make this trap, it has been used a 62 cm x 19 cm plastic container by putting approximately 100 ml. olive oil in to prevent the catching of adult tomato leafminer and a steel line over the top of the container. The pheromone traps were hang on that line as an attractant. The olive oil which was found inside the plastic container was changed every week and adults were counted to determine the population of tomato leafminer. The highest adult population of adult Tuta absoluta was recorded from K9 plot and the second highest population was found in K10 plot in Girne region for greenhouses, which was occurring in Geçitköy. The highest population of Tuta absoluta for open field was recorded from K13 plot which was occurring in Yayla village and the second highest population was determined in K6 plot which was occurring in Yeşilyurt village for Güzelyurt region. When all datas were evaluated, the population was recorded highest in K13 plot (Yayla village) for open field and greenhouse tomato growing.

Key words: Greenhouse, open field, phremone, population, Tuta absoluta .

INTRODUCTION

Tomato is the second largest vegetable crop consumed as crude and processed food worldwide. Originating in the Andes, the tomato (*Solanum lycopersicum* L.) was imported to Europe in the 16th century. At present, it is an important crop plant cultivated all over the world, and its production and consumption continue to increase (Al-Remi et al., 2018). The major tomato pests in Mediterranean region are; root swelling nematodes (*Meloidogyne* spp.), Aphid (*Myzus persicae*, *Aculops lycopersici* and *Aphis gosspyii*), Spider mite (*Tetranychus cinnebarinus*), Yellow mite (*Polyphagotarsonemus latus*), Beet root weevil (*Bothynoderes punctiventris*), greenworm (*Heliothis armigera*), cotton leaf worm (*Spodoptera littoralis*), thrips (*Thrips tabaci*, *Frankliniella occidentalis*), leaf hoppers (*Empoasca decipiens*, *Asymmetresca decedens*), whitefly (*Trialeurodes vaporarium*, *Bemisia tabaci*), American serpentine leafminer (*Liriomyza trifolii*, *Liriomyza huidobrensis*, *Liriomyza bryoninae*) (Uygun et. al. 1998). The Tomato leafminer was a pest for

tomato cultivations in South America until 2006, when it arrived to Spain probably with tomato imports from central Chile.

Afterwards, it spread rapidly to other counties of Europe, Africa and Asia, becoming a very serious worldwide threat for green-house and open-field tomato crops (Michailidis et al. 2019). The tomato leaf miner, *Tuta absoluta* (Meyrick) is a crucial tomato pest distributed from South America to Europe and introduced in Turkey in 2009 (Genç, 2017). In early infestation, newly emerged neonates (First instar) penetrate the leaf into the mesophyll layer and feed between the lower and upper surfaces of the leaf to form small and transparent mines (Moussa et al., 2013). Under heavy infestation yield loss in the range of 80-100% is common. Regarding its life cycle, this pest has high rate of reproduction and short life cycle. The damaging stage of tomato leaf miner is the larval stage. After egg hatching, the larvae make a way into tomato fruits, leaves, flower buds and young shoots on which they feed and develop creating mines and galleries (Gebremariam, 2015). Megido et al (2012) were studied about the first evidence of deuterotokous parthenogenesis in the tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) and evaluated the preventing pest mating control methods. They found that all these methods achieve only a poor success rate in controlling *T. absoluta* populations under greenhouse conditions and reported for the first time laboratory evidence of deuterotokous parthenogenesis, an asexual reproduction where both males and females are produced from unfertilized eggs. Tome et al (2013) were researched that the Azadirachtin avoidance by larvae and adult females of the tomato leafminer *Tuta absoluta* and determined Azadirachtin caused the avoidance of egg laying and affected the walking of larvae, but not affected the leaf mining. Results indicated the potential of azadirachtin not only as an insecticide potentially important for organic farming, but also as an egg-laying deterrent minimizing *T. absoluta* infestation. In Egypt, El-Aassar et al. (2015) were aimed to find the efficiency of pheromone traps on population dynamics of *Tuta absoluta*, to determine the most suitable insecticide and rate of some selected bio and chemical insecticides against *Tuta absoluta* larvae, and to estimate the damage area of tomato leaves and fruits infested with *T. absoluta* after the second spray of the tested insecticides. Results showed that the population dynamics of captured *Tuta absoluta* male have three stages and first stage made a peak from 1st week of April to 1st week of May (477.7 male/trap/week), the second stages made peak during May (210.7 male/trap/week) and third stage began 4th week of May and 4th week of July (95.7 male/trap/week). The most effective bio-pesticides against the *T. absoluta* larvae were found Biovar with 69.4% damage. The tomato leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae), is now considered to be one of the most damaging invasive pests of tomatoes in the world. Tomato is regarded as the main host of *T. absoluta*, but the pest can also feed, develop and reproduce on other cultivated Solanaceae, such as potato (*Solanum tuberosum* L) (Megido et al. 2013). This study was carried out 10 different tomato growing areas to determine the population fluctuation of Tomato leafminer in open field and greenhouse tomato growing areas on TRNC.

MATERIAL AND METHODS

During this research, a total of 10 (ten) different tomato growing areas have been visited. The 5 greenhouses are found in Girne region and related, distrinct villages [Tepebaşı 1(K1), Tepebaşı 2 (K2), Çamlıbel (K7), Geçitköy 1(K9) and Geçitköy 2 (K10)] and 5 open field areas are found in Güzelyurt region and related, distrinct villages [Yeşilırmak (K3), Çamlıköy (K5), Yeşilyurt (K6), Aydınköy (K11) and Yayla (K13)]. 5 (five) pheromone traps were used for each village and for each area. To make this trap, it has been used a 62 cm x 19 cm plastic container by putting approximately 100 ml. olive oil in to prevent the catching of adult tomato leafminer and a steel line over the top of the container. The capsules were hang on that line as an attractant. The olive oil which was found inside the plastic container was changed every week and adults were counted to determine the population fluctuation of tomato leafminer.

Table 1. Details tomato growing areas in Girne region (Greenhouses)

No.	Producer Name	Variety	Size of area
1	Necati Kararlı (K1)	Bursa, Keban	15 dn.
2	Mürsel Çakır (K2)	6515	16 dn.
3	Emine Beyitler (K7)	6515, Galina,3019	8 dn.
4	Mahmut Akmehmet (K9)	6515,3019,Mardo	8 dn.
5	Alim Duman (K10)	6515,Mardo,3019	10 dn.

Table 2. Details tomato growing areas in Güzelyurt region (Open fields)

No.	Producer Name	Variety	Size of area
1	Salih Çınar	6515	22 dn.
2	Ahmet Osman Karadayı	6515, 3019,Mardo	10 dn.
3	İzzet Savaroğlu	6515, Galina, 3019	6 dn.
4	Niyazi Kasman	6515, Mardo, 3019	3 dn.
5	Salih Efendi	6515, Mardo, 3019	11 dn.

RESULTS AND DISCUSSIONS

A total of 10 (ten) different tomato growing areas have been visited and pheromone traps were established to determine the population fluctuations of adult Tomato leafminer. The traps with pheromones (provided or not with a source of light) captured more insects than all the other types of traps (Refki et al., 2016). For this purpose, the 5 greenhouses which are found in Girne region and related, distrinct villages [Tepebaşı 1 (K1), Tepebaşı 2 (K2), Çamlıbel (K7), Geçitköy 1 (K9) and Geçitköy 2 (K10)] and 5 open field areas which are found in Güzelyurt region and related, distrinct villages [Yeşilırmak (K3), Çamlıköy (K5), Yeşilyurt (K6), Aydınköy (K11) and Yayla (K13)]. One pheromone trap was used for each area. The highest adult population of adult *Tuta absoluta* was recorded from K9 plot and the second highest population was found in K10 plot in Girne region for greenhouses, which was occurring in Geçitköy. The highest population of *Tuta absoluta* for open field was recorded from K13 plot which was occurring in Yayla village and the second highest population was determined in K6 plot which was occurring in Yeşilyurt village for Güzelyurt region. When all datas were evaluated, the population was recorded highest in K13 plot/trap 5 (Yayla village) for open field and K10 plot/trap 5 (Geçitköy) greenhouse tomato growing. *Tuta absoluta*, known as the South American tomato pinworm, is one of the most disastrous pests of tomato cultivations, presently menacing tomato cultivations worldwide (Michailidis et al. 2019). In TRNC, Tomato leafminer is the most destructive pest both open field and greenhouse tomato production areas. Mass trapping using traps baited with the female produced sex pheromone is an attractive alternative for the management of this pest (Lobos et al. 2013). Generally, pheromone traps are used both tomato production areas and after the chemical application, traps are effective management methods in TRNC. During this study, pheromone traps were used and the highest population was determined in open field tomato production than greenhouse production areas.

Table 3. Captured and considered number of *Tuta absoluta* in Girne region

	Tepebaşı K 1	Tepebaşı K 2	Çamlıbel K 7	Geçitköy K 9	Geçitköy K 10
Trap 1	87	-	-	-	-
Trap 2	-	91	-	-	-
Trap 3	-	-	62	-	-
Trap 4	-	-	-	96	-
Trap 5	-	-	-	-	113

Table 4. Captured and considered number of *Tuta absoluta* in Güzelyurt region

	Yeşilırmak K3	Çamlıköy K 5	Yeşilyurt K 6	Aydınköy K 11	Yayla K 13
Trap 1	36	-	-	-	-
Trap 2	-	48	-	-	-
Trap 3	-	-	77	-	-
Trap 4	-	-	-	59	-
Trap 5	-	-	-	-	168

CONCLUSIONS

The aim of this study was to determine the population fluctuations of Tomato leafminer in Güzelyurt and Girne regions. The pheromone traps were used due to these traps are captured more insects than other traps. The highest population of Tomato leafminer was determined in Yayla village where open field tomato is cultivated and belongs to Güzelyurt region (K13/trap5). Observation of the results, the pheromone traps were more effective in open field areas than greenhouses. Pheromone traps are used in order to develop effective control methods to develop further spread.

REFERENCES

Al-Remi, F., Arvas, Y.E., Durmuş, M., Kaya, Y. (2018). Tomato Plant and Its In Vitro Micropropagation. Journal of Engineering Technology and Applied Sciences, 3(1) 57-73.

El-Aassar, M.R., Soliman, M.H.A., Elaal, A.A. (2015). Efficiency of sex pheromone traps and some bio and chemical insecticides against tomato borer larvae, *Tuta absoluta* (Meyrick) and estimate the damages of leaves and fruit tomato plant. Annals of Agricultural Science, 60(1), 153–156.

Gebremariam, G. (2015). *Tuta Absoluta*: A Global Looming Challenge in Tomato Production, Review Paper. Journal of Biology, Agriculture and Healthcare,Vol.5, No.14, 2015.

Genç, H. (2017). Laboratory Rearing of Tomato Leaf Miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) on Artificial Diet. Turkish Journal of Agricultural and Natural Sciences, 4(4): 528–536.

Michailidis, G., Seraphides, N., Pitsillou, M., Sfenthourakis, S. (2019). Susceptibility of Cypriot *Tuta absoluta* populations to four targeted insecticides and control failure likelihood. Journal of Applied Entomology, DOI: 10.1111/jen.12627.

Lobos, E., Occhionero, M., Werenitzky, D., Fernandez, J., Gonzalez, L.M., Rodriguez, C., Calvo, C., Lopez, G., Oehlschlager, A.C. (2013). Optimization of a Trap for *Tuta absoluta* Meyrick (Lepidoptera:
Gelechiidae) and Trials to Determine the Effectiveness of Mass Trapping. Neotrop Entomol 42:448–457.

Megido, R.C., Haubruge, E., Verheggen, F.J. (2012). First evidence of deuterotokous parthenogenesis in the tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Journal of Pest Science 85 (4), 409–412.

Megido, R.C., Brostaux, Y., Haubruge, E., Verheggen, F.J. (2013). Propensity of the Tomato Leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae), to Develop on Four Potato Plant Varieties. American Journal of Potato Research, 90 (3), 255–260

Moussa, S., Sharma, A., Baiomy, F., El-Adl, F.E.(2013). The Status of Tomato Leafminer; *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Egypt and Potential Effective Pesticides. Academic Journal of Entomology, 6 (3): 110-115.

Refki, E., Sadok, B.M., Ali, B.B., Faouzi, A., Jean, V.F., Rudy, C.M. (2016). Effectiveness of pheromone traps against *Tuta absoluta*. Journal of Entomology and Zoology Studies, 4(6): 841-844.

Tomé, H.V.V., Martins, J.C., Corrêa, A.S., Galdino, T.V.S., Picanço, M.C., Guedes, R.N.C. (2013). Azadirachtin avoidance by larvae and adult females of the tomato leafminer *Tuta absoluta.* Crop Protection, 46 (2013) 63-69.

Uygun, N., Ulusoy, M.R., Başpınar, H. (1998). Sebze Zararlıları. Ç.Ü. Ziraat Fakültesi, Ofset Atölyesi, 168 pp.

(ORAL PRESENTATION)

Trends in Pomegranate Sector: Production, Postharvest Handling and Marketing

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Abstract

Pomegranate (*Punica granatum* L.) tree was one of the first cultivated crops in the world and is being produced in many regions of the earth for many years. However, its consumption was very low mainly due to the hassle of extracting the arils for eating. Studies after 21th century reported superior pharmacological and therapeutic properties for pomegranate. Results of these studies caused a considerable increase in the consumption and this caused an increase in demand which required increase in the production to meet the demand. The need for increasing the production has led new studies about the challenges affecting production, postharvest handling and marketing of pomegranate fruits. This review aimed to discuss recent studies and technologies about pomegranate production.

Key words: pest management, fruit cracking, physiological disorders**,** chilling injury, postharvest storage

1. Introduction

Pomegranate (*Punica granatum* L.) was believed to be firstly planted around 4.000 BC while it was mentioned in ancient literature by Dioscorides and Hippocrates, and even in both Bible and Quran. Recent scientific studies revealed the health benefits of pomegranate fruits (Gil et al., 2000; Jurenka, 2008; Haidari et al., 2009) and caused it to be titled as "super fruit". Then, the consumption and thus the production of this highly valuable crop started to increase all over the world. However, the production is still limited mainly due to the physiological disorders, pest and disease problems and postharvest problems. Langley (2000) reported that "pomegranate represents regeneration, life and marriage in the Greek mythology". It is also believed to be originated in Iran and spread to world from there (Levin, 1994; Kahramanoğlu and Usanmaz, 2016). Pomegranate seeds is not producing true-to-type, and its propagation is mainly done by vegetative parts (Jalikop and Kumar, 1990). Today, more than 500 varieties of pomegranates are being grown throughout the world (Kahramanoğlu and Usanmaz, 2016). This review paper summarizes the recent studies and trends in pomegranate production, postharvest handling and marketing.

2. Trends in Production and Marketing

No reliable information is available about the total pomegranate production in the world. It was estimated to be around 3 million tons in 2014 and 3.8 million tons in 2017. Due to the rapid increase in the production, it is highly difficult to calculate the total production. The top countries for the production of pomegranate are believed to be: India, Iran, Turkey, China, United States of America, Israel, Egypt, Spain, Afghanistan, Tunisia, Azerbaijan, Morocco, Argentina, Brazil, Chile, Peru, South Africa, Australia and Italy (Table 1). Pomegranate trees are known to be very sensitive against climatic conditions, i.e. water scarcity, heavy rain, nail, salinity, heat and etc. Since 2010, the seasons are becoming difficult for pomegranate producing countries due to extreme weather conditions. For example, India had quality issues in 2017 due to rain, where Egypt had quality issues due to heat (sunburn). The pomegranate fruit, due to its characteristics, is very easy to substitute by other crops. Moreover, it is very important for countries to produce at least same amount of product to protect their share in the market.

Table 1. Global availability of pomegranates

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
India												
Iran												
Turkey												
USA												
Spain												
Israel												
Argentina												
Peru												
S. Africa												
China												
Egypt												
Afghanistan												
Tunisia												
Azerbaijan												
Australia												
Italy												

In almost all of the above mentioned countries, the production area and the consumption is increasing; but the productivity (yield) is decreasing due to weather conditions and pests. Some of the countries also facing with quality issues.

India:
Pomegranate is one of the most popular horticultural crops in India and the production is growing about 20 to 25% every year. India is the only country where the pomegranate fruits are available year round due to climate. Most important varieties in India are Bhagwa and Arakta and the market of the Indian pomegranates is Europe (mainly Germany), Middle East and Asia. They mainly supply the products to the markets in December, January and March. Venkatesha and Yogish (2016) reported that even there is an increase in the area of production, the yield of the fruit-bearing trees showing a decline in the last years.

Iran:
Iran is among the most important producers in the world. They are mainly producing for local markets due to the problems in exporting. Malas Yazdi is the most important variety being produced in Iran.

Turkey:
Turkey is one of the most important growers and players in the European market. Turkish pomegranates (mainly Hicaznar) is well known in Eastern Europe, but many farmers in Turkey started to remove pomegranate plants due to high production costs and storage problems (not Hicaznar but some of other varieties). On the other hand, there are some growers who are starting new plantations (mainly with Wonderful), thus the total area is increasing.

United States of America:
In United States of America, California produces more than 90% the pomegranates. Total production in the USA was about 400 tons in 2017. California faced with a 5-years drought problem and this has impacted pomegranate production too. It was reported that some growers resorted to pulling out their pomegranate trees to use water for other crops, such as almonds and pistachios (The Packer, 2014). About 40% of the total production is known to be exported to countries around the Pacific (including Australia, Japan and Mexico) and to Europe via the Netherlands.

Spain:
Spain is among the most important producers in Europe. The most commonly grown variety is the Mollar de Elche (Mollar grown in Elche region). The other important varieties are Wonderful, Acco and Smith. Estimated local consumption is about 30%. Main exporting counties for Spain is in Europe, but since the competition is growing, Spanish exporters are searching new markets in Middle East and Asia.

Israel:
Israel is the other important player in the European market. Warm weather also affected the quality of Israeli pomegranates in last years (mainly Wonderful, Emek and Acco). European market has different preferences about origins and size. Mainly, the northern countries prefer smaller sizes, while German and Eastern Europe prefers larger sizes of pomegranate fruits.

Argentina:
Argentina has different harvest season than the countries located in northern hemisphere. This makes it important for European market. Wonderful, Acco, Emek, Shany and Camel are the important varieties. Harvest mainly starts in March and the products are being exported to different countries including Brazil, North America, Celtral Europe and Asian countries.

Peru:
Peru has an increasing production and export of pomegranates for many years. The main customers of Peruvian pomegranates are Europe, the UK, Canada and Asian countries. Peru has same season with other countries located in southern hemisphere and are competing for same markets, mainly in Europe.

South Africa:
Major varieties in South Africa are Wonderful, Herskovitz and Acco. South Africa exports more of its pomegranate (about 80%) than is consumed locally. Production and export volumes are increasing in last years. Nearly 55% of the export volume goes to European Union, about 10% to United Kingdom, more than 16% to Middle East, 10% to East Asia, 5% to Russia and 5% to other African countries (Phaleng and Lubinga, 2018).

China:
China mainly producing pomegranates for local markets. About 70% of the total production is sold in local markets. It was reported that they faced with nail problems during last years and the fruit prices raised due to the decrease in supply. A very sweet Tunisian variety is the most popular in China.

Egypt:
Most important varieties in Egypt are Baladi and Wonderful and the biggest markets for Egyptian pomegranates are currently Malaysia, Singapore, Russia, Ukraine and some European countries.

Tunisia:
Tunisia has an increase in the pomegranate production which makes it as an important player in the market. Tunisian pomegranates are known for their good quality, sweet flavor and small seeds. The season overlaps with Turkey and Egypt where the markets are more or less similar.

Afghanistan:
The country is among the origins of the pomegranate fruit and the production is always in place. Afghanistan is known to have more varieties of trees than any other countries. Country still has

more production of pomegranate fruits but has serious problems in marketing, due to political issues. Main markets for Afghan pomegranates are in Dubai and Middle East.

Azerbaijan:
Pomegranate is a favorite fruit in Azerbaijan which is a symbol of Azerbaijani profusion. The climate is so suitable for growing pomegranates. Traditionally, pomegranates have been cultivated in almost every region of Azerbaijan. Pomegranates are often consumed as juice in Azerbaijan. It is known that both fresh and processed Azerbaijani pomegranates are available in the local and foreign markets, i.e. Russia, Ukraine and European countries.

Australia:
Australia, similar with Italy, is a new player in the market, where pomegranate was an unknown fruit several years ago. Both the production and consumption are increasing. Harvest starts mainly in March and extends till June. It was reported that the weather conditions are not ideal for growing pomegranates and the yield and quality is not reaching to expected levels. Australia also imports some pomegranates due to the low production.

Italy:
New plantations are started to be established in Italy, both in south and north of the country and the Puglia region. Production in south is reported to be used in fresh consumption (few exports to northern countries) and in the north for processing. Country also imports pomegranate fruits from India.

Pomegranate fruits known as healthy exotic crops and their consumption is increasing in all over the world, but mainly in European markets. Many of the above listed countries are exporting their products to European markets. In the ITC codes, pomegranates are included in the group of fresh fruit with a HS code of 0810907530. Pomegranates are the most important fruits in this group, but in reality the group includes fruits like cherimoya, barbary figs and medlars. When evaluating the date about this group, it can be concluded that the import data is doubled in last 5 years, where Israel has a stable export to Europe while turkey and Peru have an important increase. The imports to Europe is still expected to increase.

The main entrance point of the Europe is the Netherlands, due to being arrival point of the ships and the main destination of the pomegranate fruits is Germany. It was followed by other northern countries. The climatic conditions in northern European countries are not suitable for growing pomegranates and they rely on the importing. Rather than Germany, France, Italy and the United Kingdom are the other important importers of the pomegranates. The main inner exporter of the European Union is Spain. The values of import minus export is estimated to be around 60.000 tons in the last years (2016-2017). Since the re-naming of pomegranate fruits as “super fruit”, the ways of consumption of the fruit was expanded. The fruits are used to make juice, jams and value add into salads and desserts too. The pomegranate seed oil also gained importance in the food industry, mainly for personal care. Ready-to-eat arils and deep-frozen products are also becoming so popular in the international markets.
The main requirement for the European markets is the maximum residue levels (MRLs). The MRLs for the pomegranate, as well as for other crops can be followed from the EU MRL database, but some EU member states, i.e. United Kingdom, Germany and the Netherlands has some stricter rules than the general EU rules. According to EU standards, pomegranate fruits are classified as “Extra”, “Class I” and “Class II”. In all classes, subject to the special provisions for each class and the tolerances allowed, the pomegranates must have some minimum requirements and must be (CBI, 2018):

- whole; (Fruits must not have any damage or injury spoiling the integrity of the produce. Slight defect in crown is permitted).

- sound; produce affected by rotting or deterioration such as to make it unfit for consumption is excluded; (Fruits must be free from disease. In some cases, fruits may be damaged by Heart rot or rotting without having external signals or very slight abnormal color but liable to make the produce unfit for consumption upon arrival at its destination, are to be excluded)
- clean, free of any visible foreign matter; (Fruits must be free of dust and chemical residue).
- free of pests and pest damages on the general appearance of the produce; (The presence of pests can detract from the commercial presentation and acceptance of the pomegranate).
- free of abnormal external moisture, excluding condensation following removal from cold storage; (This does not include moisture on produce following release from cool storage but applies to excessive moisture, i.e. free water lying inside the package).
- free of any foreign smell and/or taste; (in some cases, storing or transporting pomegranates with other fruits or products may cause them to absorb abnormal smells and/or tastes).
- free of damage caused by frost;
- free of damage caused by low and/or high temperatures;
- free of sunburns affecting the arils of the fruit (Sunburns might affect the arils color rather than outside. Arils color may be change from typical cultivar color to light or white color).

The highest import to Europe began in May, when the production is relying on the southern hemisphere. The wholesale prices before this peak goes around 1.0 to 1.8 €/kg, where it moves to about 1.80 to 3.40 €/kg in May. The mode of transport and the product quality are also affecting the prices. The quality is related with many external and internal conditions. Some important external conditions are: excess or less rainfall (cause of cracking) and high temperatures (cause of sunburn). The external factors are also affecting the pest populations and etc. but most of these are also in the internal factors, i.e.: pest management (introduction of Heart rot and Medfly), water deficit and water quality, wrong pruning practices, wrong fertilization, and etc. These are mainly related with the production of the "quality"; and there are some factors which are affection the protection of the "quality". The protection of the quality is related with the postharvest issues, where many researches had been conducted to help to protect the postharvest quality of pomegranate fruits.

3. Recent researches about production

Due to the increase in the demand for pomegranate fruits, there is an increase in the area of production too. However, human induced climate change is significantly influencing crop production in all over the earth mainly via water scarcity, extreme weather conditions and degradation in biodiversity. On the other hand, the human population is increasing, where the available land for crop production is stable or decreasing. Therefore, many of the new researches are focusing on the increasing yield. One of the ways for increasing the yield from a given area is using high-density planting system. In of the studies, Haneef et al. (2014) worked with cv. Bhagwa and test the growing high density of (2 m × 2 m); and reported that having high yield from the 4-years old trees is possible with correct irrigation, fertilization and pruning of the trees. In another study, Shanmugasundaram and Balakrishnamurthy (2017) reported that high density planting of cv. Mridula is possible and the fruit yield is increasing with the applications of three sprays of NAA 10 ppm + GA3 50. Bedding system was suggested by Marathe et al. (2017) in arid and semi-arid regions where they noted that bedding system provides necessary aeration in active root zone and increase nutrient uptake of pomegranate trees. Another important cultural practice for growing pomegranates is the pruning, which has a high influence on the tree yield. The pomegranate fruits are known to occur on short spurs which mostly appears on the 2-3 years old branches. Newly conducted studies reported that pruning of the braches to about 15-30 cm length provides higher yield in total per tree (Hiremath et al., 2018; Kabuli et al., 2018).

Irrigation and fertilization are also so crucial for increasing the yield. One of the newly conducted studies about fertilization reported by the Khattab et al. (2012) revealed that humic acid and amino acids plays an important role on the fruit yield of pomegranate cv. Manfalouty. Galindo et al. (2013) reported that trunk diameter with midday stem water potential (Ψ_{stem}) and midday leaf conductance (g_l) might be used to predict the exact water requirements and prepare effective

irrigation schedules. Two interesting studies by Laribi et al. (2013) and Pena et al. (2013) reported that fruits of trees irrigated with sustained deficit irrigation (SDI) with 50% of ETc shows lower weight loss during storage. In a different study Parvizi et al. (2014) reported that irrigating alternate sides of trees with 50% of ET_C reduces the fruit yield while irrigating alternate sides of trees with 75% of ET_C increases the yield.

Problems of pests and diseases are also so crucial while they are causing reductions in yield and quality of the fruits. Aphids (*Aphis punicae*), Mediterranean fruit fly (*Ceratitis capitata*), pomegranate butterfly, (*Deudorix* '*Virachola*' *livia*) and black heart (*Alternaria* spp.) are the most important problems of pomegranate orchards. A detailed study carried out by Kahramanoğlu and Usanmaz (2013) about most of these problems and reported some important suggestions about management of them. Authors suggested that Spirotetramat (as a systematic insecticide) provides good control of *P. citri*, while fruit thinning improves the efficiency of the insecticide by reducing the population of the pest. Researchers also noted that attract-and-kill traps (30 traps ha^{-1}) are effective in controlling *C. capitate* and two applications of Indoxacarb is effective in controlling *D. livia*. In another study, imidacloprid (1 µl ml^{-1}), thiacloprid (1 µl ml^{-1}) and thiamethoxam (0.35 µl ml^{-1}) were reported to be effective in controlling aphids (Rouhani et al., 2013). Farrokhzadeh et al. (2017) reported that *Binodoxys angelicae* (Haliday; Hymenoptra: Braconidae) and *Ephedrus persicae* (Frogatt; Hymenoptra: Braconidae) have potential to be used as biological control agents against aphids. Kambrekar et al. (2015) reported that Emamectin benzoate (90.83 g ha^{-1}) and spinosad (88.91 g ha^{-1}); and Nadaf (2017) noted that Chlorantraniliprole (0.15 mL L^{-1}) is a newly developed insecticide which might be used to control *D. livia*. For the control of Medfly, Pezhman (2016) recommended that cera-trap is an effective. One of the most important problems of pomegranate production is black heart or heart rot, caused mostly by *Alternaria alternata*. The affected fruits have no or slight symptoms on the fruit, but the inside of the fruits is all damaged and becomes rotted. Therefore, the marketing quality of the fruits decrease. The first appearance of *Alternata alternata* in pomegranate orchards observed after 2010 in some of the European countries [i.e. Cyprus (Kahramanoğlu et al., 2014), Spain (Berbegal et al., 2014), Italy (Faedda et al., 2015)]. Azole group fungicides (Tebuconazole and Propiconazole) were reported to be effective to inhibit the pathogen growth (Kumar et al., 2017).

Physiological disorders, i.e. sun scald and fruit cracking are common in pomegranate fruits. Sun scald and sunburn damage becomes severe when fruits are exposed to direct sunlight. Proper canopy management, application of kaolin and using some covering materials are known to prevent or reduce the incidence of sun burn (Kahramanoğlu and Usanmaz, 2016). Ghorbani et al. (2015) reported that covering fruits with 18 or 22 holes 1 cm^{-2} covering materials provide about 50% reduction in sunburn. Meena et al. (2016) reported that red nets with shade levels of 35% or 50% PAR might provide better quality and prevent sunburn on fruits. On the other hand, fruit cracking was reported to reduce significantly with the application of 300 ppm pacloputrazol (Khalil et al., 2013). Foliar calcium fertilization in the form of a nano-Ca formulation (0.50 g Ca L^{-1}) or in the form of $CaCl_2$ (2.73 and 5.45 g Ca L^{-1}) were also reported to reduce fruit cracking in pomegranate (Davarpanah et al.,2013).

4. Recent Researches about Postharvest Handling

"Maintaining" the quality of the fresh pomegranates, is as important as the "production" of the quality. This is true for all type of produce, but so crucial for pomegranate fruits, because they are so susceptible to storage conditions. Long/wrong/inappropriate storage periods/conditions cause weight loss and reduction in the quality of the fresh produce. Other important problems associated with the postharvest handling of pomegranate fruits are chilling injury and decay. Until now, numerous researches carried out about the suitability of the conditions for storage of the pomegranate fruits and the results of these valuable studies suggest that 5-7 ºC and >90% relative humidity are required for the preservation of the quality of fresh pomegranate fruits (Elyatem and Kader 1984; Al-Mughrabi et al., 1995; Kazemi et al., 2013). Temperature and relative humidity are very important for the 4 important biological process (respiration, transpiration, ethylene production

and diseases) which accelerate deterioration of the fresh produce. The other important factor for the deterioration of the fresh produce is the atmospheric composition. The CO_2 level in the ambient conditions is about 0.03% where the O_2 is about 21.0%. Increasing the level of CO_2 and reducing O_2 are crucial for slowing respiration and preventing the occurrence of diseases. Thus, the atmospheric composition is also very important for the preservation of the quality of the fresh produce. Furthermore, modified atmosphere packaging (MAP) comes to forefront of important which is a dynamic process of altering gaseous composition inside a package. Special, nano-technological packaging materials are used to store the fresh produce where the material allows some exchanges of O_2 and CO_2 by reducing the O_2 level and increasing the CO_2 level inside the package (Farber et al., 2003, Mahajan et al., 2007, Caleb et al., 2012). It is reported by some Authors (Kader, 1995; Palou et al., 2007; Mirdehghan and Ghotbi, 2014) that MAP technology is successful for the prolongation of storage duration of pomegranate fruits up to 3 months while reducing weight loss and chilling injury; and preventing decay. Some methods were previously reported to alleviate or reduce the incidence of chilling injury, i.e. intermitted heating. Sayyari et al. (2016; 2017) reported that Methyl jasmonate and Salicyloyl chitosan can reduce chilling injury on pomegranate fruits. Application of black seed oil and propolis with or without modified atmosphere packaging reported to have significant effect on the prevention of weight loss, chilling injury and decay; and on the appearance quality of the fresh pomegranate fruits and can increase the storage duration of the fruits until 5 months (Kahramanoğlu et al., 2018). Meighani et al. (2015) reported that commercial resin and carnauba waxes have potential to lower the respiration rate of fresh pomegranate fruits and reduce weight loss. Fludioxonil was on the other hand reported by Palou et al. (2007) and Kahramanoğlu et al. (2018) to reduce the fruit decay caused by *Botrytis* sp. Quaglia et al. (2016) noted that olive-mill wastewater has potential to be used as alternative for the control of fungal pathogens of pomegranate fruit. On the other hand, some biological agents i.e. crab shell chitosan reported to have positive effects on the control of these pathogens (Munhuweyi et al., 2016; Munhuweyi et al., 2017). Combined application of chitosan with modified atmosphere packaging is reported to prevent weight loss and also control chilling injury (Candir et al., 2018).

5. Summary

Pomegranate fruit has a considerable increase in the demand; and the production area of this “super fruit” is continuously increasing. Due to the characteristics of the tree and extreme weather conditions all over the earth, the yield has been showing an increase while the total production is increasing, due to the increase in the total production area. Recent studies continue to confirm its medical uses and increase the consumption. Parallel to those studies, recent researches helps to solve the important problems of the pomegranate cultivation and postharvest handling, i.e. fruit cracking, sun burn, black heart, yield reduction due to water scarcity, quality loss during storage, and etc. However, current knowledge is not necessary to ensure the sustainability of the pomegranate sector and further studies needs to resolve the problems. The test and use of environmental friendly applications in the pomegranate sector is also increasing, which are promising trends in the sector. However, it is also important that some of the limitations imposed in the tree and fruit characteristics may need to be explored by pomegranate breeding. Breeding or selection of resistant varieties to above mentioned problems; and/or varieties producing fruits with higher demand in the market, are the key issues for the future of pomegranate sector.

References

Al-Mughrabi, M.A., Bacha, M.A., Abdelrahman, A.O. (1995). Effects of storage temperature and duration on fruit quality of three pomegranate cultivars. Journal of King Saud University, 7(2), 239-248.

Berbegal, M., Lopez_Cortes, I., Salazar, D., Gramaje, D., Perez-Sierra, A., Garcia-Jimenez, J. Armengol, J. (2014). First report of Alternaria Black Spot of pomegranate caused by *Alternaria alternata*in Spain. Disease Notes, 98(5), 689.

Caleb, O.J., Opara, U.L., Witthuhn, C.R. (2012). Modified atmosphere packaging of pomegranate fruit and arils. Food and Bioprocess Technology, 5, 15-30.

Candir, E., Ozdemir, A.E., Aksoy, M.C. (2018). Effects of chitosan coating and modified atmosphere packaging on postharvest quality and bioactive compounds of pomegranate fruit cv. 'Hicaznar'. Scientia Horticulturae, 235, 235-243.

CBI, (2018). CBI Product Fact Sheet: Fresh Pomegranates in the European Market 'Practical market insight into your product'. CBI (Centre for the Promotion of Imports from developing countries) 17p. http://www.cbi.eu/sites/default/files/study/product-factsheet-pomegranates-europe-fresh-fruit-vegetables-2014.pdf (Accessed on 08.11.2018)

Davarpanah, S., Tehranifar, A., Abadía, J., Val, J., Davarynejad, G., Aran, M., Khorassani, R. (2018). Foliar calcium fertilization reduces fruit cracking in pomegranate (*Punica granatum* cv. Ardestani). Scientia Horticulturae, 230, 86-91.

Elyatem, S.M., Kader, A.A. (1984). Post-harvest physiology and storage behavior of pomegranate fruits. Scientia Horticulturae, 24, 287-298.

Faedda, R., Granata, G., Pane, A., Evoli, M., Giudice, V.L., Lio, G.M.S., Cacciola, S.O. (2015). Heart rot and soft rot of pomegranate fruit in southern Italy. Acta Horticulturae 1144.

Farber, J.N., Harris, L.J., Parish, M.E., Beuchat, L.R., Suslow, T.V., Gorney, J.R., Garrett, E.H., Busta, F.F. (2003). Microbiological safety of controlled and modified atmosphere packaging of fresh and fresh-cut produce. Comprehensive Review in Food Science and Food Safety, 2, 142-160.

Farrokhzadeh, H., Moravvej, G., Awal, M.M., Karimi, J., Rashed, A. (2017). Comparison of Molecular and Conventional Methods for Estimating Parasitism Level in the Pomegranate Aphid *Aphis punicae* (Hemiptera: Aphididae). Journal of Insect Science, 17(6), 1-7.

Galindo, A., Rodríguez, P., Mellisho, C.D., Torrecillas, E., Moriana, A., Cruz, Z.N., Conejero, W., Moreno, F., Torrecillas, A. (2013). Assessment of discretely measured indicators and maximum daily trunk shrinkage for detecting water stress in pomegranate trees. Agricultural and Forest Meteorology, 180, 58-65.

Ghorbani, M., Dabbagh, G.R., Yousefi, D., Khademi, S., Taki, M. (2015). The effect of application of different kinds of covers on the sunburn and internal qualities of pomegranate in Iran. Biological Forum – An International Journal, 7(1), 64-68.

Gil, M.I., Tomas-Barberan, F.A., Hess-Pierce, B., Holcroft, D.M., Kader, A.A. (2000). Antioxidant activity of pomegranate juice and its relationship with phenolic composition and processing. Journal of Agiruclтural and Food Chemistry, 48, 4581-4589.

Haidari, M., Ali, M., Casscells, S.W., Madjid, M. (2009). Pomegranate (*Punica granatum*) purified polyphenol extract inhibits influenza virus and has a synergistic effect with oseltamivir. Phytomedicine, 16(12), 1127-1136.

Haneef, M., Kaushik, R.A., Sarolia, D.K., Mordia, A., Dhakar, M. (2014). Irrigation scheduling and fertigation in pomegranate cv. BHAGWA under high density planting system. Indian Journal of Horticulture, 71(1), 45-48.

Hiremath, A., Patil, S.N., Hipparagi, K., Gandolkar, K., Gollagi, S.G. (2018). Influence of pruning intensity on growth and yield of pomegranate (Punica granatum L.) CV. super bhagwa under organic conditions. Journal of Pharmacognosy and Phytochemistry, 7(2), 1027-1031.

Jalikop, S.H., Kumar, P.S. (1990). Use of a gene marker to study the mode of pollination in pomegranate (*Punica granatum* L.). Journal of Horticultural Science, 65, 221–223.

Jurenka, J. (2008), Therapeutic applications of Pomegranate: A review. Alternative Medicine Review, 13(2), 128-144.

Kabuli, K., Sharma, D.P., Singh, N. (2018). Effect of rejuvenation pruning on the growth, productivity and disease incidence in declining trees of pomegranate (*Punica granatum* L.) cv. Journal of Applied and Natural Science, 10(1), 358-362.

Kader, A.A. (1995). Regulation of fruits physiology by controlled and modified atmosphere. Acta Horticulturae, 398, 59-70.

Kahramanoğlu, İ., Usanmaz, S. (2016). Pomegranate Production and Marketing. CRC Press, 148p.

Kahramanoğlu, İ., Usanmaz, S. (2013). Management strategies of fruit damaging pests of pomegranates: *Planococcus citri*, *Ceratitis capitata* and *Deudorix* (*Virachola*) *livia*. African Journal of Agricultural Research, 8(49), 6563-6568.

Kahramanoğlu, İ., Usanmaz, S., Nizam, İ. (2014). Incidence of heart rot at pomegranate fruits caused by Alternaria spp. in Cyprus. African Journal of Agricultural Research, 9(10), 905-907.

Kambrekar, D.N., Biradar A.P., Karabhantanal S.S. (2015). New insecticides for the management of pomegranate fruit borer, *Deudorix Isocrates* (F.). Indian Journal of Entomology, 77(3), 240-244.

Kaur, S., Kaur, A., Kaur, G. (2016). Effect of IBA, PHB and time of planting on rooting of pomegranate (*Punica granatum* L.) cuttings cv. Ganesh. Asian Journal of Science and Technology 7(11), 3757-3761.

Kazemi, F., Jafararpoor, M., Golparvar, A. (2013). Effects of sodium and calcium treatments on the shelf life and quality of pomegranate. International Journal of Farming and Allied Sciences, 2, 1375-1378.

Khalil, H.A., Aly, H.S.H. (2013). Cracking and fruit quality of pomegranate (*Punica granatum* L.) as affected by pre-harvest sprays of some growth regulators and mineral nutrients. Journal of Horticultural Science & Ornamental Plants, 5(2), 71-76.

Khattab, M.M., Shaban, A.E., El-Shrief, A.H., Mohamed, A.S.E. (2012). Effect of humic acid and amino acids on pomegranate trees under deficit irrigation. I: Growth, Flowering and Fruiting. Journal of Horticultural Science & Ornamental Plants, 4(3), 253-259.

Kumar, A., Chahal, T.S., Hunjan, M.S., Kaur, H., Rawal, R. (2017). Studies of *Alternaria* black spot disease of pomegranate caused by *Alternaria alternata* in Punjab. Journal of Applied and Natural Science, 9(1), 156-161.

Langley, P. (2000). Why a pomegranate? British Medical Journal, 321, 1153-1154.

Laribi, A.I., Palou, L., Intrigliolo, D.S., Nortes, P.A., Rojas-Argudo, C., Taberner, V., Bartual, J., Pérez-Gago, M.B. (2013). Effect of sustained and regulated deficit irrigation on fruit quality of pomegranate cv. 'Mollar de Elche' at harvest and during cold storage. Agricultural Water Management, 125, 61-70.

Levin, G.M. (1994). Pomegranate (*Punica granatum*) plant genetic resources in Turkmenistan. Plant Genetic Resources Newsletter, 97, 31-36.

Levin, G.M. (2006). Pomegranate Roads: A Soviet Botanist's Exile from Eden, 1st Edn. Floreant Press, Forestville, California, pp. 15-183.

Mahajan, P.V., Oliveira, F.A.R., Montanez, J.C., Frias, J. (2007). Development of user-friendly software for design of modified atmosphere packaging for fresh and fresh-cut produce. Innovative Food Science and Emerging Technologies, 8, 84-92.

Marathe, R.A., Sharma, J., Babu, K.D., Murkute, A.A. (2017). Bedding system: A unique plantation method of pomegranate in arid and semi-arid region. National Academy Science Letters, 40(4), 249-251.

Meena, V.S., Kashyap, Pö, Nangare, D.D., Singh, J. (2016). Effect of coloured shade nets on yield and quality of pomegranate (*Punica granatum*) cv. Mridula in semi-arid region of Punjab. Indian Journal of Agricultural Sciences, 86(4), 500-505.

Meighani, H., Ghasemnezhad, M., Bakhshi, D. (2015). Effect of different coatings on post-harvest quality and bioactive compounds of pomegranate (*Punica granatum*L.) fruits. Journal of Food Science and Technology, 52(7), 4507-4514.

Mirdehghan, S.H., Ghotbi, F. (2014). Effects of salicylic acid, jasmonic acid and calcium chloride on reducing chilling injury of pomegranate (*Punica granatum* L.) fruit. Journal of Agricultural Sciences and Technologies, 16, 163-173.

Munhuweyi, K., Lennox, C.L., Meitz-Hopkins, J.C., Caleb, O.J., Sigge, G.O., Opara, U.L. (2016). In vitro effects of crab shell chitosan against mycelial growth of *Botrytis* sp., *Penicillium* sp. and *Pilidiella granati*. Acta Horticulturae 1144.

Munhuweyi, K., Lennox, C.L., Meitz-Hopkins, J.C., Caleb, O.J., Sigge, G.O., Opara, U.L. (2017). Investigating the effects of crab shell chitosan on fungal mycelial growth and postharvest quality attributes of pomegranate whole fruit and arils. Scientia Horticulturae, 220, 78-89.

Nadaf, A.M. (2017). Bioefficacy of newer insecticides against anar butterfly, *Deodorex isocrates* Fab., on pomegranate. Journal of Entomology and Zoology Studies, 5(3), 1655-1657.

Packer. (2014). California pomegranate crop growing to meet demand. https://www.thepacker.com/article/california-pomegranate-crop-growing-meet-demand (Accessed on 08.11.2018).

Palou, L., Crisosto, C.H., Garner, D. (2007). Combination of postharvest antifungal chemical treatments and controlled atmosphere storage to control gray mold and improve storability of 'Wonderful' pomegranates. Postharvest Biology and Technology, 43, 133-142.

Parvizi, H., Sepaskhah, A.R., Ahmadi, S.H. (2014). Effect of drip irrigation and fertilizer regimes on fruit yields and water productivity of a pomegranate (*Punica granatum*(L.) cv. Rabab) orchard. Agricultural Water Management, 146, 45-56.

Peña, M.E., Artés-Hernández, F., Aguayo, E., Martínez-Hernández, G.B., Galindo, A., Artés, F., Gómez, P.A. (2013). Effect of sustained deficit irrigation on physicochemical properties, bioactive compounds and postharvest life of pomegranate fruit (cv. 'Mollar de Elche'). Postharvest Biology and Technology, 86, 171-180.

Pezhman, H. (2016). Comparison of various protein hydrolesates for mass trapping of *Ceratitis capitata* (Weidmen) (Dip.: Tephritidae) in a pomegranate orchard in Shiraz region. Plant Pest Research, 6(1), 61-70.

Phaleng, L., Lubinga, M. (2018). Fruit Trade Flow. South African Fruit Trade Flow. Issue 30.

Quaglia, M., Moretti, C., Cerri, M., Linoci, G., Cappelletti, G., Urbani, S., Taticchi, A. (2016). Effect of extracts of wastewater from olive milling in postharvest treatments of pomegranate fruit decay caused by *Penicillium adametzioides*. Postharvest Biology and Technology, 118, 26-34.

Rouhani, M., Samih, M.A., Izadi, H., Mohammadi, E. (2013). Toxicity of new insecticides against pomegranate aphid, *Aphis punicae*. International Research Journal of Applied and Basic Sciences, 4 (3), 496-501.

Sayyari, M., Aghdam, M.S., Salehi, F., Ghanbari, F. (2016). Salicyloyl chitosan alleviates chilling injury and maintains antioxidant capacity of pomegranate fruits during cold storage. Scientia Horticulturae, 211, 110-117.

Sayyari, M., Salehi, F., Valero, D. (2017). New approaches to modelling methyl jasmonate effects on pomegranate quality during postharvest storage. International Journal of Fruit Science, 17(4), 374-390.

Shanmugasundaram, T., Balakrishnamurthy, G. (2017). Exploitation of plant growth substances for improving the yield and quality of pomegranate under ultra high density planting. International Journal of Current Microbiology and Applied Sciences, 6(3), 102-109.

Sheikh, M.K. (2015). Effect of growth regulators and hand thinning of flowers/fruits on size of pomegranate (*Punica granatum* L. 'Ganesh'). Acta Horticulturae, 1089, 407-410.

Singh, K.K. (2014). Sffect of IBA concentrations on the rooting of pomegranate (*Punica granatum* L.) cv. Ganesh hardwood cuttings under mist house condition. Plant Archives, 14(2), 1111-1114.

Venkatesha, H., Yogish, S.N. (2016). Trends in area, production and productivity of pomegranate producing states of India. International Journal of Multidisciplinary Research and Development, 3(1): 356-359.

(ORAL PRESENTATION)

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND PARKS

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Abstract

In a developing and changing world, the individual has been struggling with some sources of stress in daily life. Advancing technology and living conditions seem to like making people's work easier, but they make people more inactive day by day. In parallel with this, in the developing society, the need for the phenomenon of movement, which is the incontestable right of the people, has been increased. Because of the many ailments caused by inactivity, the human being is affected negatively by physical, psychological and social. Regular physical activity provides the elimination of these problems. It also allows people to live a healthy and happy life physically and spiritually from childhood to old age. To be healthy and vigorous, physical activity is as important as eating, drinking and sleeping. The largest urban areas that provide an opportunity for physical activity are undoubtedly parks. It provides places for individuals to walk or run, and has special facilities for most sports, exercise and other powerful activities. Due to its appeal to people of all ages, areas suitable for physical activity in parks are also positively affecting people socially. The aim of this study is to reveal the relationships between the physical activities in parks and the places where these physical activities are carried out and to minimize the negative effects of sedentary life. In addition, the effects of physical activity on quality of life and the contribution of parks to physical activity are explained.

***Key words**: Health, Park, Physical Activity, Recreation, Quality of Life.*

1. INTRODUCTION

CDC (2008) (Center for Disease Control and Prevention) defines physical activity as the provision of bodily movement by using energy above the basic level of the skeletal and muscular system (Ayan, 2018). Recommended guidelines for physical activity encompass four components: frequency, time or duration, type, and intensity of physical activity (Bedimo-Rung 2005). Rapidly growing industrialization and technological developments cause significant adverse effects on peoples lifestyles Living conditions, technology and conveniences brought about by modernization, are making people less active on a daily basis (Bulut 2013). In parallel with this, in the developing society, the need for the phenomenon of movement, which is the incontestable right of the people, has been increased.

In a developing and changing world, the individual has been struggling with some sources of stress in daily life. Because of the many ailments caused by inactivity, the human being is affected negatively by physical, psychological and social. According to the World Health Organization (WHO) 2002 report, sedentary life causes worldwide death of 1.9 million people per year (Akyol et al. 2008).

A social ecological perspective of health suggests that social and environmental factors play an important role in increasing physical activity (Addy et al. 2004). In many countries the world, it is increasingly evident that it is detrimental for human health to live without some contact with the natural environment (Brown 2014).

Regular physical activity provides the elimination of these problems. It also allows people to live a healthy and happy life physically and spiritually from childhood to old age. Regular physical

activity has been shown to reduce morbidity and mortality by decreasing heart disease, diabetes, high blood pressure, colon cancer, feelings of depression/anxiety, and weight, while building and maintaining healthy bones, muscles, and joints (Bedimo-Rung 2005). It is also stated that physical activity has many beneficial effects such as increase in strength, increase in flexibility, bones and muscles, improvement in social relations and increase in self-confidence (Sema et al. 2014). To be healthy and vigorous, physical activity is as important as eating, drinking and sleeping.

Diseases and deaths not only affect people and their families, but also cause high economic costs due to job loss and health concerns. Due to the inactivity in the US, it is estimated that the risk of heart disease increases by 18%, colon cancer risk increases by 22%, and this results in a cost of $ 24 billion and $ 2 billion, respectively. For active people, the average cost of health is estimated to be 30% lower than inactive individuals. Obesity, which occurs as a result of partial immobility and is seen in approximately 20% of the UK population, is caused by the cost of 500 million dollars (Akyol et al. 2008). It is also associated with greatly increased costs for medical care and lost productivity, estimated to cost California approximately $13 billion a year (Babey et al. 2005).

Twenty-five years of leisure research have provided a wealth of information regarding the benefits of parks and recreation services, including individual, social, economic, and environmental benefits (Bedimo-Rung 2005). The largest urban areas that provide an opportunity for physical activity are undoubtedly parks. Parks have often been considered the centerpiece of communities and cities and are public assets that provide a venue for sports, exercise, relaxation, and social gatherings (Cohen et al. 2006). It provides places for individuals to walk or run, and has special facilities for most sports, exercise and other powerful activities.

Many disciplines (public health, landscape architecture, and parks and recreation) are now questioning how existing park settings can be better promoted or modified to increase physical activity levels and health (Bedimo-Rung 2005). There is a growing consensus among experts that routine physical activity is shaped by local environments, and it is believed that communities can facilitate physical activity by improving the design of streets, parks, and thoroughfares. Making environments pedestrian friendly and parks more attractive are believed to stimulate walking and routine exercise (Cohen et al. 2006).

We know little about the specific park characteristics that are most related to physical activity. Many aspects of parks could be measured and studied in relation to physical activity (Bedimo-Rung 2005). The aim of this study is to reveal the relationships between the physical activities in parks and the places where these physical activities are carried out and to minimize the negative effects of sedentary life. In addition, the effects of physical activity on quality of life and the contribution of parks to physical activity are explained.

2. PHYSICAL ACTIVITY AND PARK

2.1. Access to Park

In the researches on the subject, direct correlations between access to health and green areas were determined. People with greater access to recreation facilities engage in more physical activity (Abercrombie et al. 2008). The availability of urban green space is one of the environmental factors that is frequently linked to increased levels of physical activity. Positive associations with increased levels of physical activity are reported for the amount of urban green space close to home, the distance to the nearest urban green space, the size of the nearest urban green space, and the presence of certain features (Schipperijn et al. 2013). According to Grahn(1994), people who park near their houses visit parks more often. The use of the park is reduced by 5% if the distance from the park is 50 meters away from the house, 18% from the distance of 100 meters, by 26% from the distance of 300 meters and by 56% from the distance of 500 meters. Access to a safe park has a bigger benefit for teens who live in cities. Among teens living in urban areas, the prevalence of regular physical activity is higher if they have access to a safe park (68.6% vs. 61.3%) (Babey et al. 2005). Park use accounted for approximately 50% of the vigorous physical activity (VPA) time of those living within 0.5 miles of the park and 16% of those living within 1.0 miles of the park (Han et al. 2013). Inadequate green areas and limited access to these areas can affect human health negatively. The

findings suggest that communities should be designed so that all people have a park or other venue for physical activity within at least one mile of their residence (Cohen et al. 2006).

2.1.2. Park Safety

There are many studies stated that personal security problems constitute a significant obstacle in the use of park and recreation areas. Approximately two-thirds (65.1%) living in neighborhoods perceived as unsafe engage in regular physical activity compared with nearly three-fourths (72.3%) of those who live in neighborhoods in which people are not afraid to go out at night (Babey et al. 2005). Multivariable modeling demonstrated that younger age; better street lighting; trust of neighbors; and use of private recreation facilities, parks, playgrounds, sports fields, schools, and worship facilities were associated with increased physical activity (Addy et al. 2004). Increasing the availability of and access to safe spaces for physical activity is a particularly promising strategy for encouraging physical activity among all adolescents. Moreover, increasing availability of safe places for recreation can increase physical activity among those groups of adolescents who are less active (Babey et al. 2005). The fact that women do not feel safe in the park and recreation areas can reduce their participation in physical activities. It may be advisable to illuminate the parks and increase the number of security personnel (Gümüş et al. 2017).

2.1.3. Park Users

Investigation of how environments support physical activity is facilitated through a model of "The relationship between parks and physical activity" presented by Bedimo-Rung et al. (2005). This model, presented in Figure 1, highlights the potential relationships among park environmental characteristics, park visitation, physical activity within parks, and physical health benefits. The lower section of the model shows personal characteristics and environmental components thought to influence the frequency of park use. In the middle section of the model, on-site park behavior is described. This level of the model allows for investigation of personal attributes of park users as well as investigation of the types of activities (including physical activity) engaged in on site (Shores West 2008).

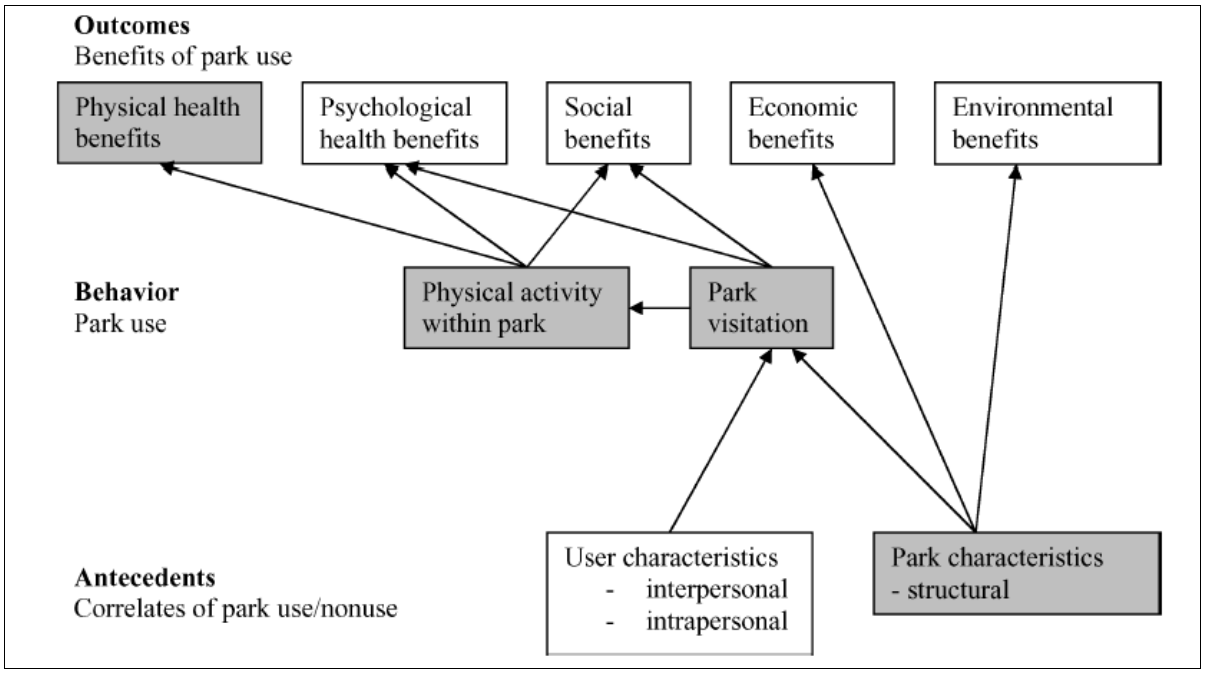


Figure 1. The relationship between parks and physical activity (Bedimo-Rung 2005)

In childhood and youth, gaining physical activity habits to people is important in terms of maintaining this habit throughout life (Akyol et al. 2008). To have more education in younger ages,

physically active neighbours, sidewalks available in the neighborhood, and using a mall for walking were associated with increased walking behaviours (Addy et al. 2004). The motor skills of children playing in green areas are more developed than others (Bird 2007). The young prefer more open areas for physical activities (Baranowski et al. 1993).

Health and physical appearance are effective in women's physical activity preferences. In addition, women's educational status and occupations are important factors in their choice of recreation areas as physical activity areas. Women face problems such as lack of adequate equipment in recreation areas and lack of information about their use (Yılmaz and Ulaş 2016). According to the research findings; A significant difference was found in the gender factor in terms of restricting participation in physical activity in parks and recreation areas. It is concluded that the reasons limiting women's participation in physical activity are higher than males (Gümüş et al. 2017).

It is known that 60% of the world's population does not have adequate physical activity, and that adults in particular in developing countries are still inactive (Akyol et al. 2008). Currently, immobility is common in adult and elderly populations. There are many psychological, behavioral and physiological reasons why people do not perform physical activities or do limited activities. The lack of leisure in Turkey, is among the most common reasons for failure to participate in physical activity (Bulut 2013). Although most Americans live in communities with a network of parks and recreational facilities suited for moderate-to-vigorous physical activity, the majority of Americans do not meet the national physical activity guidelines of 150 minutes/ week for adults and 60 minutes/day for youth. Observations of many public parks indicate that they are underutilized, particularly by adults and seniors,2–4 and most individuals who use the park are sedentary there (Cohen et al. 2013). Consequently, as physical activity scores increase; physical functioning, physical role, pain and social functioning life quality scores increase as well among middle-aged individuals. Increase in physical activity may contribute to increasing life quality among middle-aged individuals (Ölçücü et al. 2015).

2.1.4. Health

Many studies related to health and green areas advocate the positive effects of green areas on health. The quality and accessible green space or infrastructure can have many positive effects on health and well-being. The most important ones are: (1) Increasing life prospects and diminishing health problems (2) Advances in physical activity and health (3) Physiological health and mental well-being can be divided into three groups (Ayan, 2018). It has been found that physical activity is twice as effective in preventing early deaths and serious diseases in middle-aged and older individuals who perform acceptable physical activity. Daily brisk walking (6 km/60 min) was found to be sufficient to maintain energy balance. Daily walks can be achieved in short sessions. The same effect can be achieved by cycling, swimming, other sports or light running for 30-60 minutes (Akyol et al. 2008).

Parks have been identified as an important community resource to encourage disease prevention through physical activity promotion. As noted by Jackson and Kochtitzky, one of the main reasons given for physical inactivity is a “lack of structures or facilities (such as sidewalks or parks). In a recent study, 89% of city managers identified parks and recreation as the primary government agency responsible for addressing obesity. The Healthy People 2010 report suggests that the presence of parks encourages people to reach the physical activity guidelines set by the Centers for Disease Control and Prevention and recommended by the Surgeon General. These statements all point to the need for parks to help residents meet their need for physical activity (Shores West 2008). Walking in the parks every dayreduces the risk of heart attack to is 50%, paralysis to 50%, diabetes to 50%, bone fracture to 30%, colon cancer to 30%, lung cancer to 30% and alzheimer to 25% (Ayan, 2018). Findings highlight the exciting potential for park spaces to play an important role in preventive healthcare through the provision of space and equipment to support physical activity (Shores and West 2010). Given high levels of inactivity and associated chronic diseases,

like heart disease, diabetes, and cancer, it is timely to reconsider parks and their potential to improve the nation's health (Cohen et al. 2016).

2.1.5. Park Management

The green health perspective plays a strategic role in urban planning, park management and health policies. Politicians should make decisions that public spaces and residential areas should be places that provide opportunities for physical activity and mental health (Ayan, 2018). While there is a significant understanding of why people do not engage in leisure activity and visit parks, there is less understanding concerning which park characteristics relate to physical activity levels once at a park. Knowledge of such relationships may assist in the development of park environmental and policy changes to promote more physically active forms of park use collected (Bedimo-Rung 2005). For government officials who are mandated to meet resident needs, the provision of well-equipped parks may be essential for all residents to live healthy active lives (Shores and West 2010). Local governments need to create various programs according to different target groups. In particular, parks and district facilities are important places for recreational activities (Ay 2013). Total energy expenditure in parks was correlated with the percentage of supervised activities, suggesting that park management and programming are important factors that can promote population health (Cohen et al. 2006). Intervention components aimed directly at youth include the attractiveness of the physical activity programs for various subgroups of youth and appropriate social marketing efforts to inform youth and parents of physical activity programs and their benefits. Present results suggest that recreation centers could benefit from, and key staff are interested in, interventions at all levels (Moody et al. 2004).

2.1.6. Park Characteristics

Research is now emerging that describes park visitation and the physical activity that takes place within parks and what features correspond with them (Rung et al. 2011). Nonetheless, the amount of energy a person expends in a park can vary greatly, depending on individual characteristics, park characteristics, neighborhood characteristics, and even city characteristics (Rung et al. 2011). The concept of diversity comprises the mix of park facilities, programs, users, and location. A park with diversity is one that is used for a variety of purposes at different times of the day, week, and year (Bedimo-Rung 2005).

Parks with more features were more likely to be used for physical activity; size and distance were not significant predictors. Park facilities were more important than were park amenities. park amenities. Of the park facilities, trails had the strongest relationship with park use for physical activity (Kaczynski, 2008). A qualitative study done in Australia identified the availability of amenities (e.g., swings, barbecue equipment) as among the important features influencing respondents' use of local parks (Bedimo-Rung 2005).

Activity areas are the sections, zones, or opportunity areas within a park that are specifically designed or commonly used for physical activity. They can include sports fields and courts, swimming pools, paths or trails, playgrounds, open green spaces, or other areas where physical activity occurs (Bedimo-Rung 2005). Among park activity area predictors, type of activity area was significantly related to physical activity in Tampa and Chicago parks. In Tampa, more physical activity was observed on courts, and less physical activity was observed in shelter areas compared with open space areas. In Chicago, less physical activity was observed on courts and fields compared with open space areas. Neighborhood income was associated with lower physical activity in Tampa parks. Neighborhood race/ethnicity was not a significant predictor of children's physical activity in either city (Spengler et al. 2011). For physical activity in the nearest urban green spaces, positive associations with size, walking/cycling routes, wooded areas, water features, lights, pleasant views, bike rack, and parking lot were found. This indicates that physical activity in urban green spaces might be stimulated by providing these features there (Schipperijn et al. 2013). This study found that the type of activity area was associated with number of park users, mean energy expenditure, and total energy expenditure. The highest numbers of park users were observed on

basketball courts and sports fields, while the highest per-person energy expenditure was measured on playgrounds and basketball courts. Total energy expenditure was greatest on basketball courts, playgrounds, and sports fields, which by design attract large numbers of participants (Rung et al. 2011).

Park supporting areas include those facilities and equipment that make physical activity in parks attractive and safe to a variety of users. Such areas contain features that may not directly promote physical activity but are nonetheless an integral part of the park visitation experience, such as community buildings, shelters, restroom/changing facilities, picnic areas, parking lots, and so on. These areas may be correlates of frequent park use, how long people stay at parks, and how active people are within the park environment (Bedimo-Rung 2005). Moreover, supporting features, such as benches, drinking fountains, and restrooms, make park experiences more enjoyable across a broader spectrum of park visitors (Rung et al. 2011).

The improving an existing park resulted in an overall increase in park use across genders and all age groups, and an increase in the counts of park users walking and being vigorously active (Veitch et al. 2012). The intervention park playfields saw significant increases in male and female visitors, with over a 4-fold increase in the average number of visitors per observation among most age groups (Tester and Baker 2009).

Ellaway et al. (2005) found that people living in areas with a high amount of green space had 3.3 times more physical exercise than people living in other areas. Because parks of different size draw visitors from varying service areas, failure to consider service area size of both parks and private facilities is a limitation (Abercrombie et al. 2008). For this reason, large parks are needed to increase the variety of recreational activities and facilities.

3. CONCLUSION

Parks have significant roles in supporting vigorous physical activity of the local population. Because they are underutilized and vigorous activity is critical to child development and adult physical fitness, efforts should be made to promote vigorous activity within local parks (Han et al. 2013).

Support programs, staffing and maintenance for existing parks and recreational facilities, particularly in low-income and urban neighborhoods. The availability of staff, equipment, and facilities in public spaces affects the quality and usefulness of those facilities. Inadequate resources and lack of trained staff can reduce the usefulness of already available facilities.

Recent regional and local park studies have demonstrated that the majority of park visitors are more likely to engage in sedentary recreation activity. While many forms of park activity (both sedentary and active) can have a positive influence on mental health and stress, all activities do not contribute equally to recommended levels of moderate to vigorous physical activity. We should identify the kinds of park environmental characteristics that are correlated with moderate-to vigorous-intensity park activities (Bedimo-Rung 2005).

Expanding park access and safety, particularly for adolescents living in urban areas, is a promising strategy for promoting physical activity among youth (Babey et al. 2008).

Increasing awareness of environmental supports, social comparison, and safety issues as well as of the importance of using opportunities for physical activity at the neighborhood level may be an effective strategy for future community-based interventions (Addy et al. 2004).

Factors influencing the use of park and recreation areas for physical activity and the factors restricting the use of these areas should be determined. Planning, design and management decisions to be taken in the creation of new parks and renewal of existing parks will provide an increasing effect on the satisfaction of the users.

REFERENCES

Abercrombie, L.C., Sallis, J.F., Conway, T.L., Frank, L.D., Saelens, B. E., & Chapman, J. E. (2008). Income and racial disparities in access to public parks and private recreation facilities. American journal of preventive medicine, 34(1), 9-15.

Addy, C.L., Wilson, D.K., Kirtland, K.A., Ainsworth, B. E., Sharpe, P., & Kimsey, D. (2004). Associations of perceived social and physical environmental supports with physical activity and walking behavior. American journal of public health, 94(3), 440-443.

Akyol, A., Bilgic, B., & Ersoy, G. (2008). Fiziksel Aktivite, Beslenme ve Saglikli Yasam. Birinci Basim, Klasmat Matbaacilik, Ankara.

Ay, O., 2013. Parklarda Bulunan Egzersiz Alanlarını Kullanmanın Yararları ve Zararları Burdur İl Merkezi Çalışması. Mehmet Akif Ersoy Üniversitesi Eğitim Bilimleri Enstitüsü Beden Eğitimi ve Spor Öğretmenliği Anabilim Dalı, Burdur.

Ayan, B., Durak, M., & Tazebay, İ. (2018) Yeşil Alanların Planlanması ve Tasarımı ile Fiziksel ve Zihinsel Sağlık Arasındaki İlişki. II. Uluslararası Sanat ve Estetik Sempozyumu Bildiriler Kitabı, ISBN: 978-605-2132-71-5 s:17-38

Babey, S.H., Brown, E.R., & Hastert, T.A. (2005). Access to safe parks helps increase physical activity among teenagers. UCLA, Health Policy Research Brief.

Babey, S.H., Hastert, T.A., Yu, H., & Brown, E.R. (2008). Physical activity among adolescents: when do parks matter? American journal of preventive medicine, 34(4), 345-348.

Baranowski, T., Thompson, W.O., Durant, R.H., Baranowski, J., & Puhl, J. (1993). Observations on physical activity in physical locations: Ager gender, ethnicity, and month effects. Research quarterly for exercise and sport, 64(2), 127-133.

Bedimo-Rung, A.L., Mowen, A.J., & Cohen, D. A. (2005). The significance of parks to physical activity and public health: a conceptual model. American journal of preventive medicine, 28(2), 159-168.

Bird, W. (2007). Natural thinking: Investigating the links between the natural environment, biodiversity and mental health. Royal Society for the Protection of Birds.

Brown, G., Schebella, M.F., & Weber, D. (2014). Using participatory GIS to measure physical activity and urban park benefits. Landscape and Urban Planning, 121, 34-44.

Bulut, S. (2013). Sağlıkta sosyal bir belirleyici; fiziksel aktivite. Turkish Bulletin of Hygiene & Experimental Biology/Türk Hijyen ve Deneysel Biyoloji, 70(4).

Cohen, D.A., Han, B., Derose, K.P., Williamson, S., Marsh, T., & McKenzie, T.L. (2013). Physical activity in parks: a randomized controlled trial using community engagement. American journal of preventive medicine, 45(5), 590-597.

Cohen, D.A., Han, B., Nagel, C.J., Harnik, P., McKenzie, T.L., Evenson, K.R. & Katta, S. (2016). The first national study of neighborhood parks: Implications for physical activity. American journal of preventive medicine, 51(4), 419-426.

Cohen, D., Sehgal, A., Williamson, S., Sturm, R., McKenzie, T.L., Lara, R., & Lurie, N. Park use and physical activity in a sample of public parks in the city of Los Angeles. 2006. RAND Corporation.

Ellaway, A., Macintyre, S., & Bonnefoy, X. (2005). Graffiti, greenery, and obesity in adults: secondary analysis of European cross-sectional survey. Bmj, 331(7517), 611-612.

Grahn, P. (1994). Green structures-The importance for health of nature areas and parks. European Regional Planning, 56, 89-112.

Gümüş, H., Alay, Ö.S., & Karakiliç, M. (2017). Fiziksel aktivite için park ve rekreasyon alanlarına gelen kullanıcıların mekân seçimini ve fiziksel aktiviteye katılımını etkileyen faktörler. Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi, 15(1), 31-38.

Han, B., Cohen, D., & McKenzie, T.L. (2013). Quantifying the contribution of neighborhood parks to physical activity. Preventive medicine, 57(5), 483-487.

Kaczynski, A.T., Potwarka, L.R., & Saelens, B.E. (2008). Association of park size, distance, and features with physical activity in neighborhood parks. American journal of public health, 98(8), 1451-1456.

Moody, J.S., Prochaska, J. J., Sallis, J.F., McKenzie, T.L., Brown, M., & Conway, T.L. (2004). Viability of parks and recreation centers as sites for youth physical activity promotion. Health promotion practice, 5(4), 438-443.

Ölçücü, B., Vatansever, Ş., Özcan, G., & Çelik, A. (2015). Orta Yaşlilarda Fiziksel Aktivite Düzeyi Ve Yaşam Kalitesi İlişkisi. Uluslararası Eğitim Bilimleri Dergisi, (2), 63-73.

Rung, A.L., Mowen, A.J., Broyles, S.T., & Gustat, J. (2011). The role of park conditions and features on park visitation and physical activity. Journal of Physical Activity and Health, 8(s2), S178-S187.

Schipperijn, J., Bentsen, P., Troelsen, J., Toftager, M., & Stigsdotter, U. K. (2013). Associations between physical activity and characteristics of urban green space. Urban Forestry & Urban Greening, 12(1), 109-116.

Sema, Can., Arslan, E., & Ersöz, G. (2014). Güncel bakış açısı ile fiziksel aktivite. Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi, 12(1), 1-10.

Shores, K.A., & West, S.T. (2008). The relationship between built park environments and physical activity in four park locations. Journal of Public Health Management and Practice, 14(3), e9-e16.

Shores, K.A., & West, S.T. (2010). Rural and urban park visits and park-based physical activity. Preventive medicine, 50, S13-S17.

Spengler, J.O., Floyd, M.F., Maddock, J.E., Gobster, P.H., Suau, L.J., & Norman, G.J. (2011). Correlates of park-based physical activity among children in diverse communities: results from an observational study in two cities. American Journal of Health Promotion, 25(5), e1-e9.

Tester, J., & Baker, R. (2009). Making the playfields even: evaluating the impact of an environmental intervention on park use and physical activity. Preventive medicine, 48(4), 316-320.

Veitch, J., Ball, K., Crawford, D., Abbott, G.R., & Salmon, J. (2012). Park improvements and park activity: a natural experiment. American journal of preventive medicine, 42(6), 616-619.

Yilmaz, A., & Mehmet, Ulaş (2016). Kadınların Rekreatif Alanlarda Fiziksel Aktivite Yapma Amaçları ve Karşılaştıkları Sorunlar. Spor Bilimleri Dergisi, 27(3), 101-117.

(ORAL PRESENTATION)

COAT PROTEIN VARIABILITY of *Apple mosaic virus* ISOLATES FROM DIFFERENT PLANT HOSTS

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Abstract
Apple mosaic virus, apathogen of stone and pome fruits and hazelnut worldwide, shows great variability in its biological, serological and molecular properties. Apple mosaic virus (ApMV) variants were collected from hazelnut plantations located in Black Sea region of Turkey and the apple isolates were collected from main apple cultivation areas. The infection was present on different local hazelnut varieties but the infection was only detected on Granny Smith apple variety in Turkey. The *Rubus* plantations surrounding the orchards were also infected with ApMV. The coat protein sequences of fifteen ApMV variants from different hazelnut varieties and the 'Granny Smith' apple variety were obtained and the phylogenetic analyses were performed. The sequences obtained from hazelnut revealed slightly different in nucleic acid and amino acid composition compared to the sequences obtained from apples in Turkey. Since the Granny Smith is originated from abroad, the infection might be imported by the infected plant material to Turkey.

Key words: Apple mosaic virus**,** apple, hazelnut, coat protein variability

INTRODUCTION

Apple (*Malus x domestica*) is one of the most widely grown fruit crop of temperate zones in the world. It belongs to the family *Rosaceae* and it is widely produced in different climatic zones in Turkey. Turkey is one of the leading countries for apple production in the World.

Hazelnut (*Coryllus avellana L.*) is native to Turkey and it is commercially cultivated along the Black Sea coast. Turkey is the leader of hazelnut production in the world with 549 000 tons, which provides 70 % of the world's production (TUIK, 2017). *Apple mosaic virus* (ApMV) occurs world-wide and it is known as the most common virus infection on woody trees of the family *Rosaceae*, including apple, pear, apricot, plum, almond and also rose plants (Nemeth 1986). It has also been determined as the causal agent of the severe mosaic-type of infection and has a significant economical importance in hazelnut production in Turkey and also in Poland (Kobylko and Nowak 2006; Ertunc *et al.*2014). This virus is transmitted by vegetative propagation material in woody plants.

ApMV is a species of the genus *Ilarvirus* (subgroup III) in the family *Bromoviridae* and has a tripartite, positive sense, single stranded RNA genome. RNA1 and RNA 2 code for the proteins involved in virus genome replication.While RNA3 is bicistronic and encodes a movement protein (MP) and a coat protein (CP), the latter being expressed from a subgenomic RNA (RNA4) (Alrefai *et al.*1995; Shiel *et al.*1995). The genus *Ilarvirus* comprises of a large group of plant viruses and woody trees are the primary hosts (Van Regenmortel *et al.*2000).

Symptoms of ApMV vary widely depending on climatic conditions, virus isolate, host species and plant cultivar (Nemeth 1986). They range from symptomless infections to severe systemic mosaic, chlorosis and vein clearing in apples and chlorotic ringspots and severe systemic mosaic in hazelnut. An overall reduction in size of fruits and the trees of both species is also observed (Sutic *et al.*1999)

The development of rapid and reliable detection methods of variants of the virus infection. requires knowledge of sequence variability of the virus variants when designing PCR primers. Gene sequences of Indian isolates were conserved and their comparison revealed a maximum of 96 %

homology to a Korean isolate of ApMV (AY125977) (Tombisana *et al.*2009, Lakshmi *et al.*2011). Coat protein sequences of two Korean isolate of ApMV, K1 and K2 have been investigated and homology of coat proteins were determined as 85.6 % in aminoacid composition. (Lee *et al.*2002).The phylogenetic analysis of coat protein gene of ApMV discriminated two main clusters of isolates: one cluster Maloidea hosts and the second in all woody plants (Grimova *et al.*2013).

The aim and the objective of this study was to enhance the scientific knowledge on the molecular variability of ApMV variants. We sequenced the CP gene of ApMV variants from apple and hazelnut collected from different locations in Turkey and compared them with those of other ApMV variants deposited in GenBank to reveal and determine the genetic variability of ApMV.

MATERIALS AND METHODS

Virus source and sequences: Apple mosaic virus isolates were collected from symptomatic hazelnut (*Corullus avellana* L.) and apple trees (*Malus x domestica* L.) var.*'Granny Smith'*, from the Eastern and Western Black Sea coast and major apple production areas in Turkey in 2007-2010 (Ertunc *et al.*2014). Young hazelnut bark tissue scraps were used for RNA extraction using Rott and Jelkman (2001) protocol whereas used Menzel *et al.*(2002)'s RNA extraction protocol was used for apple foliage. Extracted RNAs were subjected to one step RT-PCR amplification with Menzel *et al.*(2002)'s primer pair and the amplified target coat protein gene products were 262 bp long (Ertunc *et al.*2014).

Sequence determination

Following the amplification, the amplified RT-PCR products were purified by Qiaquick PCR purification kit of Qiagen. Sequence determination wasperformed in Biotechnology Institute Laboratories at Ankara University. Coat protein gene sequences of Turkish ApMV isolates were obtained by Beckman-Coultier sequencer.

Phylogenetic analysis

Selected amplicons obtained with ApMV CP gene,s were subjected to direct sequencing. The sequences were assembled using Sequencer 4.1 software and compared with selected nucleotide sequences in the GenBank database, using BLAST (version BLASTN 2.2.18) (NCBI, Bethesda, MD, USA). Sequence alignments were performed, using Clustal X and BioEdit programmes (Hall, 1999; Thompson et al.1997). The alignments were used to construct phylogenetic trees using the computer programme MEGA 5 (Tamura *et al.*2011).

RESULTS AND DISCUSSION

A total of 15 ApMV isolates, 8 hazelnut and 7 apple were selected on the basis of symptom expression, the host and geographic origin, for the coat protein gene sequence characterization Symptoms were chlorotic systemic mosaic, oak leaf pattern and diffuse ring spots on hazelnut and severe systemic mosaic and vein clearing on apple foliage. The virus was present and observed only on cv. Granny Smith apples whereas many of the local varieties of hazelnut grown in Black Sea coast were infected with ApMV.

Primer pair of Menzel *et al.*(2002) was the only primer amplified the coat protein gene genome of the both hosts in the present research. Nucleotid sequences, obtained from the 15 variants were compiled, trimmed to correspond to coat protein region and deposited in The NCBI-Genbank Database with the accession numbers GU939596- GU9396610. The obtained sequences were between 200-237 nucleotide long and were corresponding to 3' end of the coat protein geneof ApMV. They were analysed together with the other ApMV coat protein gene sequences collected from the NCBI Genebank Database. The constructed phylogenetic tree (Figure 2) revealed that hazelnut isolates and one apple isolate showed different phylogeny and they were 50 % distinct in nucleotide sequences than the other ApMV isolates. They were close to sequences of Australian hop isolates. Apple variants of Turkish ApMV isolates were quite close to Indian ApMV sequences and were settled in the same cluster. All of the ApMV variants were clustered according to their original host plants and 5 different clusters (apple, pear, prune, hop and mixed) were obtained according to their original host plants in phylogenic analysis as seen in Figure 2. Turkish apple

isolates were with the same cluster of Indian apple isolates but Turkish hazelnut isolates occured in the mixed group.

The concensus CP nucleotide sequences of the compared ApMV isolates showed more than 88-99% identity with all the ApMV variants at the nucleotide level. Putative translation products deduced from the corresponding CPs was 245 aminoacids with percentages of identity between 87-99 % among all the isolates.

Multi-alignment with other sequences at the coat protein composition level showed quite similarity between the Turkish apple and hazelnut isolates (Figure 1) although there were minor subtitutions of amino acids unlikely to the great differences on nucleotide sequences coat protein gene. Two Turkish hazelnut isolates (GU 939607 Adapazari-Ferizli and GU 939609 Giresun) showed minor changes at the amino acid composition level, hazelnut at amino acid positions 145 (R instead of I), 147-148 (TT instead of LV), 152 (S instead of D), 178-179 (SF instead of EA) and 218 (L instead of Y). Amino acid composition of Turkish ApMV apple isolates were in great homology (100%) with other apple ApMV variants present in the world but homology ratio was 84% between the amino acid composition of Turkish hazelnut and apple isolates of ApMV.

The nucleotid sequences of hazelnut isolates were almost 50 % different than the other ApMV variants whereas the apple isolates were 74 % in homology with the other ApMV variants. Nucleotide sequences of some hazelnut isolates were located in the mixed group whereas nucleotide sequences of Turkish apple isolates were close to Indian apple isolates. Previously, Korean ApMV isolates of apple (ApMV-K1 and ApMV-K2) were investigated and according to the phylogenetic analysis, it was concluded that all the stains of ApMV can be classified into three groups according to their host plants. Therefore these results suggest that ApMV strains co-evolve with their host plants and that this may result in CP heterogeneity (Lee *et al.*2002). Recently, two isolates of ApMV collected from Malatya, (Turkey) have been compared and characterized by Korkmaz et al.(2013). Comparison of amino acid sequence of the CP gene of Indian isolate revealed that it was 96 % in homology with Korean isolate and clustered most closely with a pear isolate originating from the Czech Republic (Tombisana et al.2009).

According to the results of this research, hazelnut isolates were completely distinct from the other strains of ApMV. This data clearly shows that ApMV has many strains on the world according to geographical origin and the infected host plants. Further researchs must be conducted on the strain characterization of the virus.

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REFERENCES

Alrefai R, L.L. Domier, C. J. D'Arcy, S. S. Kobran 1995.The complete nucleotide sequence of apple mosaic virus RNA-3. *Archives of Virology* 140, 1247-1256.

Ertunc F, S. Topkaya, A. Sezer, 2014. Distribution and molecular detection of *apple mosaic virus* in apple and hazelnut in Turkey. *African Journal of Biotechnology* 13, 3144-3149.

Hall T. A., 1999. BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acid Symposium Series* 41, 95-98.

Grimova L, L. Winkowska, P. Rysanek, P. Svoboda, K. Petrzik, 2013. Reflects the coat protein variability of apple mosaic virus host reference. *Virus Genes* 47, 119-125.

Kobylko T and B. Nowak, 2006. Detection and occurence of *Apple mosaic virus* in hazelnut in South-East Poland. *Journal of Plant Pathology* 122.

Korkmaz, G., H.M. Sipahioğlu, M. Usta, 2013. Survey of *Apple mosaic virüs* in apple-growing provinces of East Anatolia (Malatya and Van) by RNA probe hybridization assay and RT-PCR. *Turkish Journal of Agriculture and Forestry* 37, 711-718.

Lakshmi V, V. Hallan, R. Ram, N. Ahmed, A.A. Zaidi, A. Varma, 2011. Diversity of *Apple mosaic virus* isolates in India based on coat protein and movement protein genes. *Indian Journal of Virology* 22(1), 44-49.

Lee P G, K.H. Ryu, H.R. Kim, D.W. Lee, J.S. Kim, M.H. Park, Y.M. Noh, S.H. Cho, D.H. Han, C.H. Lee, 2002. Cloning and phylogenetic characterization of coat protein genes of two isolates of *Apple mosaic virus* from 'Fuji' apple. *Plant Pathology Journal* 18, 259-265.

Menzel N, W. Jelkmann, E. Maiss, 2002. Detection of four apple viruses by multiplex RT-PCR assays with coamplification of plant m-RNA as internal control. *Journal of Virological Methods* 99, 89-92.

Nemeth M., 1996. *Virus, mycoplasma and rickettsia diseases of fruit trees.* Dordrecht, Netherlands, Martinus Nijhoff Publishers.

Rott M. E. and W. Jelkmann, 2001. Characterization and detection of several filamentous viruses of cherry, adaptation of an alternative cloning method (DOP-PCR and modification of an RNA extraction protocol. *European Journal of Plant Pathology* 107, 411-420.

Shiel P.J., R.H. Alrefai, L.L. Domier, S.S. Kobran, P.H. Berger, 1995. The complete sequence of *Apple mosaic virus* RNA-3. *Archieves of Virology* 140, 1247-1256.

Tamura K, D. Peterson, N. Peterson, G. Stecher, M. Nei, S. Kumar, 2011. MEGA5: Molecular Evolutionary Genetics Analysis using Maximum Likelihood, Evolutionary Distance, and Maximum Parsimony Methods. *Molecular Biology and Evolution* 28, 2731-2739.

Thompson J.D., TJ Gibson, F. Plewniak, F. Jeanmougin , D.G. Higgins, 1997. The Clustal_ X: Windows interface flexible stratejies for multiple sequence alignment aided by quality analysis tools. Nucleic Acids Research 25 (24), 4876-4882.

Tombisana T, T. Rana, V. Hallan, R. Ram, A.A. Zaidi, 2009. Molecular characterization of the Indian Strain of *Apple mosaic virus* isolated from apple (*Malus domestitica. Phytoparasitica* 37, 375-379.

TUİK, 2017. Agricultural statistics of Turkey, database.(http://tuik.gov.tr)

Van Regenmortel M. H. V., C.M. Fauquet, D.H.L. Bishop, E.B. Cartens, M.K. Estes, M.K. Lemon, J. Maniloff , M.A. Mayo, D.J. McGeoch, C.R. Pringle, R.B. Wickner, 2000. *Virus Taxonomy, Seventh Report of the International Committee on Taxonomy of Viruses*. Academic Press

AF473580
DLKVYTFIIRVNSLSSNGWIGLVEDYDESNPKGPNPMDRKGFKKDQPRGWQWEAPPNTTF
AF473581 187
NC_003480 .....GM.....187
AY054385 187
AY054386 .....Y.....Q.....187
AY054387 187
AY054388 N.....L....187
AY125977 187
AF548360 .....GM.....187

AY542540 187
AY542541 187
AY542542 187
AY542543 187
AY542544 .....LS....187
AY854050 ...I.....G...C.....187
AM403478 ...I.....187
AM490197 ...I.....187
FM178274 187
FJ429309 .....QLI.....AS.....N.....L....T....187
FJ429311 187
FJ752493 187
GQ131805 187
FN546183 187
GU939596 ----------.....187(A)
GU939607 ----------.R.TT...S.....187(H)
GU939608 ----------.....S.....187(A)
GU939609 ----------.....SF.....187(H)
GU939610 ----------.....187(A)
AF473580
DDFVKKFRLVLEFKTNFAAGAKVFMRDLYVITSELPPVQIPMNVLLIDERFVRIMKLG
AF473581 .....I.....245
NC_003480 ....R.....T.....DLLEL----241
AY054385 ....R.....V.....T.....DLLEL----241
AY054386 ....R.....L....LA.DLLEL----241
AY054387 .....LS...V..DLLEL----241
AY054388 ....R.....T.....S.....DLLEL----241
AY125977 ....R.....T.....DLLEL----241
AF548360 ....R.....T.....DLLEL----241
AY542540 .....TS.....DLLEL----241
AY542541 ....R.....T.A.....DLLEL----241
AY542542 ....R.....T.....DLLEL----241
AY542543 .....T.....DLLEL----241
AY542544 .....LSD.....DLLEL----241
AY854050 ....R.....I.....D.....DM.DL----241
AM403478 ....R.....----------214
AM490197 ....R.....R...D.....DMLDL----241
FM178274 ....R.....T.....DLL------239
FJ429309 ....R..S.....N.....S.....L.....EY..T.....DLL------239
FJ429311 ....R.....T.....DLLGL----241
FJ752493 ....R.....----------220
GQ131805 ....R.....T.....DLLEL----241
FN546183 ....R.....T.....T.....DLLEL----241
GU939596 ....R.....----------217(A)
GU939607 .....Y----------218(H)
GU939608 .....RV----------216(A)
GU939609 .....----------217(H)
GU939610 ....R.....H----------219

(A Figure 1. Multiple amino acid sequence alignment of the coat protein of ApMV Turkish isolates deposited in the GeneBank and also those sequences available from GeneBank**.** Dots indicated identical amino acides and dashes indicates the ends, (A) is apple origin and (H) hazelnut origin. Reference isolate is an coat protein gene of Australian hop strain of ApMV.

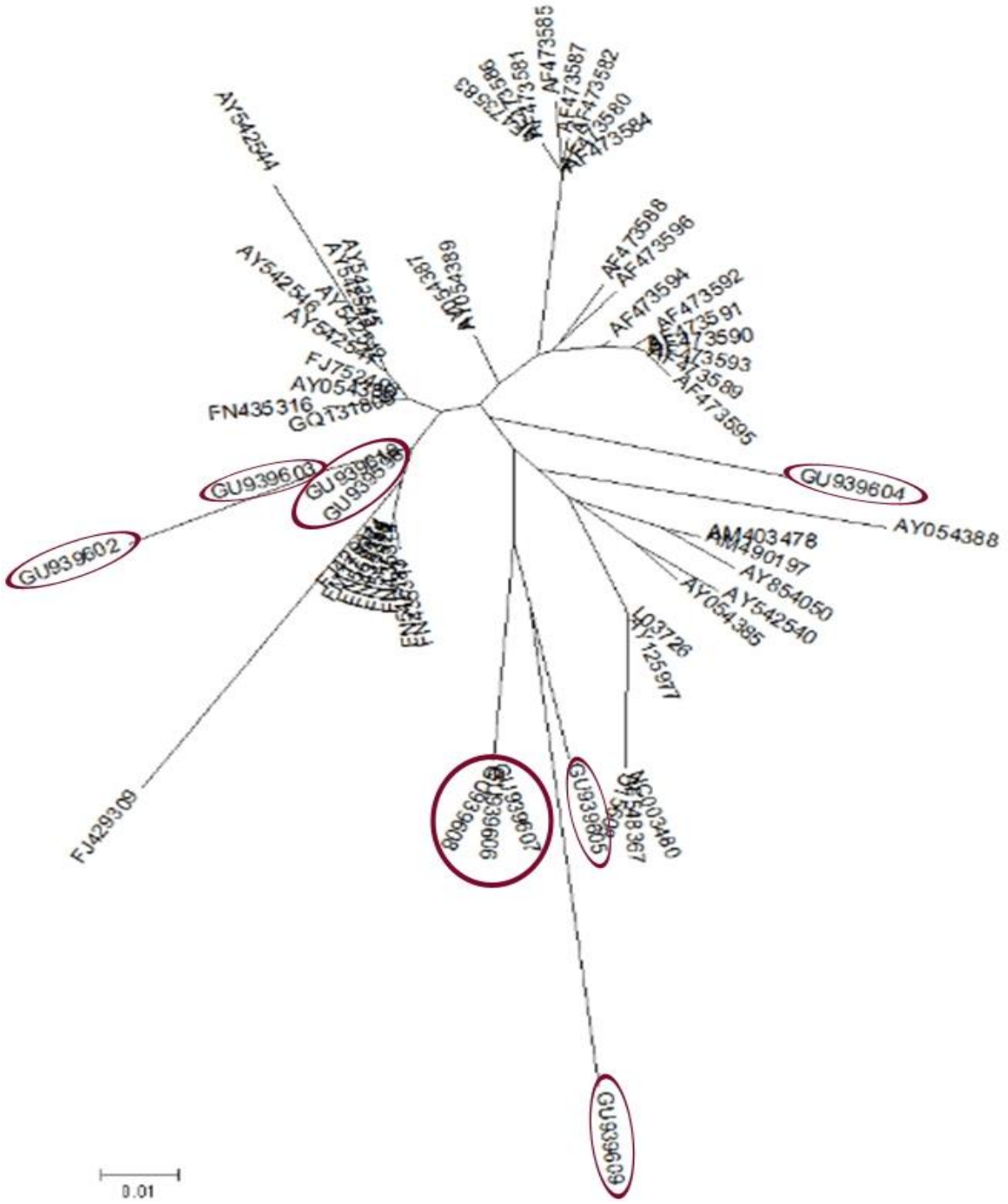


Figure 2. Phylogenetic analysis of nucleotide sequences of coat protein gene of ApMV isolates.

(ORAL PRESENTATION)

ALMOND CULTIVATION

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Abstract

Almonds known as Central Asia, almonds have adapted to various soiland climatic conditions, It is a high agricultural product. Almond, which is recommended by experts for health reasons and is very useful, is an important food for the upbringing of healthy generations. Production in Turkey's year, production technique, the amount of land devoted to agriculture, when the years in the number of trees given the more it seems that the increased importance every year. Approximately be imported which 50% of domestic use, as well as our country a lot of ground almonds agriculture it is an agricultural product worthworking on. Production on behalf of the province to make appropriate, have been adapted to conditions in Turkey is of great importance to understand the type sand micro-climates of these kinds of characters. At the same time, the choice of root stocks, which have been developed over many years according to various soil characteristics, are the factors that determine the fate of the garden. Cultural studies, fertilizers, spraying to make quality products must be appropriate and sustainable. Since almonds are an early agricultural blooming agricultural product, they are susceptible to frostdamage, so while choosing a location, yearly climate data should not be overlooked while considering watersupply, transportation, workload, soil structure. At the beginning of thereason of our inadequacy of production is the misconception that bad mine loves bad soil, water, medicine, fertilizer does not want, analytical based sprayingand fertilization, correcttype-rootstock selection, pedestal-made gardens, country harvesting will bring more positive points.

Keywords: Almond, cultivation, potential

1. INTRODUCTION

Almond (*Amygdalus communis*, L.) is a species of the genus Amygdalus of the Rosalesae family, the Prunoideae subfamily of the Rosaceae family. Some botanists have shown it to be a species of the genus Prunus (*Prunus amygdalus*, Batsch.) (Dokuzoğuz and Gülcan, 1979).

Pomologically roughly; Bitter and sweet almonds are mainly divided into 2 groups. Bitter almonds are bitter because they contain a high percentage of cyanhydric acid, so they cannot be consumed by living things. It is used to extract almond oil, which is valuable in many fields such as medicine and cosmetics. Sweet almonds are divided into 4 groups as hand, teeth, hard-shelled and stone almonds according to the breakage of the shell (Özbek, 1977). Almond consumption areas vary widely. While almonds are in age, they are consumed as fresh fruits in most parts of Anatolia. Ripe almonds are shelled and unshelled, roasted or raw as a snack, and are widely used in the confectionery industry. In addition to all of these uses, it is used in the cosmetic industry and in the manufacture of various creams due to its oil softening properties.

Almond as the homeland of Turkey, Syria, and Iran can be seen as a triangle. Firstly, Iran, Turkey, Syria and bred in Palestine, from here in Greece, North Africa, Italy, and taken to Spain and North America. After the 1840s, breeding has made great progress, especially in the state of California (Özbek, 1978). In today's world, the US dominates the market with California almonds.

Turkey's possible to encounter almost all of the almond trees, often come to the fore as the tree determines the field's borders. Although Almond is one of the oldest plant species cultivated in

Anatolia, it has been reported that in recent years, enclosed gardens are very few in comparison to the present. The loss of crops due to early spring blooms and late spring frosts did not give due attention to producer almond cultivation due to the risk of not receiving a certain amount of product each year (Kaşka, 1999).

Almond, which has a high number in our country, could not reach the desired yield level and quality. Although the gardens built on a certain kind have shown themselves in recent years, the trees usually formed by the native depressions have failed to make the farmer happy. Initially limited to only Aegean, Mediterranean and South-Eastern Anatolia regions, almond cultivation became attractive due to the high ability of almonds to adapt to various soil conditions and high demand in the market. In recent years, almond cultivation has been made with the establishment of nurseries in other regions (Kaşka, 2001).

A research carried out by Kaşka has shown the high potential of the Southeastern Anatolia Region in terms of almond cultivation (Kaşka et al., 2005). One of the main reasons for this situation is the low effect of late spring frosts in the Southeast. While the agricultural areas allocated for almonds increase in the region every year, unfortunately, the lack of irrigated agriculture has caused the almond quality to decrease. Turkey examining the overall situation of the fruit, taking the necessary precautions in case it should be noted that it is in a position to compete with developed countries about Turkey's growing almonds. The first condition for competing with other countries in the export of almonds is the selection of the most suitable varieties for the ecology of the region, taking into account the demands of the domestic and foreign markets, and cultivation in the form of enclosed gardens with standard rootstocks. Thanks to appropriate rootstocks, intensive breeding opportunities should be evaluated, efficiency and quality should be increased by means of measures such as irrigation, mechanization, fertilization, plant protection and cultural and technical practices to be done in a timely and correct manner, and export potential should be increased and almonds should be brought to their deserved place in foreign trade.

Almond cultivation is developing in the Southeastern Anatolia Region, especially in Urfa Province, because of the fact that it can be irrigated in new irrigable areas and it is economical. In these newly established gardens, it was observed that foreign varieties were grown as well as domestic varieties (Ak and Parlakçı, 2007).

Especially with the initiatives in Adıyaman region, almond garden areas are increasing rapidly. It was reported that positive results have been obtained about the adaptation of local and foreign almond varieties having similar climate in Şanlıurfa (Koruklu) conditions and it is an alternative fruit type for pistachio cultivation (Kuden,1998).

The real desired yield in almond farming is not the fruit flesh part that surrounds the seed as in other fruits but the seed itself. Hard-core fruit species, soft-seeded than the soil removed more nutrients, vegetation period of long and fruit species that do not fall in the winter indicates that they need more nutrients (Özbek,1977).

One of the main ways to avoid late spring frosts is to give importance to plant nutrition. Providing nutrient uptake positively and strong flower/fruit binding trees will be much higher resistance to agricultural frost.

In our country, almond cultivation is generally carried out under unfavorable conditions where other fruits cannot grow. Since the cultivation is carried out especially in calcareous soils, the intake of some plant nutrients is prevented due to the high calcium content. B and Zn are the leading elements. In a healthy almond tree, the optimal limit values that must be present in the leaves are often not achieved (Alpaslan et al., 2004)

The effect of boron and zinc applied in the flowering period on the attitude of fruit was investigated. Moreover, as the plant structure strengthened, the effect of agricultural frost decreased. It was determined that the effect of boron and zinc solutions applied in the period when the flowers opened at 10% did not yield positive results in terms of yield and quality (Castro and Sotomayor, 1998).

1.2. Why Almond Culture

Lands where other agricultural activities cannot be carried out can be brought to the economy through almond farming by means of breeding studies. Many soil can be purchased commercially by choosing the right rootstock. It is one of the easiest agricultural products to market. Harvest is the easiest gardening product. After harvesting, the product can be kept for months under the right conditions and there is no change in quality. Correctly managed garden returns to yield in the 3rd year and a stable yield is obtained from the same tree for 50 years. The unit is one of the most profitable garden products. Disinfestation and fertilization are not as critical as other agricultural products, they are the factors that increase quality as they show sensitivity. When selecting suitable rootstocks for dehydrated agriculture, many horticultural lands can be brought to the economy.

1.3. Benefıts of Almond

The benefits of almonds are rich in protein, iron and calcium. Almond, which contains a high percentage of fat, is a very healthy food unless it is consumed too much. It increases the milk of pregnant women and helps the development of babies. The oils contained in it make it easy to lose weight. Keeps a person full, so 10-15 pieces of almonds can be consumed in snacks. It is better to choose raw, unsalted and unroasted. Almond, fatigue of the body and mind while relieving, kidney, bladder and reproductive tract eliminates inflammation. Prevents the formation of gallstones. It contains fatty acids and enzymes that protect against cardiovascular diseases. Almonds are very useful for balancing good and bad cholesterol. The regulation of cholesterol, which forms diseases caused by unbalanced cholesterol, considerably reduces the likelihood of developing diseases. Phosphorus has an important effect on the preservation of bone health. Almonds must be consumed on a daily basis to prevent bone pain that increases with aging and to increase the strength of teeth. Almonds, which are rich in vitamin E, contain antioxidants and protect heart health significantly. The presence of magnesium and folic acid protects the body from heart diseases and prevents the formation of stains in the arteries. Alkaline rich almonds strengthen the immune system. Alkaline content that provides the excretion of unhealthy substances entering the body protects the body against possible diseases. Oils made with almonds, almond milk have an important role in repairing the skin. Almond used in many moisturizing and cleaning products protects your skin health when consumed daily. Almond regulates the blood pressure due to its potassium content and prevents the fluctuations in blood pressure. Almonds containing riboflavin, manganese and copper increase the energy and support the person to be more active. Almond, rich in dietary fiber, prevents the development of colon cancer. Almonds consumed after meals help to prevent insulin and glucose increase. You can keep your sugar level healthy by consuming almonds. Almonds, which are rich in fiber, are effective in removing constipation. According to the research, 5 almonds per day are enough to eliminate constipation. In recent biochemical studies, phenolic compounds found in almonds have been shown to be useful in medical experiments to suppress cancer cells. Various compounds extracted from almond husks have started to be used as raw materials in cosmatic industry, paint industry and textile industry. Almond oil, especially linoloic acids, have been found to be useful in the digestive system.

2.1. Local Almond Types

2.1.1. Hacı Alibey (48-5): Forms medium-strong trees. It's a very early variety. It's incompatible. Foreign pollination. Pollinators 48-1, 48-3, 48-4 and Ak almond. Shelled almond weighs 3.27 g and internal almond weighs 1.15 g. The yield is 35.17% and the double ratio is 26.67%. Inner almond is 25.87 mm long and 13.07 mm wide. Its efficiency is very good and its tendency to periodicity is negligible (Dokuzoğuz and Gülcan, 1973).

2.1.2. Akbadem (48-2): There are strong growing trees. It is an early hand almond variety that does not match itself. The pollinators are 48-1, 48-3, and Hacı alibey. Shelled almonds 4.37 g. Inner almond weighs 1.8 g. Inner almond is 25.87 mm long and 13.07 mm wide. Its productivity is very good and makes 26.67% double almonds. The yield is 35.17%. It is thin-skinned and forms large fruits. In addition to being evaluated as Çağla, it is also very qualified as an internal almond (Dokuzoğuz and Gülcan, 1973).

2.1.3. Gülcan 1 (101-23): It creates medium-strength trees. It's a transient kind, and it's incompatible. Foreign pollination. Pollinators: 101-9 and 101-13 species. The shelled almond weighs 3.04 g, is 23.4 mm long and 16.31 mm wide. The yield is 27% and the ratio of pairs is between 7-13%. Internal almond weight is 0.85 g and its productivity is quite good. It is resistant to branch cancer and forms strong growing trees (Dokuzoğuz and Gülcan, 1973).

2.2. Maıns of Commercial Almond Types

2.2.1. Nonpareil Type: Trees develop strong and upright. Very Efficient. Fruits are slightly long and swollen. Fruit peel is of medium hardness and can be easily broken by hand. Internal yield is 55-60%, the double almond ratio is 5-6%. Harvest time is mid-September. Pollinators: Texas, Cristomorto (Şen and Cangi, 1991).

2.2.2. Texas Type: Trees grow strong and upright. It is efficient. Fruits are slightly long and swollen. Fruit peel is medium-hard. Internal yield is 50% and the double almond ratio is 20-30%. Harvest time is the second and third week of September. Pollinators, Nonpariel (Şen and Cangi, 1991).

2.2.3. Drake Almond Type: Medium late variety. Pollen number is high and is a good pollinator. It has a hard shell and a high internal caliber. The pollinator is nonpareil. The rate of twins is around 8%. The interior color is bright and light. It is considered moderately delicious (Şen and Cangi, 1991).

2.2.4. Ferragnes Almond Type: Trees grow moderately strong. Branching is sparse. Very Efficient. It attracts attention to the quality of almonds. It lies quickly on the fruit and its large outer shells are hard. Internal yield is 40%, the double almond ratio is 1-2%. Harvest time is the third week of September. Pollinators, Ferraduel, Ferrastar, Tuono (Şen and Cangi, 1991).

2.2.5. Ferraduel Almond Type: Trees develop medium span. It is efficient. It attracts attention to the quality of almonds. Fruits are large-medium size, fruit peel is hard. Internal yield is 35-40% and the double almond ratio is 1%. Harvest time is the second week of September. Pollinators, Ferragnes, Ferrastar (Şen and Cangi, 1991).

3. Selection of Rootstock in Almond

Most of the time, fruit trees have to be grown in climatic and soil conditions which are not suitable for them, they want to control the development, shortening the period of youth infertility, increasing fruit quality and yield, and facilitating the control of diseases and pests. The rootstocks used in fruit growing are examined in two groups as seed and clone rootstocks.

Clone is propagated by vegetative (steel, tissue culture) methods. Vegetatively propagated rootstocks have the same and certain effects on the variety. Thus, it is possible to provide a complete standardization in fruit production and marketing with its name and an example, standard rootstocks.

In steel propagation, a branch, a root or a leaf is cut from the parent plant, root and shoot are provided to provide appropriate environmental conditions. The independent new individual thus formed has all the characteristics of the parent plant. Steel propagation is the most important and practical method of reproduction of deciduous fruit trees and shrub species as well as all green, broad and coniferous plant products.

3.1. Almond Rootstocks

3.1.1. GF 677 (PeacheAmnedier): A hybrid of peach and almond, this rootstock was developed at the INRA Research Institute in France. It is widely used especially in the Mediterranean coastal countries. It is a strong growing rootstock and 5x4m or 5x3m planting distance is applied as well as V or Y finishing systems 5x2, m planting can be applied. It is an ideal rootstock for peaches and almonds in soils with lime and limited irrigation conditions. While a peach tree cannot be planted immediately, peach seedlings can be planted on GF 677 rootstock. All peach, nectarine, and almond varieties are good in terms of vaccine compatibility and have a positive effect on the type of yield. Reproduction with wood and green cuttings is difficult and the most suitable method of propagation is tissue culture. Does not like heavy, high groundwater, poorly ventilated soils.

3.1.2. Cadaman (Avimag) Rootstock: It was found in Hungary as a natural hybrid of *P. Persica* x *P.davidiana* species and was developed at the INRA Research Institute in France. It is a weaker rootstock than GF 677 and Barrier-1 rootstocks. It can also be used in soils poor in organic matter, weak structure, calcareous and high pH. It is resistant to root nematode. Not recommended for heavy soils with high groundwater, but withstands groundwater more than GF 677 rootstock. Peach can be planted again using this rootstock. It provides an early bed of the variety on the fruit has a positive effect on the size and color of the fruit. In recent years, especially on the Mediterranean coast of Spain, especially in the use of Spain is becoming widespread.

3.1.3. Barrıer -1 (Enprean -1) Rootstock: It was developed in Venice, Italy. Peach x is a hybrid of wild Chinese peach. It develops at the same strength as GF 677. Peach is a rootstock suitable for planting the peach in the place where it is removed. It is strong to hold onto the soil. It has a positive effect on the coloration of the fruits of the variety. It is resistant to root nematode. Resistance to heavy soils is better than GF 677 rootstocks but not as tolerant as GN rootstocks.

3.1.4. Gxn (Garnem) Rootstock: *P.Persica* x *P.Persica* x *P. Dulce* species were obtained by hybridization and 3 important GN rootstocks are commercially produced. The most important GN rootstocks; GN 15 (Garnem); GN 22 (Felinem) and GN 9 are the rootstocks. Garnem rootstock is the most commonly used GN rootstock. It is resistant to root nematode. It is a strong growing rootstock with good binding to the soil. It is used as rootstock for peach, nectarine, plum, and almond varieties.

3.1.5. Bitter Almond Rootstock: Its most important feature is its resistance to thirst. Can be applied on calcareous soils. It is more productive in rocky areas compared to other varieties. It grows stronger and has a long life.

3.1.6. Nemaguard Rootstock: Nemaguard rootstock, *P. Persica*, and *P. Davidissima* hybrid. It has good resistance to root nematodes. In nematode dishwashers, this rootstocks should be preferred by manufacturers. Nemaguard rootstock has no problem with any almond variety. Both tree life (economic life) and yield are not at the desired level. Therefore, it should not be used as a rootstock in places not contaminated with nematodes. Yield and early fruit laying rate is higher in gardens formed with the almond rootstock. Nemaguard rootstock in heavy soil conditions gal, fungus, root rot, etc. factors are more tolerant. Almond varieties are good for their development. In weak soils, Nemaguard should be used as rootstock for almonds.

3.1.7. Petrones Arda Rootstock: Breeding by Beta Sapling; (*Prunus dulcis* x *Prunus persica*) x *Prunus amygdalus* hybrid. Stunted, red-leaf rootstock. Peach, Nectarine, Almond and some Japanese plum varieties are a good match with an ace. It is resistant to calcareous soil structure and heavy soil conditions. Frequent planting is a suitable rootstock for aquaculture. It is more suitable for Garnem and GF 677 rootstocks for frequent planting finishing systems under modern fruit conditions due to being a dwarf. GF-677 rootstock is very sensitive although it is very resistant to root nematodes and heavy soils. Since it is a dwarf rootstock, it provides the fruit to be laid earlier and the fruit yielded more per unit area.

3.1.8. Rootpac (20-40-70-90) Rootstock: Almond trees early yields. Suitable for frequent sewing (3 * 1.2 m). The unit is conducive to receiving more products from the area. It is suitable for machine farming and machine harvesting. It has high resistance to lime. Produces regular fruit-forming trees. It makes high quality and high yield fruits. It can be applied in difficult terrain conditions and forms early fruits. Resistant to cold, asphyxia and salinity. It is resistant to root gland and lesion nematodes.

3.2. Reasons for the Use of Rootstocks in Almond

In commercial almond cultivation, the use of seedlings produced from steel or grown from seed is not possible. Seedlings produced in this way do not have the same characteristics as the parent plant and exhibit an unstable development. Generally, inefficient trees emerge with gene expansion. Therefore, using full or semi-dwarf rootstocks will allow the development of commercially efficient varieties. Almond cultivation is not carried out especially in 1st class soil lands in our country. Rootstock selection is a vital factor for almond farming in stony, calcareous and inefficient soils where no agriculture can be done. Rootstock selection based on factors such as

the presence of nematodes in the soil, soil tillage, harvesting method, soil native rock, irrigation facilities, groundwater should be decided by considering all sensitivity values (Moser, 1984).

4. Planting of Almond Seedling

Almond seedlings are divided into two as open root seedlings and tube seedlings. Open-rooted seedlings should be planted in the period between waking up with leaves. Scuba seedlings can be planted every month of the year (Küden and Küden, 2000).

Bacteria-fungus analyzes should be performed before planting in the soil to be planted. The planting point should be exploded 1.5 * 1.5 meters and a comfortable environment should be created. Organic materials can be used to support the soil. The direction of the vaccine should be in the direction of the prevailing wind. Vaccination should be given to the opposite side of the vaccine and seedlings should be given physical support. It should be buried up to four fingers below the vaccination point; Before or after planting, agrobacterium should be vaccinated and bacterial diseases should be resistant. After planting 20 liters of water per seedling should be given.

5. Pollination in Almond

The most important issue in commercial almond cultivation is to ensure successful pollination. Developed countries in agriculture have given great importance to optimum pollination of plants. Although Turkey has a great potential for beekeeping by the presence of nearly 6 million colonies, honey bee pollination is not used widely and deliberately. Therefore, there is an economic loss of hundreds of times higher than the income from bee products. The aim of fruit growing is to obtain abundant and high-quality products. An important way to achieve this is to ensure that pollination and fertilization events take place in a healthy way. Almost all of the hard-shelled fruit species in the almond, pollination, and insemination is insufficient in cases of insufficient fruit set. For this reason, fertilization and thus the pollination stage, which is a prerequisite for the internal fruit attitude, should be realized very effectively in almond-like fruit species (Dokuzoğlu and Gülcan, 1979).

The rate of pollination in almonds starting from 4-5 hectares to 1 hive should be reduced to 1 hectare per hectare as the yield of the trees increases. It should not be forgotten that the more bees that work in the garden, the more embryo will be the flower

6. Harvest and Processing

Almond harvest is carried out between mid-August and late September, depending on the region and climate. During harvesting, tough methods should be avoided in order not to damage the fruit eyes of the following year. Methods can be determined according to economic conditions, soil slope, tree age, and worker resource. In developed countries, fully machine harvested.

After harvesting the drying process should be done meticulously, moisture loss against fungal diseases is important. It can then be stored with air-permeable canvas bags. Intervention with various machines for the Crimea and Calibration methods can be applied according to the marketing method (Çetinkaya, 1989).

7. Natural Hazards in Almond Agriculture

Almond trees are the earliest blooming trees among all fruits. Early flowering also brings serious risks. Late spring frosts are the most important risk for almond cultivation.

Frost is the ambient temperature below 0ºC. For trees, especially in the flowering period for almonds fall below -3 ºC to -4 ºC. Late spring frosts are two reasons. One of them is v Convection frost ”and the other is don Radiation frost”.

Convection frost, freeze coming from the wind. Generally, the clouds are strong at night and the wind is strong and the speed is above 8 km/sec. The depth of cold air mass is between 150m-1500m. If the wind continues, there will be no frost. The frost usually occurs within the first hour from the moment the wind stops. It is almost impossible to combat this frost and protect the trees. Radiation frost “is the frost formed by the accumulation of cold air, especially in hollow places, caused by the loss of the night heat of the soil heated on sunny and cool days.

The first condition of the fight against frost is to not install a garden in areas with a high risk of frost. It is then known to be protected from frost by 2 methods. The first is to warm the environment and the second is to wet the tree permanently. Heating is done with paper clips, steam, smoke or frost breakers. Wetting the tree is to wet the fruit or flower with small sprayers until the temperature rises to below zero. Because when the water freezes, it will give heat energy around it. Both methods are expensive.

In some regions, the heavy activity in the early period spills the fruits. The intervention is to draw the net to the garden or to the newly developed filled balls. Factors such as flood, lightning, extreme wind, etc. should not be ignored.

8. Conclusion

Almost all of our country has almond farming features. Although all these climate/soil data are positive, it is not acceptable that we depend on 50% external consumption in almond consumption. The necessary measures can be taken and the almond orchards to be established by the experts will contribute to the economy of the country and create new job sites. In the light of science, experts who are trained in the field and the land of many unused countries can be brought to the national economy. In spite of the risk of frost, in the climates where spring is more positive, successful gardens will emerge with the necessary analysis, correct varieties, and rootstocks.

Our local almond varieties are dull near the varieties of foreign origin. National self-fertile breeding work is done, the twinning rate is low, late-blooming new varieties and rootstocks remove, Turkey will be the milestone for almond cultivation.

Since almond is a pollinated plant mostly with bees, beekeeping and bee products will increase in direct proportion with almond farming and contribute to the national economy as a by-product.

References

Ak, B.E. ve Parlakçı, H., 2007. Güneydoğu Anadolu Bölgesi' nde Badem Yetiştiriciliği ve Bölgede Mevcut Çeşitler. V. Ulusal Bahçe Bitkileri Kongresi, 4-7 Eylül 2007, Erzurum, Cilt 1: Meyvecilik, 655-658.

Alpaslan, M., Güneş ve İnal, A., 2004. Gübreleme Çalışmalarında Bitki Analizlerinin Yeri ve Farklı Bitkiler için Bitki Besin Maddesi Kritik Düzeyleri. Türkiye 3. Ulusal Gübre Kongresi, Tarım-Sanayi-Çevre, 11-13 Ekim 2004, Tokat, cilt 2, s. 1215-1276.

Castro, J., and Sotomayor, C., 1998. The Influence of Boron and Zinc Sprays at Bloomtime on Almond Fruit Set. Proceedings of the Second International Symposium on Pistachios and Almonds. Acta Horticulturae Number 470: 402–405.

Çetinkaya, S., 1989. Vişne Hasadında Mekanizasyon olanakları Üzerinde Bir Araştırma (Doktora Tezi, basılmamış), Ankara Üniv., Fen Bilimleri Enst., Tarım Makinaları Anabilim Dalı, Ankara.

Çınar, Ö., 1993. Bitki Fungal Hastalıkları. Çukurova Üniversitesi Ziraat Fakültesi Yayınları Ders Kitabı No: 84, Bornova, İzmir.39 s.

Dokuzoğlu, M., Gülcan, R., 1979. Badem Yetiştiriciliği ve Sorunları. TÜBİTAK Yayınları No: 432, TOAG Seri No: 90, Ankara, 80 s.

Dokuzoğuz, M., ve R. Gülcan, 1973. Ege Bölgesi Bademlerinin Seleksiyon Yoluyla Islahı ve Seçilmiş Tiplerin Adaptasyonu Üzerine Araştırmalar. TOAG Yayınları, No: 22, Ankara.

Gülcan, R., 1976. Seçilmiş Badem Yetiştiriciliği Üzerinde Fizyolojik ve Morfolojik Araştırmalar. Ege Üniversitesi Ziraat Fakültesi Yayınları, No:310 İzmir.

Kaşka, N., 1999. South Anatolia can be an Important Almond Growing Region of Turkey. Proceedings of The XI GREMPA Seminar, 1-4 September, 1999, Sanliurfa, (Turkey) Cahiers Options Mediterraneennes, 56:87-90.

Kaska, N., 2001. Almond and Pistachio Pruduction in the Mediterranean Countries. Proceeding of the XI GREMPA Seminar, 1–4 September,1999, Sanliurfa, (Turkey) Cahiers Options Mediterraneennes, 56:13–21.

Kaşka, N., Güleryüz, M., Kaplankıran, M., Kafkas, S., Ercişli, S., Eşitken, A., Aslantaş, R., ve Akçay, E., 2005. Türkiye Meyveciliğinde Üretim Hedefleri. VI. Türkiye Ziraat Mühendisliği Teknik Kongresi, 3–7 Ocak, 2005, Milli Kütüphane Ankara, s.1-17.

Kuden, A. B., 1998. Almond Germplasm and Production in Turkey and the Future of Almonds in the GAP Area. Proceedings of the Second International Symposium on Pistachios and Almonds. Acta Horticulturae Number 470: 29–33.

Küden, A.B. ve N. Kaşka, 1993. Bazı Badem Çeşitlerinin Soğuklama Gereksinimlerinin ve Büyüme Derece Saatleri Toplamının Saptanması I. Doğa 17:197- 203.

Küden, A.B., 1998. Almond Germplasm and Production In Turkey and the Future of Almonds in The GAP Area. Acta Hort. 470:29-33,(www.actahort.org/books/470/ 470_1.htm).

Küden, A.B.,Küden, A., 2000. Badem Yetiştiriciliği. TÜBİTAK, TARP yayınları. 18 s.

Micke, W.C. and D.E. Kester, 1998. Almond Growing in California. Acta Hort. 470:21-28, (http://www.actahort. org/books/470/470_1.htm).

Moser E (1984). VerfahrenstechnikIntensivkulturen. [Management of IntensiveAgriculturalCrops.]. Verlag Paul Parey, Hamburg

Özbek , S., 1977. Genel Meyvecilik Ç.Ü. Ziraat Fak. Yayınları No:111 Ders Kitabı: 6, Adana, 386 s.

Özbek, S., 1978. Özel Meyvecilik (Kısın yapragını döken meyve türleri). Çukurova Üniversitesi Ziraat Fakültesi Yayınları, 128, Ders Kitabı No: 11, 485 s.

Şen, S.M., ve R. Cangi, 1991. Vezirköprü ve Çevresinde Yetiştirilen Bademlerin Seleksiyon Yoluyla Islahı Üzerinde Araştırmalar. Yüzüncü Yıl Üniv. Ziraat Fak. Dergisi 1 (3): 131-152.

(ORAL PRESENTATION)

ANTIOXIDANT PROPERTIES OF HORSE-CHESTNUT GROWING IN UŞAK REGION

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Abstract

Aesculum hippocastanum L., popularly called as the Horse-chestnut, is known for its magnificent beauty all over the world and has long been used in folk medicine. In this study, extraction of fruit and fruit shells of horse-chestnut trees grown in Usak region were performed with ultrasonic-assisted in 70% methanol-water mixture. The phenolic and total flavonoid contents of the extracts were determined by the Folin-Ciocalteu method and aluminum chloride colorimetric method, respectively. To determine the antioxidant activity in the extracts, 1,1-diphenyl-2-picryl-hydrazyl (DPPH) test was performed as previously described in some modifications. Gallic acid was used as the standard for the determination of total phenolic content of horse-chestnut fruit and shells and the results were given as the equivalent of gallic acid. At the end of the experiment, phenolic contents of horse fruit and shell were determined as 64.70 mg gallic acid equivalent/1 g sample and 32.43 mg gallic acid equivalent/1 g sample, respectively. Catechin was used as the standard in the total flavonoid content, the results were expressed in terms of catechin equivalent. The flavonoid content of the fruits was determined as 16,38 catechin equivalent/1 g sample, 12,41 g catechin equivalen/1 g sample of fruit shells. Ascorbic acid was used as the comparison component in antioxidant activity analysis.

The rate of inhibition of DPPH for the horse-chestnut fruit was 44,21% and for the shell was 23.15% off while the rate of ascorbic acid was 96.82%. This result shows that the antioxidant activity of the fruits is about half of the antioxidant activity of ascorbic acid. Further studies should be carried out on this plant with high bioactive components and antioxidant capacity and the medical features of this plant should be elaborated.

Key words: Antioxidant, horse-chestnut, uşak

1. INTRODUCTION

The species of the genus Aesculus are characterized by diverse susceptibility to C. ohridella. The main host of this pest is the white horse-chestnut (*Aesculus hippocastanum L.*), which is native to the Balkans and since the end of the sixteenth century has been introduced throughout Europe as an attractive ornamental tree (1). In the field of health, in addition to researching new methods in the treatment of diseases, serious studies are carried out in order to maintain a healthy life and prevent diseases. With regard to these studies, interest in antioxidants has been increasing recently. Some chemical reactions that occur in the tissues of our bodies cause damage to tissues by causing free radical formation. Free radicals are highly effective in cell growth development and they play an important role in the development of some diseases such as arteriosclerosis, cancer, rheumatic diseases, and old-age diseases. The human body takes some precautions with food supplementation or metabolic events against these damages caused by free radicals. With the measures to be taken, the harmful effects of these substances on the body can be minimized. One of the most effective substances to prevent these harmful effects are antioxidants. Antioxidants, free radicals or to prevent the formation of free radicals are ineffective substances (2). Antioxidants, which are mostly

polyphenolic, are found in almost all plants, fruits, vegetables, microorganisms, fungi and animal tissues in nature. The most important of these antioxidants are tocopherols, flavonoids, carotenoids and ascorbic acid (3, 4, 5). These polyphenolic-type flavonoids, which give colors to plants, are also largely. The chemical structure of about 4000 flavonoid compounds has been elucidated (6).

The aim of the study was to examine the content of phenolic, flavonoid content and antioxidant activity of (*Aesculus hippocastanum*) tree growing in Uşak, Turkey.

2. MATERIAL AND METHOD

2.1. Plant Material

The plant materials used in the study were collected in Usak Region, Turkey in September 2018. The shells and fruits of these plants were dried in an incubator at 60°C for one day. The shells and fruits of these samples were then pulverized to 80 mesh particle size for analysis. In order to obtain the concentrated extract, the ground seeds were defatted with 1% acetic acid then extracted with ethanol and, finally ethanol removed.

2.2.Chemicals

The chemicals and solvents used in all experiments were of analytical purity. All solvents were filtered using a 0.45 μm filter (Millipore, Bedford, MA, USA).

2.3. Ultrasonic Assisted Plant Extraction

Ultrasonic assisted extraction was conducted with ultrasonic bath (BandelinSonorex) at a frequency of 50 kHz. 1 g. of dried and ground samples was weighed and each plant sample were extracted with 30 ml. solution of (70% methanol in water) for 30 minutes separately. After the extraction, the mixture was filtered with white band filter paper (Whatman) and the extract was stored in a +4 ^{0}C refrigerator until the analysis. Total phenolic, flavonoid and antioxidant capacity were determined using the plant extracts.

2.4. Total Phenolic Content Determination

Total phenolic content of the sample extract was determined by the Folin-Ciocalteu method modified by Elzaawely and Tawata(7). Briefly, 7250 μl deionized water, 500 μl extract, and 250 μl Folin-Ciocalteu reagents were added to 10 mL tubes and mixed and stored in a dark environment for 5 minutes. After adding 2000 μl (7.5%) Na_2CO_3, the volume was completed to 10 mL and incubated for 30 min. After incubation, the absorbance values of the samples were measured with a Shimadzubrand UV-1800 spectrophotometer at 765 nm wavelength. Gallic acid was used as the standard and the findings were expressed in mg gallicacid equivalent (GAE)/1 g dry weight (DW).

2.5. Total Flavonoid Content Determination

The total flavonoid contents of the sample extract were determined by the aluminum chloride colorimetric method (8). Briefly, 50 μl extract was transferred into 10 ml test tube and 950 μl methanol and 6400 μl deionized water were added, followed by 300 μl 5% $NaNO_2$ solution. Then, 300 μl 10% $AlCl_3$ solution was added to the mixture and remixed. After 5 min. of incubation, 2000 μl 1 M NaOH solution was added and the total volume of the mixture was completed to 10 mL. Mixture was incubated for 15 min. and the absorbance value was measured at 510 nm with a Shimadzubrand UV-1800 spectrophotometer. Catechin was used as the standard and the total flavonoid content was expressed as mg catechin equivalent per dry weight.

2.6. Antioxidant Activity Analysis

Diphenyl-2-Picryl-Hydrazyl Test: Antioxidant activity of the extracts was determined by the 1,1-diphenyl-2-pixyl-hydrazyl (DPPH) test as previously described in certain previous modifications (9). Briefly, 200 μL of each extract (100 μL/mL) was mixed with 3.8 mL DPPH solution and incubated for 1 hour at room temperature in the dark. The absorbance of the mixture was measured

at 517 nm. with a Shimadzubrand UV-1800 spectrophotometer. Ascorbicacid was used as the positive control. The ability of the sample to remove the DPPH radical is determined using the following formula:

% Inhibition = $[(A_{blank} - A_{sample})/A_{blank}] \times 100(1)$

Where A_{blank} is the absorbance of the control and A_{sample} is the absorbance of the test compound.The sample concentration that provided 50% inhibition (IC50) was calculated by plotting the inhibition rates against the sample concentrations.

3. RESULTS AND DISCUSSION

Total Phenolic Content Determination:

The absorbance values for different concentrations of Gallic acid standard solutions were measured at 765 nm with a Shimadzubrand UV-1800 spectrophotometer. Gallic acid standard curve was plotted and presented in Figure 1.

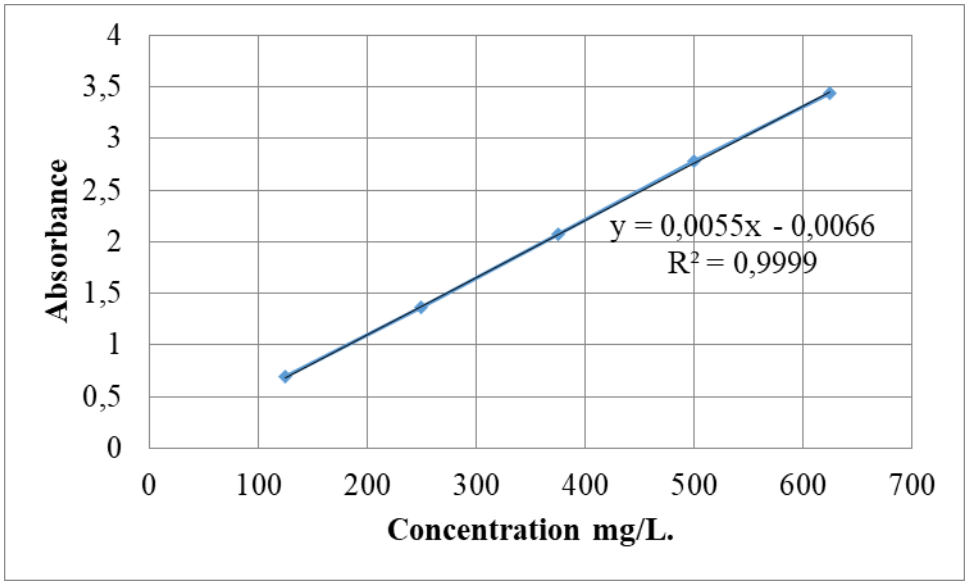


Figure 1. Gallicacid standard curve

Sample	TPC mg GA EQ/ 1 gr Sample
Conc. Extract	182.31
Fruit	64.70
Shell	32.43

Total Flavonoid Content Determination:

The absorbances for five concentrations of catechin standard solutions were measured at 510 nm wave length with a Shimadzubrand UV-1800 spectrophotometer. Catechin standard curve was plotted and showed in Figure 2.

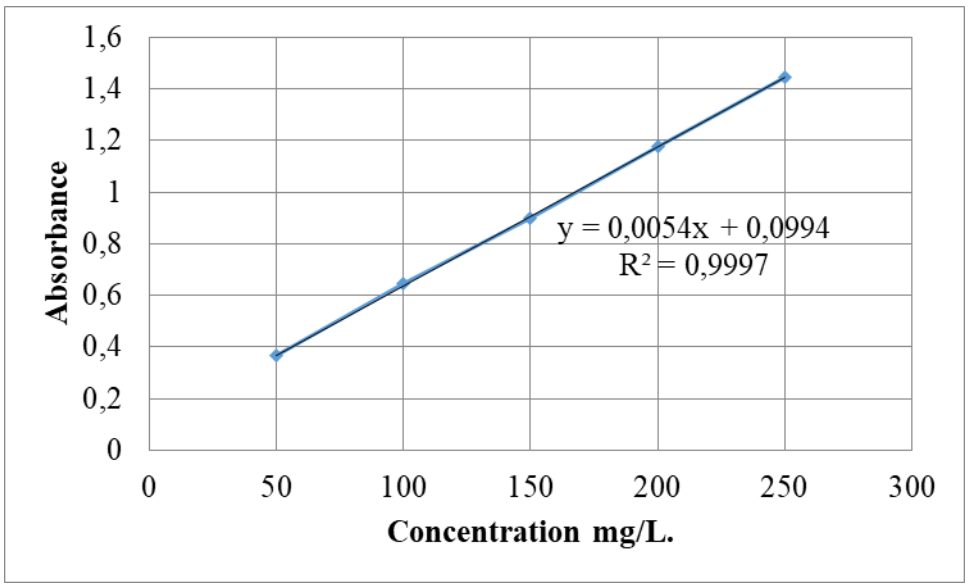


Figure 2. Catechine Standart Curve

Sample	TFC mg CATECEQ/1 gr Sample
ConcExtract	54.21
Fruit	16.38
Shell	12.41

Antioxidant Activity Analysis

1,1-Diphenyl-2-Picryl-Hydrazyl Test:

This process is based on monitoring the visible are a with the spectrophotometer until the absorbance is constant. DPPH scavenging activity was about 97% in the ascorbicacid control group.

Sample	Inhibition%
Conc.Extract	81,12
Fruit	44,21
Shell	23,15
Ascorbic Acid	96,82

4. CONCLUSION

The antioxidant effect is a common feature of phenolics. In this study, we found that phenolic compounds found in the fruit and shell of *Aesculum hippocastanum* also exhibit antioxidant activity. Our results may support the use of fruit and shell of *Aesculum hippocastanum*in food and medicine areas to prevent physiological aging disease of the human organism, because the leaves of the Pyrus species are rich in phenolic compounds and show antioxidant activity. These results reinforce the importance of preserving *Aesculum hippocastanum* as potential sources of unrecognized health-promoting compounds.

REFERENCES

1. Prada D, Velloza TM, Toorop PE, Pridchar HW (2011) Genetic population structure in horse-chestnut (*Aesculus hippocastanum* L.): effect of human-mediatedexpansion in Europe. PlantSpecBiol26:43–50

2. Baykal, Y. Gök, F. Erikçi, S. 2002. Demir, serbest radikaller ve oksidatif hasar. Sendrom Aylık Tıp Dergisi, 14 (1):94-100.
3. Yanishlieva NV, Pokomy J, Gordon, M. 2001. Inhibiting Oxidation in Antioxidants in Food: Practical Applications. CRC press LLC and Wood head Publishing Ltd, New York, USA, 288s.
4. Hudson BJF, 1990. Food Antioxidants. Elsevier Applied Science Publishers, New York. Elsevier, New York, pp. 253–307.
5. Shahidi, F. 2000. Antioxidants in Food and Food Antioxidants, Nahrung, 44,158-163.
6. Murray, M.T. 1996. Encyclopedia of Nutritional Supplements. California, Prima Publishing, 1, 320-331.
7. Elzaawely, A.A.;Tawata, S. Antioxidant activity of phenolic rich fraction obtained from Convolvulusarvensis L. leaves grown in Egypt. J. Crop. Sci. 2012, 4, 32–40.
8. C. Chang, M. Yang, H. Wen, J. Chern. Estimation of total flavonoid content in propolis by two complementary colorimetric methods. J. Food Drug Anal., 10 (2002), pp. 178-18.
9. D. Villano, M.S. Fernandez-Pachon, M.L. Moya, A.M. Troncoso, M.C. Garcıa-Parrilla. Radicalscavenging ability of polyphenolic compounds towards DPPH free radical Talanta, 71 (2007), p. 230.

(ORAL PRESENTATION)

Effect of some heavy metals on seed germination characteristics of sunflower (*Helianthus annuus* L.)

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Abstract

This research was conducted to define the effect of Co, Cu and Zn on germination in sunflower (*Helianthus annuus* L.). For this aim concentrations were 0 (control), 10, 30 and 50 mg L^{-1} Co, Cu and Zn in germination stage. Except for cobalt (Co) applications, other applications were inhibitor for shoot length and fresh and dry weight according to control. In study, all applications at increased doses negatively affected investigated characters (germination ratio (%), mean germination period (day), shoot and root length (cm) and fresh and dry weight (g)). Generally, Cobalt treatments affected investigated characters less than treatments of other metals (copper and zinc). In this study, effects of all treatments on mean germination period were insignificant. But applications extended germination period. Generally, the highest dose of zinc (50 mg L^{-1}) negatively affected characters and minimum values obtained from this application. As results of this study, It was concluded that heavy metals investigated characters at different rates.

Key words: Sunflower, germination, heavy metals.

INTRODUCTION

Sunflower (*Helianthus annuus L.*) grows up to a length of 0.3–3 m under various ecological and agricultural conditions and belongs to the annual Asteraceae family (Alaboudi et al., 2018). Sunflower (*Helianthus annuus L.*), which is rich in protein sources, is one of the leading oilseed crops. Sunflower is also consumed as a cookie and the sunflower meal is used as an animal feed. Sunflower is well grown in mild acidic, potassium rich, sandy, clayey, deep, humic and drained soils. Sunflower has problems of productivity as a result of salinity, water, temperature stress; especially as a result of heavy metal pollution of agricultural land, abiotic stress exposure problems are also available. Increasing metal concentration in plants leads to oxidative damage resulting in cell death and leading to a serious deterioration in plant growth and productivity (Paul et al., 2018).

Nowadays, environmental pollution takes place due to heavy metals as a result of industrial activities and urbanization. Heavy metals that cause global pollution threaten all living things such as plants, animals, humans, and organisms. Heavy metals that can be mixed in water are taken by plants or released into the atmosphere as a gas. It can also be absorbed by soil components such as clay or organic matter. Heavy metals cannot be biologically degradable, and they cause a great deal of concern for living organisms and the environment as carcinogenic and mutagenic compounds.

Copper (Cu) and zinc (Zn) from heavy metals, and cobalt (Co), which are needed in a small amount for plant development and have a toxic effect even at very low concentrations, are micronutrients. These heavy metals also have a toxic effect on organisms in high concentrations.

Zn, which is among heavy metals, acts in enzyme activation, gene expression, phytohormone activity, protein synthesis, photosynthesis, carbohydrate metabolism, seed production and disease resistance (Sadeghzadeh and Rengel, 2011). It is also necessary for the regulation of germination, nucleic acid (RNA-DNA) metabolism and gene expression (Hafizi and Nasr, 2018). When the Zn causes toxicity, the growth of the roots and shoots of plants is reduced, cell growth and elongation are prevented (Rout and Das, 2009).

Copper, which is also the main element for the plant, is a major metal for normal plant growth and development, although it is potentially toxic. However, excessive copper accumulation in cells prevents plant growth and disrupts important cellular processes (i.e. photosynthetic electron transport) (Yruela, 2005). Cobalt, which is the other micronutrient element, is necessary for the root growth and formation of coleoptile and bud. However, at a high concentration, it inhibits chlorosis, causing necrosis in the plant, so prevents nutrient and water intake, cell division and plant growth (Minz et al., 2018)

Plants are the biggest intermediate members among the polluting substances and soil. Therefore, phytotoxicity studies are gaining importance. The test of germination rate and root elongation, which determine the toxic effects in plants, is a rapid phytotoxicity test method (Wang et al., 2001) Although there are reports on the effect of metal toxicity on plants, there are very few studies on how heavy metals affect seed physiology.

It was reported that copper (Cu) produced oxidative stress in sunflower seedlings by producing reactive oxygen species, thus catalase (CAT) enzyme activity was reduced due to oxidation of the protein, as a result of all these, copper had a toxic effect on the plant (Pena et al., 2011)

Chaves et al. (2011) investigated the effects of heavy metals (Cd, Cu and Zn) on plant growth in sunflower and reported that, as the dose of Cd and Zn increases in heavy metal treated soil [treated with 0, 10, 20, 30 and 40 mg/dm^{-3} cadmium (Cd), 0, 20, 40, 60 and 80 mg/dm^{-3} copper (Cu) and zinc (Zn)], the height of the plants is significantly decreased, but Cu has no effect on high doses. It was stated that heavy metals at low concentrations increased the dry weight very little, and the accumulation of heavy metals in the shoot and root was Zn>Cd>Cu and Cd> Zn>Cu, respectively, and high concentrations caused toxic effects.

In another study on sunflower, the effect of high doses of Cu application (1-10-50 and 100 ppm dose) on seed was very apparent, also the germination rate decreased in 50 and 100 ppm, but low doses did not affect the germination rate. Again 50 and 100 ppm applications caused a toxic effect on the root and shoot length, while the same doses significantly reduced the fresh weight, the highest values in dry weight were obtained at 100 ppm (Boroş and Micle, 2015).

Plant growth in sunflower, including heavy metal leaf chlorosis, decreased germination, and its negative effect resulted in plant death ((Mahmood and Ibrahim, 2017).

Zinc, which is important for plant growth and development, plays an important role in metabolic events, and the percentage of germination and germination rate are important factors in obtaining high efficiency from the unit area (Abbasi et al., 2017).

Some metals, such as mercury (Hg), zinc (Zn), cadmium (Cd), cobalt (Co), lead (Pb), copper (Cu) and nickel (Ni), inhibit seed germination. The threshold levels of metal toxicity on seed germination, plant development, and gene regulation have not been studied yet in detail (Czajka et al., 2019).

In this study, considering the increasing concerns about heavy metal stress affecting agricultural products, the effects of Co, Cu, and Zn on sunflower germination (*Helianthus annuus* L.) were investigated.

MATERIALS AND METHODS

In the study, seeds of "Palancı I" sunflower variety were used as plant material. The seeds were surface-sterilized by agitating them for 10 min in 1% sodium hypochlorite solution, which was followed by rinses in deionized water. Four different doses of Co, Cu and Zn solutions (0 (control)-10-30 and 50 mg L^{-1}) were prepared. For germination tests, the 25 seeds were placed between two germination papers in each of the 9 cm diameter petri dishes. The moistening processes were performed in 4 different doses (0-10-30 and 50 mg L^{-1}) of Co, Cu and Zn prepared during the trial, and seeds were germinated at 20 ºC for 16/8 hours light/dark photoperiod. After the seeds were placed in the germination environment, the counting was made once a day for 5 days so that the rate of germination (%) (Bewley and Black, 1994) (seeds with a root length of 1 mm and above were accepted as germinated) and the mean germination period (day) (Bewley and Black, 1994) were calculated. In addition, at the end of the experiment, the root and shoot lengths (cm) of the young shoots were determined by measuring the root and shoot lengths of the 10 germinated seeds taken from each germination dishes. After the wet weights (g) were determined, 10 plants (for each petri) were dried 48 hours in 70 ºC to measure dry weights (g). The study was arranged in 3 recurring plots according to the factorial trial plan in randomized blocks. The obtained data were analyzed in the SAS package software. The significant differences were determined by the LSD and Duncan multiple comparison test in the MSTAT-C software. Percentage values from the resulting data were transformed.

RESULT AND DISCUSSION

Germination rate (%)

The effect of heavy metals (Co, Cu, and Zn) in different concentrations on the germination rate of sunflower seeds was found to be not statistically significant. According to the general averages, sunflower germination rate changed between 16.00%-62.67% (Table 1). Again, the effect of heavy metals on the germination rate was significant at the level of 5%, and the germination rate was found to be numerically low (31.67%) in the Cu application compared to the other metals (Co and Zn).

Table 1. The effect of heavy metals on the germination rate of sunflower

Heavy metals[1]	**Concentration[2] (mg/L)**				
	0	**10**	**30**	**50**	**Mean**
Co	62.67 **a**	44.00 **b**	36.00 **bc**	32.00 **bcd**	43.67 ***a***
Cu	64.00 **a**	20.00 **def**	26.67 **cde**	16.00 **ef**	31.67 ***b***
Zn	61.33 **a**	34.67 **b**	37.33 **bcd**	16.00 **f**	37.33 ***ab***
	62.67 a	32.89 b	33.33 b	21.33 c	
LSD	1**: 5.023	2**: 5.800	1x2**: 10.05		

**: Significant at P<0.01; Italic bold lowercase: 1; Lowercase : 2; Bold lowercase: 1x2

Wang et al. (2011) applied 0, 0.5, 1, 10, 50, 100 and 250 mM copper (Cu), lead (Pb) and zinc (Zn) to the seeds of wheat. In the study, the germination rate decreased significantly in parallel to the metal concentration compared to the control groups. The toxic effect of metals on seed germination parameters can be shown as Cu > Pb > Zn.

Although heavy metal x concentration interaction is not significant in our study, high dose application (50 mg L^{-1}) reduced the rate of germination significantly. In a study investigating the effect of copper on seed germination to determine the tolerance of sunflower to copper, the low copper concentration increased the rate of germination, and in contrast, high concentration showed a toxic effect (Boros and Micle, 2015).

Mean germination period (day)

The different concentration of heavy metals did not affect the mean germination period significantly, while the germination period changed generally between 1.56-2.46 days. Sunflower germination was delayed in the heavy metal concentration of 10, 30, and 50 mg L^{-1}, the longest germination period was determined with 50 mg L^{-1} Zn application in 2.46 days (Table 2).

Table 2. The effect of heavy metals on the mean germination period of sunflower

Heavy metals[1]	**Concentration[2] (mg/L)**				
	0	**10**	**30**	**50**	**Mean**
Co	1.64	1.91	2.28	2.00	1.96
Cu	1.50	2.00	2.29	2.22	2.00
Zn	1.53	2.27	2.13	2.46	2.10
	1.56 b	2.06 a	2.23 a	2.23 a	
LSD	1: non-significant 2**: 0.4374 1x2: non-significant				

**: Significant at P<0.01; Lowercase : 2

Similar to our findings, in a study, GA_3, KNO_3, and water were applied to perennial British grass seeds exposed to heavy metals of cadmium and nickel in different doses (0-75-150 and 300 mg L^{-1}), thus the effects of applications on the development of germination and seedlings were reported, the average germination times in heavy metal applied seeds (75-150 and 300 mg L^{-1}) were statistically similar, but the germination was reported to be slow compared to the control group (Akar and Atis, 2018). In another study, the effect of different doses of copper (10-20-40 and 60 mg/L) and zinc (300 and 400 mg/L) on the percentage of germination and the average germination period of *Brassica oleracea* L. was not significant (Stratu and Costica, 2018).

Shoot length (cm)

As a result of the application of different heavy metals to the seed, the length of shoot changed between 2.33-7.44 cm. In the study, the shoot length was high in the control groups without the application of heavy metal (7.44), while low in zinc application of 50 mg L^{-1} followed by 30 and 10 mg L^{-1} zinc applications. In general, the negative effect of the copper application on the shoot length was minimal compared to cobalt and zinc (Table 3).

Table 3. The effect of heavy metals on the shoot length of sunflower

Heavy metals[1]	**Concentration[2] (mg/L)**				
	0	**10**	**30**	**50**	**Mean**
Co	4.71 **b**	4.44 **bc**	3.56 **b-e**	4.42 **bc**	4.28 ***ab***

Cu	7.44 **a**	5.00 **b**	3.85 **b-e**	4.22 **bcd**	5.13 ***a***
Zn	6.94 **a**	2.96 **cde**	2.71 **de**	2.33 **e**	3.74 ***b***
	6.36 a	4.14 b	3.37 b	3.66 b	
LSD	1**: 1.154	2**: 1.333	1x2*: 1.704		

**: Significant at P<0.01; *: Significant at P<0.05; Italic bold lowercase: 1; Lowercase : 2; Bold lowercase: 1x2

Root length (cm)

According to Table 4, the effect of heavy metal applications on the length of the root is significant ($p < 0.01$). In the study, the effect of Co application was minimal as the Cu and Zn applications reduced the length of the root. Again, in a dose of 50 mg L^{-1} of all three heavy metals, the length of the root was negatively affected. However, the length of the root was increased in the concentration of 10 and 30 mg L^{-1} of Co and shown in the same group with the control application (8.15 and 8.09 mm, respectively). In general, the length of root decreased in parallel to the increase of heavy metal concentration (Table 4).

Table 4. The effect of heavy metals on the root length of sunflower

Heavy metals[1]	**Concentration[2] (mg/L)**				
	0	**10**	**30**	**50**	**Mean**
Co	7.60 **ab**	8.15 **a**	8.09 **a**	5.00 **c**	7.21 ***a***
Cu	9.65 **a**	5.33 **bc**	3.17 **c**	3.09 **c**	5.31 ***b***
Zn	9.06 **a**	4.40 **c**	4.37 **c**	3.63 **c**	5.37 ***b***
	8,77 a	5,96 b	5,21 bc	3,91 c	
LSD	1**: 1.716	2**: 1.981	1x2*: 2.532		

**: Significant at P<0.01; *: Significant at P<0.05; Italic bold lowercase: 1; Lowercase : 2; Bold lowercase: 1x2

Different doses of copper (10-20-40 and 60 mg/L) and zinc (300 and 400 mg/L) reduced the length of shoot and root in *Brassica oleracea L.* species, and the development of root was more affected than shoot (Stratu and Costica, 2018).

Fresh weight (g/plant)

The effect of heavy metals on sunflower fresh weight was statistically significant (Table 5). The fresh weight values in accordance with the heavy metal concentrations were determined to change between 0.46-2.75 g. The 10 mg L^{-1} dose of Co did not significantly affect plant wet weight, which was determined in the same group as the control (2.39 g). Again, the effect of cobalt on the fresh weight was lower compared to copper and zinc; Zinc also significantly reduced fresh weight by 1.58 g compared to other metals (Table 5). In general, as the heavy metal concentration increased, plant fresh weight decreased in the present study.

Table 5. The effect of heavy metals on the fresh weight of sunflower

Heavy metals[1]	Concentration[2] (mg/L)				
	0	**10**	**30**	**50**	**Mean**
Co	2.49 **abc**	2.39 **abc**	1.88 **b-e**	2.10 **a-d**	2.22 ***a***
Cu	2.75 **a**	1.87 **b-e**	1.56 **de**	1.31 **e**	1.87 ***ab***
Zn	2.54 **ab**	1.56 **de**	1.76 **cde**	0.46 **f**	1.58 ***b***
	2.59 a	1.94 b	1.73 bc	1.29 c	
LSD	1^{**}: 0.3860	2^{**}: 0.4457	$1x2^{**}$: 0.7720		

**: Significant at P<0.01; Italic bold lowercase: 1; Lowercase : 2; Bold lowercase: 1x2

Dry weight (g/plant)

In the study, the effect of heavy metals (Co, Cu, and Zn) in different concentrations on sunflower dry weight was statistically significant ($p < 0.01$). The dry weight values of the plants decreased as the concentration of heavy metals increased. Considering the 50 mg L^{-1} doses, the dry weight of the plants was least (0.10 g) with Zn, followed by copper and cobalt applications with a dry weight of 0.14 and 0.17 g. In general, a minimum amount of dry weight was obtained in the application of 50 mg L^{-1} dosage. In addition, the study revealed that the effect of zinc on dry weight is high compared to cobalt and copper (Table 6).

Table 6. The effect of heavy metals on the dry weight of sunflower

Heavy metals[1]	Concentration[2] (mg/L)				
	0	**10**	**30**	**50**	**Mean**
Co	0.32 **ab**	0.33 **ab**	0.27 **cd**	0.17 **g**	0.27 ***a***
Cu	0.35 **a**	0.26 **de**	0.25 **def**	0.14 **g**	0.25 ***a***
Zn	0.30 **bc**	0.22 **f**	0.23 **ef**	0.10 **h**	0.21 ***b***
	0.32 a	0.27 b	0.25 b	0.14 c	
LSD	1^{**}: 0.02644	2^{**}: 0.03053	$1x2^{*}$: 0.03901		

**: Significant at P<0.01; *: Significant at P<0.05; Italic bold lowercase: 1; Lowercase : 2; Bold lowercase: 1x2

Moya et al. (1993) kept paddy seedlings in the solution of Cd (0.01, 0.1 mmol/L) and Ni (0.1, 0.5 mmol/1) for 5-10 days, then the researchers stated that the dry weight/fresh weight ratio in the plants completing their development increased especially in the application of 0.5 mmol/1 Ni.

Alaboudi et al. (2018) investigated the effects of soil metals (Pb and Cd) on *H. annuus* by adding Pb and Cd in different concentrations to the soil (0, 10, 20, 40, 80, 100 and 200 mg kg-l). Plant weights and lengths in all plants grown in metal (Pb and Cd) rich soils were found the same as the control plants, and it was reduced in soil that was moderately contaminated with the metals (Pb and Cd).

In a study, corn seedlings were kept 24 hours in 0-0.00-0.00-0.01-0.1-1-2 and 5 mM zinc solution ($ZnCl_2$). Fresh weight of seedlings decreased significantly in the concentrations of 1 and 5 mM, while dry weight decreased slightly ((Waghmare and Gadre, 2018).

CONCLUSION

According to the findings obtained from the research, a negative effect was observed in the investigated parameters with 50 mg L^{-1} heavy metal applications due to the increase in concentrations of Co, Cu and Zn. In this study, the negative effects of heavy metals on germination parameters in the Sunflower were determined.

Today, heavy metal pollution is a major problem. Therefore, toxic metals also severely limit agricultural production. Hence, it is necessary to develop heavy metal resistant varieties in sunflower.

REFERENCES

Abbasi A., Shekari F., Mousavi S.B., Sabaghnia N., Javanmard A., 2017. The partitioning trend of resources and alpha-amylase enzyme activity with zinc priming in wheat (*Triticum aestivum*) seed. Iranian J. Seed Res., 3(2):1-13.

Akar M., Atis I. 2018. The effects of priming pretreatments on germination and seedling growth in perennial ryegrass exposed to heavy metal stress. Fresenius Environmental Bulletin, 27:10, 6677-6685.

Alaboudia K.A., Ahmed B., Graham Brodie G. 2018. Phytoremediation of Pb and Cd contaminated soils by using sunflower (*Helianthus annuus*) plant. Annals of Agricultural Sciences, 63, 123-127.

Bewley, J.D, Black, M. 1994. Seeds: Physiology, development and germination. New York, Plenum Press, 445p.

Boros M-N., Micle V. 2015. Copper influence on germination and growth of sunflower (*Helianthus annuus*). Studia Ubb Ambientum, LX, 1-2, pp. 23-30.

Chaves L.H.G., Estrela M.A., Souza R.S. 2011. Effect on plant growth and heavy metal accumulation by sunflower. Journal of Phytology, 3(12): 04-09.

Czajka K.M., Michael P., Nkongolo K. 2019. Differential effects of nickel dosages on in vitro and in vivo seed germination and expression of a high affinity nickel-transport family protein (AT2G16800) in trembling aspen (*Populus tremuloides*). Ecotoxicology, 28: 1, 92-102.

Hafizi Z., Nasr N. 2018. The effect of zinc oxide nanoparticles on safflower plant growth and physiology. Engineering, Technology & Applied Science Research, 8: 1, 2508-2513.

Mahmood Z.F., Ibrahim K.M. 2017. Evaluation of Helianthus annuus L. tolerance for zinc in vitro post combination with naphthalene acetic acid and benzyl adenine. World J Exp Biosci., 5: 1, 14-18.

Minz A., Sinha A.K., Kumar R., Kumar B., Deep K.P., Kumar S.B. 2018. A Review on importance of cobalt in crop growth and production. Int. J. Curr. Microbiol. App. Sci., Special Issue-7: 2978-2984.

Moya J.L., Ros R., Picazo I. 1993. Influence of cadmium and nickel on growth, net photosynthesis and carbohydrate distribution in rice plants. Photosynthesis Research 36: 75-80.

Paul S., Banerjee A., Roychoudhury A. 2018. Role of polyamines in mediating antioxidant defense and epigenetic regulation in plants exposed to heavy metal toxicity. In: Hasanuzzaman M., Nahar K., Fujita M. (eds) Plants under metal and metalloid stress. pp 229-247, Springer, Singapore.

Pena L.B., Claudia E. Azpilicueta C.E., Gallego S.M. 2011. Sunflower cotyledons cope with copper stress by inducing catalase subunits less sensitive to oxidation. Journal of Trace Elements in Medicine and Biology, 25: 3, 125-129.

Rout G.R., Das P. 2009. Effect of metal toxicity on plant growth and metabolism: I. Zinc. In: Lichtfouse E., Navarrete M., Debaeke P., Véronique S., Alberola C. (eds) Sustainable agriculture, pp 873-884, Springer, Dordrecht.

Sadeghzadeh B., Rengel Z. 2011. Zinc in soils and crop nutrition, In: Hawkesford M.J., Barraclough P. (eds), The molecular and physiological basis of nutrient use efficiency in crops, pp 335-375, John Wiley & Sons, Inc.

Stratu A., Costica N. 2018. The influence of some heavy metals on seed germination and early seedling growth in Brassica oleracea L. var. Acephala. Analele Stiintifice ale Universitatii Alexandru Ioan Cuza din Iasi. Sectiunea II A, Biologie Vegetala, 64(1/2), p63-70. 8p.

Waghmare R., Gadre R. 2018. Impact of essential micronutrient, Zn, on growth and chlorophyll biosynthesis in young *Zea mays* seedlings. American Journal of Plant Sciences, 9, 1855-1867.

Wang X., Sun C., Gao S., Wang L., Shuokui H. 2001. Validation of germination rate and root elongation as indicator to assess phytotoxicity with *Cucumis sativus*. Chemosphere, 44(8),1711-1721.

Wang H., Zhong G., Shi G., Pan F. 2011. Toxicity of Cu, Pb, and Zn on seed germination and young seedlings of wheat (Triticum aestivum L.). D. Li, Y. Liu, and Y. Chen (Eds.): CCTA 2010, Part III, IFIP AICT 346, pp. 231-240.

Yruela I. 2005. Copper in plants. Brazilian Journal of Plant Physiology, 17, 145-156.

(ORAL PRESENTATION)

Sage (S*alvia officinalis* L.) and its usage

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Abstract

Salvia which has been considered as a medical herb since the ancient times is an odorous herb from the *Salvia officinalis* species that is a member of the family Labiatea. It is native of the Mediterranean region. It was revealed in many studies that the components of salvia were commonly used for the treatment of various diseases in traditional medicine. *Salvia officinalis* has antimicrobial, antioxidant, antiviral effects and is stimulant to immune system so its use as a medical and aromatic plant is important. Since salvia contains phenolic antioxidants, it has a strong antioxidant activity. By this means salvia can be used for conditions such as; weakening of brain activities, cancer, heart diseases and weakening of immune system etc. Although salvia has been considered and used as a medical herb from past to present, more pharmacologic and scientific researches are needed to make certain comments about this issue.

Key words: Antioxidant, essential, pharmaceutical, sage oil, *Salvia officinalis* L.

INTRODUCTION

Salvia officinalis L. is an aromatic herb that is a member of the family Labiatea and contains essential oil and its medical use is legitimately accepted in Europe (Table 1). Sage whose motherland is Mediterranean especially grows in sea view calcareous slopes and islands. Besides, today sage is cultivated worldwide especially in Mediterranean, Europe and North America.

Table 1. Scientific classification of sage

Kingdom	**Plantae**	**Plants**
Division	Magnoliophyta	Angiospermae
Class	Magnoliopsida	Monocotyledons
Family	Lamiaceae	
Genus	*Salvia L.*	
Species	*Salvia officinalis L.*	Sage, garden sage, common sage

The name Salvia is derived from “salveo - to heal”. In addition to this plant is also called as sage, garden sage, or common sage. More than 900 species of salvia grow worldwide. Sage produces chemicals which have medical features and are used in perfumery industry. Sage has been considered as a medical plant since the ancient times and it was called as “herb of immortality” in Ancient Greek Medical Schools 2,500 years ago. This plant has been used as seasoning and medicine since the ancient Egypt, Greek and Rome.

Sage is an annual and perennial plant whose length varies between 40 and 100 cm, is shrubby with grey-green colored, hairy and spiked leaves and has purple-blue colored flower clusters While the plants have male (anther) and female (pistil) organs, they also have one female organ (pistil). They have two male organs (anther). The leaves contain high incidence of various essential oils mostly before the inflorescence. Therefore, sage leaves are picked before or at the beginning of the inflorescence in May-June. The leaves picked at midday that is the time that active substances culminate, are put on a shady and narrow place to dry.

The best moment for harvesting is the initial flowering period, if the objective is a high content in alpha-thujone, and during full flowering, if the objective is a high yield in essential oil.

Since the essential oils evaporate at high temperatures, the drying heat should not be more than 35 ^{0}C. Completely dried leaves are stored in an airtight container. Although salvia is resistant to the dry conditions; it is more productive under irrigated conditions. It needs humid air especially at its early growth period. As the growth continues the resistance towards dry conditions increases. Sage grows well especially on the soil that is calcareous, sandy - loamy, rich in nutrients. For this reason, within crop rotation it should be planted after the leguminous plants or a mattock plant that is composted with farmyard manure. For being both generatively and vegetatively reproductive, sage ensures ample opportunities for researchers especially in breeding works. In vegetative production, it can be produced by means of fractionating the axilla shoot and the old plants. Seed time is spring or autumn in production with seed. The first hoe is done nearly 20 days after the seed time when the sage plants that rise to the surface become 5-7 cm length. Since the development of plant is slow in the first year, hoeing is repeated for several times. The root collars of sage plants get filled in the second hoeing. The number of hoeing depends on the growth of weeds and ecologic conditions. In sage cultivation, especially in the dry months irrigation should be done for high efficiency. Thereby more than one harvest can be done in the vegetation period. Due to the fact that sage is a perennial plant, product can be obtained with more than one harvest each year.

The essential oil from sage is procured by distillation. Essential oil is a scented, generally colorless or straw yellow natural product that is liquid at ambient temperature (Figure 1). It also contains types of hydroxycinnamic acid, diterpenes, flavanoids, phenol glycosides, triterpenes, polysaccharides in the leaves that are used for medical purposes. Besides it has tannin and bitter substance. The most important substances of sage leaves are essential oils (*Oleum salviae*). The rate of essential oil in leaves varies between 1-2.5 %.



Fig. 1. Sage (*Salvia officinalis* L.) oil

Sage contains etherish essential oils, thujone, pharmacologically important cineole, linalool, bornyl, salven, pinene and substances like camphor, tannins, triterpoids, flavones, estrogen and resinous compounds. Compound of essential oil also contains Triterpenes and flavones. Sage extract contains antioxidative phenolic substances as;

Monoterpene (1-60 %), triterpene (0.4-3.5 %) and flavonoid (1.1 %) (Table 2) (EMA, 2010). Besides the chemical elements as water, protein, carbohydrate, calcium, iron, magnesium, phosphorus, sodium and zinc, also vitamins A, C and niacin (vitamin B_3) are contained within the plant. Different amounts of chemical compounds exist in sage essential oil and tea.

Table 2. The essential oil components in sage (*Salvia officinalis* L.)

Essential oil	Up to 3%	Monoterpenoids	α -thujone	10-60%
			β -thujone	4-36%
			camphor	5-20%
			1,8-cineole	1-15%
Hydroxycinnamic acid derivates	About 3.5%	Caffeic acid dimer	Rosmarinic acid	Up to 3.3%
		Caffeic acid trimers	Melitric acid A	
			Methyl melitrate A	
			Sagecoumarin	
			Salvianolic acid K	
		Caffeic acid tetramer	Sagerinic acid	
Phenolic diterpenes				0.35%
Triterpenes		Pentacyclic triterpene acids		0.4-3.5 %
		Triterpene alcohols		0.10-0.18 %
Flavonoids	About 1.1%	Flavones and their glycosid		

While components like α-thujene, limonene and α-terpine exist in salvia essential oil, they do not exist in sage tea. Surplus amount of components other than monoterpene, hydrocarboric are found generally in sage tea (Table 3) (Lima et al., 2006).

Table 3. Composition of essential oil (EO) and essential oil constients of tea

Compound	**EO from *S. officinalis* (%)**	**EO constituents from *S. officinalis* tea (%)**
Cis-2-methyl-3-methylene-hep-5-ene	0.7	-
Trans-2-methyl-3-methylene-hep-5-ene	0.1	2.1
Tricyclene	0.1	-
α-Thujene	0.1	-
Sabinene	0.1	-
Myrcene	0.5	-
α-Terpinene	0.2	-
p-Cymene	0.1	-
Limonene	1.5	-
1.8-Cineole	12.7	18.1
γ-Terpine	0.1	-
Cis-thujone	17.4	34.0
Trans-thujone	3.9	5.3
Camphor	3.3	10.6
Borneol	8.3	13.8
α-Selinene	0.5	1.1
Monoterpene hydrocarbons	15.9	2.1
Oxygen-containing monoterpenes	47.7	86.2
Monoterpenly esters	1.8	0.0
Others	0.3	7.4

Since some species of sage are used as hallucinogens, they are illegal in some regions of the world. This substance with hallucinogenic effect is obtained from dried leaves. Because of this effect, sage is used in many religious rites.

Rosmarinic acid, carvacrol and luteoin that are contained within sage has antioxidant effects. Due to tannin substance, sage is used for the treatments of diseases like periodontitis and dental cavities (Böszörmenyi et al., 2009). Within sage there is thujone, a cytotoxic substance that causes contraction and spasm. For this reason, it has a toxic effect in high doses. In addition to that it may conduce to a permanent damage in central nervous system caused by dementia and seizures. Thujone that is contained within the essential oils of sage varies between 17 % and 58 % according to the climate and the habitat that sage grows and it is thought that in the high doses of camphor, which sage contains, there is the risk of hepatotoxicity (kidney toxicity) and neurotoxicity (nervous system toxicity). The substance of camphor is antispasmodic, disinfectant and antioxidant. So that it is effective for vomiting, diarrhea and pains (Sabbaghzadeh, 2013).

Sage is quite effective for acute upper respiratory tract infections because of the cineole, thujone and borneol substances and it contains 1,8-cineol which has expectorant effect and can be used for the treatments of acute bronchitis, sinusitis (Fischer and Dethlefsen, 2013). This chemical compound has anti-bacterial and anti-parasitic, anti-acetylcholinesterase, anti-laryngitis, anti-inflammatory and antifungal features. It reduces the blood pressure and strengthens the liver (Sabbaghzadeh, 2013).

Use and applications in pharmaceutical science of sage oil

Sage is a plant that people make use of since the early ages and is preferred as drink or oil in food, pharmaceutics, perfumery and cosmetics (Table 4).

Fresh sage is used to give flavor to food and give smell and flavor to meat. It is used accomplishedly in food as a spice or in storage techniques. Since sage delays or reduces the formation of microorganisms, it is used to prevent the rotting of food. European countries use it for french-fries, beef aging and dry-salting. Fresh sage leaves are consumed with bread and butter for the protection of health by peasants in Italy. And in Italian cuisine the fresh or dried leaves of *Salvia officinalis* are used as spice, appetizer or side dish with meat and chicken dishes, soups, pasta and potatoes. Also this plant is preferred for cheese making and tea brewing. Honey, which has slow crystallization and a beautiful taste and smell, is made from this aromatic plant. So sage has a great importance for agriculture and apiculture. Since sage prevents beetle formation in seeds, legumes are stored with several sage leaves.

Even more than 900 species of sage grows worldwide, only some of them are used as raw material of medicine. Rest of the species are unsavory and bad for human health. Sage had been used for the treatment of pertussis for many years before the pertussis vaccine was invented. Since the ancient times sage is known for its antiseptic feature. It was used for fertility, fruitfulness and productivity in ancient Egypt. Sage that is considered as a sacred plant by Romans, was used against inflammatory diseases in Middle ages and pruritus in The Ebers Papyrus (1500 B.C.) era. Also it is known to be used for labor pain, ulcer, coughing, hoarseness, sweating and contractions. Again it was used for improvement of the memory in the late 17th century and for the treatment of high fever, rheumatoid arthritis and venereal diseases by American physicians in the 19th century. In the late 1920s it was stated that sage is effective against sore throat, sprains and swellings. In India, physicians indicated that it can be used for the treatment of hemorrhoids, gonorrhea, metritis and visual impairment.

Today in conventional wisdom it is used as preventive and therapeutical for common cold, coughing, diabetes (**Behradmanesh et al., 2013**), over sweating, gastric ulcer, stress, sleep withdrawal, pharyngitis and periodontitis. It has a protective effect for cancer with the antioxidants (flavonoids) it contains (Cenıć-Mıloševıć et al., 2013). It can be said

that sage improves the memory and the body and reduces the risk of heart attack. It can be affective in liver diseases (El-Banna et al., 2013), dementia and Alzheimer's disease (Vladimir-Knežević et al., 2014). It successfully can be used for the treatment of cramps, spinal cord diseases, tonsillitis, laryngitis (Charantimath and Oswal, 2011), pharyngitis and oral cavity inflammations, menstrual irregularity and pains and metritis. It has a digestive, diarrhea preventive (Al-Maamori, 2011; Khan et al., 2011) and diuretic effects. It also has a blood cleansing effect. It cleanses the respiratory organs and stomach from pituitary fluids and is an appetizer. Because of its antifungal effect, it can be applied onto fungi for treatment. It is used for dandruff, acne, cellulite treatment and insect stings. Sage showed hypertension dropping effects as a result of animal testing. It also helps preventing oral malodor when sage leaves are chewed.

Focused areas of research on sage oil

Sage extracts, mostly essential oil (EO), are also widely used in the food, drug, beverage, cosmetic and fragrance industries. Sage is a medical plant that contains strong antioxidant, antibiotic, antifungal and antiviral (Table 4).

Table 4. Popular uses of *Salvia officinalis* L.

Botanical name	Family	Botanical partused	Commen names	Action	Popular uses
Salvia officinalis	Salvia	Leaves Whole herbs	Broad-leaved white sage Common sage Garden sage Narrow-leaved white sage Sagea Salbei Salvia saltatrix Ada çayı	Antibacterial Antihydrotic Antiseptic Antispasmodic antiviral phrodisiac astringent Carminative Stimulant Sytyptic Tonic	Bacterial and viral Brain and nervous system Cardiovascular Gastrointestinal Genitourinary Glandular Liver diseases Respiratory tract Cosmetics Food (as resource of antioxidant and spice, condiment added to meat, preservatin and flavour of food) Biological control of pests

In many clinical studies the importance of salvia's substances as a treatment of various diseases is stated. In a study done on designed to compare the efficacy of sage on improvement of insulin sensitivity and bioche -mical complications of alloxanized. In studies, showed that the oral administration of sage caused marked amelioration of serum glucose concentration of alloxan diabetic rats, besides elevating insulin concentration and increasing liver glycogen content which was reduced by alloxan administrain (Moram, 2001).

Perry et al. (2018) stated that sage oil and extracts, may have potential for treatment of Alzheimer's disease (AD) and memory related disorders.

In their found study, drinking of sage tea (common sage) (300 ml, twice a day) showed increase in antioxidant defenses, decreased fasting blood glucose in normoglycemic mice and prevented lipoprotein oxidation, related gluco- and lipotoxicity and prevent progressive β-cell destruction (Sá et al., 2009).

In the research on intended to evaluate the protective effect of sage extract on the bone mass loss occurring in young female rats; sage in an rat model of postmenopausal bone loss, had shown promising and beneficial effects on the

progress of bone loss and thus, detecting its helpful as a potential therapeutic agent in humans (Abdallah et al., 2010). Moreover, the sage can be helpful against muscle pains and long lasting stress or mental tension. In addition, sage can be used as mouthwash against sore throat, infected gingiva, mouth ulcer and cold. There is aroma like camphor, thujone within sage oil therefore it is used in perfume industry. Since this plant has sedative effect on sweat glands, it was reported that sage decreases sweat secretion in hand, foot, armpit zone and the whole body (Mohammad, 2011).

Akkawi et al. (2012) stated in their study that the mechanism of inhibition is probably through formation of a complex between active compounds in sage extract and ferriheme; this complex prevents the formation of B-hematin.

Osman and Abd El-Azime (2013) stated in their research that on investigate the oxidative stress and the role of gamma irradiation in brain damage, revealed that sage extract possibly has a protective role against radiation induced oxidative stress and alteration of enzymes activities in the brain. For this reason, sage may encourage patients undergoing radiotherapy to improve general health condition (Table 5)

Table 5. The amount of enzyme activities in the brain in the different animal groups

Enzyme	Animals Groups			
	Control	**Radiation**	**Sage tea**	**Sage tea+Radiatin**
TBARS (n mol/g protein) thiobarbituric acid reactive substances	397.80±7.85^{c}	478.10±8.99^{a}	388.54±5.00^{c}	413.04±7.87^{b}
PCC (n mol/g protein) protein carbonyl content	4.00±0.71^{c}	5.83±0.56^{a}	3.98±1.03^{c}	4.30±0.66^{b}
NO (n mol/g protein) nitric oxide	23.12±1.25^{c}	45.00±3.14^{a}	23.60±1.27^{c}	34.65±1.98^{b}
SOD (U/g tissue) superoxide dismutase	7.51±0.17^{a}	5.38±0.25^{c}	7.57±0.21^{a}	6.63±0.16^{b}
CAT (U/g tissue) catalase	5.74±0.28^{a}	3.60±0.24^{c}	5.51±0.24^{a}	4.52±0.19^{b}
GSH (mg/g tissue) glutathione	26.37±0.95^{a}	13.63±0.94^{c}	28.41±1.97^{a}	20.37±1.45^{b}
ALP (U/100 mg tissuse) alkaline phosphatase	65.28±4.75^{c}	93.19±8.11^{a}	63.38±5.29^{c}	74.20±3.71^{b}
ACP (U/100 mg tissuse) acid phosphatase	85.20±1.02^{c}	126.13±2.78^{a}	83.79±5.41^{c}	93.70±2.35^{b}
LDH (U/mg protein) lactate dehydrogenase	5.74±0.20^{c}	8.52±0.52^{a}	5.70±0.19^{c}	7.41±0.37^{b}
AchE (n mol/mg protein) acetylcholinesterase	138.50±7.12^{c}	363.97±11.00^{a}	142.26±2.01^{c}	183.60±9.88^{b}

Values are expressed as means of 6 records ± Standard Error
Means with different superscripts are significantly different at the 0.05 level

In a study done on **performed to investigate the hypoglycemic effect of *Salvia officinalis* on blood glucose, glycosylated hemoglobin (HbA1c), lipid profile, liver and kidney function tests in diabetic patients,** results showed that *Salvia officinalis* might be beneficial in diabetic patients to reduce two-hour postprandial (2hpp) and cholesterol (**Behradmanesh et al., 2013)**

In their study, Cenić-Mıloševıć et al. (2013) investigated the antiproliferative effects of water extracts of previously obtained ethanolic dry extracts of three different medicinal plants (*Echinacea angustifolia, Salvia officinalis* and *Melissa officinalis*) on cell lines derived from human cervix adenocarcinoma (HeLa cells). The extract of *Salvia officinalis* also showed a good cytotoxic activity against HeLa cell lines; the IC50 value was 70.41 μg/ml. In their study were investigated the antiproliferative properties of *Salvia officinalis* extracts in the HeLa cell line derived from human cervix adenocarcinoma. The study was show that antiproliferative properties are exhibited by *Salvia officinalis*.

In the research on treatment of liver disease indicate that essential oil of *Salvia officinalis* possessed a hepatoprotective activity against hepatotoxicity induced by paracetamol model due to their antioxidant activity. As a result of the activity of antioxidant enzymes are significantly increased in pretreated extract rat liver homogenate.

Inhibition (%) of reaction reactive rate by oils of Salvia in vitro was determined that it is a potent free radical scavenger (El-Banna et al., 2013; Table 6-7).

Table 6. Effect of treatments on the levels of lactate dehydrogenase (LDH), lipid peroxides (TBARS) in serum and liver of rats

Group	Dose (mg/kg b. wt.)	LDH (U/g protein)		TBARS (nmol/ml)	
		Serum of rats (n=7)	Liver of rats (n=7)	Serum of rats (n=7)	Liver of rats (n=7)
Control healty	0.0	188.00±6.78^{c}	308.24±2.57^{b}	2.47±0.17^{b}	268.2±1.58^{b}
Paracetamol	500 mg/kg b.w	530.4±7.45^{a}	760.42±3.16^{a}	7.85±0.46^{a}	785.54±2.68^{a}
Salvia officinalis	50 mg/kg b.w	164.7±4.21^{c}	270.5±3.36^{b}	1.8±0.11^{c}	185.7±2.36^{b}
Salvia officinalis + Paracetamol	50 mg/kg b.w + 500 mg/kg b.wt	274.00±3.46^{b}	335.47±2.68^{b}	3.2±0.21^{b}	295.3±1.27^{b}

Values within a column with no common superscript letters are significantly different (P ≥ 0.05).

Table 7. Effect of treatments on the levels of reduced glutathione (GSH) and activities of superoxide dismutase (SOD), alanine transaminase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) in blood of rats and rats

Group	Dose (mg/kg b. wt.)	GSH (mg/%)	SOD (U/g Hb)	ALT (U/ml)	AST (U/ml)	ALP (U/ml)
		Blood of rats (n=7)			Rats (n=7)	
Control healty	0.0	55.2±3.89^{a}	15.2±2.37^{a}	82.8±2.24^{a}	133.4±1.96^{a}	135.8±2.63^{a}
Paracetamol	500 mg/kg b.w	32.5±0.24^{b}	7.54±0.27^{b}	124.5±5.0^{b}	263.0±7.68^{b}	229.4±1.91^{b}
Salvia officinalis	50 mg/kg b.w	70.5±4.38^{a}	18.7±0.57^{a}	76.8±4.16^{a}	148.0±4.96^{a}	127.6±1.58^{a}
Salvia officinalis + Paracetamol	50 mg/kg b.w + 500 mg/kg b.wt	51.2±1.35^{a}	13.6±0.19^{a}	79.4±4.62^{a}	139.2±2.59^{a}	136.6±2.87^{a}

Values within a column with no common superscript letters are significantly different (P ≥ 0.05).

Rosmarinic acid is an ester of caffeic acid present in of the *Lamiaceae* family including *Salvia officinialis.* The antioxidant and anti-inflammatory effects of rosmarinic acid make it a valuable tool in the treatment of allergic conditions, especially respiratory allergies (Jill Stansbury, 2014).

Vladimir-Knežević et al. (2014) showed in their study that Lamiaceae species containing multifunctional phenolic and terpenic components that can affect different targets, such as acetylcholinesterase (AchE) activity and oxidative stress, may have great relevance in the prevention and therapy of Alzheimer's disease (AD) and other neurodegenerative disorders.

Sage has been reported to assist the brain in the fight against Alzheimer's disease. Sage contains the antioxidants carnosic acid and rosmarinic acid. These compounds are thought to protect the brain from oxidative damage (Singhal et al., 2014).

The sage which is a medical and aromatic plant is used as spice, protection methods and prolong shelf life successfully in food. The sage delays or decreases formation of microorganisms, therefore used in order to prevent spoiling of food. The sage can be used as alternative protective material in foods and in pathogen control. In order to prevent or delay oxidative deformation, sage which contains antioxidant material is used as additive material in foods. *Salvia officinalis* has a commercial importance in food industry as resource of natural antioxidant. Some researchers determined that there is a firm relation between food and medical natural antioxidant resources, phenolic components and antioxidant activity quality. In the studies carried out in this issue, it was stated that antioxidant effect of sage is especially depends on phenolic components (Table 3). Phenolic components found in the sage are rosmarinic acid, carnosic acid, salvianolic acid, flavonoids, cinnamic acid derivatives, coumarins, tocopherols and phenolic acids

(Sensoy, 2007). Sage includes carnosic acid, carnosol and metyl carnosate components and have strong antioxidant activity according to thyme species (Pizzale et al., 2002)

In the studies made on salvia plant it is found that its antioxidant features are related to rosmarinic acid and carnosic acid. The phenolic compounds in salvia are rosmarinic acid, carnosic acid and salvianolic acid (Sensoy, 2007). In another study, salvia was added to the drinking water of rats and mice for two weeks and as a result, it was seen that salvia has an antioxidant effectiveness (Lima et al., 2005).

Roman et al. (2009) showed in their study that the efficiency of ultrafiltration process by obtaining of *Salvia officinale* concentrated extracts, with a very high antioxidative activity.

In the study on the shelf life of meat, sage extract were found to be a significant effective in improving microbiological quality and prolonging the shelf-life of the minced beef to day seven of retail display (Ahmed and Ismail, 2010).

Since the beetles can cause severe damages in the quality of the seeds and the sage prevents beetle formation in seeds, legumes are stored (Dal et al., 2001) with several sage leaves, so it can be used as an insect repellent. Because the long storage time of legume seeds is important for its physical and biological quality, it was stated that sage can be used for the storage of the seeds (Altındal and Altındal, 2011). In the recent studies, it was focused on that the oil of *Salvia officinalis* can be used for the biologic control of insects. Sage essential oils spread faster than synthetic extracted components and also do not harm useful bugs. So the sage essential oil can be used in biologic insect control.

Sage has allelopathic effect on other plants. Altındal and Altındal (2013) analyzed the allelopathic effect of sge and Turkish oil of thyme under *in vitro* conditions. In the study, sage essential oil increased the germination of the seed and the length of the plant and its root. In another study on this issue, it was stated that it can be used for the germination and the radical growth on *Raphanus sativus* L., *Lactuca sativa* L. and *Lepidium sativum* L. plants (Arminante et al., 2006).

Toxicity and adverse reactions of sage oil

In overuse of sage, nausea, vomiting, stomachache, palpitation, hot flushes and dizziness can be seen and it also may increase the blood pressure of hypertension patients. Since it contains estrogen and stimulates uterine muscles, it should not be used in pregnancy (Winston, 2002) and since it contains features that reduce breast milk (Mills et al., 2006) it should also not be used by nursing mothers. Also because it contains some substances that increase the miscarriage risk, it should not be used by pregnant women. Due to the fact that sage contains camphor substance, it is thought that hepatotoxicity (liver toxicity) and neurotoxicity (neural system toxicity) may be seen in very high doses because of this substance. In very high doses, the toxic effect may be seen in liver and neural system (Khalil and Li, 2011). Besides, sage contains high amounts of thujone substance that may cause contraction and spasm. Thujone substance is a neurotoxin and in overuse indications like formication can be seen.

Initial studies show that sage may have a hypoglycemic effect and may lower the blood sugar (Sá et al., 2009). Accordingly, diabetic patients that use sage should regularly measure their blood sugars.

Epilepsy patients and people with diseases related to neural system accompanied by contractions should not use sage more than that is used in food (Baricevic and Bartol, 2000). The reason of this is the thujone substance that may stimulate contractions and is toxic in high doses.

Arıca et al. (2012) stated that the accidental oral usage of the sage essential oil, which was prepared by an herbalist to be applied to the skin, by a two-month-old baby, caused convulsional poisoning.

Adekomi et al. (2013) analyzed the effects of sage leaf extract on the kidney and livers of male Sprague Dawley rats and in the study they determined that sage is neither hepatotoxic nor nephrotoxic on rats' kidneys and livers.

REFERENCES

Abdallah I.Z.A., Khattab H.A.H., Sawiress F.A.R., El-Banna R.A.S., 2010. Effect of *Salvia officinalis L.* (sage) herbs on osteoporotic changes in aged non-cycling female rats. Med. J. Cairo Univ., 78(1), 1-9

Adekomi D.A., Afodun A.M. Quadri, K.K., Adeniyi, T.D., 2013. Adoption of improved millet varieties by farmers in Argungu local government area of Kebbi State. Scientific Journal of Biological Sciences, 2(2) 32-38

Ahmed A.M., Ismail T.H., 2010. Improvement of the quality and shelf-life of minced_beef mixed with soyprotein by sage (*Saliva officinalis*). African Journal of Food Science, 4(6), 330-334

Akkawi M., Sharif A.A., Salem K., Saleh A., AbuRemeleh Q., 2012. Wild sage (*Salvia officinalis*) as a potential anti-malarial drug. Malaria Journal, 11(Suppl 1):P3

Al-Maamori J.A.I., 2011. Evaluation of the anti-motility-Related diarrhoeal activity of the sage tea *Salvia officinalis* L. in laboratory mice. International Journal of Biology, 3(4), 36-40

Altındal D., Altındal N., 2011. The effects of sage volatile oil (*Salvia officinalis*) and Turkish oregano volatile oil (*Origanum onites*) on stored cowpea (*Vigna sinensis L.*) seed. Journal of Medicinal Plants Research, 5(20), 5017-5020

Altındal N., Altındal D., 2013. Allelopathic effect of sage and turkish oregano volatile oils on *in vitro* in sainfoin (*Onobrychis viciifolia*). Journal of Essential Oil Bearing Plants, 16(3), 328-333

Arıca V., Arıca S., Tutanç M., Motor S., Motor V.K., Doğan M., 2012. Convulsion in infants as a result of oral use of garden sage. Turkish Archives of Pediatrics, 47, 70-71

Arminante F., De Falco E., De Feo V., De Martino L., Mancini E., Quaranta E., 2006. Allelopathic activity of essential oils from mediterranean labiatae. I. International Symposium on the Labiatae: Advances in production, biotechnology and utilisation. ISHS Acta Horticulturae, 30 November, 72

Baricevic D., Bartol T., 2000. Sage. The Genus *Salvia* (Edited by Kintzios, S.E). V. Pharmacology 11. The Biological/Pharmacological Activity of the Salvia Genus. OPA (Overseas Publishers Association) N.V. Published by license under the Harwood Academic Publishers imprint, part of the Gordon and Breach Publishing Group. pp 143 -184

Behradmanesh S., Derees F., Rafieian-kopaei M., 2013. Effect of *Salvia officinalis* on diabetic patients. Journal of Renal Injury Prevention, 2(2): 51-54

Böszörmenyi A., Hetnelyi E., Farkas A., Horvath G., Papp N., Lemberkovics E., Szoke E., 2009. Chemical and genetic relationships among sage (*Salvia officinalis* L.) cultivars and Judean sage (*Salvia judaica* boiss.). J. Agric. FoodChem, 57, 4663-4667

Cenić-Mıloševıć D., Tambur Z., Bokonjic D., Ivancajic S., Stanojkovic T., Grozdanic N., Juranic Z., 2013. Antiproliferative effects of some medicinal plants on hela cells. Arch. Biol. Sci., 65(1), 65-70

Charantimath S., Oswal R., 2011. Herbal therapy in dentistry: A review. Innovative Journal of Medical And Health Science, 1(1) 1-4

Dal B.G,, Pnadin S., Lopez I.C., Fabrizio M., 2001. Laboratory evaluation of chemical-biological control of the rice weevil (*Sitophilus oryzae* L.) in stored grains. J. Stored Prod. Res., 37, 77-84

El-Banna H., Soliman M., Al-wabel N., 2013. Hepatoprotective effects of thymus and *Salvia* essential oils on paracetamol-induced toxicity in rats. Journal of Physiology and Pharmacology Advances, 3(2), 41-47

EMA (European Medicines Agency) 2010. Committee on herbal medicinal products (hmpc). Assessment report on *salvia officinalis* L., folium and *salvia officinalis* L., aetheroleum. *European Medicines Agency*, 1-39. London

Fischer J., Dethlefsen U., 2013. Efficacy of cineole in patients suffering from acute bronchitis: a placebo-controlled double-blind trial. Cough, 9(25), 1-5

Jill Stansbury N.D., 2014. Rosmarinic acid as a novel agent in the treatment of allergies and asthma. Journal of Restorative Medicine, 3, 121-126

Khan A., Rehman N., AlKharfy K.M., Gilani A.H., 2011. Antidiarrheal and antispasmodic activities of Salvia officinalis are mediated through activation of K+ channels. Bangladesh J Pharmacol., 6, 111-116

Lima C.F., Carvalho F., Fernandes E., Bastos M.L., Santos-Gomes P.C., Fernandes-Ferreira M., Pereira-Wilson C., 2006. Evaluation of toxic/protective effects of the essential oil of *Salvia officinalis* on freshly isolated rat hepatocytes. Cristóvão Fernando Macedo Lima, C. F. M. Effects of Salvia officinalis in the liver: Relevance of glutathione levels. 53-69. Universidade do Minho. Escola de Ciências

Lima C.F., Andrade P.B., Seabra R.M., Fernandes-Ferreira M., Pereira-Wilson C., 2005. The drinking of a *Salvia officinalis* infusion improves liver antioxidant status in mice and rats. J Ethnopharmacol., 97(2), 383-389

Mills E.J, Dugoua J.J, Perri D., Koren G., 2006. Herbal medicines in pregnancy and lactation-an evidence-based approach. 1st ed. London, UK: Taylor & Francis Group

Mohammad S.M., 2011. A study on sage (*Salvia officinalis*). Journal of Applied Sciences Research, 7(8), 1261-1262

Moram G.S., 2001. Effect of aqueous extracts from some plants on alloxan-diabetic rats. The Egyptian Journal of Hospital Medicine, 2, 57-69

Osman N.N., Abd El-Azime A. Sh., 2013. *Salvia officinalis* L. (sage) ameliorates radiation-induced oxidative brain damage in rats. Arab Journal of Nuclear Science and Applications, 46(1), 297-304

Perry N.S.L., Menzies R., Hodgson F., Wedgewood P., Howes M-J. R., Brooker H.J., Wesnes K.A., Perry E.K., 2018. A randomised double-blind placebo-controlled pilot trial of a combined extract of sage, rosemary and melissa, traditional herbal medicines, on the enhancement of memory in normal healthy subjects, including influence of age. Phytomedicine, 39, 42-48

Pizzale L., Bortolomeazzi R., Vichi S., Überegger E., Conte L.S., 2002. Antioxidant activity of sage (*Salvia officinalis and S fruticosa*) oregano (*Origanum onites* and *O indercedens*) extracts related to their phenolic compund content. J. Sci.Food Agric., 82, 1645-1651

Khalil R., Li Z-G., 2011. Antimicrobial activity of essential oil of *Salvia officinalis* L. collected in Syria. African Journal of Biotechnology, 10(42), 8397-8402

Roman G.P., Neagu E., Radu G.L., 2009. Antiradical activities of *salvia officiınalis* and *viscum album* L. extracts concentrated by ultrafiltration process. Acta Sci. Pol. Technol. Aliment., 8(3), 47-58

Sá C.M., Ramos A.A., Azevedo M.F., Lima C.F., Fernandes-Ferreira M., Pereira-Wilson C., 2009. Sage tea drinking improves lipid profile and antioxidant defences in humans. International Journal of Molecular Sciences, 10, 3937-3950

Sabbaghzadeh R., 2013. Botanical medicines. Nationalpark-Forschung in der Schweiz, 102(11), 1412-1425

Sensoy N.D., 2007. Obtaining of natural antioxidant from sage leaves (*Salvia Officinalis*) with supercritical carbon dioxide extraction (M. Sc. Thesis). Gazi University, Institute of Science And Technology, 108 pp., Ankara

Singhal A.K., Naithani V., Bangar O.P., 2014. Medicinal plants with a potential to treat Alzheimer and associated symptoms. International Journal of Nutrition, Pharmacology, Neurological Diseases, 2(2), 84-91

Vladimir-Knežević S., Blažeković B., Kind M., Vladić J., Lower-Nedza A.D., Brantner A.H., 2014. Acetylcholinesterase inhibitory, antioxidant and phytochemical properties of selected medicinal plants of the Lamiaceae family. Molecules, 19, 767-782

Winston D., 2002. Herb-drug interactions and herb toxicity: myths, facts and theory. Paper presented at: Southwest Conference on Botanical Medicine; April 5-6, 2002; Tempe, Ariz

(ORAL PRESENTATION)

Effect of Different Organic Materials on Strawberry Seedling Yield

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Abstract

The population of the world is increasing day by day and the value of agricultural production is also emerging in order to meet the nutritional needs of this population. Agricultural areas need to be protected in order to meet these nutritional needs. However, in recent years, pollution in the agricultural areas and the deterioration of natural resources have not only affected human health but also caused the destruction of nature. For this reason, organic agriculture, which is a production system that will affect the nature and human health in the world at least, has been accepted and has increased every year. The most important problem of strawberry cultivation is undoubtedly the difficulties in supplying healthy seedlings. Also, as in all fruit species, selection of varieties in strawberry cultivation is of great importance. It is possible to produce high quality and satisfactory production, but the seedlings, which are the plant material, with high efficiency and high-quality varieties to ensure the production of seedlings free from diseases and pests. In this study, the use of different organic fertilizers and strawberry seedlings without using synthetic chemicals, pesticides or synthetic fertilizers in strawberries, which have been used in many areas in recent years and the consumption of which is used in different ways, is mentioned.
Keywords: Organic fertilizer, Strawberry, Seedling

Introduction

Berries are in the group of berries. Strawberry's homeland is North and South America. Along with the temperate climate zones of the northern hemisphere, the Southern hemisphere is also widely cultivated. The United States, Europe, South and East African countries, New Zealand, Australia, and Japan are the countries that produce the most strawberries. Strawberry fruit is widely used in the production of jam, marmalade, ice cream, pastry, and liquor as well as fresh consumption. In addition, it can be stored in the deep freeze, canned, fruit juice is obtained and has become an indispensable part of industrial establishments producing milk and yogurt in recent years (Özdemir, 1999). Strawberry cultivation has an increasing potential in the world and in our country. Strawberry cultivation in almost every region of our country allows strawberry fruit to be available in the market for a longer period of time. The fact that strawberries can be sold especially in the season when other fruits are not available in the market provides a good source of income for the producers, while at the same time it is a pleasant species that appeals to the palate and satisfies the need for fruit (Kılıçel, 2005). Another factor that is effective in strawberry growing is the benefits of strawberry for human health and nutrition. This fruit is especially rich in vitamin C and can be up to 100 mg in 100 grams of vitamin C, 92 g water, 0.6 g protein, 0.4 g fat, 0.5 g fiber is available. Strawberry is also rich in cellulose, which plays an important role in facilitating digestion. It is now known that strawberries have cancer prevention properties due to their high content of ellagic acid. In addition, 100 g of strawberry fruit yields 40-45 calories and contains a significant amount of salicylic acid, vitamins A, B, calcium, iron, phosphorus and a small amount of bromine, silicon, iodine and sulfur (Özdemir, 1999).

Studies on strawberry seedling production showed that the seedlings obtained from the plants grown at high altitudes were more tight and rich in carbohydrates. These seedlings were grown in lower altitude regions and it was found that higher amounts, earlier and better quality fruit production was possible than the cultivation with seedlings obtained from lowland conditions (Türemiş et al.,1996). In a study conducted to determine the effects of seedlings locations on yield and quality, it was determined that seedlings produced in highland conditions gave better results than seedlings produced in lowland conditions. It was reported that obtaining seedlings from the plateau conditions affected the yield and quality positively (Donnan, 1998).

The use of various agricultural inputs (synthetic mineral fertilizers, synthetic chemical pesticides, etc.) has increased, especially in order to increase production in agriculture due to the rapid increase of the world population and rapid development in industrialization in recent years. As a result of this, the remnants of pharmaceutical products, degradation of natural balance and environmental pollution have become a threat to human health and the sustainability of natural resources. Due to these negativities, producers and consumers come together and aim to re-establish the ecological balance, which is disrupted by faulty practices, by using conscious agricultural techniques and natural inputs, together with live and sustainable agro-ecosystem. put forward the idea (Anonymous, 2004). Organic farming; without using synthetic chemical inputs and drugs in production; It is a controlled and certified form of agricultural production, from production to consumption, with the use of inputs permitted under regulations. The aim of organic agriculture; soil and water resources and air pollution, environmental, plant, animal and human health are to protect the maximum degree (Kirazlar, 2001). Many studies conducted today show that most of the organic materials, which are considered as waste, can be a source of organic matter and plant nutrients by direct addition to soils or they can be used as a growth rate with mixtures (Özenç, 2004; Benito et. al, 2005a, b). The most important source of organic matter in our country is barn manure (Bayındır et.al, 2004). However, it has been determined that many vegetable wastes can be a good source of organic matter (Sönmez et.al., 2002., Kütük and Çaycı 2005). The amount of organic matter that the plant wastes provide to the soil varies depending on the amount of waste, the type of plant, the cultivation method and climatic conditions.

Hancock et al. (1999), strawberries yield per plant and a positive relationship between the number of plants produced by the plants stated that the fry.

Türemiş (1996) as a result of the seedling production experiment made by the seedlings, showed significant differences in terms of body thickness, the fruit yield potential of thick-stemmed seedlings has been found to be higher. The researcher obtained more seedlings from Adana, October, November and December plantings compared to April and May plantings. It was also emphasized by Türemiş (1996) that taking the planting date earlier than the normal planting date (April) causes increases in the arm yield. The use of refrigerated strawberry seedlings in Turkey yet fully settled, the seedlings are still observed that some strawberry growers in obtaining parcels of production. It has been shown in some studies that this situation increases the yield potential as well as increases many diseases and pest problems. Seedlings obtained from seedlings, production parcel seedlings and earliness and plant development, yield and quality are superior to the results revealed in the studies (Kaşka et al., 1984).

Hart et al. (2000) stated that strawberries respond better to soils with organic matter, adding straw or green fertilization before planting in plant breeding; recommended plant to be tested for soil performance before planting. The same investigators stated that the application of 3.4-4.5 kg N/da may be sufficient during planting in strawberries. Strawberry plant during planting or after planting; it is recommended to give nitrogen to 3.97–5.67 kg/ha in order to improve the growth of the plants, rooting and arm formation (Mahler and Barney, 2000). Many studies have been conducted on the effects of strawberry seedling quality on fruit yield. It is stated that the yield is higher in the cultivation with coarse stem seedlings (stem diameter more than 10 mm) (Zurawicz and Dominikowski, 1993).

It is stated that the burnt farm manure is very expensive and increasing the weed problem in the field increases the cost and thus the producers are looking for different materials that increase the yield and quality (Türemiş et al., 1996).

Burnt farm manure, which positively changes the physical characteristics of the soil, has the power to absorb more nutrients; It is stated that nutrient ions which are held in the solid phase in the soil are partially released by burnt farm manure and therefore chemical fertilizers applied to the soil can be transported more from soil to plants, especially phosphorus (Türemiş et al., 1996).

Within the scope of organic agriculture as fertilizer and soil conditioner; manure, fertilizer sherbet, plant residues (green manure plants), peat, mushroom production waste and other organic media, straw, compost of plant residues, organic household waste composts, bark, wood waste, seaweed, animal waste and their processed products (leather dust, raw bone, leather dust, blood dust, meat, horn and nail, hair and wool wastes, etc.), various rocks (limestone, tuff, phosphate rock, etc.), sulfur and rock flour have been reported to be used (Gaur,1992) .

Guvenc and Yildirim (1999), horticultural crops in the growing demand for organic materials that improve the soil with each passing day of different organic residues stated that it is compulsory to be reworked.

Results

Organic strawberry seedling cultivation seems possible under these conditions. However, only green fertilization and farm manure are not sufficient for the nutrition of the plant, and for this purpose, the use of natural rocks and humic acid sources permitted in the regulation of organic agriculture is required. For this purpose, it is necessary to carry out more extensive researches in which such materials will be tested in the future. Cultural measures in organic strawberry cultivation, soil management, the usability of different organic nutrients, disease, weed, and weed control methods and preparations that can be used in the struggle against the development and transfer of these studies to producers is very much needed.

References

Anonymous, 2004. "Ekoloji İstanbul 2004". Cine tarım Dergisi, Nisan 2004, Sayfa: 36.

Bayındır, Ş., Şahin, S., Uysal, F. 2004. Türkiye'de Çiftlik Gübresi Kullanım Potansiyeli. Türkiye 3.Ulusal Gübre Kongresi, Tarım-Sanayi-Çevre, 11–13 Ekim, 2004. ss 735.

Benito, M., Masaguer, A., De Antonio, R., Moliner, A. 2005b. Use of Pruning Waste Compost as a Component in Soilless Growing Media. Bioresource Technology 96, 597–603.

Benito, M., Masaguer, A., Moliner, A., De Antonio, R. 2005a. Chemical and Physical Properties of Pruning Waste Compost and Their Seasonal Variability. Bioresource Technology. Article in Press.

Donnan, R. 1998. Hydroponics around the world. Practical Hydroponics&Greenhouses July/August 1998: 18-25.

Gaur, A. C., 1992. In Fertilizers, Organic Manures, Recycable Wastes and Biofertilizers ed. H.L.S., Tanden. New Delhi, India, 36–51.

Güvenç, İ., Yıldırım, E. 1999. Sebze Yetiştiriciliğinde Organik Artıkların Değerlendirilmesi. Türkiye 1. Ekolojik Tarım Sempozyumu, Sempozyum Kitabı Sayfa: 297–301. 21–23 Haziran 1999, İzmir.

Hancook, J.F. 1999. Strawberries crop production science in horticulture; 11.ISBN. 0-85-199-339-7.

Hart, J., Righettı, T., Sheets, A., Martin, L. W. 2000. Strawberries (Western Oregon- West of Cascades) Oregon State University, Fertilizerguide FG 14 Reprinted.

Kaşka, N., Çınar, A., Eti, S. 1984. Adana ve Pozantı'da yetiştirilen fidelerin çileklerde erkencilik verim ve kalite üzerine etkileri. Doğa Bilim Dergisi, Cilt:8, Sayı:3. Ankara.

Kılıçel, İ. 2005. Bazı Çilek çeşitlerinin Van Ekolojik Koşullarında Fide verim Özelliklerinin Belirlenmesi. Y.Y Üniv. Fen Bilimleri Enstitüsü Bahçe Bitkileri Ana Bilim Dalı.

Kirazlar, N. 2001. Ekolojik (Organik) Tarım Mevzuatı. Türkiye 2. Ekolojik Tarım Sempozyumu, Sempozyum Kitabı. Sayfa: 11–19. 14–16 Kasım 2001, Antalya

Kütük, C., Çaycı, G. 2005. Effect of Beer Factory Sludge on Yield Components of Wheat and Some Soil Properties. http://toprak.org.tr/isd/isd_57.htm Martinez, F., J. A. Oliveira, E. O. Calvete, and P.

Mahler, R.L., Barney, D.L. 2000. Blueberries, Raspberries and Strawberries, CIS 815, Northern Idaho Fertilizer Guide, University of Idaho, Moscow.

Özdemir, E. 1999. Çilek Yetiştiriciliği. T.C. Tarım ve Köyişleri Bakanlığı, Teşkilatlanma ve Destekleme Genel Müdürlüğü, Yayım Dairesi Başkanlığı. Ankara.

Özenç, N. 2004. Fındık Zurufu ve Diğer Organik Materyallerin Fındık Tarımı Yapılan Toprakların Özellikleri ve Ürün Kalitesi Üzerine Etkileri. Ankara Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi.

Sönmez, S., Kaplan, M., Orman, Ş., Sönmez, İ. 2002. Antalya-Kumluca Yöresi Domates Seralarında Hasat Sonrası Bitkisel Atıklarla Kaldırılan Besin Maddeleri Miktarları ve Bu Atıkların Değerlendirilmesi İle İlgili Öneriler. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 15 (1), 19–25.

Türemiş, N., Kaşka, N., Kaya, Z., Özgüven, A.I. 1996. Doğal Kaynakların Sürdürülebilir Kullanımı. Tarım-Çevre İlişkileri Sempozyumu. Sayfa: 171–178. 13- 15 Mayıs1996, Mersin.

Türemiş, N., Özdemir E., Kaşka, N. 1996. Bazı Önemli Çilek Çeşitlerinde Değişik Dikim Mesafelerinin Fide Verim ve Kalitesi Üzerine Etkileri, Bahçe, 25(1-2): 3-10.

Zurawıcz, E., Domınıkowskı, J. 1993. Influence of Low Winter Temperatures on Growth and Fruiting of Elsenta Runner Plants in Poland.

(ORAL PRESENTATION)

INVESTIGATIONS ON *IN VITRO* PROPAGATION OF BLACK MULBERRY

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Abstract

In this study a micropropagation protocol was developed for *Morus nigra* L. (black mulberry) using shoots of nodal explant obtained from glutton branch of adult tree. Explants were placed onto MS (Murashige and Skoog) medium containing 1 mg /L IBA (indole butyric acid)+0.50 mg/LBAP (benzyl amino purine), 1 mg/lIBA + 0.75 mg/l BAP), 1 mg/l IBA + 1 mg/l BAP, 2 mg/l IBA + 0.50 mg/lBAP, and 2 mg/l IBA 2 mg/l IBA + 0.75 mg/lBAP, and 2 mg/l IBA + 1 mg/l BAP after sterilization. The cultures were incubated in a culture room at 24±2 ºC with a 16-h photoperiod under 2500 lux light irradiance explants. The MS basal medium during the rooting stage was supplemented with 0, 4, 6 and 8 mg/l NAA (naftalen acetic acid). The highest shoot number (5.40) and shoot lenght (1.43 cm) were obtained from 1 mg/l IBA + 0.50 mg/l BAP and 2 mg/l IBA + 1 mg/l BAP combination, respectively. For rooting stage, different concentrations of NAA (0, 4, 6, and 8 mg/l) were added. 8 mg/l NAA gave the highest rooting percentage (84 %) during the rooting stage.

Key words: *Morus nigra*, tissue culture, nodal explant, BAP

INTRODUCTİON

Mulberry (*Morus* sp.) has been domesticated over thousands of years and has been adapted to a wide area of tropical, subtropical, and temperate zones of Asia, Europe, North and South America, and Africa. There are approximately 68 mulberry species (*Morus*) in the World (Davis, 1972)**.** Mulberry is well known for its economic importance in the sericulture industry as its foliage is used as food for silkworms. About 1000 species of mulberry are cultivated worldwide and could be classified into foliage, fruit, timber or ornamental use. Conventionally, techniques for the propagation of mulberries involve cutting, grafting and sowing seeds, depending on the cultivar. Certain limitations exist for cutting and grafting, such as low survival rate, difficulty rooting and low multiplication rate due to the physiological state or environmental factors (Lu, 2002). It is a perennial tree or shrub as an a large number of uniform plantlets in a short time and economically important plant used for sericulture The offer potential means not only for rapid mass economic importance of mulberry is primarily due to its multiplication of existing stocks but also for the leaf, which is being used for feeding the silk producing (Ercişli and Orhan 2007).

Conventionally, mulberry is propagated by cuttings as well as through seeds. Often cuttings prove difficult to root, thus posing problems for mulberry breeders. Propagation through seed is undesirable because of enormous heterozygosity in the plants resulting from cross pollination. (Anis, 2003). Tissue culture techniques such as micropropagation provide a fast and dependable method for production of a large number of uniform plantlets in a short time and offer potential means not only for rapid mass multiplication of existing stocks but also for the conservation of important, elite and rare plants (Zaki et al.,2011). Tissue culture techniques such as micropropagation Mulberry belongs to the Moraceae family and to the provide a fast and dependable method for production of genus *Morus*. The offer potential means not only for rapid mass economic importance of mulberry is primarily due to its multiplication of existing stocks but also for the leaf, which is being used for feeding the silk producing conservation of important, elite and rare plants. Plant cell and tissue mulberry varieties with higher leaf yield are importantculture has contributed significantly to Crop improvement to sustain profitability in sericulture (Zaki et. al., 2011). Since mulberry fruit is good for human consumption, many commercial products such as jam, marmalade, frozen des-serts, pulp, juice, paste, ice cream, and wine are produced

from it (Koyuncu 2004). *M. nigra* fruit has good source of directly derived from the proteins of the mulberry leaves several phytonutrients and contain high amounts. For targeted crop improvement through biotechnological approaches, attempts have been made to standardize in vitro regeneration protocols in different mulberry varieties. The rapid development of tissue culture technology provides an alternative method to mass produce certain plants with desirable traits.
The present study was undertaken to determine the culture conditions for rapid induction, regeneration and proliferation of mulberry plants.

MATERIAL AND METHOD

The plant material of the research consisted of black mulberry trees which grow naturally in Mahmatlar region of Isparta. Shoots of nodal explant obtained from glutton branch of adult tree were used for explant. Firstly samples were washed first in tap water. Then 70% ethyl alcohol solution for 3 minutes, following into 1-2 drops of Tween 20 added 10% sodium hypochlorite solution 20 min. After 3 repeats with sterile distilled water for 5 minutes sterilization has been completed. Murashige and Skoog's basal medium was used. For the preparation of a given volume of MS medium, the desired volume of the stock solution from macrosalts, microsalts, vitamins and iron source were added to known quantity of double distilled water. To this solution 30 g/L sucrose and 1g/L agar was added. This solution was heated till agar got dissolved completely. It was then cooled and the pH of medium adjusted between 5.6-5.8 using 0.1 N NaOH or 0.1N HCl. Prepared MS medium 10 ml in 2.5x15 cm culture tubes autoclaved at 121 ^{0}C, 1.2 atmospheric pressure.

Control (Basal MS medium), 1mg/l IBA + 0.50 mg/l BAP, 1mg/l IBA + 0.75 mg/l BAP ; 1 mg/l IBA + 1mg/l BAP; 2 mg/l IBA + 0.50 mg/l BAP, 2 mg/l IBA + 0.75 mg/l BAP; 2mg/l IBA + 1 mg/l BAP combinations were used for shoot regeneration stage; and for the rooting stage 0, 4, 6, 8 mg/l NAA added.

Sterilization was performed for 15 minutes. The cultures were incubated in a culture room at 24±2 ^{o}C with a 16-h photoperiod under 2500 lux light. After 45 days of inoculation, the numbers of shoots per explant (shoots/explant), average shoots length (cm), were determined.

Statistical Analyzes

Statistical analyses were performed with the General Linear Model using SPSS (V.22; Statistical software, SPSS. Inc., USA). Analysis of variance was performed. The differences among means were analyzed using the Duncan's multiple range test at $P < 0.05$ significance.

RESULTS AND DİSCUSSİON

The effects of growth regulators on different shoots and average shoot lengths in different combinations were statistically significant ($p<0.05$) (Table 1). The number of shoots from 2.98 in the control medium was 5.40 in the medium with 1 mg / l IBA + 0.50 mg / l BAP. The shortest shoot length was obtained from the control application with 1.19 cm when the longest were obtained from the application of 2 mg / l IBA + 1 mg / l BAP with 1.46 cm. The highest shoot number (5.40) and shoot lenght (1.43 cm) were obtained from 1 mg/l IBA + 0.50 mg/l BAP and 2 mg/l IBA + 1 mg/l BAP combination, respectively (Figure 1.)

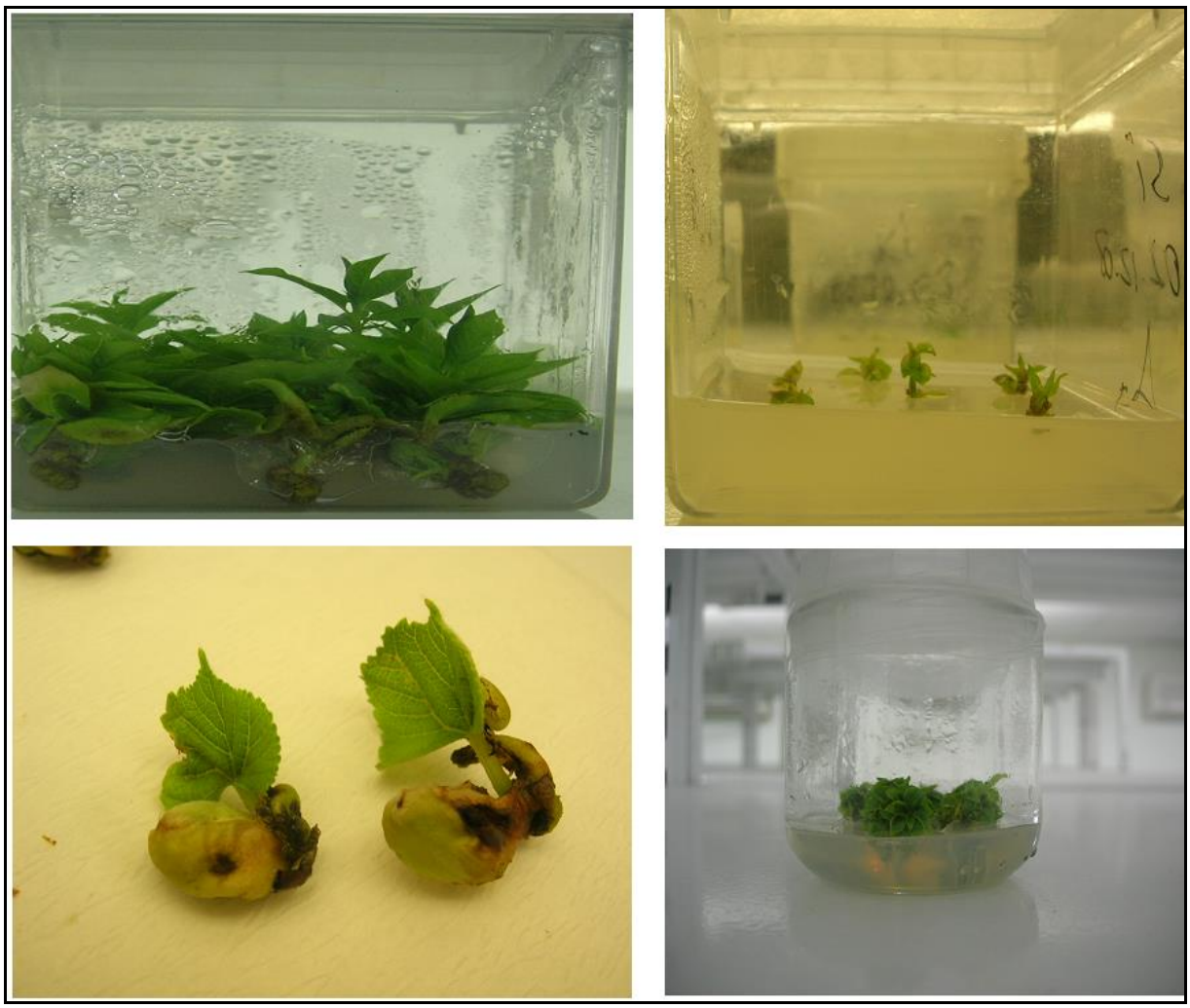


Figure 1. Regenaration of black mulberry nodal segments

Table 1. Effect of different concentrations of IBA and BAP on multiple shoot induction

Medium	Number of shoots	Shoot length (cm)
Control	2.98±0.12d	1.19±0.09c
1mg/l IBA + 0.50 mg/l BAP	5.40±1.58a	1.36±0.05b
1mg/l IBA + 0.75 mg/l BAP	4.74±0.65b	1.39±0.13b
1mg/l IBA + 1 mg/l BAP	4.77±0.34b	1.38±0.96b
2mg/l IBA + 0.50 mg/l BAP	4.79±0.27b	1.38±0.08b
2mg/l IBA + 0.75 mg/l BAP	4.66±0.35c	1.39±0.11b
2mg/l IBA + 1 mg/l BAP	4.72±0.45b	1.43±0.06a

*Values within a column followed by different letters are significantly different ($P < 0.05$).

Concentration of 4, 6, 8 mg/l of NAA effects on rooting percentage and root numbers were found significantly. Rooting percentage was 53.86% in control medium when 84% in added 8 mg/l NAA medium. Number of roots were 11.25 in 8 mg/l NAA whwn the 5.29 in control medium. Application of 8 mg/l NAA was found the best medium for rooting (Table 2)

Table 2. Effect of various concentrations of IBA on root induction

Concentration of NAA	Rooting percentage (%)	Number of roots
Control	53.86	5.29±0.16c
4 mg/l NAA	62.25	6.02±0.45b
6 mg/l NAA	71.36	6.54±0.36b
8 mg/l NAA	84.00	11.25±0.10a

*Values within a column followed by different letters are significantly different ($P < 0.05$).

The nodal segment, which had a pre-existing meristem, is suitable for clonal propagation because it is easily manipulated, has a high proliferation rate and maintains clonal fidelity (Lu, 2002, Vijaya Chitra and Padmaja 1999). The regeneration potential from the nodal segments of *Morus nigra* L as observed in present work was attention creating. On MS medium as control, explants showed no response for a couple of weeks. Same results were obtained by Hussain *et al.* from nodal explants of *Morus laevigata*. The production of shoots from nodal segments was also established by Anis *et al.*. But these workers achieved shoot multiplication by culturing explants on MS medium fortified with BAP (2.5 mg/l) along with Glutamin (1 mg/l).This medium facilitated the elongation of shoots and sprouting of nodal segments from *In vitro* grown micro cuttings. Chitra and Padmaja (1998) reported that *in vitro* proliferated shoots were multiplied rapidly by culture of shoot tips on MS medium with BAP (0.5 and 1.0 mg/l) which produced the greatest multiple shoot formation. Multiplication was also achieved by culture of shoot tips on MS medium with BAP (4.0 mg/l) and GA_3 (0.05 mg/l) which facilitated the elongation of shoots followed by sprouting of axillary buds of in vitro grown shoots and A high frequency of rooting (86.7%) with development of healthy roots was observed from shoots cultured on medium with 2,4-D (1.0 mg/l). Several studies have indicated that themedium composition and culture environment have an important role in the modulation of morphogenic reaction in micropropagation (Amancio et al., 1999; Baker et al., 1999). Desai et al (2018) reported that highest shoot induction response was recorded on Murashige and Skoog (MS) medium supplemented with 2 mgl-1 6-benzylaminopurine (BAP) and 0.2 mgl-1 1-naphthylacetic acid (NAA). During shoot multiplication stage, shoots were best multiplied on MS medium supplemented with 0.2 mgl-1 BAP which produced maximum number of shoots (6.75 ± 0.48) and leaves (29.3 ± 0.85). *In vitro* developed shoots were successfully rooted on MS medium supplemented with 0.5 mgl-1 Indole- 3-butyric acid (IBA) which produced highest number (16.25 ± 0.63) and length (7.30 ± 0.16 cm) of roots. Similarly Anis *et al*. (2003) obtained maximum number of shoots on MS supplemented with 2 mgl-1 BAP + 0.2 mgl-1NAA + 25 mgl-1 aspargine + 1 mgl-1 glutamine. Instead of checking the effect of various auxins and their combinations (NAA, IBA and IAA), present investigation used different concentrations of IBA for *in vitro* root induction. Kalkışım et al. 2013 reported that *the MS* medium, supported with BAP (2.0 mg/L), TDZ (0.1 mg/L) and NAA (0.25 mg/L), was the most effective with respect to trunk regeneration and all other parameters. The shoots obtained from in vitro were taken to rooting mediums. In rooting mediums the best rooting percentage and the number of roots per explant were obtained with a combination usage of BAP (1.0 mg/L) and NAA (0.5 mg/L). Similarly, Zaki et al. (2011) pointed in their study on the micropropagation of black mulberry plants, shoot regeneration values obtained from the media enriched with 0.5 mg / L and 1.5 mg / L BAP were 80% and 90% respectively. The maximum number of shoots and shoot lengths per explant. Sajeevan et al. (2011) obtained a maximum regeneration value of 68.33% from the environments where BAP was 1.0 mg / L in their studies with white mulberry. Our results are supported by the these results.

REFERENCES

Anis, M., Faisal, M., Singh, S. K. (2003). Micropropagation of mulberry (Morus alba L.) through in vitro culture of shoot tip and nodal explants. Plant Tissue Cult, 13(1), 47-51.

Bhau, B. S., Wakhlu, A. K. (2003). Rapid micropropagation of five cultivars of mulberry. Biologia plantarum, 46(3), 349-355.

Chitra, D. V., Padmaja, G. (1999). Clonal propagation of mulberry (Morus indica L. cultivar M-5) through in vitro culture of nodal explants. Scientia Horticulturae, 80(3-4), 289-298.

Davis, P.H.,(1972). Flora of Turkey. IV. Edinburg Uni. Press, Edinburg, 657 p.

Desai, S., Desai, P., Mankad, M., Patel, A., Patil, G., Narayanan, S. (2018). Development of micropropagation protocol for Morus nigra L.(black mulberry) through axillary buds. IJCS, 6(2), 585-589.

Ercisli, S.,Orhan, E. (2007). Chemical composition ofwhite (Morus alba), red (Morus rubra)and black (Morus nigra) mulberry fruits.Food Chemistry,103, 1380–1384.doi:10.1016/j.foodchem.2006.10.054

Hussain, M., S.M. Rehman, A. Zaman, Joader, O.I., Koyuncu, F., (2004). Organic acid composition of and R. Islam, 1992. Micropropagation of M. Laevigata black mulberry. Chemistry of Natural Compounds, wall from mature leaves. Plant Cell Rep., 40: 368-369. 11(10): 522-524.

Kalyoncu, I. H., Ersoy, N., Yılmaz, M., Aydın, M. (2009). Effects of humidity level and IBA dose application on the softwood top cuttings of white mulberry (Morus alba L.) and black mulberry (Morus nigra L.) types. African Journal of Biotechnology, 8(16).

Kalkışım, Ö.,Turan, A., Azeri, F. N., Özdeş, D.,(2013). Kara Dut (Morus nigra L.) Bitkisinin In Vitro Çoğaltımı. Gümüşhane Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 3(2).

Koyuncu, F. (2004). Organic acid composition of black mulberry. Chemistry of natural compounds, 40, 368-369.

Koyuncu F, Vural E, Çelik M.,(2004). Karadut (Morus nigra L.) çeliklerinin köklendirilmesi üzerine ara_tırmalar. Ulusal Kivi ve Üzümsü Meyveler Sempozyumu Kitabı, Trabzon, 424-427.

Lu, M. C. (2002). Micropropagation of Morus latifolia Poilet using axillary buds from mature trees. Scientia Horticulturae, 96(1-4), 329-341.

Murashige, T., Skoog, F. (1962). A Revised Medium For Rapid Growth and Bioassays With TobaccoTissue Cultures. Physiology Plant 15(3), 473- 497.

Sajeevan, R. S., Singh, S. J., Nataraja, K. N., Shivanna, M. B. (2011). An efficient in vitro protocol for multiple shoot induction in mulberry, Morus alba L variety V1. International Research Journal of Plant Sciences, 2(8), 254-261.

Vijaya Chitra, D.S., Padmaja, G., (1999). Clonal propagation of mulberry (Morus indica L. cultivar M-5) through in vitro culture of nodal explants. Sci. Hortic. 80, 289–298.

Zaki, M., Kaloo, Z. A., Sofi, M. S. (2011). Micropropagation of Morus nigra L. from nodal segments with axillary buds. World Journal of Agricultural Sciences, 7(4), 496-503.

(ORAL PRESENTATION)

Improvement of the Rheological Properties of Wheat Flour Doughs Containing Various Concentrations of Grape Seed Flour by Using Glucose Oxidase

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Abstract

The purpose of this study was to improve the rheological parameters of the wheat flour dough substituted with grape seed flours (GSF) by using glucose oxidase (GO). GSF were obtained by separating, drying and grinding of the seeds from the grape pomace that is the by-product of wine industry. Öküzgözü (red grape variety) seed flour (ÖSF) and Narince (white grape variety) seed flour (NSF) was added at 0, 5, and 10% levels in replacement with bread wheat flour. GO was added at 0, 50, and 100 ppm concentrations. The rheological properties of the dough, substituted with ÖSF, NSF and GO were recorded in the texture analyser device by using Kieffer dough extensibility system and the Dobraszczyk/Roberts (D/R) dough inflation system. The substitution of ÖSF and NSF was showed a significant decreasing effect on the area (K_{Area}) under Kieffer force–distance curve simultaneously with the increase of the substitution level. Addition of 50 ppm GO in to ÖSF doughs was led to a significant increase at both Kieffer maximum extensibility (K_{ext}) and $K_{Area.}$ (from 12.80 mm to 20.92 mm and from 164.57 g.s to 325.18 g.s respectively) while addition of 100 ppm GO was not had a similar improving effect. On the other hand improving effect of GO on NSF containing doughs were found at the 100 ppm usage levels of GO by measuring with Kieffer dough extensibility system. Extensional rheology of experimental doughs was measured with the D/R dough inflation system. The substitution of ÖSF or NSF had the significant effect ($P<0.01$) of decreasing the tenacity (P, mm), extensibility (L, mm) and baking strength (W) simultaneously with the increase of the substitution level. The advantage of using GO is clearly evident in dough D/R inflation system values. With the addition of GO, P, L and W values of the doughs increased significantly compared to the ones without GO. In particular, both P and W values of 5% ÖSF or NSF doughs gave similar results with the control sample by using 50 ppm GO. On the other hand, it was found that the rheological properties of dough containing 10% NSF and 10% ÖSF could be partially improved in the case of using 100 ppm GO. As a conclusion, by regarding Kieffer and D/R together; ÖSF or NSF at 5% levels can be added in to bread formulations to benefit their functional properties without impairing dough rheological properties much more. Furthermore rheological properties of their doughs can be improved by using 50 ppm GO.

Key words: Bread, dough, D/R dough inflation system, glucose oxidase, grape seed, rheology, Kieffer,

INTRODUCTION

Grape pomace, includes the skins, seeds and, in some cases, the stems, is obtained as a by-product of grape juice and wine processing. Grape seeds separated from grape pomace are an excellent source for usage as a food additive because of their valuable nutrient components. 40 % fibre, 16% essential oils, 11% protein and 7% phenolic compounds are found in the proximate composition of grape seeds. Various researches represents the higher antioxidant activity and high total phenolic contents of grape seeds (Rockenbach et al, 2011; Nunes et al., 2016; Chen and Yu, 2017).
Rich composition of grape seeds in terms of phenolic compounds, total dietary fiber, total lipid, magnesium and phosphorus content is reported by Gül et al. (2013). Grape seeds are associated

with also antimicrobial effects (Mohammad et al., 2019), cholesterol-lowering activity (Ngamukote et al., 2011, Kandasamy et al., 2016), cardioprotective properties (Nunes et al., 2016), anti-inflammatory (Pallarès et al., 2013), anticarcinogenic, excellent protection activity against oxidative stress and free radical-mediated tissue injury (Bagchia, et al., 2000), valuable source of antioxidant fibers (Costa et al., 2019) and anti-arthritic effects (Ahmad et al., 2013).

During wine production huge amounts of grape pomace occur which cause storage and environmental problems. However as stated above it has a potential rich source of natural antioxidant and other healthy compounds. Therefore, converting of this by product to a value added product for the industrial and economic point of view is very important. Various studies have been done on the use of grape pomace and grape seed flour (GSF) in different food products particularly in bakery products. Acun and Gül (2014) used grape pomace and GSF in cookie formulations. Grape pomace was used by Gül et al. (2018) as an ingredient to enhance the nutritional and functional properties of gluten-free cookies. Gül et al. (2017a) investigated the effects of grape pomace powder on rheological characteristics of wheat flour dough. Our previous study focused on the consumer acceptability of bread produced from by-products of wine industry (Gül et al., 2017b) indicate that; flours of these by-products, can be used in bread formulations with acceptable consumer preference up to a certain supplementation level.

Bread quality and also rheological properties of the bread dough are negatively affected after a certain additional level of grape pomace or GSF thus, they do not contain gluten. In one of the studies (Mironeasa et al., 2012) it is mentioned that GSF above the level 5% has an increasing effect on amylase activity while has a decreasing effect on dough's consistency.

Deteriorative effects of GSF on rheological properties of dough can be improved by using different oxidative enzymes such as glucose oxidase. Glucose oxidase has a positive effect on rheological properties of bread dough by strengthening of gluten network structure (Gül et al., 2009). Liu et al (2018) reported that continuous and highly dense gluten network was occurred when whole wheat dough treated with GO. Oxidation of β-D-glucose to gluconic acid is catalyzed from glucose oxidase (β-D-glucose:oxygen 1-oxidoreductase; EC 1.1.2.3.4). Molecular oxygen is used as an electron acceptor in this reaction and hydrogen peroxide is produced simultaneously (Bankar et al, 2009). Thus leads to formation of disulfide and non-disulfide bonds.

Most prior studies have focused on the effects of grape seeds flours or extracts on the dough and bread quality. However, to the best of our knowledge studies regarding to improve their effects on rheological properties of dough by using glucose oxidase (GO) have not been undertaken. Therefore, the aim of the study was to evaluate the effects of combinations of both GSF and GO at different concentrations on some rheological properties of bread dough.

MATERIALS AND METHODS

Materials

Berad wheat flour was purchased from Berberoğlu Gıda Sanayii ve Ticaret A.Ş. (Burdur, Turkey). GSF: Drying and grinding proseses of grape pomace was made according Gül et al. (2013). After grinding and sieving to under 300 µm, Öküzgözü (red grape variety) seed flour (ÖSF) and Narince (white grape variety) seed flour (NSF) were vacuumed packed and stored at -18ºC until further analysis.

Glucose oxidase: Gluzyme Mono 10000BG (GOX, 10000 GODUF/g) was supplied by Novozymes (Novozymes Dış Ticaret Ltd.Şti, İstanbul, Turkey). All other chemicals used were of analytical grade.

Experimental design

ÖSF and NSF were added at 0-5 and 10 % levels in replacement with bread wheat flour seperately. GO was implemented as 50 and 100 ppm in to each wheat flour- GSF or NSF mixture. All experiments were carried out in triplicate.

METHODS

Chemical and physicochemical properties of bread wheat flour

Moisture (AACC Metod, 44-01.01), ash (AACC Method 08-01.01), protein (AACC Method 46–12.01), wet and dry gluten and gluten index (AACC Method 38-12.02), sedimentation (AACC Method 56-60.01) falling number (Method 56-81.03), and farinogram (AACC Method 54-21.02) values of wheat flour was determined according to American Association of Cereal Chemists Methods (AACC, 2000).

SMS/Kieffer dough and gluten extensibility test

Rheological properties of doughs prepeared with different amounts of ÖSF, NSF and GO were tested by using SMS/Kieffer Dough and gluten extensibility ring of Texture analyser (TA-XT2, Stable Micro Systems, Surrey, UK) according to the methods of Kieffer et al., (1998). Test parameters; pre-test speed: 2.0 mm/s, test speed: 3.3 mm/s, post-test speed: 10.0 mm/s, distance: 75mm, trigger force: auto - 5g, data acquisition rate: 200pps were applied by using 5 kg load cell. Brief summary of this method as follows: 9.73 g flour or flour mixture was weighed and 0.2 salt was added in to it. Accurate amount of water for each mixture was added. The amount of water added and kneading time were adjusted accordingly to farinogragraph test results. After kneading, dough was roled gently in to a ball. And then in to a sausage shape. Dough was placed on the grooved base form, after placing the top form excess dough was removed, which from the sides with a spatula. This form was cut the dough sample in to strips and allowed the dough to relax, whilst preventing moisture loss. Then dough were relaxed for 40 minutes at a constant relative humidity and temperature (at aroun 24 °C). After relaxation time test was performed with Kieffer rig. Maximum force “resistance to extension”, mean distance at max. force 'extensibility' and area under the curve were measured.

Dobraszczyk/Roberts (D/R) dough inflation test

Baking peformance of dough is related to its rheological properties. D/R Dough Inflation test are applied to predict baking performance of dough under strain likes baking expansion. A sheet of dough is inflated with air which is generated by a piston of Texture Analyser. Pressure to inflate of the dough sheet and the volume of the inflated dough sheet are measured (Anonymous, 2019).
The rheological properties of control dough and doughs containing different amounts of ÖSF, NSF and GO were measured using a D/R dough inflation system of a texture analyzer (TAXTPlus; Stable Micro System Ltd., Godalming, UK) according to the procedure established by Dobraszczyk (1997). Brief summary of this method as follows: on the basis of the 100 g flour or flour mixture 2% salt, water according to farinograph water absorbtion values were added. Then these mixutures were kneaded at 25±1 ºC for 6 minutes. Dough samples were placed on the the preperation board and rolled out to 8 mm thickness. Doughs were cut in to 55 mm diameter with circular sample cutter. Doughs were pressed for 30 seconds under the pressure by using press base which subsequently compressed each sample to a fixed thickness of 2.67 mm. Then dough samples were allowed to rest until 30 min. After resting D/R dough inflation system was performed with parameters as; pre-test speed: 8.63 cm^3/sn, test speed: 26.70 cm^3/sn, volume : 2.000.000 mm^3, Trigger volume: 30.000 mm^3). Tenacity (P, mm); the maximum pressure required during inflation of the buble, extensibility (L, mm); the length of the curve up to the point of rupture and baking strength (W); the deformation energy necessary to inflate the sample values of the doughs were measured.

Statistical analysis

Statistical analysis of the doughs prepared with different rates of ÖSF and NSF including different quantity of GO or not were evaluated according to Duncan's multiple range test with significance defined at $P < 0.01$. Analysis of variance (ANOVA) was performed by using the software, statistical package for social science (SPSS 16.0). All the analysis was done in triplicate.

RESULTS AND DISCUSSIONS

Chemical and physicochemical properties of bread wheat flour

Proximate composition and some physicochemical properties of bread wheat flour used for prepearing control doughs and grape seed added doughs are presented in Table 1.

Table 1. Some properties of bread wheat flour

Analysis	Bread Wheat Flour
Moisture (%)	13.23 ± 0.07
Ash (%)	0.61 ± 0.01
Protein (%)	10.44 ± 0.13
Wet gluten (%)	30.65 ± 0.03
Dry gluten (%)	10.29 ± 0.26
Gluten index (%)	93.74 ± 1.28
Sedimentation (ml)	32.3 ± 0.58
Falling number (s)	305 ± 7 .00
Farinograph parameters	
Water absorbtion capacity (WAC, %)	62.0 ± 0.1
Dough development time (DDT, min)	1.7 ± 0.14
Stability (STB, min)	12.3 ± 0.54
Softening 12. minute (SFT12, BU)	35.0 ± 8.00

Moisture, ash and protein contents in wheat flour were found as 13.23 ± 0.07 %, 0.61 ± 0.01%, 10.44 ± 0.13%, respectively. According to Turkish Food Codex Notification No. 2013/39 on wheat flour (Anonymous, 2018) bread wheat flour should not have to moisture more than 14.5%, ash content of it should be between 0.7-0.8% and protein content at least %10.5, sedimentation at least 26 ml, and falling number should be at least 250 seconds. Wet gluten, dry gluten and gluten index and farinogram values of wheat flour indicated that it is a good quality flour and can be used at bread making. When all chemical and technological characteristics of wheat flour were observed it meets nearly the criteria of Turkish wheat flour standards.

SMS/Kieffer dough and gluten extensibility test results

SMS/Kieffer dough and gluten extensibility test results of both ÖSF and NSF containing doughs with or without GO are presented in Table 2.

Table 2. SMS/Kieffer dough and gluten extensibility values of dough prepeared with different amounts of GSF and GO[(1)]

GSF (%)	GO (ppm)	Rmax [(4)] (g)	Extensibility (mm)	Area (g.s)
0 (Control)	0	46.10^{d}	14.49^{ef}	250.14^{ef}
	50	53.00^{c}	16.02^{d}	470.98^{ab}
	100	61.98^{b}	16.06^{d}	497.10^{a}
	0	45.17^{d}	12.80^{gh}	164.57^{h}

5 % ÖSF[2]	50	35.72^{fg}	20.92^{a}	325.18^{cd}
	100	34.21^{g}	12.67^{gh}	200.46^{fgh}
	0	37.86^{ef}	13.57^{fg}	194.53^{fgh}
10 % ÖSF	50	38.54^{ef}	17.90^{c}	210.41^{fgh}
	100	38.34^{ef}	12.22^{h}	179.95^{gh}
	0	37.26^{efg}	19.55^{b}	279.03^{de}
5 % NSF[3]	50	48.07^{d}	21.27^{a}	366.18^{c}
	100	65.20^{a}	17.24^{c}	425.95^{b}
	0	39.97^{e}	13.55^{fg}	155.45^{h}
10 % NSF	50	34.27^{g}	14.94^{de}	191.26^{fgh}
	100	46.43^{d}	13.26^{gh}	240.60^{efg}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).

(2): ÖSF: Öküzgözü seed flour

(3): NSF: Narince seed flour

(4): Rmax: Maximum force resistance to extension

When compared with the control sample (46.10g) which contain no GSF and GO, the addition of 5% ÖSF did not change the Rmax (45.17g) while increasing the addition rate to 10 % caused a significant decrease ($p<0.01$) in this value (37.86g). On the other hand NSF contributed to the further reduction of Rmax values. However, there was no statistically significant difference between the 5% and 10% addition levels of NSF. The addition of 5% ÖSF reduced the extensibility values of the doughs, whereas the 5% NSF caused a significant rice on extensibility. There was no significant difference was found between the extensibility values of control and 10% levels of ÖSF and NSF. When all samples were compared in terms of area values, it was determined that the highest area value was obtained with the use of 5% NSF. This may be arisen from the high extensibility value of this dough sample.

Effects of GO at O, 50 and 100 ppm usage quantities can be seen from the Table 2. Rmax was increased significantly from 46.10 g to 53.0 g and 61.98 g with the increasing rates of GO from 0 to 50 and 100 ppm respectively. The extensibility of control dough also increased slightly with the addition of GO. However, the addition of 50 or 100 ppm of GO did not create a statistical difference on this value. The addition of GO significantly increased the area value but as on extensibility values incresing levels of GO from 50 ppm to 100 ppm did not made any significant change on area values of control dough.

The addition of GO to ÖSF containing flours did not cause a significant change in the Rmax futhermore a limited drop was observed in the samples with 5% ÖSF. The addition of 50 ppm GO to flour containing 5% and 10% ÖSF did not have a significant effect on the Rmax of the dough. However, the addition of 50 ppm of GO gave a statistically significant increase in the area and extensibility values of the both 5% and 10% ÖSF added doughs. On the contrary this positive effect of 50 ppm GO was not seen when its usage levels was increased to 100 ppm. This may be due to the excessive oxidation that may occur as a result of the high levels of GO. Over oxidation leads to a decrease in the elasticity of the dough.

The use of GO was increased the Rmax values of dough samples containing NSF significantly. The positive effect of GO on Rmax and area values was particularly detected when it was used at 100 ppm level.

As a result, since the addition of ÖSF had less negative effect on the rheological properties of the dough than the addition of NSF, the use of 50 ppm GO in the dough containing 5% ÖSF improved the rheological properties. Since the NSF had a more negative effect on the dough structure, it was possible to eliminate this negative effect to some extent by adding 100 ppm of GO.

Dobraszczyk/Roberts (D/R) dough inflation test results

D/R dough inflation values (p, L and W) of dough prepeared with different amounts of GSF and GO are given in Table 3.

Table 3. Dobraszczyk/Roberts (D/R) dough inflation values of dough prepeared with different amounts of GSF and GO[(1)]

GSF (%)	GO (ppm)	P[4] (mm)	L[5] (mm)	W[6] (Joules*10000)
0 (Control)	0	238.4 ^{cd}	52.0 ^{a}	512.2 ^{a}
	50	402.60^{def}	19.21^{bc}	291.97^{cde}
	100	602.60^{a}	8.19^{e}	270.82^{de}
5 % ÖSF[2]	0	217.9 ^{cd}	13.4 ^{cd}	131.9 ^{def}
	50	445.43^{cde}	21.38^{b}	421.58^{ab}
	100	514.83^{abc}	10.55^{de}	361.90^{bcd}
10 % ÖSF	0	174.7 ^{ef}	7.7 ^{de}	78.8^{defg}
	50	347.43^{f}	6.13^{e}	125.24^{fg}
	100	478.20^{bcd}	8.75^{e}	234.29^{ef}
5 % NSF[3]	0	235.4^{cd}	13.3^{cd}	150.4^{de}
	50	514.58^{abc}	15.53^{cd}	402.99^{abc}
	100	443.90^{cde}	14.72^{cd}	402.72^{abc}
10 % NSF	0	79.2^{g}	9.0^{de}	40.1^{fg}
	50	438.56^{cdef}	5.42^{e}	139.74^{fg}
	100	556.48^{ab}	8.68^{e}	257.35^{de}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).
(2): ÖSF: Öküzgözü seed flour,
(3): NSF: Narince seed flour
(4): P: maximum pressure
(5): L: extensibility
(6): W: Deformation energy

The addition in increasing rates of GO to the control dough prepared with bread wheat flour was provide a significant increase in the P values whereas it was caused a significant decrease in the L and W values.
The addition of GSF to the bread wheat flour was began to reduce the P values significantly after 5% addition levels. There is no difference was determined between the control and % 5 NSF and 5% ÖSF containing doug samples in terms of P values whereas there was a significant reduced was observed at their L and W values. When the usage level of ÖSF and NSF further increased to 10% considerable deterioration on the dough structure was identified. Advantage of GO supplementation in order to partially improve the dough rheological properties which is the purpose of the present study, has been clearly revealed in dough inflation values.
As can be seen in Table 3, addition of GO significantly increased both the P and W values of the GSF containing doughs compared to the ones without GO. W values of 5% NSF and ÖSF doughs were yielded similar results with control sample with 50 ppm GO. On the other hand, more positive results were obtained in the case of using 100 ppm GO in 10% NSF and 10 % ÖSF added dough samples.

Generally, when the results of dough iflation test were considered collectively, it was seen that GSF caused a decrease in the rheological properties of the dough due to interruption of gluten network, but at 5% additional level, this effect was less and the negative effect increased as the addition rate increased. This negative effect was improved significantly by using 50 ppm GO for 5 % ÖSF and 5% NSF added dough samples. It was determined that the negative effects of NSF and ÖSF at the 10% suplementation levels could be reduced when the GO ratio was increased to 100 ppm. Even in this case, W values were not reached neither in the control sample nor in the samples which include 5% GSF and 50 ppm GO.

CONCLUSION

The results demonstrate the deteriorative effects of ÖSF and NSF by products of red wine and white wine processing industry respectively on the rheological properties of wheat bread dough. This weakening impact of GSF has become more evident at the high levels of GSF (10 %) supplementation. Results of the present study also indicates that the reheological quality of wheat flour doughs prepeared with GSF can be improved to some extent by the contribution of GO in to formulation. Rheological properties of bread dough obtained by adding ÖSF or NSF into bread wheat flour at 5% concentration and using GO at 50 ppm would be close to those of control sample values. On the other hand, for the samples added with 10% GSF, the use of 100 ppm GO positively influenced the rheological properties of dough.These results suggested the potential utility of GSF in the production of bread bakery products. When GSF is used up to 5% level a limited weakening effect on rheological quality of bread doughs can be obtained. Furthermore their rheological quality can be improved by adding GO in to bread wheat flour formulations with GSF.

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REFERENCES

AACC, (2000). International. Approved Methods of Analysis, 11th Ed. AACC International, St. Paul, MN, U.S.A.

Acun, S., Gül, H. (2014). Effects of grape pomace and grape seed flours on cookie quality. Quality Assurance and Safety of Crops and Foods. 6 (1), 81-88.DOI: 10.3920/QAS2013.0264.

Ahmad, S.F., Zoheir, K.M.A., Hamied, H.E.A., Ashour, A.E., Bakheet, S.A., Attia, S.M., Abd-Allah, A.R.A. (2013). Grape seed proanthocyanidin extract has potent anti-arthritic effects on collagen-induced arthritis by modifying the T cell balance. International Immunopharmacology, 17 (1), 79-87. DOI: 10.1016/j.intimp.2013.05.026

Anonymous, (2018). Turkish Food Codex Notification No. 2013/39 on wheat flour. www.resmigazete.gov.tr

Anonymous, (2019). https://www.stablemicrosystems.com/DoughInflationSystem.html

Bagchi, D., Bagchi, M., Stohs, S.J., Dipak, K.D., Ray, S.D., Kuszynski, C.A., Joshi, S.S., Pruess, H.G. (2000). Free radicals and grape seed proanthocyanidin extract: importance in human health and disease prevention, Toxicology, 148 (2-3), 187-197. DOI: 10.1016/S0300-483X(00)00210-9.

Bankar, S.B., Bule, M., Singhal, R.S., Ananthanarayan, L. (2009). Glucose oxidase-an overview. Biotechnology Advances, 27(4), 489–501. DOI: 10.1016/j.biotechadv.2009.04.003.

Costa, G.N.S., Tonon, R.V., Mellinger-Silva, C., Galdeano, M.C., Iacomini, M., Santiago M.C.P.A., Almeida, E.L., Freitas, S.P. (2019). Grape seed pomace as a valuable source of antioxidant fibers. Journal of the Science of Food and Agriculture, 99, 4593-4601. DOI: 10.1002/jsfa.9698.

Dobraszczyk, B.J. (1997). Development of a new dough inflation system to evaluate doughs. Cereal Foods World, 42, 516–519.

Gül, H., Acun, S., Şen, H., Nayır N., Türk, S. (2013). Antioxidant activity, total phenolics and some chemical properties of Öküzgözü and Narince grape pomace and grape seed flours. Journal of Food, Agriculture and Environment Vol.11 (2): 28 -34 .

Gül, H., Gül, M., Acun, S., Aslan, S.T., Nayır, N., Şen, H. (2017a). Influence of grape pomace powder on rheological characteristics of wheat flour dough. Abstract Proceeding Book of International Conference on Agriculture, Forest, Food Sciences and Technologies (ICAFOF 2017) Conference, May 15 - 17, 2017, Cappadocia / Turkey, 25p.

Gül, H., Gül, M., Aslan, S.T., Acun, S., Nayır, N., Şen, H. (2016). Consumer acceptability of breads fortified with the grape pomace and grape seed flours. 15th International Cereal and Bread Congress, April 18-21, 2016, İstanbul, Turkey. p:174.

Gül, H., Gül M., Aslan, S.T., Acun, S., Nayır, N., Şen, H. (2017b). Consumer acceptability of bread produced from by-products of wine industry. Volume 26. Fresenius Environmental Bulletin, No. 11/2017, 6924-6931.

Gül, H., Hayıt F., Acun S. (2018). Grape Pomace as an Ingredient to Enhance the Nutritional and Functional Properties of Gluten-Free Cookies. Proceedings, 1st International Symposium on Innovative Approaches in Scientific Studies, Antalya / Turkey April 11-13, 2018 , SETSCI Conference Indexing System, Volume 2, 83-83.

Gül, H., Özer, M.S., Dizlek, H. (2009). Improvement of the Wheat and Corn Bran Bread Quality by Using Glucose Oxidase and Hexose Oxidase. Journal of Food Quality, 32, 209-223. DOI: 10.1111/j.1745-4557.2009.00246.x

Kandasamy, M., Nasimuddin, S., Malayan J., Nithyalakshmi J., Gnanadesikan S., Chandraseka M. (2016). A study on antibacterial effect of grape seed extracts in common clinical and drug resistant isolates. International Journal of Clinical Trials, 3(3), 165-168. DOI: 0.18203/2349-3259.ijct20162799.

Kieffer, R., Wieser, H., Henderson, M.H., Graveland, A. (1998). Correlations of the bread-making performance of wheat flour with rheological measurements on a micro-scale. Journal of Cereal, Science, 27, 53–60. DOI:10.1006/jcrs.1997.0136.

Liu, L., Yang, W., Cui, S.W., Jiangb, Z., Chend, Q., Qianb, H., Wangb, L., Zhoua, S. (2018). Effects of pentosanase and glucose oxidase on the composition, rheology and microstructure of whole wheat dough. Food Hydrocolloids, 84, 545-551. DOI: 10.1016/j.foodhyd.2018.06.034.

Luo, S.Z., Shen, X.Y., Pan, L.H., Zheng, Z., Zhao, Y.Y., Zhong, X.Y., Jiang, S.T. (2018). Effect of grape seed extract on sensory, textural, andanti-staling properties of Chinese steamed bread Journal of Food Processing and Preservation. 2018;42:e13497. DOI:10.1111/jfpp.13497.

Chen, M., Yu, S., (2017). Lipophilized Grape Seed Proanthocyanidin Derivatives as Novel Antioxidants. Journal of Agricultural and Food Chemistry, 65, 1598−160. DOI:10.1021/acs.jafc.6b05609.

Mironeasa, S., Codina, G.G., Mironeasa, C. (2012). The effects of wheat flour substitution with grape seed flour on the rheological parameters of the dough assessed by mixolab. Journal of Texture Studies, 43, 40–48.

Mohammad, Y.M., Khosrod, A., Safare, F., Samadia, K.H., Minaa, Y., Nasera, A., Reza, G. (2019). The grape seed extract, a natural antimicrobial agent against different pathogens. Reviews in Medical Microbiology, 30:173–182. DOI: 10.1097/MRM.0000000000000174.

Ngamukote, S., Mäkynen, K., Thilawech, T., Adisakwattana, S. (2011). Cholesterol-lowering activity of the major polyphenols in grape seed. Molecules 2011, 16, 5054-5061. DOI:10.3390/molecules16065054.

Nunes, M.A., Pimentel, F., Costa, S.G.A., Alves, R.C., Oliveira, M.B.P.P. (2016). Cardioprotective properties of grape seed proanthocyanidins: An update. Trends in Food Science and Technology, 57 (Part A), 31-39. DOI: 10.1016/j.tifs.2016.08.017.

Pallarès, V., Cedó, L., Castell-Auví, A., Pinent, M., Ardévol, A., Arol,a L., Blay, M. (2013). Effects of grape seed procyanidin extract over low-grade chronic inflammation of obese Zucker fa/fa rats. Food Research International, 53 (1), 319-324. DOI: 10.1016/j.foodres.2013.05.006.

Rockenbach, I.I., Gonzaga, L.V., Rizelio, V.M., Gonçalves, A.E.S.S., Genovese, M.I., Fett, R. (2011). Phenolic compounds and antioxidant activity of seed and skin extracts of red grape (*Vitis vinifera and Vitis labrusca*) pomace from Brazilian winemaking. Food Research International 44 (4), 897-901. DOI: 10.1016/j.foodres.2011.01.049.

(ORAL PRESENTATION)

VIRUS DISEASES OF LETTUCE in ANKARA PROVINCE

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Abstract

Lettuce is one of the widely grown vegetable in Ankara province of Turkey and virus diseases cause great yield loss. Surveys were conducted to five different districts of Ankara during two years, 2014-2015 and a total of 544 samples were collected, and all were tested with the DAS-ELISA against *Mirafiori lettuce big vein virus* (MiLBVV), *Lettuce mosaic virus* (LMV), *Cucumber mosaic virus* (CMV), *Tomato spotted wilt virus* (TSVW) antisera. LMV was the predominant and unique infection detected in 2014 and was present in the 65 of the specimen but in 2015, 39 MiLBVV, 25 LMV infected isolates were detected. TSWV and CMV were not present in the research area. RT-PCR tests were performed to determine the coat protein gene regions of those viruses. Amplicons were obtained at 800 bp, 469 bp and 296 bp of LMV, MiLBVV and LBVaV, respectively. Lettuce big vein-associated virus (LBVaV) were present in the 5 out of a total of 6 samples, as mixed infected with MiLBVV. Microscopic observations were performed to determine the presence of *Olpidium* spp. in the roots which is the vector of the viruses belong to Lettuce Big Vein diseases (LBV), resting spores were observed in 146 of the investigated root samples. These results indicate that LMV and LBV diseases are the most common endemic viral pathogens in Ankara's lettuce cultivation areas and the vector *Olpidium* spp. was also present in the research area.

Key words: Ankara, lettuce viruses, DAS-ELISA, *Olpidium* spp.

INTRODUCTION

Lettuce (*Lactuca sativa L.*, Family: *Asteraceae*) is cultivated intensively in all parts of the world with mild climate. (Anonymous, 2019). Although Ankara is located in arid climate region, many types of vegetables are produced, among them iceberg-type lettuce cultivation stays at top (Yanmaz et al. 2015; Balkaya et al. 2016). Average lettuce production of Ankara is 75.105 tons and cultivation area is 2,65 hectares (TUIK, 2018) and all types of lettuce, including green or red leaf lettuce (*Lactuca sativa* var. *crispa*), romaine (*Lactuca sativa* var. *longifolia*), and iceberg (*Lactuca sativa* var. *capitata*), types are produced in the research area (Yanmaz et al.2015).

Plant virus infections are economiccally important and cause great yield reduction in the lettuce cultivation. Major plant virus infections are *Lettuce mosaic virus* (LMV, *Potyvirus*) which is one of the most important virus infection and cause great economic loss, *Tomato spotted wilt virus* (TSWV, *Tospovirus*), *Cucumber mosaic virus* (CMV, *Cucumovirus*), *Mirafiori lettuce big vein virus* (MiLBVV, *Ophiovirus*) and *Lettuce big vein associated virus* (LBVaV, *Varicosavirus*) viruses have been previously reported in the world (Verbeek et al. 2014).

Widespread virus infection of lettuce is LMV, it is also transmitted by seeds and aphid vectors (Tomlinson, 1970). It causes severe systemic mosaic infection on lettuce plants. CMV is another infection causes the similar symptoms on lettuce leaves. It is also seed and aphid transmitted virus infection and infects very wide spectrum of plants (Palukaitis, et al. 1992).

Another group of virus diseases of lettuce is “Lettuce big-vein diseases, and are composed of two distinc virus infection, *Mirafiori lettuce big vein virus* (MiLBVV, *Ophiovirus*) and *Lettuce big vein associated virus* (LBVaV, *Varicosavirus*). The viruses cause enlargement of veins of the foliage which is defined as “ big vein” symptom of lettuce. MiLBVV and LBVaV viruses, generally present in moist and heavy soils and transmitted by *Olpidium brassicae, O. bornovanus* or *O.virulentis* fungi (Herrera-Vasquez et al. 2009; Moreno and Fereres, 2012; Maccarone, 2013).

TSWVis another virus infection and causes necrotic lesions on leaves, latter enlarges and causes the death of the entire plant (Pavan et al. 2008). It belongs to *Tospovirus* genus and transmitted by different *Thysanoptera* species in persistent-propagative pathway (Whitfield et al. 2005).

Lettuce viruses are detected in different vegetable production areas in Turkey, among the LMV is widespread virus infection (Ozalp, 1964; Tekinel et al., 1969; Erkan and Schlosser, 1985; Fidan and Turkoğlu, 1988; Doken et al.,1994, Kamberoglu and Alan, 2011; Karanfil et al., 2018). TSWV is only detected in southern parts of Anatolian peninsula.

Since the Ankara is the leader for lettuce production in Turkey, this research was conducted in order to determine the viruses of lettuce which cause great yield reduction.

MATERIALS AND METHODS

Virus sources: Surveys were conducted in summer in 2014 and 2015 to Ayaş, Beypazarı, Nallıhan and Cubuk districts and symptomatic and non-symptomatic plant samples were collected.

Detection of viruses by DAS-ELISA test: All plant samples were tested for the presence of LMV, TSWV, CMV and MiLBVV by DAS-ELISA method (Clark and Adams, 1977). The tests were performed with commercial ELISA kits (Bioreba, Switzerland and Loewe, Germany) and tests were performed to according to the manufacturer's recommendations.

Nucleic acid isolations and Reverse Transcriptase-PCR amplification: Total RNAs were extracted by using GeneJET Plant RNA Purification Kit (Thermo Sci., Lithuania) and the quantity of RNAs were estimated by Nano-Drop 2000 (Thermo Sci., Waltham, MA, USA), then stored at -80 °C. RT-PCR assays were conducted in two steps which encompassing cDNAs synthesis from total RNAs and amplifications of the CP gene regions of MiLBVV, LBVaV and LMV. cDNAs were synthesized in a 25 µl reaction mixtures containing 40 units of Reverse Transkriptase enyzme (Thermo Sci., Lithuania), 16 units of RNase inhibitor and 1.2 mM specific reverse primers of the viruses. The PCR assays were performed in 25 µl reaction volume containing 2 µl of cDNA, 1.5 units of Taq DNA polymerase (Thermo Sci., Lithuania), and, 2 mM $MgCl_2$, 2 µM each of the spesific primers.Primers used and RT-PCR conditions are shown in Table1. PCR amplification specifications consisted of 3 min denaturation at 94 °C, followed by 35 cycles of 95 °C for 1 min, primer annealing at 42 °C for 1 min and primer extension at 72 °C for 2 min, with a final extension at 72 °C for 10 min. The PCR products were electrophoresed on 1,2 % agarose gel at 100 volt for 1 h, stained with ethidium bromide and visualized under UV light by Gene Genius imaging system (UK).

Morphological observation of *Olpidium* spp: Plant roots were examined under a light microscope to reveal the absence or presence of resting spores of *Olpidium* spp. These roots were washed in tap water and then kept in 70% ethyl alcohol for 10 seconds, and then washed again with distilled water.The cleaned root samples were stained with acid fuchsin-lactophenol solution and investigated under light microscope.

RESULTS AND DISCUSSION

Identification of virus infections in lettuce, and their prevalence and distribution in Ankara region, which is the most economically important lettuce producing area in Turkey, were carried out for the first time by this present research.

The symptoms of viruses were generally observed in the lettuce fields were unbinding of heads (Romaine type-Yedikule), excessive growth of leaf veins, small heads (icebergs) (Fig. 1 and Fig. 2), growth retardation, chlorosis and severe mosaic on leaves (green leaf lettuces). No symptoms were detected on red leaf lettuces. In this present research, LMV was the only virus detected on samples showing different severities of mosaic and necrosis, while CMV and TSWV was not present in the research area.

LMV, which is widespread virus infection in the world (Zerbini et al. 1995), infects the lettuce and has some important isolates which formed three main groups: LMV-Yar (Yemen), LMV-Greek (Greece), and LMV-RoW as result of a phylogenetic analysis of isolates belonging to different geographies in the world (German-Retana et al. 2008). LMV isolates collected in the Southern Marmara Region of Turkey were shown to be seed transmitted, and were also determined as LMV-RoW strain (Karanfil and Celik, 2018). In another phylogenetic study of CP gene region of LMV isolates it was also determined as LMV-RoW group (Randa Zelyut and Ertunc, 2018). TSWV was only detected at low rates in the Eastern Mediterranean region of Turkey (Kamberoglu and Alan, 2011).

LBVaV and MiLBVV usually co-infection in field conditions and cause different necrotic symptoms in BV disease according to climatic conditions (Verbeek et al. 2013). When air temperatures are in the range of 18-22 °C, BV disease symptoms are developing, while the replication of LBVaV in above this ranges, is slowing down (Westerlund et al. 1978). MiLBVV shows typical BV disease symptoms either in single infection or mixed infection with LBVaV, but LBVaV does not show those typical symptoms in single infection (Sasaya et al. 2008). All of the collected lettuce samples were tested by ELISA with antiserum kits (Loewe, Germany) of CMV, TSWV, LMV, MiLBVV and only LMV was detected in 65 out of 220 lettuce samples collected in 2014. However, in 2015, a total of 324 samples were

tested by ELISA using specific antiserums kits to CMV, TSWV, LMV, MiLBVV and 39 MiLBVV and 25 LMV infections were detected, but no reaction was obtained by TSWV and CMV antisera again (Table. 2).

LBVaV is very weak in its antigenic properties, in other side, although MiLBVV virion is not stabil, its CP region is highly antigenic (Navarro et al. 2004; King et al. 2012). As result, high absorbance values in ELISA were observed in the samples collected during the cool and abundant rainy spring against MiLBVV antiserum. This suggests that the virus replicates itself more in favorable climatic conditions and in sensitive hosts such as *L. sativa* var. *capitata* (iceberg) (Sasaya et al. 2008) .

Total RNAs were tested for LMV, MiLBVV, LBVaV presence by RT-PCR with specific primers designed for coat protein gene regions. A 800 bp, 469 bp and 296 bp amplification fragments (Fig. 4,5 and 6) were obtained with 25 LMV, 39 MiLBVV and 6 LBVaV isolates respectively, and co-infection was detected in 5 samples infected by MiLBVV and LBVaV.

In the microscopic observations for determination of presence or absence of *Olpidium* spp. in the lettuce roots, their resting spores were observed in 146 samples, but no resting spore was observed in the remaining samples. They were in circular shape and generally present in the BV infected samples (Figure 3). They were determined from the samples collected from the Beypazarı region in which its groundwater level is quite high.

CONCLUSIONS

Plant viruses causing high economic losses in different lettuce varieties cultured in Ankara were identified in this study. The virus vector, and the pathogens were identified by using serological and molecular methods. In regions where the winter is hard, the vector *Olpidium spp.* was found still present and their viruliferous zoospores infect icerbergs which highly sensitive to BV infections and curly type lettuce which sensitivity to BV is moderate. In regions where temperature rise above 27º C, LMV severely infected ‘’Romaine’’ variety but only very few curly type lettuce. CMV and TSWV, which were transmitted by aphids and thrips vectors, were not detected and no vector populations were encountered. It is recommended that the species belonging to different families should be planted as rotation plants for the continuity of lettuce production in the region. Furthermore, in order to prevent the spreading of viruliferous zoospores in fields and in seedlings by irrigation, it is absolutely necessary to refrain the drainage of unsuitable field soils and avoid the cultivation of sensitive varieties in cool seasons. The use of certified virus free lettuce varieties can also be recommended to reduce the prevalence of the seed-transmitted virus diseases.

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REFERENCES

Annonymous, 2019. https:// www.brirannica.com/plant/Asteraceae

Balkaya,A., Sarıbaş,S., Özgen,T. 2016. Türkiyede kışlık sebze türlerinin tarımsal üretimdeki yeriş ve önemi. Türktob, 20: 10-14.

Clark, M. F. and Adams, A. N. (1977) Characteristics of the micro plate method of enzyme linked immunosorbent assay for the detection of plant viruses. Journal of General Virology, 34:475-48.

Döken, M. T., Demirci, E. and Açıkgöz, S. (1994). Morphology of Olpidium brassicae (Wor.) Dang. and its transmission of big-vein virus to lettuce. Journal of Turkish Phytopathology, 23(3): 133-142.

Erkan, S. and Schlösser, E. (1985) Virus diseases on lettuce in Turkey. Journal of Plant Diseases and Protection, 92 (2), 127-131.

Fidan, Ü. and Türkoğlu, T. (1988) Ege bölgesi marul bitkilerinde görülen virüs hastalıkları üzerinde ön çalışmalar. Bitki Koruma Bülteni, 28 (1-2):43-56.

German-Retana, S., Walter, J. and Gall, O. L. (2008) Lettuce mosaic virus: from pathogen diversity to host interactors. Molecular Plant Pathology, 9:127-136.

Herrera-Vasquez, J. A., Cebria, M.C., Ana Alfaro-Fernandez, A., Cordoba-Selles, M. and Jorda, C. (2009) Multiplex PCR assay for the simultaneous detection and differentiation of Olpidium bornovanus, O. brassicae, and O. virulentus. Mycological Research, 113, 602–610.

Kamberoğlu, M. A. and Alan, B. (2011) Occurrence of Tomato spotted wilt virus in lettuce in Çukurova Region of Turkey. International Journal of Agriculture & Biology, 13: 431–434.

Karanfil, A., Çevik, B. and Korkmaz, S. (2018) Detection of Lettuce mosaic virus infection in South Marmara Region of Turkey and coat protein gene characterization. Zemdirbyste-Agriculture, 105(4): 363-368.

King, A. M. Q., Adams, M. J., Carstens, E. B. and Lefkowitz, E. J. (2012) Virus taxonomy classification and nomenclature of viruses ninth report of the international committee on taxonomy of viruses. Elsevier, UK, pp. 1072-1077.

Maccarone, L. D. (2013) Relationships between the pathogen Olpidium virulentus and viruses associated with lettuce big-vein disease. Plant Diseases, 97: 700–707.

Moreno, A. and Fereres, A. (2012) Virus diseases in lettuce in the Mediterranean Basin. Advances Virus Research, 84, 247–288.

Navarro, J. A., Botella, F. A., Maruhenda, A., Sastre, P., Sanchez-Pina, M. A. and Pallas, V. (2004) Comparative infection progress analysis of Lettuce big-veinvirus and Mirafiori lettuce virus in lettuce crops by developed molecular diagnosis techniques. Phytopathology, 94, 470-477.

Ozalp, O. (1964) İzmir'de sebzeler de görülen virüs hastalıkları. Bitki Koruma Bülteni, 4(1): 18-25.

Palukaitis, P., Roossinck, M. J., Dietzgen, R. G. and Francki, R. I. B. (1992) Cucumber mosaic virus. Advances Virus Research, 41, 281–348.

Pavan, M. A., Krause-Sakate, R., da Silva, N., Zerbini, F. M. and Le Gall, O. (2008) Virus diseases of lettuce in Brazil. Plant viruses, 2: 35-41.

Randa Zelyüt, F. and Ertunç, F. (2018) Molecular characterization of lettuce mosaic virus isolates in Ankara province. International Journal of Agriculture Innovations and Research, 6(5):239-245.

Sasaya, T., Fujii, H., Ishikawa, K. and Koganezawa, H. (2008) Further evidence of Mirafiori lettuce big-vein virus but not of Lettuce big-vein associated virus with big-vein disease in lettuce. Phytopathology, 98:464- 468.

Tekinel, N., Dolar, M. S., Sağsöz, S. and Salcan, Y. (1969) Mersin Bölgesinde Ekonomik Bakımdan Önemli Bazı Sebzelerin Virüsleri Üzerinde Araştırmalar. Bitki Koruma Bülteni, 9:1, 37-49.

Tomlinson, J. A. (1970) Lettuce mosaic virus. CMI/AAB Descriptions of Plant Viruses, no:9.

TUIK, (2018) Bitkisel üretim istatistikleri. Retrieved in December, 10, 2018 from https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr

Verbeek, M., Dullemans, A. M., van Bekkum, P. J. and van der Vlugt, R. A. A. (2013) Evidence for Lettuce big-vein associated virus as the causal agent of a syndrome of necrotic rings and spots in lettuce. Plant Pathology, 62: 444- 451.

Verbeek, M., Dullemans, A.M., Raaij, H.G.,Verhoeven, J.T.J. and van der Vlugt, R.A.A. (2014) Lettuce necrotic leaf curl virus, a new plant virus infecting lettuce and aproposed member of the genus Torradovirus. Archives of Virology, 159:801–805.

Westerlund, F. V., Campbell, R. N. and Grogan, R. G. (1978) Effect of temperatue on transmission, translocation, and persistence of the lettuce big-vein agent and big-vein symptom expression. Phyopathology, 921-926.

Whitfield, A. E., Ullman, D. E. and German, T. L. (2005) Tospovirus–thrips interactions. Annual Review of Phytopathology, 43: 459–489.

Yanmaz, R., Duman, I., Yaralı, F., Demir,K., Sarıkamış, G., Sarı, N., Balkaya,A., Kaymak, H.Ç., Akan, S., Ozalp, R. 2015. Sebze üretimindeki değişimler ve yeni arayışlar. Türkiye Ziraat Mühendisleri Odası 8. Türkiye Ziraat Mühendisleri Teknik Kongresi, Bildiriler Kitabı, Cilt 1, 579-605.

Zerbini, F. M., Koike, S. T. and Gilbertson, R. L. (1995) Biological and molecular characterization of Lettuce mosaic potyvirus isolates from Salinas Valley of California. Phytopathology, 8: 746-752.



Figure 1. Lettuce big-vein symptom on iceberg lettuce.



Figure 2. Little head formation on iceberg lettuces.

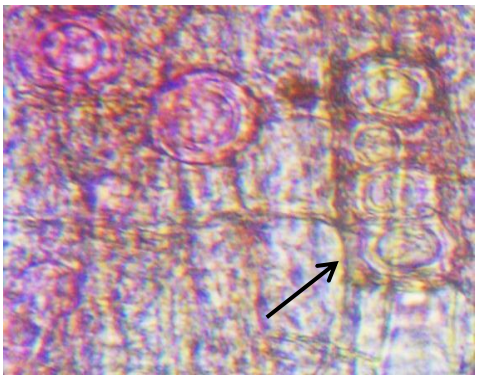


Figure 3. Resting spores of *Olpidium* spp. in the lettuce root

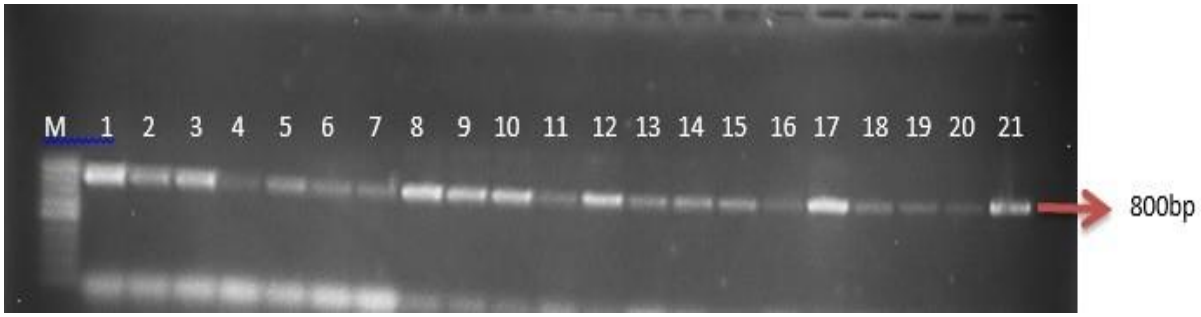


Figure 4. RT-PCR results of Lettuce mosaic virus coat protein gen sequences (800 bp) (M: Marker, 100bp DNA ladder, Thermo Scientific, 1-12: Samples collected from Ankara-Beypazarı, 13-14: Samples collected from Ankara-Cubuk, 15-21: Samples collected from Ankara-Beypazarı plato.

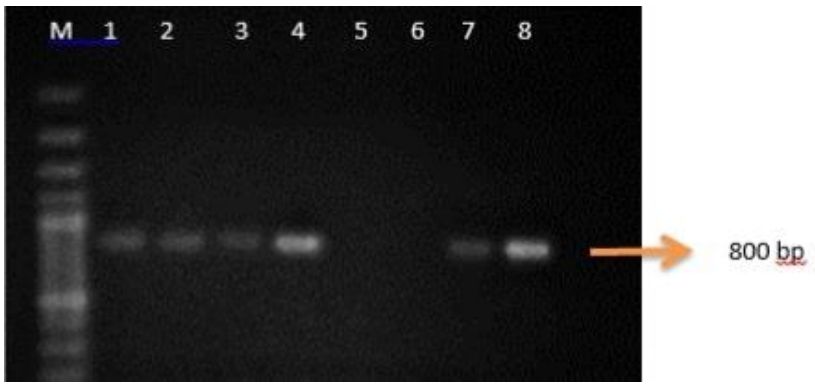


Figure 5. RT-PCR results of Lettuce mosaic virus coat protein gen sequences (800 bp) (M: Marker, 100bp DNA ladder, Thermo Scientific, 1-4: Samples collected from Ankara-Beypazarı, 5: Healthy lettuce 6: Water coıntrol 7-8: Samples collected fron Ankara-Nallıhan.

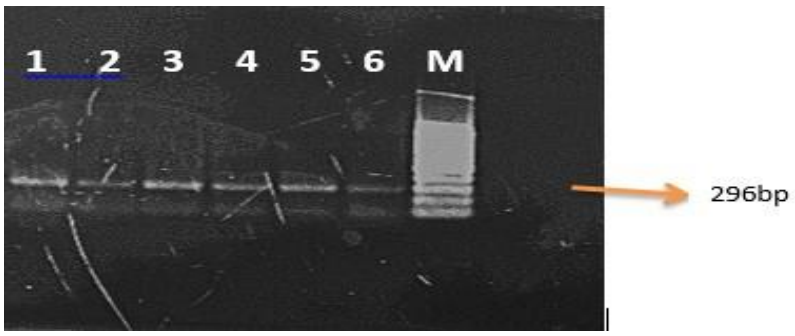


Figure 6. RT-PCR results of Lettuce big-vein virus coat protein gen sequences (296 bp) (M: Marker, 100bp DNA ladder, Thermo Scientific, 1- 6: Samples collected from Ankara-Beypazarı

Table 1. The primer sequences used in RT-PCR tests for molecular detection of LMV, MLBVV and LBVaV.

Virus name	Primer sequence 5'-3'	Fragment size (bp) and region	Denaturation temperature and time	Annealing temperature and time	Extension temperature and time	Reference
LBVaV	CGCCAGGATCTTTGATCCATCTG TTGCGACATGTTCCTCCTCATCG	296-CP	95 ºC 30 s	66 ºC 30 s	72 ºC 45 s	Whitfield et al. 2005
MiLBVV	TATCAGCTCACATACTCCCTATCG CAACTAGCTCAGAATACATGCAG	469-CP	95 ºC 30 s	61 ºC 30 s	72 ºC 120 s	Whitfield et al. 2005
LMV	AAGGCAGTAAAACTGATG TTTATACTACAGTCTTTA	800-CP	95 ºC 60 s	42 ºC 60 s	72 ºC 120 s	Zerbini et al. 1995

Table 2. Prevalence of viruses of lettuce samples collected in 2015.

The region	Field surveyed	Samples collected	MiLBVV	LMV	CMV	TSWV	LBVaV	Infection rates
Beypazarı	39	289	29	22	-	-	6	2.71
Nallıhan	3	20	9	-	-	-	-	10.5
Ayaş	1	5	-	1	-	-	-	2.5
Çubuk	1	5	1	2	-	-	-	3
Centrum	1	5	-	-	-	-	-	0
Total	45	324	39	25	-	-	6	9.76

(ORAL PRESENTATION)

Effects of Fig Seed Flour on Some Quality Parameters of Cookies

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Abstract

In the presented study, it was aimed to develop cookies with fig seed flour (FSF) and to determine their chemical, physical, textural and sensory parameters. FSF was replaced with wheat flour at 0%, 10% 20% and 30% levels in cookie formulation. FSF usage increased protein and ash content of cookies while it was provided with a considerable increment in total dietary fibre content (from 1.93% to 11.06% at 30% usage level of FSF). Increase at the diameter and spread ratio of cookies were observed and they were showed lower instrumental hardness by adding 10, 15 and 30% FSF (4362.3 kg to 3328.7 kg) when compared to control cookie (6394.8 kg). Usage of FSF led to cookies become darker and redder. On the other hand, their yellowness value was decreased in proportion to the rising FSF level. The developed cookies were found a high potential for acceptance and commercialisation. It is noteworthy that as the level of FSF in cookie formulations increased, purchasing score was also increased. It was concluded that the use of FSF in cookie production would improve dietary fibre, protein and mineral content, without affecting their technological quality or sensory acceptance.

Key words: Cookie, dietary fibre, fig seed, acceptance.

INTRODUCTION

Ficus carica L. is the member of the Moraceae family and has significant commercial importance for dry and fresh consumption and commonly referred to as "fig" (Barolo et al., 2014). Figs, native to Turkey and the eastern Mediterranean are one of the first plant cultivated by humans (Mawa et al., 2013). Areas, where the fig can be grown, are limited because it requires unique fertilisation and different drying possibilities compared to other fruits. Turkey has a great contribution to the world fruit production with its fresh figs production quantity (Gül and Akpınar, 2006). Total fig production in 2017 in the world was 1050.459 tonnes (FAO, 2019). Turkey is ranked first over the world with its 306.499 tonnes of fresh fig production in 2018 (TUİK, 2019). According to the latest statistical data (2016) of FAO; Turkey takes first place in terms of exportation (69.683 tonnes) of dried figs in the world (FAO, 2019).

Fresh and dried figs (*Ficus carica L.)* have higher amounts of phenolic compounds (Vallejo et al., 2012), superior quality antioxidants and most notably fiber. Thus they should be a greater part of the diet (Vinson et al., 2005). Alshaeri et al. (2014) reported that higher Ca, K, Fe and Cu intakes, with the consumption of dried figs. Dried figs have the best score among the dried fruits with their healthy nutrient composition (Barolo et al., 2014). Because of its higher health beneficial effects, *F.carica* has been traditionally used for its medicinal and therapeutic benefits as metabolic, anti-inflammatory, respiratory, antispasmodic, laxative, and cardiovascular remedies (Mawa et al., 2013).

Dried figs are consumed as a snack. Besides they have various consumption areas such as in the pastry, dishes, bread, candies, desserts and fruit mixtures. They are used whole, concentrate, diced, powder or paste form in these foods. Low-quality figs are used to produce molasses and/or ethyl alcohol. The fig seeds arisen during the production of ethyl alcohol are also evaluated in the paint, cosmetic and pharmaceutical industries (Anonymous,2017).

Cookies are a shelf-stable product, and also they can be consumed at any time of the day by every age group. Monthly consumption of biscuits was reported by Gül et al. (2017) as 433.44 g in Isparta, Turkey. As a result of increasing demand to functional cookies formulated with several value-added ingredients, considerable development in the biscuit industry has been beginning. Consequently, a large number of ingredients and flours such as; grape pomace and grape seed flours (Acun and Gül, 2014), fenugreek seed (Wani et al., 2016), alfalfa seed (Giuberti et al., 2018), heat stabilized wheat germ (Gül et al., 2018) and *Hibiscus sabdariffa L*. seed powder (Nguyen et al., 2018), chia seed (O et al., 2019) have been supplemented in cookie formulations to improve their nutritional, functional and technological qualities.

Fig seeds after grinding to flour can also be considered as a functional ingredient in cookie formulations and/or other bakery products. To the best of our knowledge, no published studies focused on the usage of fig seed flour (FSF) in cookie formulation. In this study, we aimed to investigate the effect of the replacement of wheat flour with different percentages of FSF on chemical, physical, textural and sensorial properties of cookies.

MATERIALS AND METHODS

Materials

Vacuum packed FSF was obtained from Bir Numaralı Bitkisel Ürünler Gıda (Aydın, Turkey). Commercial cookie wheat flour from Türkmenler Milling Factory (Gaziantep, Turkey), corn syrup (42%) from Sunar Corn Integrated Plant Inc. (Adana, Turkey), sodium bicarbonate from Şişecam Chemicals Group Soda Industry (Mersin, Turkey), hydrogenated vegetable oil, fine granulated sugar and salt were purchased from local markets. All chemicals were used in analytical grade.

Preparation of cookies

Cookies were produced in triplicate following the AACC Method 10-50.05 (AACC, 2000) with slight modifications. In the control cookies, FSF was not used. 10%, 20% and 30% of FSF were replaced with wheat flour in the FSF enriched cookies. 225 g wheat flour or wheat flour-FSF mixture, 130.0 g fine granulated sugar, 64 g hydrogenated vegetable oil, 33 g high fructose corn syrup (42%), 16.0 ml distilled water, 2.5 g sodium bicarbonate and 2.1 g salt were used in the cookie formulation.

The dough was kneaded with a mixer (Hobart, N-50, Germany) according to the procedure given in the method 10-50.05 (AACC, 2000). Subsequently, the dough was laminated to a thickness of 5 mm by rolling pin. The round form of the cookies was obtained by circular scone cutter 60 mm in diameter. The cookies were baked in an electric convection oven (Fimak FSET4, Turkey) at a temperature of 205 ± 5 °C during 10 min. Afterwards, the cookies were cooled at ambient temperature (20–25°C) and packed in high-density polyethene bags with hermetic cover until further analysis.

Chemical analysis

Moisture (Method 44-01.01), ash (Method 08-01.01), protein (Method 46-12.01), total lipid (Method 30-25.01), pH (Method 02-52.01) and total dietary fibre (Method 32-05.01) content of control and cookies prepared with FSF were determined by using AACC Methods (AACC, 2000). Water activity (aw) of cookies were measured according to methods of Woody (2003) by using aw-meter (Novasina AG, LabSwift-aw, Switzerland).

Physical analysis

Diameter (Width, W), thickness (T), and spread ratio (W/T) were calculated as reported by Gül et al. (2018). Colour values; L (lightness), a (redness) and b (yellowness) of cookies were measured by using colourimeter (Minolta CR410, Minolta Co Ltd., Tokyo, Japan). Average values were recorded after five readings for each measurement.

Texture analysis

Hardness and "fracturability" of cookies were measured with 3-Point Bending Rig (HDP/3PB) of texture analyser (TA-XTplus, Stable Micro Systems, UK) with 5 kg load cell. Test parameters were performed as; pre-test speed: 1.0 mm/s, test speed: 3.0 mm/s, post-test speed; 10 mm/s, distance: 5.0 mm and data acquisition rate 500 pps.

Sensory analysis

Sensory evaluation of all cookies was performed by fifteen untrained members of the Food Engineering Department of Süleyman Demirel University by using the sensory profiles method (Lawless and Heymann, 2010). Cookie samples were coded with three digits and served to panellist randomly. Glass of water was presented to panellists to rinse their mouth when crossing between samples. Cookies were evaluated in terms of colour, surface structure, texture (hardness and brittleness), flavour, odour, mouthfeel, overall acceptability, and purchasing intent. Hedonic scale from 1 to 5 point 'dislike extremely' to 'like extremely' was used, respectively.

Statistical analysis

Statistical analysis of the cookies prepared with different amounts of FSF was evaluated according to Duncan's multiple range test with significance defined at $P < 0.01$. Analysis of variance (ANOVA) was performed by using the software, statistical package for social science (SPSS 16.0). All the experiments were done in triplicate.

RESULTS AND DISCUSSIONS

Chemical composition of cookies

Moisture, ash, protein, total lipid, total dietary fibre, pH and aw values of cookies are given in Table 1. There is no significant difference between the moisture content of cookies. It is an important advantage that the moisture levels of cookies did not increase with the addition of FSF. Because high moisture content reduces eating quality by means of reducing brittleness. Higher moisture content (16.63%) of dried fig fruit had been found by Soni et al. (2014). Because of its dry nature, FSF did not lead to an increase in the moisture content of cookies.

Table 1. Chemical composition of control and FSF enriched cookies[1]

FSF (%)	Moisture (%)	Ash (%)	Protein (%)	Total lipid (%)	Total dietary fibre (%)	pH	aw
0	6.15±0.16^{a}	1.32±0.00^{d}	9.70±0.01^{b}	13.73±0.02^{c}	1.93±0.12^{d}	7.30±0.00^{c}	0.45±0.00^{a}
10	7.69±0.40^{a}	1.43±0.02^{c}	12.33±0.10^{a}	13.80±0.04^{bc}	6.16±0.26^{c}	7.33±0.00^{bc}	0.44±0.01^{a}
20	7.30±0.18^{a}	1.54±0.00^{b}	13.00±0.08^{a}	14.28±0.01^{b}	8.74±0.20^{b}	7.40±0.01^{b}	0.44±0.01^{a}
30	6.33±0.79^{a}	1.56±0.00^{a}	13.00±0.10^{a}	15.15±0.02^{a}	11.06±0.27^{a}	7.50±0.00^{a}	0.39±0.00^{b}

[1]: There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).

All the FSF containing cookies had significantly higher levels of ash, protein, total lipid and total dietary fibre than the control made from 100% wheat flour (Table 1). As expected, with the addition of FSF in wheat flour increased, the ash content –indicates the higher mineral content- was increased due to the higher content of minerals in the FSF. Ash refers to the total amount of minerals present in food. High ash content (4.65%) of dried fig fruit indicates that it is a good source of minerals like strontium, calcium, magnesium, phosphorus and iron (Soni et al., 2014). Ficsor et al. (2013) stated that the eating five dkg of dried fig satisfies the more than 15% of the Recommended Dietary Allowances due to its contents of minerals for Ca, Cr, Cu, Fe, K, Mg, Mn and Mo. There is no literature data on the nutrient content of fig seed supplemented cookies. Therefore the results of the presented study were compared with published data dealing with the composition of fresh and/or dried figs and cookies incorporated with other fruit seeds other than fig seeds.

Protein content was increased from 9.70% to 13.00% with the replacement of wheat flour with 30% FSF (Table 1). This limited increase in the protein content of cookies may be attributed to a moderate amount of protein content (4.67%) of dried fruit (Soni et al., 2014). A slight increase in total lipid content of cookies about the control sample was achieved by incorporation of FSF, ranging from 10% to 30% (Table 1). Notably part of the bulk of dried fig consists of seeds may be large, medium, small or minute and range in number from 30 to 1,600 per fruit and these seeds are rich in oil (Kolesnik et al., 1986; Joseph and Raj, 2011).

Dried figs take an important place among dried fruits in nutritional point of view with their high fiber content (Vinson et al., 2005). Thus they have several health benefits with their good dietary fiber content (Soni et al., 2014). The most important improvement was observed in the dietary fiber content of cookies by the supplementation of FSF. Total dietary fiber content of cookies was increased from 1.93% (control) to 6.16%, 8.74% and 11.06% for 10%, 20% and 30% FSF containing cookies, respectively (Table 1). The findings suggest that FSF can be used in cookie formulations or other bakery products as a dietary fiber enhancer. Cookies supplemented with 10%, 20% and 30% FSF can be categorised in the source of fibre and high fibre food according to Regulation of the European Parliament of the Council (EC) No 1924/2006 of 20 December on Nutrition and Health Claims Made on Foods. In this regulation claims that a food is a source of fibre, and any claim likely to have the same meaning for the consumer, may only be made where the product contains at least 3 g of fibre per 100 g or at least 1.5 g of fibre per 100 kcal. A claim that a food is high in fibre, and any claim likely to have the same meaning for the consumer, may only be made where the product contains at least 6 g of fibre per 100 g or at least 3 g of fibre per 100 kcal (EC Regulation No 1924/2006).

Similar observations - an increase in the dietary content of cookies by the addition of different seeds-were reported by several researchers. In a previous study of Nguyen at al. (2018), the result shows that the increase of the fiber content in the cookies with *Hibiscus sabdariffa L.* seed powder. Acun and Gül (2014) have established that an increase in the dietary fibre content of cookies that include grape seed flour. Presentation of the higher fiber of the cookies incorporated with pumpkin seed (Moura et al., 2010), grape seeds (Kuchtová et al., 2018) also has been reported.

The addition of FSF to wheat flour cookies has slightly affected the pH and aw values of cookies (Table 1). Control cookie (7.33) was shown the lower pH (7.33) value, while the FSF added cookies were shown a gradual increase parallel to the FSF level. Although O et al. (2019) determined a lower pH of the cookies (6.31-6.41) containing roasted chia seed powders.

Cookie Properties

Geometrical Properties of Cookies

Measurements of geometrical and colour properties of cookies are presented in Table 2. The addition of FSF in cookie formulation resulted in a significant increase in diameter (W values) when the substitution level of FSF increased over 10% level. However, no significant difference was detected between control and FSF enriched cookies in terms of thickness (T value). Spread ratio (W/T) of FSF enriched cookies was increased significantly compared to 100% wheat flour cookies (control). However, increasing the level of substitution from 10% to 30% did not change the spread ratio significantly, a significant difference being observed between control and FSF cookies. Higher spread factor is the indicator of better cookie quality (Miller and Hoseney, 1997). The same results of an increase in the spread ratio of

cookies than the control cookies were also reported by O et al. (2019) and Kuchtová et al. (2018) after incorporating of 3% roasted chia seeds (180°C, 15 min) and by 15% grape seeds respectively.

Table 2. Physical properties of control and FSF enriched cookies[1]

FSF (%)	W (mm)	T (mm)	W/T	L	a	b
0	63.94±0.15^{c}	8.95±0.36^{a}	7.14±0.29^{a}	60.92±0.63^{a}	6.51±0.17^{d}	20.08±0.11^{a}
10	64.95±0.95^{bc}	8.18±0.10^{a}	7.94±0.08^{b}	51.38±0.07^{b}	7.81±0.08^{c}	17.94±0.01^{b}
20	66.47±0.88^{ab}	8.56±0.31^{a}	7.76±0.37^{b}	47.15±0.03^{c}	7.98±0.09^{b}	16.18±0.01^{c}
30	67.86±0.46^{a}	8.62±0.03^{a}	7.87±0.06^{b}	42.13±0.02^{d}	8.94±0.01^{a}	14.98±0.08^{d}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$). W: Width, T: Thickness, W/T: Spread ratio, L: Lightness, a: redness, b: yellowness

Colour properties of cookie samples

The lightness parameter L and yellowness parameter b were decreased linearly with the increasing level of FSF (Table 2). 30 % of FSF containing cookies showed the darkest colour. In contrast, a value (redness) of cookies containing FSF has exhibited an increasing trend with increasing substitution level of FSF. Darkening effect of FSF on cookies may be attributed to the natural pigments found naturally in the fig seeds and also Maillard reaction that produces desirable colours and flavours in baked products. Maillard reactions occur under alkaline conditions; thus, optimal browning takes place at pH 6–8. Therefore when the pH level of FSF enriched cookies (7.33-7.50) is regarded, it can be said that they have an optimal pH to occur Maillard reactions. Moreover, sugars in the FSF can enhance Maillard reactions. Acun and Gül (2014) and Kuchtová et al. (2018) reported a decreasing trend at lightness "L" and redness "a" while increasing trend at yellowness "b" values of the cookies with increasing substitution level of grape seed flours which were in agreement with our results.

Textural properties of cookie samples

Textural properties of cookies can be observed in Table 3. The texture is an important quality evaluation factor of cookies (Giuberti et al., 2018). Replacement of a part of wheat flour with increasing levels of FSF decreased linearly the hardness of cookies which required less force to compress. The hardness value of control cookies was nearly %92 greater than the 30% FSF, including cookies. On the other hand, FSF usage in cookie formulation did not cause a considerable change in fracturability values of cookies. Our results are in line with those reported by Giami and Barber (2004) who found a gradual decrease on the hardness of the cookies when germinated pumpkin seed incorporated in the composite cookie at 5%, 10%, 15%, 20% and 25% levels. In contrast to our results, Rajiv et al. (2012) and Awolu et al. (2018) reported an increased at the breaking strength of cookies with the increase in the level of flaxseed and defatted mango kernel seed flour respectively.

Table 3. Textural properties of control and FSF enriched cookies[1]

FSF (%)	Hardness (kg)	Fracturability (mm)
0	6394.8±572.53^{a}	39.20±0.43^{a}
10	4362.3±103.01^{b}	38.91±0.15^{a}
20	4062.5±109.94^{c}	38.83±0.11^{a}
30	3328.7±152.00^{d}	38.68±0.18^{a}

(1): There is no statistically significant difference between the averages indicated by the same letter in the same column ($p<0.01$).

Sensory evaluation of control and FSF enriched cookies

The effect of FSF addition on sensory attributes and overall acceptability of cookies were evaluated. The surface colour of the cookies was scored similarly to control cookies except 20% FSF containing cookies which were scored the least. Interestingly surface colour of 30% FSF supplemented cookies was more liked than others by the evaluators. Compared to control cookie, cookies containing FSF gave a similar or slightly higher sensory score in terms of all sensorial properties. Also, the overall acceptability of 10% and 30% FSF added cookies was found as well as control samples.

Moreover, the odour of 30% FSF cookies was admired the most. Purchasing intent of cookies was linearly increased as the usage level of FSF increased. As a result, FSF had no detrimental effect on colour, taste, aroma, odour, overall acceptability and affordability of cookies. Furthermore, some sensorial values, especially overall acceptability and purchasing intent of FSF supplemented cookies, were found higher than control cookies.

Our sensory scores showed that increasing levels of FSF in cookie formulation made cookies more attractive.

Whereas generally addition of fiber to cereal products at an increasing level lead them to become less attractive.

Therefore the positive sensorial evaluations of FSF at higher usage levels is an important advantage of for cookie producers and consumers. It could, therefore, be inferred that incorporation of 30% FSF into wheat flour resulted in cookies with acceptable sensory properties. However, in the literature, the use of fiber sources has been achieved in a less level than the present study to produce cookies with acceptable quality. Giami and Barber (2004) were produced acceptable cookies from wheat flour – pumpkin concentrate blends containing 5 – 15% protein concentrate from ungerminated seeds. Acun and Gül (2014) reported that the cookies containing up to 5% grape seed flour were most appreciated in terms of sensorial properties and purchasing intent. Maximum sensorially acceptable tamarind (*Tamarindus indica L.*) seed powder level was determined as 6% for cookies by Natukunda et al. (2015). Awolu et al. (2018) stated that of up to 25% mango kernel flour into wheat flour resulted in cookies with acceptable sensory properties.

CONCLUSIONS

In this study, the effects of fig seed flour obtained from dried figs on the quality of cookies were investigated. Results of the present study conclude that the FSF can be used in cookie formulations or other oven-baked products as a valuable alternative for the enrichment of cookies. The results from chemical composition analysis showed that FSF addition increased the nutritional value of cookies in terms of protein, total lipid, total dietary fibre and ash (mineral) content without affecting their technological and sensorial quality. FSF addition at higher levels (30%) was increased the affordability of cookies compared with control. This indicates that the market share of FSF added cookies might be high if they are produced commercially. Also, usage of FSF as an additive in the other bakery products and also other food products will provide an economic contribution to fig producers.

REFERENCES

AACC, 2000. International. Approved Methods of Analysis, 11th Ed. AACC International, St. Paul, MN, U.S.A.

Acun, S., Gül, H., 2014. Effects of grape pomace and grape seed flour on cookie quality. Quality Assurance and Safety of Crops & Foods, 6 (1), 81-88. DOI: 10.3920/QAS2013.0264.

Alshaeri, H.K., Natto, Z.S., Tonstad, S., Haddad, E., Siegl, K.J. (2014). Effect of dried California Mission figs on mineral status and food replacement. Public Health Nutrition, 18(6), 1135–1140. DOI:10.1017/S1368980014001566.

Anonymous (2017). Dried fig. Sectorial report of Republic of Turkey Ministry of Economics. https://ticaret.gov.tr/data/5b8700a513b8761450e18d81/Kuru_Incir.pdf

Awolu, O.O., Sudha, L.M., Manohar, B. (2018). Influence of defatted mango kernel seed flour addition on the rheological characteristics and cookie making quality of wheat flour. Food Science & Nutrition, 6(8), https://doi.org/10.1002/fsn3.825.

Barolo, M.I., Mostacero, N.R., López, S.N. (2014). *Ficus carica L.* (Moraceae): An ancient source of food and health. Food Chemistry, 164, 119–127. DOI:10.1016/j.foodchem.2014.04.112.

EC Regulation No 1924, (2006). Parliament, E. Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods. E. Parliament (Ed.),

FAO. (2019). Food and Agriculture Organization of the United Nations, Statistics.

Ficsor, E., Szentmihályi, K., Lemberkovics, E., Blázovics, A., Balázs, A., (2013). Analysis of *Ficus Carica L.* –volatile components and mineral content. European Chemical Bulletin, 2(3), 126-129.

Giami, S.Y., Barber, L.I. (2004). Utilization of protein concentrates from ungerminated and germinated fluted pumpkin (*Telfairia occidentalis Hook*) seeds in cookie formulations. Journal of the Science of Food and Agriculture, 84:1901–1907. DOI: 10.1002/jsfa.1881.

Giuberti, G., Rocchetti, G., Sigolo, S., Fortunati, P., Lucini, L., Gallo, A., (2018). Exploitation of alfalfa seed (*Medicago sativa L.)* flour into gluten-free rice cookies: Nutritional, antioxidant and quality characteristics. Food Chemistry, 239, 679-687. DOI:10.1016/j.foodchem.2017.07.004

Gül, H., Hayıt, F., Bıçakcı, S., Acun, S. (2018). Effect of heat stabilized wheat germ on some properties of cookies. Fresenius Environmental Bulletin, 27 (2), 1145-1151.

Gül, H., Kart, F.M., Gül, M., Akpınar, M.G. (2017). Bakery products consumption and consumers' awareness in urban areas of Isparta city, Turkey. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", 17 (2), 137-146.

Gül, M., Akpınar, M.G. (2006). An assessment of developments in fruit production in the world and Turkey. Journal of the Faculty of Agriculture, Akdeniz University, 19(1), 15-27.

Joseph, B., Raj, S.J. (2011). Pharmacognostic and phytochemical properties of *Ficus carica* Linn –An overview. International Journal of PharmTech Research 3 (1), 08-12.

Kolesnik, A.A., Kakhniashvili, T.A., Zherebin, Y.L., Golubev, V.N., Pilipenko, L.N. (1986). Lipids of the fruit of *Ficus carica*. Chemistry of Natural Compounds, 22(4), 394–397.

Kuchtová, V., Kohajdová, Z., Karovičová, J., Lauková, M. (2018). Physical, textural and sensory properties of cookies incorporated with grape skin and seed preparations. Polish Journal of Food and Nutrition Sciences, 68 (4), 309–317. DOI: 10.2478/pjfns-2018-0004.

Lawless, H. T., Heymann, H. (2010). Sensory evaluation of food principles and practises, descriptive analysis (2nd ed.). Gaithersburg: Chapman & Hall/Aspen Publishers, Inc.

Mawa, S., Husain, K., Janta, I. (2013). Ficus carica L. (Moraceae): Phytochemistry, traditional uses and biological activities. Evidence-Based Complementary and Alternative Medicine, Volume 2013, Article ID 974256, 8 pages http://dx.doi.org/10.1155/2013/974256.

Miller, R.A., Hoseney, R.C. (1997). Factors in hard wheat flour responsible for reduced cookie spread. Cereal Chemistry. 74(3):330–336.

Moura, F.A., Spier, F., Zavareze, E.R., Dias, A.R.G., Elias, M.C. (2010). Cookie elaborated with different fractions of pumpkin seed (*Curcubita maxima*)/Biscoitos tipo 'cookie' elaborados com diferentes fracoes de semente de abobora (*Curcubita maxima*)." Alimentos e Nutricao [Brazilian Journal of Food and Nutrition], 21 (4), 579-585.

Natukunda, S., Muyonga, J.H., Mukisa, I.M. (2015). Effect of tamarind (*Tamarindus indica L.*) seed on antioxidant activity, phytocompounds, physicochemical characteristics, and sensory acceptability of enriched cookies and mango juice. Food Science & Nutrition, 4(4),494-507. DOI: 10.1002/fsn3.311

Nguyen, N.T.T., Le, H.A.V., Pham, D.A., Tran, T.N.Y. (2018). Evaluation of physical, nutritional and sensorial properties cookie supplied with *Hibiscus sabdariffa L*. seed powder (without shell). International Food Research Journal, 25 (3), 1281–1287.

O, H.B., Song, K.Y., Joung, K.Y., Shin S.Y., Kim Y.S. (2019). Effects of chia (Salvia Hispanica L.) seed roasting conditions on quality of cookies. Italian Journal of Food Science, 31(1), 54-66. DOI:https://doi.org/10.14674/IJFS-1198.

Rajiv, J., Indrani, D., Prabhasankar, P., Rao, G.V. (2012). Rheology, fatty acid profile and storage characteristics of cookies as influenced by flax seed (*Linum usitatissimum*). Journal of Food Science and Technology, 49(5):587–593. DOI 10.1007/s13197-011-0307-2.

Soni, N., Mehta, S., Satpathy, G., Gupta, R.K., (2014). Estimation of nutritional, phytochemical, antioxidant and antibacterial activity of dried fig (*Ficus carica*). Journal of Pharmacognosy and Phytochemistry, 3 (2): 158-165.

TUİK, 2019. Turkish Statistical Institute, http://www.turkstat.gov.tr

Vallejo, F., Marín, J.G., Barberán, F.A.T. (2012). Phenolic compound content of fresh and dried figs (*Ficus carica L.*). Food Chemistry, 130, 485–492. https://doi.org/10.1016/j.foodchem.2011.07.032

Vinson, J.A., Zubik, L., Bose, P., Samman, N, Proch, J. (2005). Dried fruits: excellent in vitro and in vivo antioxidants. Journal of the American College of Nutrition (J Am Coll Nutr), 24(1), 44-50. DOI:10.1080/07315724.2005.10719442

Wani, S.A., Bishnoi, S., Kumar, P. (2016). Ultrasound and microwave-assisted extraction of diosgenin from fenugreek seed and fenugreek-supplemented cookies. Journal of Food Measurement and Characterization, 10(3), 527-532. DOI 10.1007/s11694-016-9331-2

Woody, A.L. (2003). Probing and three-point bend methods compared to sensory scales as measurements for cookie texture, Master's Thesis, University of Tennessee, Knoxville, 112p.

(ORAL PRESENTATION)

The new functional fruit: Goji berry for Turkey

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Abstract
Goji berry has been used in traditional medicine and food for over 2000 years, especially in China and Tibet and which are commonly grown in East Asia, especially in Tibet and nicknamed `happy berries` because of the sense of wellbeing. Lycium barbarum, L. chinense and L. ruthenicum, belonging to the genus Lycium is a common name given to the fruits of its species. Lycium species containing about 80 species, distributed in tropical and subtropical regions of the world is a member of the family Solanaceae (Levin and Miller, 2005). Official record of the total amount of goji berry produced in our country could not be found. However, up to now we can reach the goji berry cultivation according to the information we have obtained from entrepreneur farmers, goji berry agriculture was started within 3-4 years and success was achieved in the harmony of the plant. But this plant cultivation areas are quite limited. In this research, different genotypes of goji berry, which are very important in terms of medicine, were planted on the Research and Application Area of Akdeniz University, Faculty of Agriculture in Antalya city and will be carried out phenological and pomological experiments in the future time. In addition, the purpose of this research is to discuss the effects on human health.

***Key words**: usage area, human health, growing technique*

INTRODUCTION

Goji berry (*Lycium barbarum* L., English name; Wolfberry) is a species that belongs to the Solonaceae family and has been used in traditional medicine and food for more than 2000 years, especially in China and Tibet. The fruit consumed as a functional food in China is named as “fruit of happiness “.The most widely cultivated species around the World are *Lycium barbarum*, *L. chinense* and *L. ruthenicum* (Figure 1) (Wang et al., 2015).



Figure 1. Lycium species: (a) *L. barbarum*, (b) *L. chinense* and (c) *L. ruthenicum*.

Goji berry's fruits and leaves are used as a functional food in China because of very valuable in terms of health. Roots, leaves and even flowers are also very valuable for their benefits to human health.

In recent years, research on this plant has gained speed in our country (Endes et al., 2015; Gunduz et al.,2015; Dursun et al., 2015; Ozer and Bayraktar 2016; Bekci et al., 2017; Ozpınar et al., 2017; Kocyigit et al., 2017; Cumaoglu et al., 2018; Basaran et al., 2018; Ozkan et al., 2018; Balcı and Yakupoglu 2018; Oguz et al., 2019; Colak et al., 2019; Oguz et al., 2019) and it is seen that multidisciplinary studies are needed in addition to increasing the cultivation areas and yield of Lycium species having commercial and medical importance. Therefore, the garden with 4 different genotypes were established in the Research and Application Area of Akdeniz University, Faculty of Agriculture in Antalya city and the researches were started.

USAGE AREAS

Their fruits in terms of healthy eating, their flowers due to long flowering period as a source of pollen and nectar for beekeeping, their leaves that can be used as tea (Figure 2) and it has an important role in cosmetic industry with its chemical content.



Figure 2. Fruit-flower-leaf of Goji berry (Anonymous 2019a).

Besides being a good food source, it is used as herbal medicine with its antipyretic, anti-inflammatory and anti-aging properties. Because of difficulties to maintain as fresh, it is usually consumed as dried; within fruit juice, tea, chocolate, cake, cosmetics, oil etc. areas can be used widely. Prior et al. reported that it has much more ORAC (Oxygen Radical Absorbance Capacity) value than many known fruits and vegetables (Figure 3) (Anonymous 2019c). ORAC refers to the

antioxidant level of nutrients. Nutrients with high ORAC levels protect cells and cell components from oxidative damage. Goji berry polysaccharides have been found to have many different important biological activities such as antioxidant, immunomodulatory, anti-tumor, neuro-protective, radiation protection, anti-diabetes, liver protection, bone resorption inhibitor, fatigue inhibitor (Mingliang et al., 2013). In recent years, it has a wide place in the markets of many countries as a healthy diet and retarding aging (Potterat, 2010).

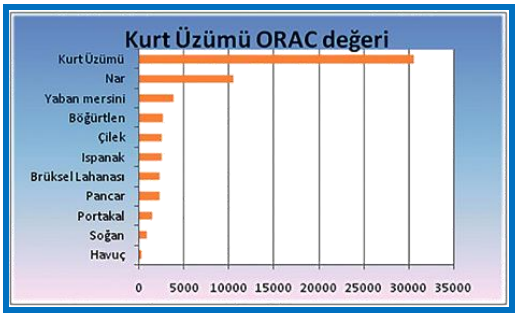


Figure 3. ORAC values of Goji berry (Turkish name: Kurt Üzümü) and some plants (Anonymous 2019c).

The benefits of the goji berry fruit can be listed as follows;

- ✓ Strengthens the immune system (Zhang et al., 2015).
- ✓ Balances blood sugar (Zhao et al., 2005; Cai et al., 2015).
- ✓ Protects the liver (Wang et al., 2009; Xiao et al., 2014).
- ✓ Revitalizes the skin (Zhao et al., 2005; Reeve et al., 2010; Zhao and Bojanowski, 2015).
- ✓ Increases the strength of heart vessels (Jia et al., 1998).
- ✓ Significantly prevents blood pressure elevations (Mi et al., 2015).
- ✓ Inhibits colon cancer cell lines (Mao et al., 2011).
- ✓ It has been shown to have a preventive effect on Alzheimer's disease. It's a good brain booster (Ho et al., 2015).
- ✓ It has been used as an aphrodisiac in China for centuries (Luo et al., 2006).
- ✓ It is recorded that it prevents sight loss (Cheng et al., 2005).
- ✓ It contains important elements such as iron, chromium, copper, magnesium, potassium, iodine, selenium, zinc, calcium, germanium and phosphorus in human nutrition (Pop et al., 2013; Gogoasa et al., 2014).
- ✓ It contains solavetivone with a strong anti-fungal and anti-bacterial effect (Wang et al., 2015).
- ✓ Contains physalin, an active natural compound against all types of leukemia (Amagase et al., 2009).

The possible side effects of Goji berry are as follows;

- It may cause side effects when taken with blood thinner and blood coagulant medication such as warfarin; - People who use diabetes medications need to be careful in the consumption of this fruit; - When consumed excessively, it may negatively affect the blood pressure levels of the body and cause hypertension; - In people with pollen allergies may cause health problems such as wheezing, sneezing, nasal congestion and itching in the eyes; it should only be taken during the day because it may cause insomnia when consumed too much; -Excessive consumption significantly increases the energy level and can cause problems such as too much energy concentration disorder, hyperactivity

and restlessness; - Excessive consumption increases the blood flow rate to more than normal levels, and this can lead to adverse conditions such as haemophilia that affect especially elderly people; - It may cause severe side effects such as dizziness, eye disease, blurred vision and hallucinations; - It contains plenty of selenium and may affect the growth of the fetus. Because of this feature, pregnant women should not consume this fruit; - Excessive consumption may cause problems such as indigestion, nausea and vomiting (Anonymous 2019).

GROWING TECHNIQUE

Goji berry does not choose the ecology and can grow up in all the soil conditions immediately. In very moist areas, problems occur in terms of fungal diseases. Tolerate extreme hot summer months. It can easily adapt to almost all types of soil from weak sandy soil to heavy clay soils, alkaline soils to acidic soils. If the regular pruning process is not applied, the plant can grow rapidly and branch up to 4 meters. Plant size (1.5-2 m) can be controlled by regular pruning and more fruit yield can be obtained. Although it varies according to the regions, irrigation should be done especially in the first years in order to overcome the summer drought and reach the desired yield. The ideal system is drip irrigation. In regions where precipitation is sufficient, irrigation can be terminated after 3-4 years by gradually decreasing in subsequent years. According to our preliminary experiments, it is easy to propagate by cuttings.

CONCLUSIONS

Goji berry is a multifunctional fruit which has many different types of evaluation and has the potential to be used in the treatment of many diseases. Similarly, goji berry, which has been used as a functional plant for centuries in China, has attracted the attention of the producers in our country with its high antioxidant properties and our producers have started to grow this fruit species. The garden has been established in Akdeniz University about this fruit and the studies have been started too. Although it refers to many sectors in terms of product variety, the areas of cultivation in our country are very limited, however studies on development should be focused on.

Goji berry cultivation, which does not require much additional input except for annual maintenance and harvesting processes, is promising.

Goji berry, which is considered as an alternative product in order to bring the unproductive lands into the economy, has the potential to contribute to the national economy through the processing plants, marketing and distribution networks to be established. Nowadays, the importance of natural foods from production to consumption is increasing. The activities provided by Goji berry gardens from the natural nutritional sources can contribute to the national economy.

Because of the root structure keeping the soil, as well as its high altitude, hot and cold resistance, it can be considered as the among primary plants in the forestation of forest lands.

This fruit should be considered as an alternative and functional fruit for consumers who are in a healthy and natural diet. Indeed, Republic of Turkey Ministry of Agriculture and Forestry added this fruit to the list of supporting medicinal and aromatic plants in 2015.

REFERENCES

Amagase, H., Sun, B., Borek, C. (2009). Lycium barbarum (Goji) juice improves in vivo antioxidant biomarkers in serum of healthy adults. *Nutrition Research*, 29(1), 19-25.

Anonymous(2019a). https://www.etsy.com/sg-en/listing /600172996/goji-berry-100-seeds-lycium-barbarum (Access date: 01.01.2019).

Anonymous(2019b).http://www.stylecraze.com/articles/serious-side-effects-of-goji-berries/(Access date: 01.01.2019).

Anonymous(2019c).http://www.gojiberrybahcesi.com/FileUpload/ks431142/File/kurt_uzumu.pdf

Balcı, G., Yakupoglu, T. (2018). Yarı-Kurak Bölgede Tesis Edilen Bir Üzümsü Meyve Bahçesindeki Toprak Sıkışması, *Türk Tarım – Gıda Bilim ve Teknoloji Dergisi*, 6(10), 1412-1418.

Bekci, H., Basaran, G. S., Baldemir, A., Cumaoglu, A. (2017). Goji Berry Fruit Extract Suppresses Cell Proliferation of Breast Cancer Cells by Inhibiting EGFR/ERK Signalling, *Proceedings*, 1,1058; doi:10.3390/proceedings1101058,www.mdpi.com/journal/proceedings

Cai, H., Liu, F., Zuo, P., Huang, G., Song, Z., Wang, T., Lu, H., Guo, F., Han, C., Su, G. (2015). Practical application of antidiabetic efficacy of Lycium barbarum polysaccharide in patients with type 2 diabetes. *Medicinal Chemistry*, 11, 383–390.

Cheng, C. Y., Chung, W. Y., Szeto, Y. T., Benzie, I. F. (2005). Fasting plasma zeaxanthin response to Fructus barbarum L. (wolfberry; kei tze) in a food-based human supplementation. *British Journal of Nutrition*, 93, 123–130.

Cumaoglu, A., Bekci, H., Ozturk, E., Yerer, M. B., Baldemir, A., Bishayee, A. (2018). Goji Berry Fruit Extracts Suppress Proliferation of Triple-Negative Breast Cancer Cells by Inhibiting EGFR-Mediated ERK/MAPK and PI3K/Akt Signaling Pathways, *Natural Product Communications*, 13 (6), 701-706.

Colak, A. M., Okatan, V., Polat, M., Guclu, S. F. (2019). Different harvest times affect market quality of Lycium barbarum L. berries, *Turkish Journal of Agriculture and Forestry*, 43, 1-8.

Dursun, R., Zengin, Y., Gunduz, E., Icer, M., Durgun, H. M., Daggulli, M., Kaplan, I., Alabalık, U., Guloglu C. (2015). The protective effect of goji berry extract in ischemic reperfusion in testis torsion, *Int J Clin Exp Med*, 8(2):2727-2733.

Endes, Z., Uslu, N., Ozcan, M. M., Er, F. (2015). Physico-chemical properties, fatty acid composition and mineral contents of goji berry (Lycium barbarum L.) fruit, *Journal of Agroalimentary Processes and Technologies*, 21(1), 36-40.

Gogoasa, I., Alda, L., Rada, M., Negrea, P., Negrea, A., Bordean, D. M., Velciov, A., Draghici, G. A., Gergen I. (2014). Goji berries (Lycium barbarum) as a source of trace elements in human nutrition. *Journal of Agroalimentary Processes and Technologies*, 20(4), 369–372.

Gunduz, E., Dursun, R., Zengin, Y., Icer, M., Durgun, H. M., Kanıcı, A., Kaplan, I., Alabalık, U., Gurbuz, H. Guloglu, C. (2015). Lycium barbarum extract provides effective protection against paracetamol-induced acutehepatotoxicity in rats. *International Journal Clinical Experimental Medicine*, 8(5), 7898–7905.

Ho, L., Qin, W., Pompl, P. N., Xiang, Z., Wang, J., Zhao, Z., Peng, Y., Cambareri, G., Rocher, A., Mobbs, C. V., Patrick, R., Hof, P. R., Pasinetti G. M. (2015). Diet-induced insulin resistance promotes amyloidosis in a transgenic mouse model of Alzheimer's disease, *The FASEB Journal*, 18, 902-904.

Jia, Y. X., Dong, J. W., Wu, X. X., Ma, T. M., Shi, A. Y. (1998). The effect of Lycium barbarum polysaccharide on vascular tension in two-kidney, one clip model of hypertension. *Acta Physiologica Sinica*, 50(3), 309–314.

Kocyigit, E., Sanlier, N. (2017). A Review of Composition and Health Effects of Lycium barbarum. *International Journal of Chinese Medicine*, 1(1), 1-9, http://www.sciencepublishinggroup.com/j/ijcm, doi: 10.11648/j. ijcm.20170101.11

Luo, Q., Li, Z., Huang, X., Yan, J., Zhang, S., Cai, Y. Z. (2006). Lycium barbarum polysaccharides: protective effects against heat-induced damage of rat testes and H2O2-induced DNA damage in mouse testicular cells and beneficial effect on sexual behavior and reproductive function of hemicastrated rats. *Life Science*, 79(7), 613–621.

Mao, F., Xiao, B., Jiang, Z., Zhao, J., Huang, X., Guo, J. (2011). Anticancer effect of Lycium barbarum polysaccharides on colon cancer cells involves G0 / G1 phase arrest. *Medical Oncology*, 28(1), 121–126.

Mi, X. S., Huang, R. J., Ding, Y., Chang, R. C. C., So, K. F. (2015). Effects of Lycium barbarum on modulation of blood vessel and hemodynamics. *In: Lycium barbarum and Human Health,* (Eds: Chang, R.C.C. and So, K.F.), Springer, pp. 65–79.

Mingliang, J., Qingsheng, H., Ke, Z., Peng, S. (2013). Biological activities and potential health benefit effects of polysaccharides isolated from Lycium barbarum L. *International Journal of Biological Macromolecules*, 54, 16–23.

Oguz, H. I., Erdogan, O., Karasahin, Z., Gokdogan, O. (2019). Determining the Morphologic, Yield and Phytochemical Properties of 'Damaye' and 'Nq-7' Goji Berry Varieties Under Semi-Arid Climate Conditions, *Erwerbs Obstbau*, https://doi.org/10.1007/s10341-019-00420-w.

Ozkan, E. E., Ozden, T. Y., Toplan, G. G., Mat, A. (2018). Phenolic content and biological activities of Lycium barbarum L (Solanaceae) fruits (Goji berries) cultivated in Konya, Turkey, *Tropical Journal of Pharmaceutical Research*, 17 (10), 2047-2053.

Ozpinar, H., Ozpinar, N., Karakus, S. (2017). The Physiological and Genotoxic Effects of Water and Ethanol Extracts of Goji Berry (Lycium barbarum L.) on Model Organisms. *Journal of Clinical and Experimental Investigations*, 8(3), 76-84.

Ozer, G., Bayraktar, H. (2016). First Report of Powdery Mildew, Caused by Arthrocladiella Mougeotii, on Goji Berry in Turkey, *Journal of Plant Pathology*, 98 (3), 677-697.

Pop, A., Muste, S., Man, S., Mureşan, C. (2013). Study of valorification of Lycium barbarum (goji) in pastry products. *Bulletin UASVM Food Science and Technology*, 70(2), 93–98.

Potterat, O. (2010). Goji (Lycium barbarum and L. chinense): phytochemistry, pharmacology and safety in the perspective of traditional uses and recent popularity. *Planta Medica*, 76(1), 7–19.

Prior, R. L., Joseph, J. A., Cao, G., Shukitt-Hale, B. (1999). USDA-ARS Human Nutrition Research Center on Aging at Tufts University, 711 Washington St., Boston, MA.

Reeve, V. E., Allanson, M., Arun, S. J., Domanskia, D. Paintera, N. (2010). Mice drinking goji berry juice (Lycium barbarum) are protected from UV radiation-induced skin damage via antioxidant pathways. *Photochemistry Photobiology Science*, 9(4), 601–607.

Tipoe, G. L. (2014). Lycium barbarum polysaccharides therapeutically improve hepatic functions in non-alcoholic steatohepatitis rats and cellular steatosis model. *Scientific Reports*, 4, 55–87.

Wang, N. T., Lin, H. I., Yeh, D. Y., Chou, T. Y., Chen, C. F., Leu, F. C., Wang, D., Hu, R. T. (2009). Effects of the antioxidants Lycium barbarum and ascorbic acid on reperfusion liver injury in rats. *Transplantation Proceedings*, 41(10), 4110–4113.

Wang, Y., Chen, H., Wu, M., Zeng, S., Liu, Y., Dong, J. (2015). Chemical and genetic diversity of wolfberry. In: Lycium barbarum and Human Health, (Eds: Chang, R.C.C. and So, K.F.), Springer, 1–27.

Xiao, J., Xing, F., Huo, J., Fung, M. L., Liong, E. C., Ching, Y. P., Xu, A., Chang, R. C. C., So, K. F., Zhang, X., Zhou, W., Zhang, Y. (2015). Immunoregulation and Lycium barbarum, In: Lycium barbarum and Human Health, (Eds: Chang, R.C.C. and So, K.F.), Springer, 27–44.

Zhao, H., Bojanowski, H. (2015). Dermatologic uses and effectsof Lycium barbarum. In: Lycium barbarum and Human Health, (Eds: Chang, R.C.C. and So, K.F.), Springer, pp. 79-85.

Zhao, R., Li, Q., Xiao, B. (2005). Effect of Lycium barbarum polysaccharide on the improvement of insulin resistance in NIDDM rats. *Journal of the Pharmaceutical Society of Japan*, 125(12), 981-988.

(ORAL PRESENTATION)

THE INVESTIGATION OF POSSIBILITY OF PROPOLIS AS ADDITIVES IN ALFALAFA SILAGES

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ABSTRACT

This study was carried out to determine chemical, fermentation, microbiological and sensory properties of alfalfa silages of propolis added at different levels as additive. In the study, propolis was added to alfalfa silages at 0 % (control), 0.5, 1.0 and 2.5 levels. The ensiling period continued for 75 days. There was no statistically significant difference between dry matter, crude ash, crude protein, NDF ADF contents and lactic acid bacteria count ($P>0.05$). pH and propionic acid content decreased with the addition of propolis to the silages ($P<0.01$). The content of acetic acid decreased with the 1.0% and 2.5% propolis ($P<0.01$). *Listeria* spp., ammonia nitrogen and butyric acid were not found in silages. The Fleig Score of the groups containing 0.5% and 1.0% propolis was higher than the other groups ($P<0.05$). Sulphite reducing anaerobes, mold and *Enterobacteriaceae* were found to be below the detection limit and yeast was observed in the propolis group 0.5% and in only one sample. At the end of the study, it was concluded that the addition of 1.0 % propolis could increase the quality of silages.

Keywords: Propolis, alfaalfa, silage, additive, quality.

INTRODUCTION

Propolis comes from the Ancient Greek words pro (front, entrance) and polis (city) and it was defined as " a sticky material with very strong antiviral, antibactrial and antifungal effect collected by honey bees from the cones and barks of trees and from the buds and shoots of plants and composed of the mixture of various oils, pollens, special resins and waxy substances (Kumova et al., 2002). According to another definition, Propolis is the common name of resinous substance collected by honey bees from various plantive sources and also called as "bee glue" (Chemid, 1996).

Colour and physical features of propolis vary according to the plant source and it is used by bees for several purposes (Şahinler 1999; Hepşen et al.,1996). Physical and chemical structure of propolis vary according to the region, plant source and season (Bonvehi and Coll 2000; Oruç et al., 2014). There are more than 300 different compounds in propolis. So far, more than 180 compounds, mostly polyphenols, have been identified as the component of propolis (Castaldo and Capasso 2002).

There are a lot of bioactive substances forming the chemical structure of propolis. These are phenolic compounds (flavonoids and phenolic acids) and their esters, alcohols, aldehydes, ketones, terpenes, coumarins, steroids, aminoacids, elements such as Mg, Ca, I, K, Na, Cu, Zn, Mn and Fe, vitamin B_1, B_2, B_6, C and E and lots of fatty acids and enzymes (Ghisalberti 1979). Bioactive matters in propolis have protective and curing effects for various bacterial, viral and tumoral diseases depending on their amounts (Velazquez et al., 2007; Szliszka et al., 2009; Oruç et al., 2014). Majority of these effects derive from flavonoids and pheonolic acids that are among the pheonolic compounds in propolis (Grange and Davey, 1990).

In this study it was aimed to investigate the effects of propolis added to alfaalfa in different quantities on chemical, fermentational and microbiological properties of silages.

MATERIAL AND METHODS

Silage materials: Alfaalfa, the main silage materials used in this study, were obtained from a producer in the territory. Alfaalfa were collected fresh from the field one day after the harvest and they were ensiled at the day that they were collected. The propolis used as silage additives was collected from the hives belonging to Usak University Faculty of Agriculture and Natural Sciences Deparment of Animal Science. The obtained propolis was kept in a deep freezer and then ground. 80 g of the ground propolis was taken and it was mixed with 920 ml of 70 % of ethanol. By keeping this mixture waiting in a dark room for a week, it was stirred three times a day for a while and at the end of this period it was filtered by a filter paper. The obtained filtrate was kept at +4 **°C** until it was used. Propolis used as a silage additive was added to the alfaalfa silages at 0 % (control), 0.5 %, 1.0 % and 2.5 % rates. Silage samples were prepared in 1 lt of anaerob glass jars as 4 parallels. Ensiling period lasted for 60 days.

Chemical Analyses: The method reported by Kılıç (1986) was used in calculating silage quality classes and Fleig scores. At the end of ensiling period, dry matter contents were determined after the silage samples were dried in

circulated incubator at 65 ºC for 48 hours (AOAC, 1999). Samples were ground with 1 mm of sieve diameter after they were dried and crude ash content as indicated in AOAC (1999) and crude protein contents through Kjeldahl distilation method were determined. Acid detergent fiber (ADF) and neutral detergent fiber (NDF) analyses were made using the method reported by Van Soest (1982). When the silages were opened, in order to determine the pH values of the samples 100 ml of distilled water was added to 25 g of silage sample and pH of the liquid obtained after stirring by a shaker was measured using pH digital pH meter (Polan et al., 1998). In addition, as soon as the silages were opened, 40 g of silage sample was taken and it was shaken by adding 360 ml of distilled water. Following this procedure, the this mixture was filtered with Whatman (no:1) paper and ammonia nitrogen (NH_3-N) was determined using Kjeldahl distilation method by taking 100 ml of obtained filtrate (Broderick and Kang, 1980). In order to determine volatile fatty acid (VFA) and lactic acid (LA) contents, 2 ml was taken from the same filtrate and it was kept in a deep freezer at -18 °C until the day of analysis. VFA (acedic acid, propionic acid and butyric acid) and lactic acid analyses of the silages taken out of the deep freezer on the day of analysis were made in HPLC device**.** (Properties of HPLC: Column: C18, 5 µm, 4.6 x 250-mm; Mobile Phase: Isocratic; 25-mM K-phosphate buffer; pH 2.4; Flow Rate: 1.5 mL/min.; Column Temperature: 30 ºC; UV Sensor: Wavelength: 210 nm; Injection Volume: 20 µL).

Microbiological analyses: Using the method reported by Stanley et al. (1971) sülfite-reducing anaerobes, using the method reported by Harrigan (1998) number of lactic acid bacteria, whether there exists *Enterobacteriaceae*, *Listeria* spp., yeast and mold or not were determined in each silage.

Statistical analyses: The obtained results were analyzed in SPSS Package Programme according to One-Way Anova procedure and Duncan Multiple Comparison Test was implemented for the differences of the groups. In addition, microbiological features of the silages were analyzed and evaluated in SPSS Package Programme according to Frequency procedure (SPSS, 2007).

RESULTS

The effect of propolis treatment on the chemical properties of alfalfa silages are given in Table 1.

Table 1. The effect of propolis on the chemical properties of alfaalfa silages

Parameters	Control	0.5 % Propolis	1.0 % Propolis	2.5 % Propolis
DM, %	34.82±0.58	34.68±0.08	34.87±0.15	34.35±0.57
CA, % DM	11.46±0.19	11.59±0.15	11.47±0.10	11.71±0.31
CP, % DM	28.94±0.33	28.94±0.56	29.03±1.14	28.79±0.33
NDF, % DM	24.18±1.00	23.73±0.27	23.07±0.44	23.90±0.34
ADF, % DM	17.35±0.70	16.88±0.57	17.40±1.31	17.86±0.37

DM: Dry matter; CA: Crude ash; CP: Crude protein; NDF: Neutral detergent fiber; ADF: Acid detergent fiber.

Propolis did not affect dry matter, crude ash, crude protein, NDF and ADF contents of alfalfa silages (P>0.05). The effect of propolis additive to alfaalfa silages at different levels on fermentation properties of the silages was presented in Table 2.

Table 2. The effect of propolis on the fermentation properties of alfaalfa silages

Parameters	Control	0.5 % Propolis	1.0 % Propolis	2.5 % Propolis
pH**	4.86±0.04^{a}	4.53±0.01^{c}	4.56±0.07^{c}	4.60±0.03^{b}
LA, %*	2.95±0.81^{a}	2.58±0.74^{a}	1.16±0.15^{b}	1.30±0.47^{b}
AA, %**	0.35±0.11^{a}	0.26±0.07^{a}	0.10±0.03^{b}	0.12±0.05^{b}
PA, %**	0.42±0.12^{a}	0.15±0.05^{b}	0.08±0.01^{b}	0.02±0.01^{c}
BA, %	ND	ND	ND	ND
NH_3-N	ND	ND	ND	ND
Fleig Score*	79.94±1.54^{c} Good	93.10±0.63^{a} Excellent	91.49±2.39^{a} Excellent	88.43±1.32^{b} Excellent

* $^{a-c:}$ The differences between the averages in the same column are significant (P<0.05).

**$^{a-c:}$ The differences between the averages in the same column are significant (P<0.01).

LA: Lactic acid; AA: Acetic acid; PA: Propionic acid; BA: Butyric acid. ND: Not determined

Accordingly, it was found that the pH of the silages especially including 0.5 % and 1.0 % of propolis was significantly lower than the other groups (P<0.01). It was determined that lactic acid (P<0.05) and acetic acid contents of the silages statistically reduced with 1.0 % and 2.5 % of propolis additives (P<0.01). Especially 2.5 % of propolis additive reduced the propionic acid content of the silages (P<0.01). No butyric and ammonia nitrogen contents were detected in experiment silages. While the quality class of the control group was "good", the quality class of the silages with propolis procedure increased to "excellent". The effect of propolis additive to alfaalfa silages on microbiological properties was shown in Table 3.

Table 3. The effect of propolis on the microbiological properties of alfaalfa silages

Parameters	Control	0.5 % Propolis	1.0 % Propolis	2.5 % Propolis
LAB (Log(cfu/g)	6.07±0.13	5.79±0.23	6.08±0.08	5.54±0.22
SRA (cfu/g)	$<1.0x10^2$	$<1.0x10^2$	$<1.0x10^2$	$<1.0x10^2$
Listeria spp.	ND	ND	ND	ND
Mold (cfu/g)	$<1.0x10^2$	$<1.0x10^2$	$<1.0x10^2$	$<1.0x10^2$
Yeast	$<1.0x10^2$ cfu/g	2 (1 sample) (Log(cfu/g)	$<1.0x10^2$ cfu/g	$<1.0x10^2$ cfu/g
Enterobacteriaceae (cfu/g)	$<2.0x10^2$	$<2.0x10^2$	$<2.0x10^2$	$<2.0x10^2$

LAB: Lactic Acid Bacteria; SRA: Sulphite Reducing Anaerobes ND: Not determined

The differences among silages in terms of lactic acid bacteria (LAB) content were not found as significant (P>0.05). The lowest LAB was found in 2.5 % of propolis, the highest LAB was found in 1.0 % of propolis. Sulphite reducing anaerobes, mold and *Enterobacteriaceae* were determined under the detection limit; however, *Listeria* spp. could not be identified in all experiment silages. Yeast was found in 0.5 % of propolis and only one sample.

DISCUSSION

The studies to increase both silage qualities and the yield of animals without harming both human and animal health by adding natural additives to especially hard ensiled fresh material like alfalafa have been increased in number recently. Propolis is also thought to be one of these additives. Propolis has strong antibacterial, antifungal and antiviral features (Bonkava, et al., 2000). It is also reported that especially propolis extracts have antibacterial activities against Gram negative (-) and Gram positive (+) bacteria and also antifungal activities against the fungi (Matsuno et al., 1997; Aksoy and Dığrak, 2006; Menensez et al., 2009; Gallez et al., 2014). Propolis is used in many different fields. However, according to us, there is no study on the use of propolis as silage additives.

It was determined in this study that propolis procedure had no effect on chemical contents of the silages. No dry matter lost in silages with propolis additive to alfalafa. Accoding to these findings, it can be said that propolis inhibits dry matter losses via its strong antimicrobial effect by preventing the development of harmful microorganisms. In also the studies with different silage additives Ke et al. (2015), Acar and Bostan (2016) and Pour et al. (2017) obtained similar results.

Decreasing pH and quantity and compositions of organic acids in fermentation stage are important criteria in determining the quality of silages. pH of silages reduced with propolis procedure. It can be said that the fact that the pH level of hard ensiled fodders like alfalafa which are water-soluble, poor in carbonhydrade and rich in protein is reduced by ensiling is due to the antibacterial and antifungal activities of propolis. Morover, these activities reduced the lactic acid content that is necessary for especially a good silage. However, it was reported that lower amount of lactic acid content lower than the values indicated in literature developed poor fermentation in silages, but did not cause dry matter losses (Baytok et al., 2005). No dry matter losses, suppression of acedic acid and propionic acid formation and no butyric acid content in experiment silages support these findings. Liu et al. (2016) reported that lactic acid, acetic acid and butyric acid levels significantly reduced with *Lactobacillusplantarum* inoculant additive to alfaalfa silages. There are studies indicating that different additives to alfalafa silages reduced the pH (Filya et al., 2006; Guo et al., 2008; Wen et al., 2017).

Ammonia concentration indicates the fragmentation rate of proteins by butyric acid bacteria. It was reported that ammonia nitrogen content of a quality silage was required to be lower than 80 g/kg of total N (Petterson, 1988). It is also stated that deamination occurs in aminoacids in case of high acedic acid content in silages and as a result the ammonia nitrogen level in silages increases (McDonald et al., 1991). With propolis additives to alfalafa lactic acid fermentation developed in silages and therefore pH reduced and the development of undesired butyric acid bacteria and the formation of ammonia nitrogen which is the final product of proteolisis were completely blocked.

The quality classes of the silages increased to "very good" with propolis additive. Fleig Scoring method is a scoring method based on dry matter and pH values of silages. pH value is an important criterion which numerically reveals the quality class of silages and whether the silages are sufficiently fermented or not. It is stated that high dry matter content not only reduces pH but also affects the lactic acid fermentation negatively and therefore, reduces the quality of silages (Kılıç, 1986). When the pH and dry matter content criteria used in the calculation of Fleig Scores are considered, it can be said that low pH level of the groups with propolis treatment in the study also reflects to Fleig Scores of the silages.

When the experiment silages are appreciated in terms of microbiological features, we can see that lactic acid bacteria reproduced in sufficient amounts; however, harmful microorganisms did not generate. Only 2 log (cfu/g) rate of yeast reproduced in 0.5 % of propolis. Many problems can be introduced while ensiling leguminosae, herbs and their mixtures. During the ensiling, these fresh materials may include both aerobic and anaerobic microorganisms and various bacteria and fungi affecting the quality of silages (Muck, 2010). The existence of low pH and sufficient lactic acid bacteria in good quality silages prevents the reproduction of these microorganisms which reduce the quality of silages. The fact that lactic acid bacteria are the dominant flora and their pH level is low, butyric acid and ammonia nitrogen can not be detected and there are almost no undesirable microorganism activity is considered as an indicator of the formation of acidic environment in experiment silages. Filya et al. (2001) and Koç et al. (2017) obtained similar findings in alfalafa silages.

CONCLUSION

It was aimed to determine the possibility to use propolis as silage additives. As a result of the study, no dry matter losses in silages, reduction in pH of silages, production of lactic acid up to protect the silages, undesirable harmful microorganisms in silages and no butyric acid and ammonia nitrogen contents indicate that propolis can be used as an additive in silages. It was concluded that especially 1.0 % of propolis may have a positive effect to protect silages.

CONFLICT AND INTEREST

Authors declare no conflict and interest.

REFERENCES

Acar, Z., Bostan, M., 2016. Değişik doğal katkı maddelerinin yonca silajının kalitesine etkilerinin belirlenmesi. Ondokuz Mayıs Üniversitesi Ziraat Fakültesi Anadolu Tarım Bilim. Derg., 433-440.

Aksoy, Z., Dığrak, M., 2006. Bingöl Yöresinde Toplanan Bal ve Propolisin Antimikrobiyal Etkisi Üzerinde *in vitro* Araştırmalar. Fırat Üniv. Fen ve Müh. Bil. Dergisi 18 (4), 471-478.

AOAC., 1999. Official Methods of Analysis. Association of Official Analytical Chemists, 16th Ed.,Arlington VA

Baytok, E., Aksu, T., Karslı, M.A., Muruz, H., 2005. The effects of formic acid molasses, and inoculant as silage additives on corn silage composition and ruminal fermentation characteristics in sheep. Turk J Vet Anim Sci, 29, 469-479.

Bonvehi, J.S., Coll, F.V., 2000. Study on propolis quality from China and Uruguay. Zeitschrift für Naturforsch C, 55: 778-784.

Castaldo, S., Capasso, F., 2002. Propolis, an old remedy used in modern medicine, Fitoterapia, 73, Suppl 1, S1-S6.

Chemid, 1996. A chemical database sponsored by the National Library of Medicine. Bethesda, MD.

Filya İ, Ashbell G, Weinberg ZG, Hen Y., 2001. Hücre duvarını parçalayıcı enzimlerin yonca silajlarının fermantasyon özellikleri, hücre duvarı kapsamı. ve aerobik stabiliteleri üzerine etkileri. Ankara Üniv Zir Fak Tarım Bilim Derg,7 (3): 81-87, 2001.

Filya, I., Muck, R. E., Contreras-Govea, F. E., 2006. Inoculant Effects on Alfalfa Silage: Fermentation Products and Nutritive Value. J. Dairy Sci. 90:5108–5114.

Gallez, L., Kiehr, M., Fernández, L., Delhey, R., Stikar, D., 2014. Antifungal activity in vitro of propolis solutions from Argentina against two plant pathogenic fungi: *Didymella bryoniae* and *Rhizotocnia solani*. Journal of Apicultural Research, 53:4, 438-440

Ghisalberti, E. L., 1979. Propolis: A review, Bee World, 60: 59-84.

Grange, J.M., Davey, R.W., 1990. Antibacterial properties of propolis. Journal of the Royal Society of Medicine, Volume 83, March.

Guo, X.S., Ding, W.R., Han, J.G., Zhou, H., 2008. Characterization of protein fractions and amino acids in ensiled alfalfa treated with different chemical additives. Animal Feed Science and Technology. 142: 89–98.
Harrigan, W.F., 1998. Laboratory methods in food microbiology. London, 3nd ed., Academic Pres.
Hepşen, İ.F., Tilgen, F., Hamdi E., 1996. Propolis: Tıbbi Özellikleri ve Oftalmolojik Kullanımı. Turgut Özal Tıp Merkezi Dergisi, 3(4), 386-391.
Ke, W.C., Yang, F.Y., Undersander, D. J., Guo, X.S., 2015. Fermentation characteristics, aerobic stability, proteolysis and lipid composition of alfalfa silage ensiled with apple or grape pomace Animal Feed Science and Technology 202 (2015) 12–19.
Kılıç, A., 1986. Ensilage feed. İzmir, Turkey: Bilgehan Press; 1986.
Koç, F., Aksoy, S.O., Okur, A.A., Celikyurt, G., Korucu, D., & Ozduven, M.L., (2017). Effect of pre-fermented juice, *Lactobacillus plantarum* and *Lactobacillus buchneri* on the fermentation characteristics and aerobic stability of high dry matter alfalfa bale silage. The Journal of Animal & Plant Sciences, 27(6), 1766-1773.
Kumova, U., Korkmaz, A., Avcı, B.C., Ceyran, G., 2002. An important bee products: Propolis. Uludag Apiculture J. 2: 10-24.
Liu.,C., Yu-jiao, L., Xiao-nan, L., Ping-ting, G., Hai-ling, L., 2016. Effect of lactic acid bacteria inoculants on alfalfa (*Medicago sativa L.*) silage quality: assessment of degradation (*in situ*) and gas production *(in vitro*). Journal of Integrative Agriculture 2016, 15(12): 2834–2841.
Matsuno, T., Chen, C., Basnet, P., 1997. A tumoricidal and antioxidant compound isolated from an aqueous extract of propolis. Medical Science Research 25, 583–584.
McDonald, P., Henderson, A. R., Herson, S. J. E., 1991. The Biochemistry of Silage. 16th ed., Chalcombe Publication, Marlow, UK.
Muck, R.E., 2010. Silage microbiology and its control through additives. R. Bras. Zootec. 39: 183-191.
Oruç, H.H., Sorucu, A., Aydın, L., 2014. Propolisin Sağlık Açısından Önemi, Kalitesinin Belirlenmesi ve Türkiye Açısından İrdelenmesi. Uludag Bee Journal, 14(1).
Petterson, K., 1988. Ensiling of Forages: Factors Affecting Silage Fermantation and Quality. Sveriges Lantbruksuniversitet, 46 p,Uppsala.
Polan, C.E., Stive, D.E., Garrett, J.L., 1998. Protein preservation and ruminal degradation of ensiled forage treated with heat, formic acid, ammonia, or microbial inoculant, Journal of Dairy Science, 81, 765-776.
Pour, H.A., Naserian, A.A., Vakili, A.R., Tahmasbi, A.M., (2017). Effect of Essential Plant Oil Used as an Additive to Alter Silage Fermentation in Ruminant by In Vitro. Biosciences Biotechnology Research Asia. 14(1), 145-152.
Stanley, E.R., Bradley, T.R., Sumner, M.A., 1971. Properties of the mouse embryo conditioned medium factor(s) stimulationg colony formation by mouse bone marrow cells grown in vitro. J. Cell. Physiology, 78, 301–317.
Szliszka, E., Czuba, Z.P., Domino, M., Mazur, B., Zydowicz, G., Krol, W., 2009. Ethanolic extract of propolis (EEP) enhances the apoptosisinducing potential of TRAIL in cancer cells Molecules, 14: 738-754.
Şahinler, N., 1999. Propolisin Bileşimi ve Kullanma Olanakları. M.K.Ü. Ziraat Fakültesi Dergisi, 4(1-2), 167-180.
SPSS, 2007. SPSS for Windows Release 16.01. SPSS Incorporation. 2007.
Wen, A., Yuan, X., Wang, J., Desta, S.T., Shao, T., 2017. Effects of four short-chain fatty acids or salts on dynamics of fermentation and microbial characteristics of alfalfa silage. Animal Feed Science and Technology 223:141–148.
Van Soest, P. J., 1982. Analytical systems for evaluation of feeds. In: P. J. Van Soest (Editor), Nutritional Ecology of the Ruminant. Cornell University Press. Chapter 6, pp. 75-94. Ithaca, NY.
Velazquez, C., Navarro, M., Acosta, A., Angulo, A., Dominguez, Z., Roble, R., Robles-Zepeda, R., Lugo, E., Goycoolea, F.M., Velazquez, E.F., 2007. Antibacterial and free-radical scavenging activities of Sonoran propolis. J. Appl. Microbiol, 103: 1747–1756.

(ORAL PRESENTATION)

MONITORING OF THE EFFECT OF DIFFERENT ACETIC ACID RATIOS ON THE COLOR OF MARINATED ANCHOVY FILLETS AND SKIN DURING 24 HOURS

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Abstract

The marinated seafood preparation method is based on the ripening of a seafood product with sodium chloride and acetic acid. It is common for seafood to be processed by the marinating method. The ratio of acetic acid used is effective in the quality of the marinated product. The sodium chloride and acetic acid used during the marinating process also significantly alter the color of the seafood. Monitoring of color changes is very important for product control at the sales stage. The reason for this is that the consumer's preference varies according to the color quality. Color analysis can be done with instrumental devices and is also performed by using computer-based imaging technology for the last three decades. Some studies have shown that this method is more objective and reliable than instrumental methods. In this study, color changes of marinated anchovy (fillet and skin) using different ratios of acetic acid (3%, 4%, 5%, and 6%) were performed during raw, after salting, 1st, 20th and 24th hours of the marinating. The color parameters analyzed were L*, a*, b*, Chroma and Whiteness values. According to results, the L* value of anchovy fillets increased significantly after brining and showed significant changes in all groups during the marinating process ($p<0.05$). The a* value showed a significant decrease in all groups until the 1st hour after marinating. However, 5% and 6% groups showed a rise at 20th hours of marinating ($p<0.05$) but groups of 3% and 4% showed no significant change ($p>0.05$). However, all groups showed similar values at 24h hours of marinating. Skin a* values of anchovy was also showed similar fluctuations with fillet of anchovy. The b* value of anchovy fillets increased significantly after salting. In the process of the 1st hour of marinating, the value of b* has decreased rapidly. Since this decrease was at the same level for all groups, there was no statistically significant difference between the groups ($p>0.05$). However, between the after salting and the 1st hour of marinating, it was found a statistical significance for all groups ($p<0.05$). The b* value of 3% and 4% ratios between the 20th hours of the marinating process was not statistically different ($p>0.05$). The same findings were observed in 5% and 6% groups for anchovy fillets ($p>0.05$). However, this similarity has changed in the 24 hours of marinating process and the 3% group was found to be statistically different from all other groups ($p<0.05$). Skin b* values of anchovy were also showed similar fluctuations with fillet of anchovy. Whiteness value was found similar to L* values of anchovy fillets and skin samples. The results of the study showed that there was a relationship between the increase in acetic acid ratio and color change. However, as the marinating time increases, the color parameters close to each other.

Keywords: Color, marinating, anchovy, fillet, skin.

INTRODUCTION

Seafood has a good source for human nutrition especially because of its unique nutritional composition (Atar & Alçiçek, 2009). Therefore, it is recommended to consume seafood at least three times a week. Despite these good features, seafood is rapidly deteriorating. Various processing techniques have been applied to prevent this (smoking, drying, canning, etc.). One of these techniques is seafood marinating with acetic acid. Thus, seafood has a longer shelf life than fresh seafood and gains a unique flavor and color. Acetic acid used for marinating prevents bacterial growth. It also lowers the pH.

Anchovy is one of the most suitable fish for marinating with its lipid content and texture. There are some researches about the marinating process of anchovy. However, the color changes of the marinated anchovy monitoring record with computer-based image analyses system do not exist in the literature. The aim of the study was to monitor

the color changes of the anchovy skin and fillets during some marinating steps (initial, after the 1st hour of marinating, after the 20th hour of marinating, after the 24th hour of marinating) with different acetic acid ratios by computer-based image analysis (CBI).

MATERIALS AND METHODS

Fresh anchovy (*Engraulis encrasicolus*, Linnaeus, 1758) samples used were transported to the laboratory in Styrofoam boxes filled with ice. Samples were filleted and then immersed in a brine solution (8% NaCl, 1:1, w/v) at 4°C. After 4 hours, these samples were divided into four groups with using commercial acetic acid as the following ratios: 3%, 4%, 5%, and 6%.

The Computer-based imaging system (CBI) was carried out in a light-box which described by Luzuriaga, Balaban, & Yeralan, (1997). The image acquisition was done with the method described by Alçiçek & Balaban, (2012). LensEye software (ECS, Gainesville, FL, USA) was used to analyze the color values (*L**, *a**, *b**, Chroma, and Whiteness).

One-Way ANOVA determined the significance of the effects of ratio on the samples during processes and Tukey's multiple range test, using SPSS for Windows, Version 23.0 (IBM, NY, US) at $p \leq 0.05$. The bar charts created by using the same software. The bar error plots demonstrate the confidence interval at 95%.

RESULTS AND DISCUSSION

The color changes of the fillet part

Table 1 shows the color parameters' changes in the fillet part of the samples. The initial *L** values of the samples were ranged in 55.22-55.97. These values increased immediately after brining due to NaCl for all groups (Figure 1). Acetic acid has a bleaching effect on meat (Dickens & Whittemore, 1997). There was a significant increase in the *L** value of the samples after the 1st hour of the marinating in the range of 70.29-72.12. This increase continued during 20th and 24th hours of marinating. The same trend was observed for Whiteness value (Figure 5). According to (Gokoglu, Topuz, & Yerlikaya, 2009) consumers prefer lighter color for marinating products.

The *a** value was analyzed in the range of 2.92-3.62 for initial anchovy samples (Figure 2). The decreased a* value was monitored immediately after brining for all groups ($p<0.05$). This results showed that brining has a decreasing effect on the *a** value of anchovy samples due to Na and Cl ions whitening efficacy. After 1st hour of the marinating process color results showed that there was significant decrease for all groups ($p<0.05$), but this decrease did not show any significant difference between groups ($p>0.05$). The difference between groups was monitored after 20th hours of marinating ($p<0.05$). The 5% and 6% ratio groups significantly different from the other two groups ($p<0.05$). However, after 24th hours of the marinating, the difference was disappeared.

The initial *b** value of the fillet part of anchovy samples was -0.83, 0.39, 0.63, and 0.36 for 3%, 4%, 5%, and 6% acetic acid groups, respectively (Figure 3). The value of the samples slightly increased after brining and this increase was found statistically significant ($p<0.05$). The first hour of marinating there was no statistically significant difference between groups until 20th hours of the marinating. The 5% and 6% of groups showed a statistically significant difference from 3% and 4% groups ($p<0.05$). This difference continued for 3% groups even after 24th hours of the marinating.

Chroma value showed a slight increase after brining ant acetic acid application had an increasing effect too (Figure 4). The statistical difference was not recorded after the 1st hour of marinating ($p<0.05$). However, Chroma values of the samples were increased after 20th hours marinating. This increase changed after 24th hours marinating and the Chroma value of the 4%, 5%, and 6% groups. These groups showed increasing trend due to the ratio of the acetic acid and there was no statistically significantly different between these groups ($p>0.05$).

Table 1: The color changes of the fillet part during the progress

Color Parameter	Raw				After Salting			The 1st hour after marinating			20th hours after marinating			24th hours after marinating		
	Group	**Mean**	**Std. Error**	**Sig.**	**Mean**	**Std. Error**	**Sig.**	**Mean**	**Std. Error**	**Sig.***	**Mean**	**Std. Error**	**Sig.****	**Mean**	**Std. Error**	**Sig.**
L*	Ratio 3	55.22	0.40	Aa	58.63	0.38	Ba	70.29	0.28	Ca	74.50	0.29	Da	71.50	0.30	Ca
	Ratio 4	55.85	0.46	Aa	59.66	0.41	Ba	72.12	0.36	Cb	74.62	0.25	Da	72.57	0.27	Ca
	Ratio 5	55.94	0.67	Aa	59.83	0.65	Ba	71.10	0.39	Cab	71.95	0.39	Cb	72.00	0.31	Ca
	Ratio 6	55.97	0.55	Aa	59.93	0.44	Ba	71.69	0.44	Cab	71.51	0.35	Cb	72.05	0.33	Ca
a*	Ratio 3	2.92	0.24	Aa	0.61	0.18	Ba	-2.90	0.07	Ca	-2.99	0.07	Ca	-2.42	0.06	Ca
	Ratio 4	3.28	0.34	Aa	0.95	0.25	Ba	-3.08	0.09	Ca	-3.45	0.09	Cb	-2.09	0.09	Db
	Ratio 5	3.68	0.32	Aa	1.18	0.24	Ba	-2.78	0.09	Ca	-1.53	0.09	Dc	-1.76	0.09	Dc
	Ratio 6	3.31	0.30	Aa	0.98	0.24	Ba	-2.80	0.10	Ca	-1.56	0.11	Dc	-1.81	0.10	Dbc
b*	Ratio 3	-0.83	0.28	Aa	1.28	0.30	Ba	-6.86	0.24	Ca	-4.58	0.19	Da	-6.04	0.21	Ca
	Ratio 4	0.39	0.37	Aa	2.18	0.32	Ba	-6.19	0.25	Cab	-4.05	0.28	Da	-7.75	0.23	Eb
	Ratio 5	0.63	0.35	Aa	2.03	0.37	Ba	-5.92	0.22	Cb	-6.06	0.27	Cb	-7.61	0.21	Db
	Ratio 6	0.36	0.27	Aa	1.58	0.27	Ba	-6.41	0.19	Cab	-6.06	0.23	Cb	-7.37	0.23	Db
Chroma	Ratio 3	6.19	0.14	Aa	6.20	0.12	Aa	7.90	0.19	Ba	6.03	0.14	Aab	6.87	0.16	Ca
	Ratio 4	6.48	0.25	Aa	6.56	0.18	Aa	7.25	0.21	Bab	5.96	0.21	Ca	8.21	0.22	Db
	Ratio 5	6.67	0.27	Aa	6.57	0.17	Aa	7.06	0.16	Ab	6.72	0.20	Ab	8.07	0.19	Bb
	Ratio 6	6.22	0.22	Aa	6.26	0.15	Aa	7.32	0.18	Bab	6.61	0.22	Aab	7.83	0.22	Bb
Whiteness	Ratio 3	54.57	0.40	Aa	57.91	0.36	Ba	69.03	0.28	Ca	73.60	0.27	Da	70.48	0.29	Ea

	Ratio 4	55.13	0.48	Aa	58.86	0.41	Ba	70.98	0.33	Cb	73.74	0.22	Ca	71.11	0.24	Da
	Ratio 5	55.20	0.69	Aa	59.04	0.64	Ba	70.01	0.39	Cab	70.91	0.36	Cb	70.59	0.29	Ca
	Ratio 6	55.31	0.57	Aa	59.19	0.45	Ba	70.52	0.40	Cb	70.54	0.31	Cb	70.72	0.28	Ca

*Different small letters indicate significant differences at $p<0.05$ within each row for the same color parameters by Tukey's HSD test.

** Different capital letters indicate significant differences at $p<0.05$ within each column for the same application and color parameters by Tukey's HSD test.

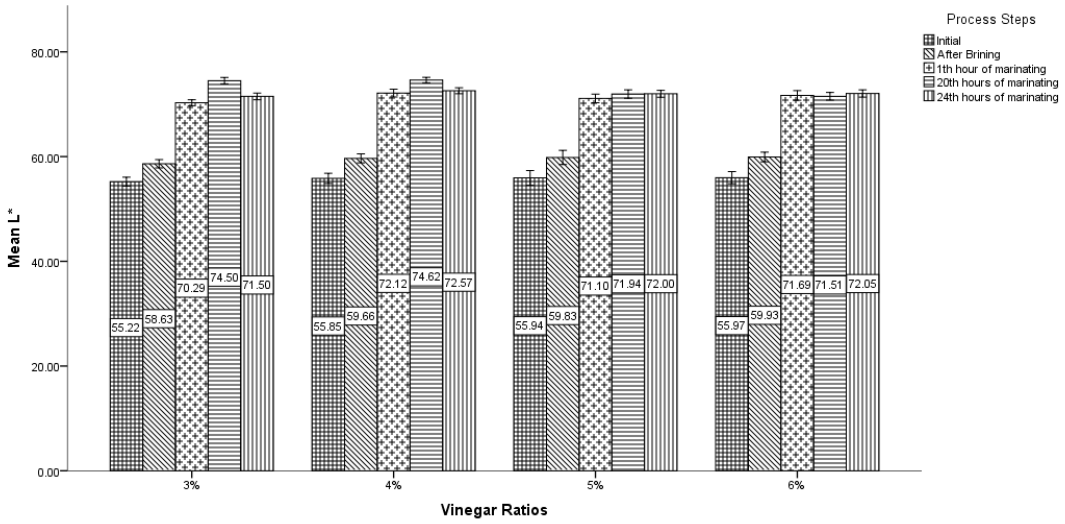


Figure 1: The mean *L** value changes of anchovy fillet parts during the process

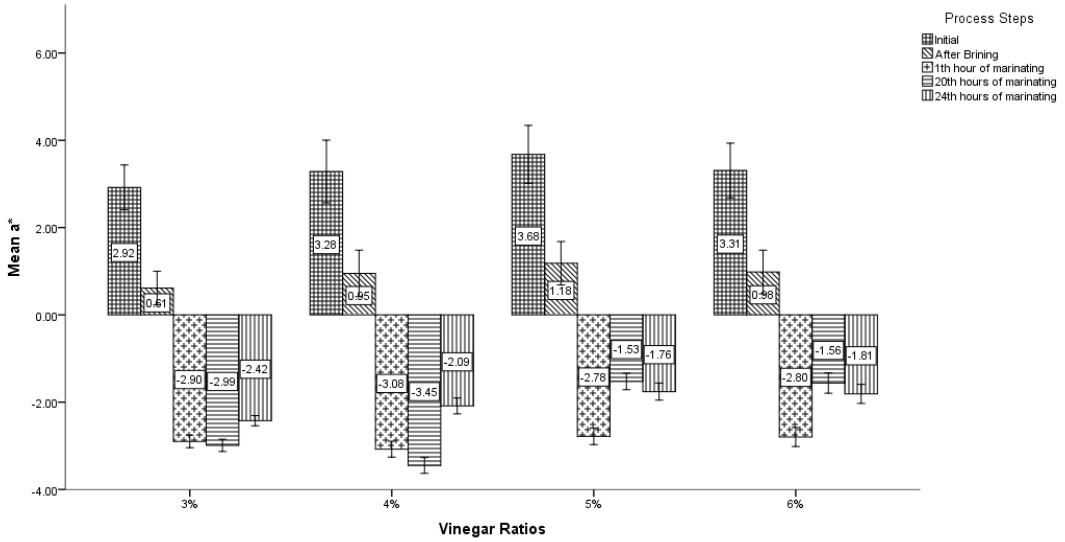


Figure 2: The mean *a** value changes of anchovy fillet parts during the process

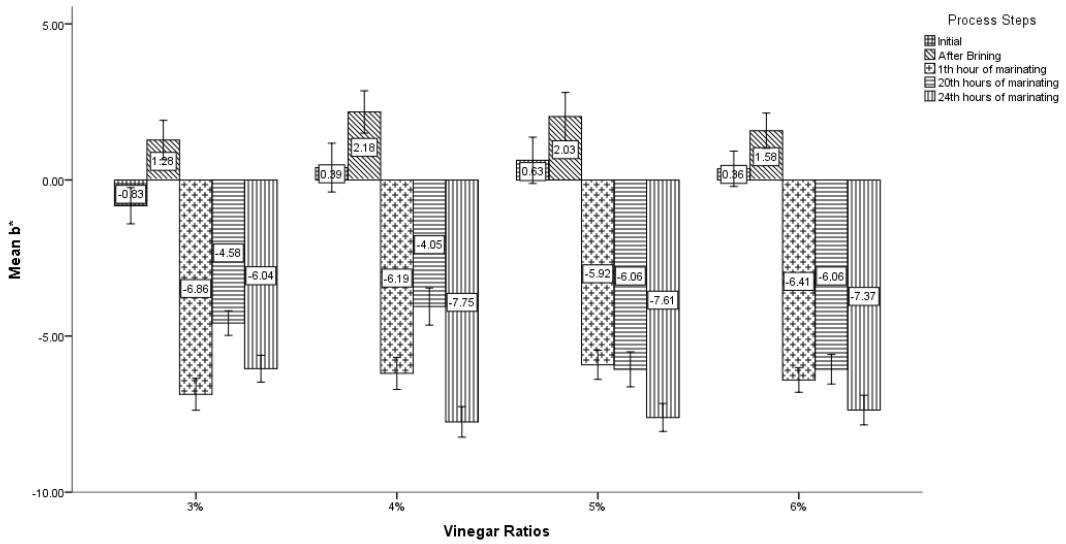


Figure 3: The mean *b** value changes of anchovy fillet parts during the process

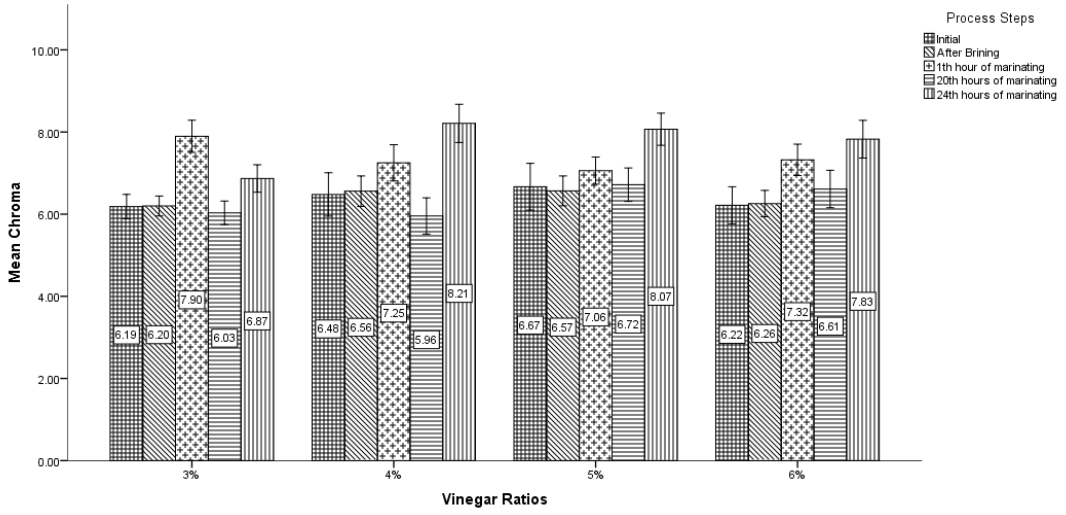


Figure 4: The mean value Chroma changes of anchovy fillet parts during the process

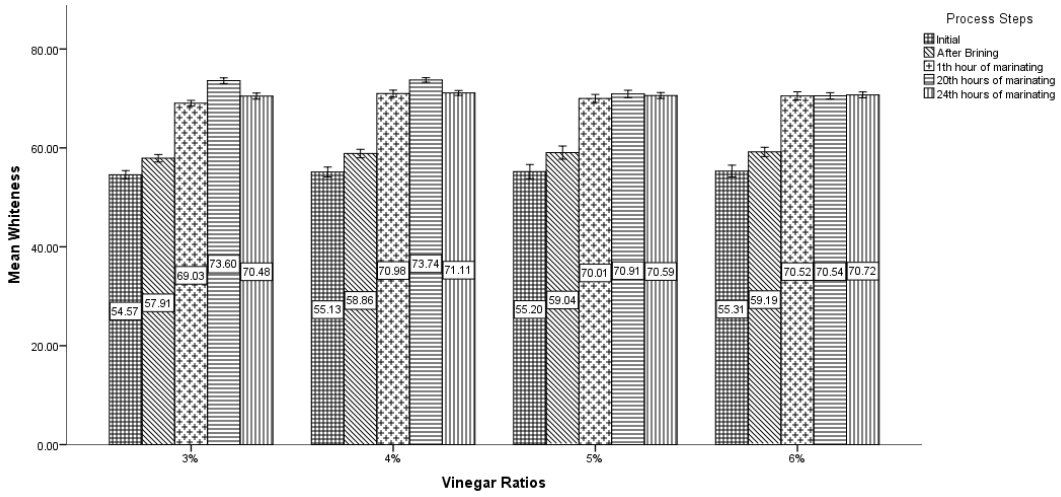


Figure 5: The mean Whiteness value changes of anchovy fillet parts during the process

The color changes in the skin part

Table 2 shows the color parameters' changes in the skin part of the samples. The skin part *L** value of the samples showed a significant increase after brining ($p<0.05$) (Figure 6). There was also an increase after the 1st hour of marinating, but this difference did not show a significant difference between groups in the same application process ($p>0.05$). The main differences were recorded after 20th hours of the marinating. The 5% and 6% groups showed a statistically significant difference from the other two groups ($p<0.05$). These results can be explained by the acetic acid bleaching effect. The 4%, 5%, and 6% of groups did not show any statistically significant difference even after 24th hours marinating ($p>0.05$). The same trend was observed for Whiteness value (Figure 10).

The *a** value of the skin part of the samples slightly decreased after salting (Figure 7). The decreasing continued after the 1st hour of the marinating due to acetic acid application. However, there was no statistically significant difference between groups in the same application process. The main difference was recorded after 20th hours of the marinating. The 5% and 6% groups were showed statistically significant. However, this difference was disappeared after 24th hours of the marinating ($p>0.05$).

The *b** values of the samples were increased after brining, and this increase was found statistically significant ($p<0.05$) (Figure 8). The acetic acid application had a decreasing effect on the *b** values of the skin part of the samples. After 20th hours of the marinating the *b** value of the 5% and 6% ratio groups had lower *b** values than the other two groups. This difference was found statistically significant ($p<0.05$). The group differences did not monitor after 24th hours of the marinating ($p>0.05$). Chroma values of the samples increased after marinating application ($p<0.05$) (Figure 9).

Table 2: The color changes of the skin part during the progress

Color Parameter	Raw				After Salting			The 1st hour after marinating			20th hours after marinating			24th hours after marinating		
	Group	**Mean**	**Std. Error**	**Sig.**	**Mean**	**Std. Error**	**Sig.***	**Mean**	**Std. Error**	**Sig.****	**Mean**	**Std. Error**	**Sig.**	**Mean**	**Std. Error**	**Sig.**
*L**	Ratio 3	56.83	0.34	Aa	60.97	0.38	Bca	61.99	0.38	Ca	63.71	0.38	Dac	60.11	0.42	Ba
	Ratio 4	57.81	0.28	Aa	62.34	0.38	Bda	63.16	0.23	Bca	64.00	0.41	Ca	61.35	0.31	Da
	Ratio 5	57.42	0.73	Aa	62.53	0.73	Ba	63.33	0.70	Ba	62.00	0.73	Bbc	61.67	0.59	Ba
	Ratio 6	57.66	0.40	Aa	62.26	0.40	Ba	63.02	0.48	Ba	61.49	0.45	Bb	61.53	0.44	Ba
*a**	Ratio 3	0.27	0.17	Aa	-1.62	0.12	Ba	-2.88	0.05	Cab	-2.84	0.05	Ca	-1.89	0.05	Ba
	Ratio 4	0.26	0.16	Aa	-1.45	0.13	BDa	-3.07	0.05	Ca	-2.98	0.05	Ca	-1.77	0.05	Da
	Ratio 5	1.09	0.18	Ab	-1.36	0.14	BDa	-2.86	0.06	Cb	-1.50	0.06	Db	-1.69	0.06	Da
	Ratio 6	0.86	0.16	Aab	-1.27	0.13	Ba	-2.87	0.06	Cab	-1.32	0.05	Bb	-1.73	0.05	Da
*b**	Ratio 3	-8.37	0.24	Aa	-5.71	0.32	Ba	-9.02	0.20	Aab	-8.69	0.23	Aa	-11.91	0.22	Ca
	Ratio 4	-7.04	0.30	Ab	-5.71	0.23	Ba	-9.27	0.16	Ca	-9.59	0.23	Cb	-12.10	0.16	Da
	Ratio	-7.10	0.29	Ab	-4.52	0.31	Bb	-8.34	0.21	Cb	-10.01	0.25	Db	-11.12	0.23	Eb

	5															
	Ratio 6	-7.32	0.26	Ab	-5.13	0.22	Bab	-8.36	0.18	Cb	-10.29	0.17	Db	-10.79	0.15	Db
Chroma	Ratio 3	10.13	0.18	Aa	9.38	0.13	Aa	9.86	0.17	Aab	9.70	0.19	Aa	12.23	0.21	Ba
	Ratio 4	9.26	0.17	Ab	9.42	0.11	Ba	10.09	0.14	Ca	10.50	0.19	Cb	12.38	0.15	Da
	Ratio 5	9.90	0.16	ACb	9.10	0.13	BCa	9.41	0.15	Cb	10.56	0.19	Db	11.51	0.19	Eb
	Ratio 6	9.66	0.18	Ab	9.36	0.13	Aa	9.35	0.15	Ab	10.72	0.15	Bb	11.22	0.13	Bb
Whiteness	Ratio 3	54.89	0.34	Aa	59.19	0.37	Ba	59.91	0.38	Ba	61.60	0.37	Ca	57.33	0.44	Da
	Ratio 4	56.16	0.30	Aa	60.51	0.35	Ba	60.99	0.24	Ba	61.59	0.40	Ba	58.42	0.32	Cab
	Ratio 5	55.59	0.71	Aa	60.87	0.72	Ba	61.35	0.69	Ba	59.66	0.73	Bb	59.02	0.59	Bb
	Ratio 6	55.92	0.38	Aa	60.50	0.39	BCa	61.10	0.47	Ba	59.12	0.43	Cb	59.02	0.43	Cab

*Different small letters indicate significant differences at $p<0.05$ within each row for the same color parameters by Tukey's HSD test.

** Different capital letters indicate significant differences at $p<0.05$ within each column for the same application and color parameters by Tukey's HSD test.

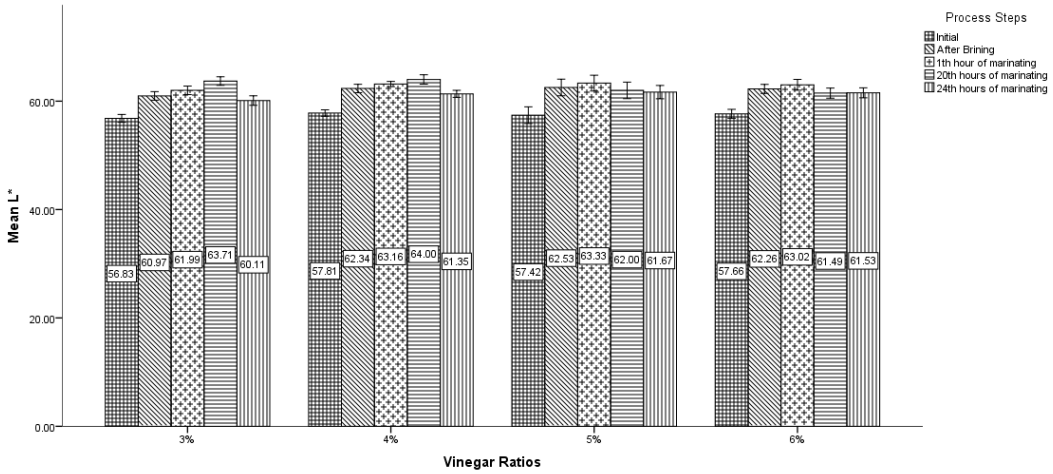


Figure 6: The mean *L** value changes of anchovy skin parts during the process

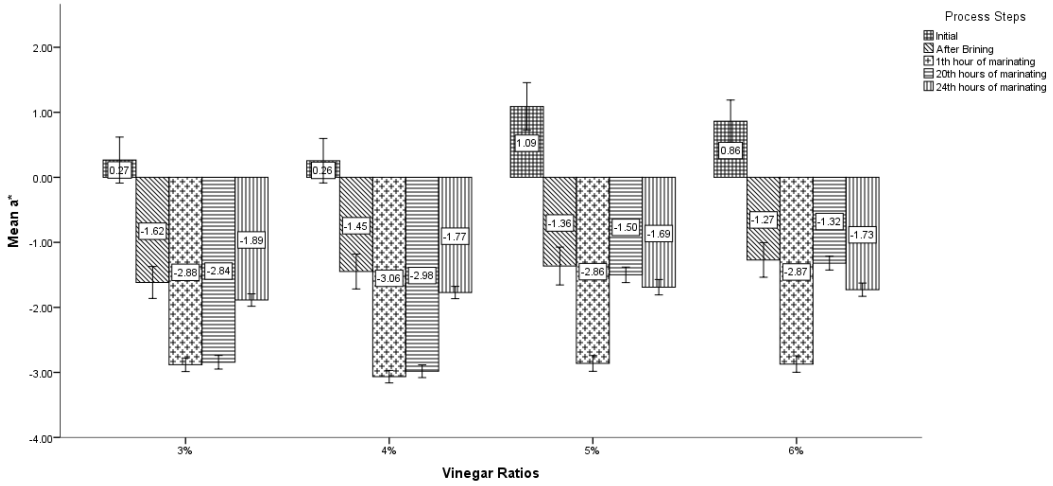


Figure 7: The mean *a** value changes of anchovy skin parts during the process

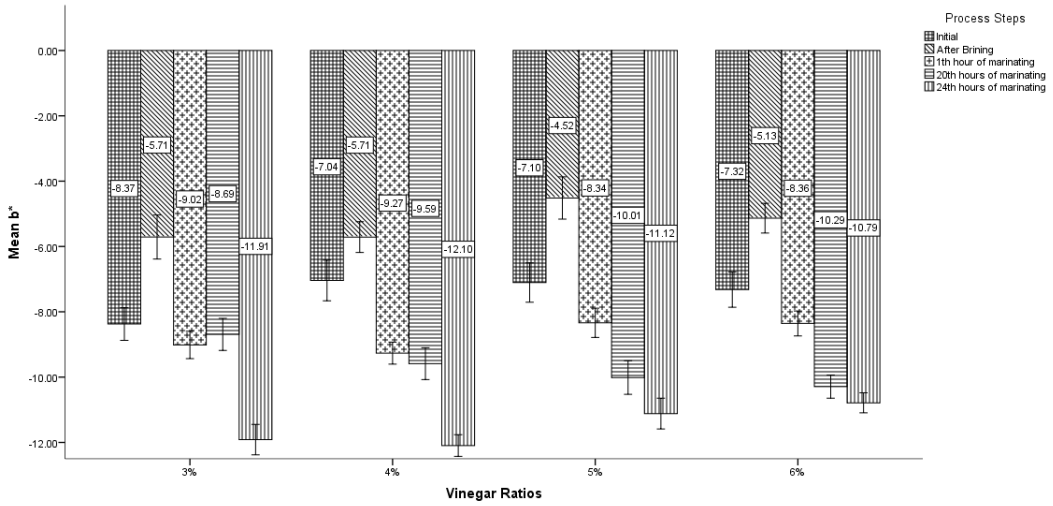


Figure 8: The mean *b** value changes of anchovy skin parts during the process

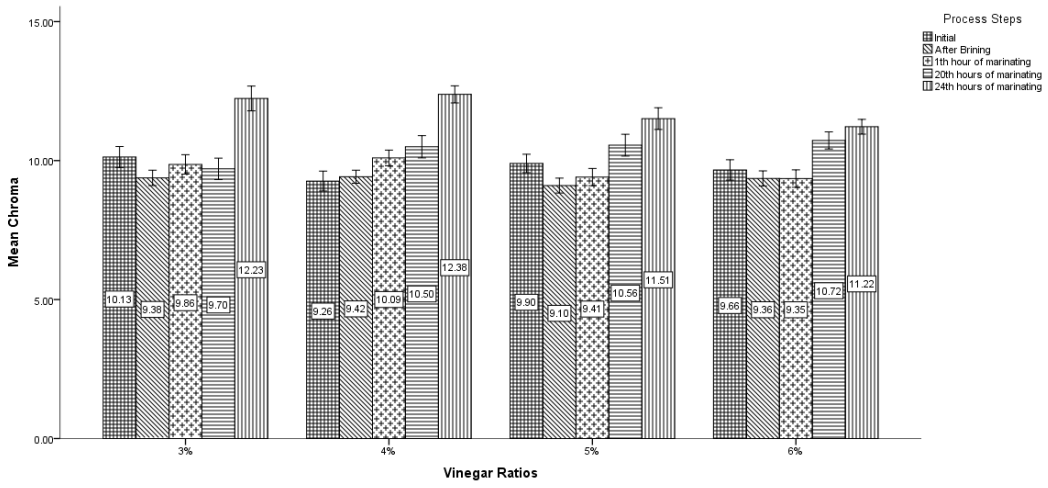


Figure 9: The mean Whiteness value changes of anchovy skin parts during the process

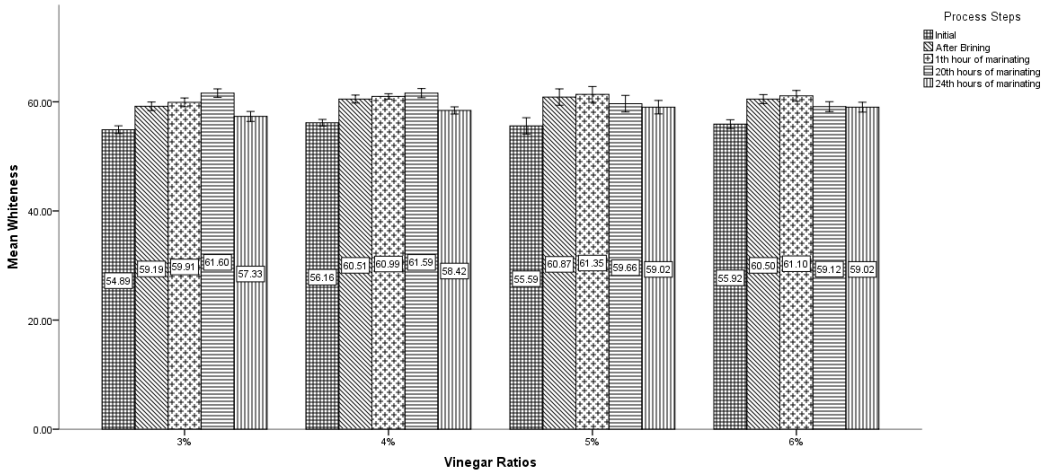


Figure 10: The mean Chroma value changes of anchovy skin parts during the process

Finally, the results showed that the brining and acetic acid application had an effect on the color values of the anchovy fillet. The ratio percentage effect can be monitored only 20th hours of the marinating. This change generally disappeared after 24th hours marinating.

REFERENCES

Alçiçek, Z., & Balaban, M. Ö. (2012). Development and application of “the Two Image” method for accurate object recognition and color analysis. *Journal of Food Engineering*. https://doi.org/10.1016/j.jfoodeng.2012.01.031

Atar, H. H., & Alçiçek, Z. (2009). Su Ürünleri Tüketimi ve Sağlık. *TAF Preventive Medicine BulletinResearch Article TAF Prev Med Bull*.

Dickens, J., & Whittemore, A. (1997). Effects of acetic acid and hydrogen peroxide application during defeathering on the microbiological quality of broiler carcasses prior to evisceration. *Poultry Science*, *76*(4), 657–660. https://doi.org/10.1093/ps/76.4.657

Gokoglu, N., Topuz, O. K., & Yerlikaya, P. (2009). Effects of pomegranate sauce on quality of marinated anchovy during refrigerated storage. *LWT - Food Science and Technology*, *42*(1), 113–118.

https://doi.org/10.1016/j.lwt.2008.04.007

Luzuriaga, D. A., Balaban, M. O., & Yeralan, S. (1997). Analysis of Visual Quality Attributes of White Shrimp by Machine Vision. *Journal of Food Science*, *62*(1), 113–118. https://doi.org/10.1111/j.1365-2621.1997.tb04379.x

(ORAL PRESENTATION)

EFFECT OF DRY SALTING ON THE COLOR OF SARDINE

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Abstract

Salting is known as one of the oldest methods used to preserve foods and traditionally divided into dry salting and brine salting practices. Dry salting technique is one of the most widely used salting techniques. This technique is based on the application of sodium chloride directly to the foodstuff. Dry salting of fish has been in use since antiquity to extend the shelf life of fish. In the modern world, dry salted fish is still a popular food. However, the color of dry salted fish changes over time. This study aims to reveal these color changes of dry salted sardines. Color parameters L *, a *, b *, Chroma and Whiteness values were measured during raw, after brine and after dry salting of the fish samples. According to results, the L * value increased significantly after brining and decreased slightly after dry salting. It was observed that dry salting altered L * value of the sardine samples. However, the most dramatic differences were observed in the brine, and dry salting stages a * and b * values. According to this, while fresh sardines a * value was 6.19 ± 0.46, it decreased to -4.66 ± 0.10 after brine. After dry salt, a * value was determined as -5.26 ± 0.06. b * value was found to be -0.07 ± 0.62 for fresh sardines. However, this value decreased to -7.70 ± 0.26 after the brine, and a statistically significant difference was found. At the end of dry salting, b* value of sardines increased to 0.07 ± 0.35. The reason for this increase is the yellowing of the fish. According to the color scheme (NBS) determined by the Inter-Society Color Council, sardine fish were classified as grayish purple. However, after brine, the color of the sardine fish was classified as pale purple. After dry salting, the color category was determined as 'greenish gray.' According to these data, the salting stages significantly change the color of sardine fish. In later studies, it is recommended to examine consumer preferences using different salting rates and temperatures.

Key words: Color, dry salting, brine salting, sardine.

INTRODUCTION

Fish consumption has been in the human diet for at least 380 000 years (Arason et al. 2013; Toussaint-Samat 2009). However, fish should be consumed quickly because it deteriorates rapidly. The most effective method found in the earliest times is undoubtedly to extend the shelf life by salting. This method, which is still in use today, is based on the removal of water from fish muscle. Meat has a wonderful flavor and texture during complex reactions, including proteases and lipases, during the salting process (Hall 2011). Salt affects not only flavor and texture but also color. Its effect on color is yellowish with pure NaCl, while white with magnesium and calcium content (Hall 2011). There are four type of salting; dry, pickle, brine and injection (Arason et al. 2013).

Dry salting has been known as kench salting and the salted products accepted as heavily salted products because they come into direct contact with the salt and too much salt passes through the osmosis to the meat. (Arason et al. 2013; Oehlenschlager 2014). They have also lower water activity, which avoid microbial growth (Pittia and Antonello 2015). However, this halophilic environment is suitable for *Halobacterium spp.*, which is responsible 'pink dots' on the salted fish products (Hall 2011). Brine salting generally using for pickling and also for first step of smoking (Alcicek and Atar 2010).

Color determination of food products is important step for consumer acceptance. There are instrumental methods for color analyze. In recent years, computer based image processing techniques have been used successfully for color analysis of seafood (Alçiçek and Balaban 2015a, 2015b; Balaban et al. 2014; Balaban and Alçiçek 2015; Kim et al. 2014; Kong et al. 2015). It is based on the analysis of digital images with special software and reliable digital data is obtained (Yagiz et al. 2009).

The aim of this study was to determine the color parameters of sardines salted with brining and then dry salting.

MATERIALS AND METHODS

Fresh sardine (*Sardina pilcardus)* samples were bought from a local fish market (Canakkale, Turkey) and transferred immediately in a Styrofoam box with ice. The whole fish samples washed with tap water and put in a brine solution (8%, 1:1 w/v) for 4 hours at 4°C. The brined samples were drained and put into dry salt (1:1 v/v) for dry salting process during 20 days at 4°C. The samples washed with tap water after the process and dried with paper towel. The color analysis of the samples was performed at each step (raw, after brining and after salting) with computer based image analysis which explained by Alçiçek and Balaban (2012). The statistical analysis was performed by SPSS v23 (IBM, NY, US). The One-Way ANOVA was used to determine the difference of the processes. The Tukey multiple range test was used as post-hoc test at $p<0.05$.

RESULTS AND DISCUSSION

Table 1 shows the color parameters of the sardine samples.

Table 1: The color parameters of the samples during process steps

Color parameters	Process steps	Mean	Std. Error	*Post-Hoc test	Min	Max
*L**	Raw	56.60	0.46	a	53.63	59.27
	After brining	60.06	0.86	b	55.40	64.71
	After dry brining	58.99	0.84	b	53.58	64.36
*a**	Raw	6.19	0.46	a	3.62	8.04
	After brining	-4.66	0.10	b	-5.14	-3.84
	After dry brining	-5.26	0.06	b	-5.53	-4.71
*b**	Raw	-0.07	0.62	a	-4.10	3.89
	After brining	-7.70	0.26	b	-10.01	-6.58
	After dry brining	0.07	0.35	b	-3.24	2.26
Chroma	Raw	10.12	0.22	a	9.00	11.63
	After brining	10.35	0.20	a	9.48	12.21
	After dry brining	10.61	0.17	a	9.60	12.01
Whiteness	Raw	55.17	0.47	a	52.32	57.93
	After brining	58.48	0.78	b	54.09	62.80
	After dry brining	57.22	0.78	b	52.18	62.38

*The different letters show the difference between process steps in the same color parameter

The *L** value of the raw material of the sardine (initial) was 56.60±0.46. This value increased after brining and this increase was statistically significant ($p<0.05$). This result showed that brining process highly effective on the brightness of the sardine samples due to magnesium and calcium content of the salt (Hall 2011). Same increased levels were observed by the other researchers (Alçiçek and Balaban 2015a). After dry brining the *L** value of the samples slightly decreased (Figure 1). However, this decrease did not show any statistically significance ($p>0.05$). Same trend was observed in Whiteness parameter (Figure 5). The *a** and *b** values of the samples dramatically decreased after brine salting step. This difference was found statistically significant ($p<0.05$). However, there were no significant difference between the salting *a** and *b** values of the brine salting and dry ($p>0.05$) (Figure 2 and 3). These results showed that

brining and dry salting have a strong effect on the redness and yellowness of the sardine samples. The Chroma value of the samples did not show any significance during process steps ($p>0.05$) which is not expected (Figure 4).

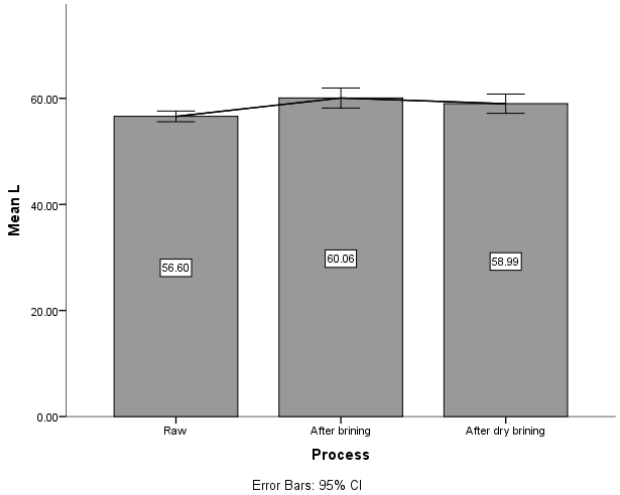


Figure 1: The L^* value of the sardine samples changes during process steps

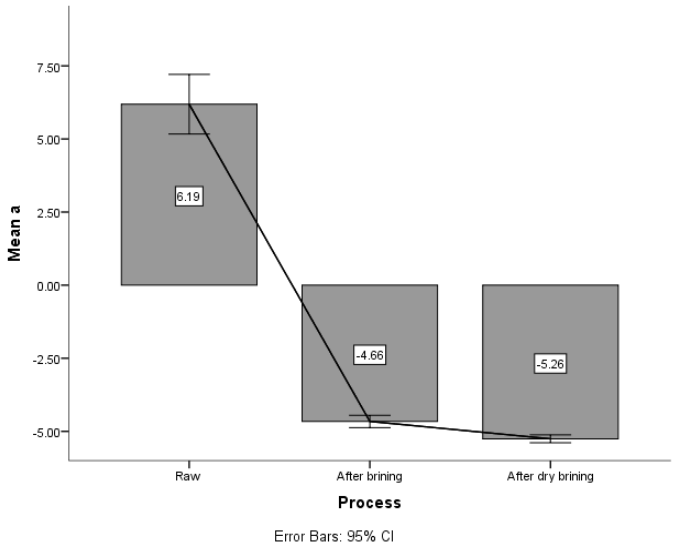


Figure 2: The a^* value of the sardine samples changes during process steps

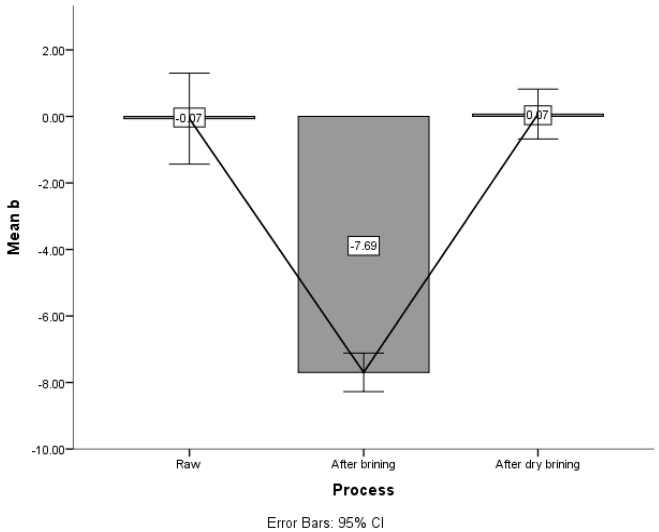


Figure 3: The b^* value of the sardine samples changes during process steps

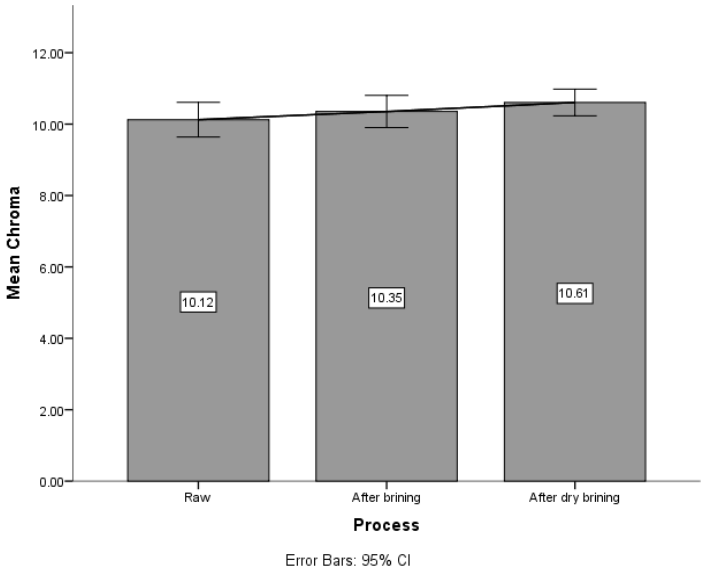


Figure 4: The *Chroma* value of the sardine samples changes during process steps

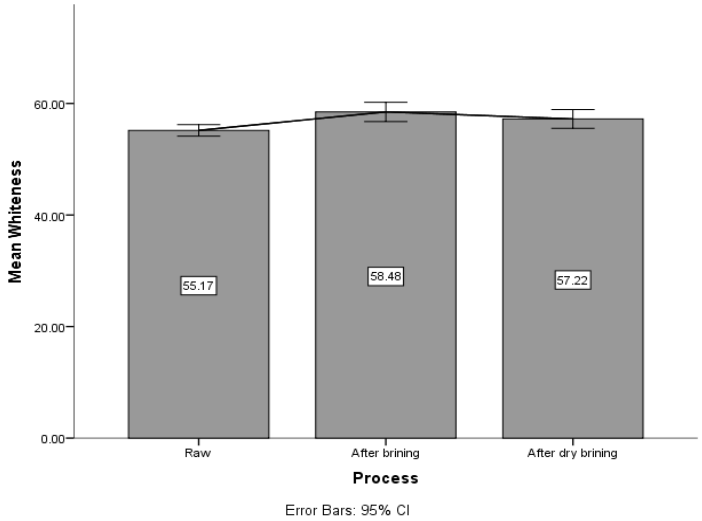


Figure 5: The *Whiteness* value of the sardine samples changes during process steps

According to the color scheme (NBS) determined by the Inter-Society Color Council, sardine fish were classified as grayish purple. However, after brine, the color of the sardine fish was classified as pale purple. After dry salting, the color category was determined as 'greenish gray.' According to these data, the salting stages significantly change the color of sardine fish. In later studies, it is recommended to examine consumer preferences using different salting rates and temperatures.

REFERENCES

Alcicek, Z., & Atar, H. H. (2010). The Effects of Salting on Chemical Quality of Vacuum Packed Liquid Smoked and Traditional Smoked Rainbow Trout (Oncorhyncus mykiss) Fillets During Chilled Storage. *Journal of Animal and Veterinary Advances*, *9*(22), 2778–2783. doi:10.3923/javaa.2010.2778.2783

Alçiçek, Z., & Balaban, M. Ö. (2012). Development and application of "The Two Image" method for accurate object recognition and color analysis. *Journal of Food Engineering*, *111*(1), 46–51. doi:10.1016/j.jfoodeng.2012.01.031

Alçiçek, Z., & Balaban, M. Ö. (2015a). Characterization of Green Shelled Mussel Meat. Part I: Quantification of Color Changes During Brining and Liquid Smoke Application Using Image Analysis.

Journal of Aquatic Food Product Technology, *24*(1), 2–14. doi:10.1080/10498850.2012.751566

Alçiçek, Z., & Balaban, M. Ö. (2015b). Characterization of green lipped mussel meat. Part II: Changes in physical characteristics as a result of brining and liquid smoke application. *Journal of Aquatic Food Product Technology*. doi:10.1080/10498850.2012.760188

Arason, S., Nguyen, M. V., Thorarinsdottir, K. a., & Thorkelsson, G. (2013). Preservation of fish by curing. In I. S. Boziaris (Ed.), *Seafood Processing: Technology, Quality and Safety* (pp. 129–160). NJ, USA: John Wiley & Sons, Ltd. doi:10.1002/9781118346174.ch6

Balaban, M. Ö., & Alçiçek, Z. (2015). Use of polarized light in image analysis: Application to the analysis of fish eye color during storage. *LWT - Food Science and Technology*, *60*(1), 365–371. doi:10.1016/j.lwt.2014.09.046

Balaban, M. O., Stewart, K., Fletcher, G. C., & Alçiçek, Z. (2014). Color Change of the Snapper (Pagrus auratus) and Gurnard (Chelidonichthys kumu) Skin and Eyes during Storage: Effect of Light Polarization and Contact with Ice. *Journal of Food Science*, *79*(12), E2456–E2462. doi:10.1111/1750-3841.12693

Hall, G. M. (2011). *Fish Processing: Sustainability and New Opportunities*. (G. M. Hall, Ed.). Iowa, USA: Wiley-Blackwell.

Kim, M. G., Alçiçek, Z., Balaban, M. O., & Atar, H. H. (2014). Image analysis method to quantify the effect of different treatments on the visual meat/shell ratio of half-shelled green lipped mussels (Perna canaliculus). *Journal of the Science of Food and Agriculture*. doi:10.1002/jsfa.6383

Kong, K. J. W., Alçiçek, Z., & Balaban, M. O. (2015). Effects of dry brining, liquid smoking and high-pressure treatment on the physical properties of aquacultured King salmon (Oncorhynchus tshawytscha) during refrigerated storage. *Journal of the Science of Food and Agriculture*, *95*(4), 708–714. doi:10.1002/jsfa.6754

Oehlenschlager, J. (2014). Seafood Quality Assessment. In I. S. Boziaris (Ed.), *Seafood Processing: Technology, Quality and Safety* (pp. 361–386). Wiley Blackwell. doi:10.1002/9781118346174.ch14

Pittia, P., & Antonello, P. (2015). *Safety by Control of Water Activity: Drying, Smoking, and Salt or Sugar Addition*. *Regulating Safety of Traditional and Ethnic Foods*. Elsevier Inc. doi:10.1016/B978-0-12-800605-4.00002-5

Toussaint-Samat, M. (2009). *A history of food*. (M. Toussaint-Samat, Ed.) (First.). MA, USA: Wiley-Blackwell.

Yagiz, Y., Balaban, M. O., Kristinsson, H. G., Welt, B. A., & Marshall, M. R. (2009). Comparison of Minolta colorimeter and machine vision system in measuring colour of irradiated Atlantic salmon. *Journal of the Science of Food and Agriculture*, *89*(4), 728–730. doi:10.1002/jsfa.3467

(ORAL PRESENTATION)

INVESTIGATION OF COLOR CHANGES OF ANCHOVY AND SARDINE FILLETS TREATED WITH DIFFERENT OILS AND LIQUID BY COMPUTER-BASED IMAGE ANALYSIS TECHNOLOGY

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Abstract
It is in the expectation that specific sensory characteristics are appropriate to their own experience before consumers buy a food product. Color is one of the most important of these sensory properties. In addition to instrumental techniques, computer-based imaging techniques are used in color measurement. This technique is used safely in non-homogenous food products, especially in seafood. Food additives that can affect the color of processed seafood can be added by commercial enterprises. The most popular of these food additives are plant-oils. These oils called natural and green chemicals are considered safe food additives. Orange and lemon oils were used in this study. The aim of the study was to determine the effects of lemon oil and orange oil spread applications on the color, area and meat yield of anchovy and sardine fillets. These analyses were carried out when samples raw, after application and after cooking. The statistical relationships were monitored between applications for both fish species. According to results, the area of control, lemon oil and orange oil groups of anchovy and sardine showed significant differences after cooking ($p<0.01$). L* values of the control group of anchovy and sardine were between 54.43-58.00 and 54.83-65.40, respectively. The a* values of anchovy in Lemon Oil group were 4.40, 2.57, and -0.10 for raw, after application and after cooking, respectively. Same values for sardine were 6.46, 3.90, and -1.73 for raw, after application and after cooking, respectively. All color values of the control group of both fish species showed a statistically significant change only after cooking ($p<0.01$). Lemon and orange oil have resulted in significant changes in a* value of fillets after application and cooking ($p<0.01$). However, L*, b*, and Chroma values have changed significantly only after cooking ($p<0.01$). The meat yield of anchovy samples were 48.28%, 51.41%, and 44.96% for lemon oil, orange oil and control groups, respectively. Sardine meat yields were 62.87%, 64.49%, and 59.81% for lemon oil, orange oil and control groups, respectively. According to the results of the study; lemon and orange oil has a significant effect on changing the color of anchovy and sardine samples. It has also been found that the cooking process varies the area and meat yield of the fillets.

Keywords: Color, anchovy, sardine, meat yield, cooking

INTRODUCTION

Food additives are using for developing the flavor, texture, and color of the product (Socaciu, 2008). Many food additives are using by industry. In recent years, non-chemical food additives have been demanded due to increased consumer awareness (Alçiçek, 2011). The most popular of these food additives are plant-oils (Verzera, Trozzi, Dugo, Di Bella, & Cotroneo, 2004). These oils are called natural and green chemicals and are considered safe food additives (Rahman, 2007).

Rutaceae family has many fruits crops including lemon, orange, limes (URL, 2019). These fruits have a sour and sweet taste and strong flavor. Their peels have also using for color enricher by bakers manually. Some species are carotenoid-rich (Vinha, Rodrigues, Nunes, & Oliveira, 2018).

There are some researches about orange oil and/or lemon oil added seafood (Özpolat, 2019; Tosun, Üçok Alakavuk, Ulusoy, & Erkan, 2018; Yildiz Oguzhan, 2019) and lemon oil and their effects on surimi (Ramroop & Neetoo, 2018). However, there is no literature about the color effects of lemon and orange oil on anchovy and sardine. This study focused on lemon and orange oils to determine their color enricher effects on anchovy and sardine fillets. For color determination, the computer-based image analysis was used to gain objective and repeatable data (Balaban, Stewart, Fletcher, & Alçiçek, 2014).

MATERIALS AND METHODS

The fresh anchovy and sardine samples purchased from a local fish market (Canakkale, Turkey) and transferred in ice to the laboratory. The samples immediately washed with tap water, de-headed, neatly eviscerated and removed pin

bones. The fillets were divided into 3 groups: Control, Lemon and Orange oil groups. The raw fillets pictures were taken by using a Nikon D300 camera (Nikon Co., Tokyo, Japan) mounted in a light-box which described by Luzuriaga, Balaban, & Yeralan, (1997). A single layer of commercial lemon and orange oil (Defne & Doga Co., Antalya, Turkey) was applied to the fillets with a thin brush. Then, the lemon and orange oil groups' samples pictures were taken in the light-box. All samples cooked in a fan oven at 120°C for 10 minutes. The samples cooled at ambient temperature and then the pictures were taken. There were a reference color (Gretag Color Checker, X-Rite Inc., Grand Rapids, MI, USA) and area reference square (16 cm^2) in the light-box for color and area determination by using LensEye software (Gainesville, FL, US). The statistical analysis was performed by SPSS v.23 (IBM, NY, USA). A one-way ANOVA was conducted to determine the difference between groups during the process. Tukey post-hoc test was used to show the difference level of the groups at $p<0.01$.

RESULTS AND DISCUSSION

Table 1 demonstrates the color and area values of the anchovy and sardine fillets during the process.

The *L** value of the initial anchovy samples were 54.43±0.67, 53.23±1.09 and 51.80±0.55 for Control, Lemon and Orange oil groups, respectively. After application of the oils, the fillets' *L** value slightly increased, but this increase was not found statistically significant for all groups ($p<0.01$). The main changes were monitored after the cooking process. The *L** value of the anchovy samples dramatically increased and this increase was found statistically significant for all groups ($p<0.01$). A same increasing trend was observed for *b** values of the Lemon oil groups while the *a** value showed a decrease ($p<0.01$) during the process. However, Orange oil group' *b** value was different from the other groups. The *b** value was found statistically significant even after application ($p<0.01$). This results showed that Orange oil affects the *a** and the *b** values of the anchovy fillets both after application and after cooking ($p<0.01$). The *a** value of the Lemon oil group and Orange oil group were found statistically significant ($p<0.01$) after the cooking process. This is probably because the carotenoid content in the orange oil is higher than the lemon oil (Guimarães et al., 2010).

Sardine fillets initial *L** values were 54.83±0.57, 53.57±0.83 and 55.07±0.99 for Control, Lemon oil, and Orange oil groups, respectively. After application, this value slightly increased, but this increase was not found statistically significant ($p<0.01$) for Lemon and Orange oil groups. The main change was monitored after cooking. The cooking process increased the *L** value of the samples for all groups ($p<0.01$). There was no significant difference between groups in the same application process ($p<0.01$). This result showed that the oil application has not a significant effect on the color parameters of sardine fillets' *L** value, but cooking has. The same trend was also observed for Whiteness. The initial *a** value of the sardine fillets was 12.77±0.33, 6.46±0.17 and 6.20±0.44, for Control, Lemon oil, and Orange oil groups, respectively. The high ranges of the *L** values between groups were probably due to individual differences in fish samples. There was a significant difference between Control and oil applied groups after application ($p<0.01$). This is probably due to the content of lemon and orange oils, which are capable of changing color. The decreased *a** value of the Lemon and Orange oil groups was monitored after the application process. The main drastic change was occurred after cooking for all groups. The *a** value was decreased after cooking ($p<0.01$). However, the *a** value of the Lemon and Orange oil groups did not show any significance ($p>0.01$), but Control group showed a significant difference from the other two groups ($p<0.01$). This results clearly shows the lemon and orange oil application decreased the *a** value of the cooked sardine fillets. The *b** value of the raw sardine fillets was -7.90±1.04, 0.67±0.85 and 0.68±0.69 for Control, Lemon and Orange oil groups, respectively. The high ranges of the *b** values between groups were probably due to individual differences in fish samples. The *b** value of the Lemon oil group was decreased while Orange oil group *b** value increased. This is probably because the carotenoid content in the orange oil is higher than the lemon oil (Guimarães et al., 2010). However, the *b** value of all groups were increased after cooking ($p<0.01$). The main reason of this probably due to temperature and water loss during cooking and as well as changes in muscle proteins and lipids. The same color change results were found by Ayvaz, Çakır, Gündüz, & Erdağ, (2017). Chroma value of the sardines slightly decreased after application. However, this decrease was not found statistically significant ($p<0.01$). The Chroma value was dramatically increased after cooking for all groups ($p<0.01$). This result shows that the oil application had no effect on the Chroma value of the sardine fillets, but cooking had.

Area of the anchovy and sardine fillets dramatically decreased after cooking ($p<0.01$). This is due to the water loss of the samples during cooking at a high temperature. This caused the samples to shrink and reduce their area. It has also an effect on the meat yield of the samples. The meat yield of anchovy samples were 48.28%, 51.41%, and 44.96% for Lemon oil, Orange oil and Control groups, respectively. The same cooking loss was found by the other researchers (Alçiçek, Zencir, Çelik Çakiroğullari, & Atar, 2010). Sardine meat yields were 62.87%, 64.49%, and 59.81% for Lemon oil, Orange oil and Control groups, respectively.

Finally, this research showed that lemon and orange oil application on the small size fish samples like anchovy and sardine, which are accepted as fatty fish, affect color parameters especially *a** and *b**. Moreover, their effect on the color parameters of fish samples was sometimes suppressed by the effect of cooking due to changes in the muscle structure.

Table 1: The color and area values of the anchovy and sardine fillets during process

Anchovy													
		Area	±St.Er	*L**	±St.Er	*a**	±St.Er	*b**	±St.Er	Chroma	±St.Er	Whiteness	±St.Er
Control	Raw	13.18	0.35^{Aa*}	54.43	0.67^{Aa}	3.53	0.36^{Aa}	6.54	0.53^{Aa}	10.49	0.32^{Aa}	52.68	0.70^{Aa}
	After app	13.18	0.35^{Aa}	54.43	0.67^{Aa}	3.53	0.36^{Aa}	6.54	0.53^{Aa}	10.49	0.32^{Aa}	52.68	0.70^{Aa}
	After Cooking	9.71	0.21^{Ab}	58.00	0.57^{Ab}	0.81	0.32^{Ab}	17.32	0.60^{Ab}	19.32	0.59^{Ab}	53.03	0.60^{Aa}
Lemon Oil	Raw	14.20	0.42^{Aa}	53.23	1.09^{Aa}	4.40	0.25^{Aa}	6.39	0.75^{Aa}	10.77	0.38^{Aa}	51.51	1.07^{Aa}
	After app	15.54	0.49^{Ba}	53.89	0.67^{Aa}	2.57	0.22^{Ab}	6.83	0.64^{Aa}	10.31	0.39^{Aa}	52.18	0.70^{Aa}
	After Cooking	11.25	0.45^{Bb}	60.58	0.75^{Ab}	-0.10	0.22Ac	16.85	0.41^{Ab}	18.59	0.42^{Ab}	55.83	0.82^{Aa}
Orange Oil	Raw	13.43	0.38^{Aa}	51.80	0.55^{Aa}	4.38	0.42^{Aa}	5.03	0.48^{Aa}	9.91	0.35^{Aa}	50.30	0.57^{Aa}
	After app	14.86	0.37^{ABa}	54.32	0.54^{Aa}	2.37	0.28^{Ab}	8.59	0.52^{Ab}	11.44	0.40^{Aa}	52.21	0.58^{Aab}
	After Cooking	10.45	0.34^{Ab}	60.73	0.84^{Ab}	-0.54	0.26^{Bc}	18.10	0.99^{Aca}	19.90	0.98^{Ab}	55.28	1.13^{Ab}
Sardine													
		Area	±St.Er	*L**	±St.Er	*a**	±St.Er	*b**	±St.Er	Chroma	±St.Er	Whiteness	±St.Er
Control	Raw	25.39	1.55^{Aa}	54.83	0.57^{Aa}	12.77	0.33^{Aa}	-7.90	1.04^{Aa}	17.85	0.48^{Aa}	51.17	0.51^{Aa}
	After app	25.39	1.55^{Aa}	54.83	0.57^{Aa}	12.77	0.33^{Aa}	-7.90	1.04^{Aa}	17.85	0.48^{Aa}	51.17	0.51^{Aa}
	After Cooking	18.54	1.20^{Ab}	65.40	0.81^{Ab}	1.01	0.22^{Ab}	13.47	0.49^{Ab}	14.71	0.49^{Ab}	61.85	0.92^{Ab}
Lemon Oil	Raw	25.99	1.46^{Aab}	53.57	0.83^{Aa}	6.46	0.17^{Aa}	0.67	0.85^{Aa}	10.66	0.39^{Aa}	52.11	0.92^{Aa}
	After app	29.95	1.95^{Aa}	55.35	0.85^{Aa}	3.90	0.48^{Bb}	-0.34	0.92^{Ba}	9.47	0.38^{Ba}	54.13	0.91^{ABa}
	After Cooking	21.50	1.21^{ABb}	67.70	0.75^{Ab}	-1.73	0.25^{Bc}	12.77	0.78^{Ab}	14.32	0.72^{Ab}	64.22	0.90^{Ab}
Orange Oil	Raw	29.86	1.13^{Aa}	55.07	0.99^{Aa}	6.20	0.44^{Aa}	0.68	0.69^{Aa}	10.34	0.30^{Aa}	53.63	1.04^{Aa}
	After app	29.98	1.56^{Aa}	56.02	0.37^{Aa}	3.94	0.52^{Bb}	2.12	0.85^{Ba}	9.60	0.24^{Ba}	54.69	0.38^{Ba}
	After Cooking	23.61	0.71^{Bb}	67.24	0.79^{Ab}	-2.15	0.25^{Bc}	18.59	0.41^{Bb}	19.76	0.39^{Bb}	61.18	0.73^{Ab}

*Different big letters show the difference between the different group, same process step and same parameters, different small letters show the difference between the same group, same parameter and different process steps ($p<0.01$).

REFERENCES

Alçiçek, Z. (2011). The effects of thyme (Thymus vulgaris L.) oil concentration on liquid-smoked vacuum-packed rainbow trout (Oncorhynchus mykiss Walbaum, 1792) fillets during chilled storage. *Food Chemistry*, *128*(3), 683–688. https://doi.org/10.1016/j.foodchem.2011.03.087

Alçiçek, Z., Zencir, Ö., Çelik Çakiroğullari, G., & Atar, H. H. (2010). The Effect of Liquid Smoking of Anchovy (Engraulis encrasicolus , L. 1758) Fillets on Sensory, Meat Yield, Polycyclic Aromatic Hydrocarbon (PAH) Content, and Chemical Changes. *Journal of Aquatic Food Product Technology*, *19*(3–4), 264–273. https://doi.org/10.1080/10498850.2010.512995

Ayvaz, Z., Çakır, F., Gündüz, H., & Erdağ, M. (2017). The Use of Computer-Based Image Analysis on Colour Determination of Liquid Smoked Trout (Oncorhynchus mykiss) Treated with Different Dry Salt-Sugar Mixtures. *Turkish Journal of Agriculture - Food Science and Technology*, *5*(12), 1528. https://doi.org/10.24925/turjaf.v5i12.1528-1535.1446

Balaban, M. O., Stewart, K., Fletcher, G. C., & Alçiçek, Z. (2014). Color Change of the Snapper (Pagrus auratus) and Gurnard (Chelidonichthys kumu) Skin and Eyes during Storage: Effect of Light Polarization and Contact with Ice. *Journal of Food Science*, *79*(12), E2456–E2462. https://doi.org/10.1111/1750-3841.12693

Guimarães, R., Barros, L., Barreira, J. C. M., Sousa, M. J., Carvalho, A. M., & Ferreira, I. C. F. R. (2010). Targeting excessive free radicals with peels and juices of citrus fruits: Grapefruit, lemon, lime and orange. *Food and Chemical Toxicology*, *48*(1), 99–106. https://doi.org/10.1016/J.FCT.2009.09.022

Luzuriaga, D. A., Balaban, M. O., & Yeralan, S. (1997). Analysis of Visual Quality Attributes of White Shrimp by Machine Vision. *Journal of Food Science*, *62*(1), 113–118. https://doi.org/10.1111/j.1365-2621.1997.tb04379.x

Özpolat, E. (2019). Effects of Lemon (Citrus limon) and Bitter Orange (Citrus aurantium) Essential Oils on Microbiological Quality of Stored tt 4±1°C Rainbow Trout (Oncorhynchus mykiss). *Gida/The Journal of Food*, *44*(2), 185–190. https://doi.org/10.15237/gida.GD18128

Rahman, S. (2007). *Handbook of food preservation*. (S. Rahman, Ed.) (Second). London: CRC Press. Retrieved from https://www.crcpress.com/Handbook-of-Food-Preservation/Rahman/p/book/9781574446067

Ramroop, P., & Neetoo, H. (2018). Antilisterial activity of (Cymbopogon citratus) on crabsticks. *AIMS Microbiology*. https://doi.org/10.3934/microbiol.2018.1.67

Socaciu, C. (2008). *Food Colorants Chemical and Functional Properties*. (C. Socaciu, Ed.). USA: Taylor & Francis Group, LLC.

Tosun, Ş. Y., Üçok Alakavuk, D., Ulusoy, Ş., & Erkan, N. (2018). Effects of essential oils on the survival of Salmonella Enteritidis and Listeria monocytogenes on fresh Atlantic salmons (Salmo salar) during storage at 2 ± 1 °C. *Journal of Food Safety*. https://doi.org/10.1111/jfs.12408

URL. (2019). List of plants in the family Rutaceae. Retrieved September 2, 2019, from https://www.britannica.com/topic/list-of-plants-in-the-family-Rutaceae-2038278

Verzera, A., Trozzi, A., Dugo, G., Di Bella, G., & Cotroneo, A. (2004). Biological lemon and sweet orange essential oil composition. *Flavour and Fragrance Journal*, *19*(6), 544–548. https://doi.org/10.1002/ffj.1348

Vinha, A. F., Rodrigues, F., Nunes, M. A., & Oliveira, M. B. P. P. (2018). Natural pigments and colorants in foods and beverages. In *Polyphenols: Properties, Recovery, and Applications* (pp. 363–391). Elsevier. https://doi.org/10.1016/B978-0-12-813572-3.00011-7

Yildiz Oguzhan, P. (2019). Influences of Citrus Peel Oils on Shelf Life of Rainbow Trout (Oncorhynchus mykiss) Fillets. *Journal of Limnology and Freshwater Fisheries Research*, *5*(1), 17–26. https://doi.org/10.17216/limnofish.423440

MONITORING OF COLOR CHANGES IN DIFFERENT PROCESSES OF ANCHOVY AND SARDINE FILLETS DIPPED IN ORANGE OIL, LEMON OIL AND LIQUID SMOKE

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Abstract

Color is an important sensory attribute to determine the seafood quality by consumers. Computer-based image analysis is an objective, repeatable, and fast method to determine non-homogenized color samples like seafood. Essential oils and liquid smoke are essential to developing seafood color, taste, and shelf-life. In this study, lemon oil, orange oil, and water-based liquid smoke were added in a brine solution of anchovy and sardine fillets. The aim of the study was to determine the effects of lemon oil, orange oil and water based liquid smoke on the color, area and meat yield of anchovy and sardine fillets in raw, after application and after cooking processes. According to results, the area of fillets was significantly changed after cooking for all groups ($p<0.05$). The a* value of lemon oil group of anchovy was 4.56±0.25, 53.90±0.67, and 61.77±0.75 during raw, after salting and application, after cooking, respectively. The same value for sardine was changed 6.15±0.49, 3.90±0.48, and -1.26±0.24 during raw, after salting and application, after cooking, respectively. a* value of lemon oil, orange oil, and liquid smoked anchovy and sardine groups were significantly changed after brine solution applications and cooking ($p<0.05$). However, the importance of L *, b *, Chroma and Whiteness values of lemon and orange oil groups of anchovy and sardine fillets increased only after cooking. The meat yield values were 52.02, 48.73 and 49.95 for lemon, orange oil and liquid smoked of anchovy fillets, respectively. The meat yield of sardine fillets were 68.73, 64.49 and 55.18 for lemon, orange oil, and liquid smoked fillets, respectively. Results were shown that adding liquid smoke to brine solution has always created differences that are more pronounced over the color characters than the lemon and orange oil applications in each application for anchovy and sardine fillets. Cooking has a significant impact on the areas of anchovy and sardine fillets. The salting effect changed the meat yield. It was found that the meat yields of liquid smoked products were lower than the other groups.

***Keywords**: Color, orange oil, lemon oil, liquid smoke, consumer preference*.

INTRODUCTION

Color improvement of food with food additives have been widely used by the industry. The use of synthetic color development agents is losing popularity because of increasing consumer awareness. The plant oils are accepted as green chemicals (Rahman, 2007). Their effects are not only on color but also they provide longer shelf life especially in seafood (Alçiçek, 2011; Mayeli, Mehdizadeh, Tajik, Esmaeli, & Langroodi, 2019). The pigments of the plant oils can react more or less depends on plant and food products properties (Bohra, Waman, Roy, & Shivashankara, 2019; Diehl, 2008). The oils of carotenoid-containing plants such as lemons and oranges can be easily applied to seafood (Mayeli et al., 2019; Yildiz Oguzhan, 2019).

Smoke flavoring usage for seafood has been using the last four decades (Varlet, Serot, & Prost, 2010). The smoke flavors have complex compounds. One of them is phenolic compounds and they directly affect the color of the applied food surface and give brown/yellow color, which is the characteristic color of smoked foods (Ayvaz, Çakır, Gündüz, & Erdağ, 2017; Varlet et al., 2010).

Color analyze is important to determine the color of a food product. It can be determined by food experts. However, individual perception differences highly affect the color determination results. Thus, there is instrumental equipment for analyzing color. However, some researchers have argued that this equipment does not always have accurate results on the seafood surface due to the nonhomogeneous color distribution (Balaban, Aparicio, Zotarelli, &

Sims, 2008; Oliveira & Balaban, 2006; Ünal Şengör et al., 2018). For eliminate the problems, the computer-based image analyses systems have been used for the last four decades (Ayvaz, Balaban, & Kong, 2017; Balaban et al., 2008).

This study aimed to determine the effectiveness of lemon, orange oils and water-based smoke flavoring on the anchovy and sardine fillets by using computer-based image analysis.

MATERIALS AND METHODS

Fresh anchovy and sardine samples were obtained from a local fish market in Canakkale-Turkey on March 2019. They were gutted, de-headed and washed with tap water in the laboratory. After filleting process, the samples were divided into four groups for each fish species as lemon oil, orange oil, and liquid smoke flavoring (LS) groups. The colorants added in a brine solution (4% commercial salt) for every group. the fish samples dipped in the solutions (1:1 w/v) for 2 hours at 4°C. Then, the samples drained at the room temperature. They cooked at 120°C for 8 minutes in a fan oven after draining. All samples pictures were taken by a Nikon D300 camera (Nikon Co., Tokyo, Japan) in a light-box, which described by Alçiçek & Balaban, (2012) and Luzuriaga, Balaban, Hasan, & Teixeira, (1997) to determine the area (cm^2) and color parameters (*L**, *a**, *b**, Chroma, and Whiteness) of samples at every step of the process: initial, after salting and application, and after cooking. Besides, the weight of the samples was recorded to determine the meat yield. A software (SPSS v.23, IBM, IL, US) used to carry out the statistical analysis. Data were subjected to analysis of variance (one-way ANOVA). Results were reported as mean values ± standard error. The Tukey post-hoc test was used to show the difference between groups at the alpha level 95% ($p<0.05$).

RESULTS AND DISCUSSION

Table 1 shows the area and color parameters' changes of anchovy and sardine samples during process steps.

The *L** value of the initial anchovy fillets were 53.65±0.72, 53.81±0.44, and 53.90±0.78 for lemon, orange oil, and LS groups, respectively. After salting and application process, this values slightly increased for all groups, but this increase was not found statistically significant ($p>0.05$). The expectation was that the LS application would turn dark the color of the fillet. The results showed that the brining suppressed the LS effect and the color went to lighter. However, the *L** value of the samples dramatically changed after cooking and the LS group showed the expected results. The same trend was observed for Whiteness value. The *L** value of the anchovy samples were 61.77±0.75, 60.61±0.50, and 36.83±1.05 for lemon, orange oil, and LS groups in the after cooking process step, respectively. There was no statistical significance between lemon and orange oil groups ($p>0.05$), but the LS group had statistical significance from the other groups ($p<0.05$). This is probably because of the high-temperature occurrence during cooking and this provided water lost and changed in the muscle structure. Besides, the LS gave a dark color due to reduced moisture the phenolic compounds had an effect on the structure of the fillets (Alçiçek & Balaban, 2015; Varlet et al., 2010). Same effects were followed for the other color parameters. The *a** value of the anchovy samples were decreased even after brining and application process. This decrease was found statistically significant than initial *a** value of the samples ($p<0.05$). On the other hand, the LS group showed statistical significance from the other two groups on the after brining and application process step ($p<0.05$). This is due to phenolic compounds of LS applied. When samples cooked at high temperature, the *a** value of the oil applied groups decreased, the *a** value of LS group increased due to combining effects of phenolic compounds and cooking temperature. The *a** value of the cooked samples was found statistically significant both in the group and between the groups ($p<0.05$). The *b** value of the anchovy samples increased after brining and application stage. This increase was found statistically significant for the LS group ($p<0.05$), but was not for the oil applied groups ($p>0.05$). This result showed that the LS application has a significant effect on the *b** value of anchovy fillets. Besides, cooked fillets of the LS group's *b** value did not show any significant difference from the latter process step ($p>0.05$). This clearly confirms that cooking does not significantly change the *b** value of the LS applied anchovy samples. The *b** value of the lemon oil applied group stayed nearly the same value with initial in the after brining and application step ($p>0.05$). However, the orange oil added group's *b** value was monitored a slight increase in the same process step, but this increase did not show any statistical significance also ($p>0.05$). This is probably due to the carotenoid levels of orange oil (Guimarães et al., 2010). The same trend was observed Chroma values for all groups. When the sardine samples color parameters were observed, there was no different finding from the trend of anchovy samples. This is clearly showed that the application process affected both of fish species in the same way.

The meat yield values were 52.02%, 48.73% and 49.9%5 for lemon, orange oil and liquid smoked of anchovy fillets, respectively. The meat yield of sardine fillets were 68.73%, 64.49% and 55.18% for lemon, orange oil, and liquid smoked fillets, respectively. The area values dramatically decreased after cooking for all groups.

Results were shown that adding liquid smoke to brine solution has always created differences that are more pronounced over the color characters than the lemon and orange oil applications for anchovy and sardine fillets. Cooking has a significant impact on the areas of anchovy and sardine fillets. The salting step changed the meat yield. It was found that the meat yields of liquid smoked products were lower than the other groups except orange oil applied anchovy group.

Table1: The area and color parameters of anchovy and sardine fillets during process steps.

Anchovy									
Application	Lemon Oil			Orange Oil			Liquid Smoke		
Shape and Color Values	Raw	After Brining and Applications	After Cooking	Raw	After Brining and Applications	After Cooking	Raw	After Brining and Applications	After Cooking
Area	14.66 ± 0.50^{Aa}	15.53 ± 0.48^{Aa}	10.15 ± 0.29^{Ab}	14.05 ± 0.31^{Aa}	14.86 ± 0.36^{Aa}	9.63 ± 0.28^{Ab}	14.33 ± 0.31^{Aa}	14.40 ± 0.22^{Aa}	8.20 ± 0.29^{Bb}
*L**	53.65 ± 0.72^{Aa}	53.90 ± 0.67^{Aa}	61.77 ± 0.75^{Ab}	53.81 ± 0.44^{Aa}	54.30 ± 0.54^{Aa}	60.61 ± 0.50^{Ab}	53.90 ± 0.78^{Aa}	55.65 ± 0.55^{Aa}	36.83 ± 1.05^{Bb}
*a**	4.56 ± 0.25^{Aa}	2.58 ± 0.22^{Ab}	-0.38 ± 0.23^{Ac}	4.58 ± 0.32^{Aa}	2.39 ± 0.28^{Ab}	-0.43 ± 0.16^{Ac}	4.39 ± 0.52^{Aa}	0.52 ± 0.21^{Bb}	9.49 ± 0.30^{Bc}
*b**	6.59 ± 0.77^{Aa}	6.84 ± 0.63^{Aa}	13.07 ± 0.71^{Ab}	6.87 ± 0.54^{Aa}	8.60 ± 0.52^{Aa}	13.83 ± 0.73^{Ab}	5.62 ± 0.48^{Aa}	11.90 ± 0.60^{Bb}	10.31 ± 0.85^{Bb}
Chroma	10.95 ± 0.47^{Aa}	10.32 ± 0.39^{Aa}	14.91 ± 0.66^{Ab}	11.23 ± 0.49^{Aa}	11.45 ± 0.40^{Aa}	15.62 ± 0.64^{Ab}	10.36 ± 0.32^{Aa}	13.21 ± 0.59^{Bb}	16.36 ± 0.69^{Ac}
Whiteness	51.79 ± 0.71^{Aa}	52.18 ± 0.69^{Aa}	58.39 ± 0.84^{Ab}	51.79 ± 0.55^{Aa}	52.18 ± 0.58^{Aa}	57.10 ± 0.46^{Ab}	52.23 ± 0.78^{Aa}	53.19 ± 0.44^{Aa}	34.27 ± 0.96^{Bb}
Sardine									
Application	Lemon Oil			Orange Oil			Liquid Smoke		
Shape and Color Values	Raw	After Brining and Applications	After Cooking	Raw	After Brining and Applications	After Cooking	Raw	After Brining and Applications	After Cooking
Area	27.77 ± 1.87^{Aa}	29.94 ± 1.94^{Aa}	19.28 ± 1.47^{Ab}	28.47 ± 1.59^{Aa}	29.97 ± 1.55^{Aa}	19.02 ± 1.88^{Ab}	27.47 ± 1.75^{Aa}	28.38 ± 1.85^{Aa}	16.94 ± 1.46^{Ab}
*L**	55.17 ± 0.84^{Aa}	55.38 ± 0.84^{Aa}	67.70 ± 0.79^{Ab}	56.62 ± 0.36^{Aa}	55.98 ± 0.36^{Aa}	66.49 ± 0.57^{Ab}	56.53 ± 0.73^{Aa}	56.57 ± 0.63^{Aa}	42.75 ± 3.96^{Bb}
*a**	6.15 ± 0.49^{Aa}	3.90 ± 0.48^{Ab}	-1.26 ± 0.24^{Ac}	6.34 ± 0.56^{Aa}	3.92 ± 0.51^{Ab}	-1.47 ± 0.25^{Ac}	5.77 ± 0.61^{Aab}	2.08 ± 0.53^{Ba}	9.33 ± 1.91^{Bb}
*b**	-0.12 ± 0.79^{Aa}	-0.31 ± 0.92^{Aa}	6.70 ± 0.54^{Ab}	-0.58 ± 0.58^{Aa}	2.06 ± 0.84^{Ab}	4.81 ± 0.48^{Ac}	0.84 ± 0.61^{Aa}	13.23 ± 0.68^{Bb}	13.89 ± 1.70^{Bb}
Chroma	10.33 ± 0.39^{Aa}	9.46 ± 0.38^{Aa}	9.61 ± 0.41^{Aa}	10.27 ± 0.26^{Aa}	9.58 ± 0.24^{Aa}	9.26 ± 0.33^{Aa}	10.01 ± 0.26^{Aa}	14.81 ± 0.59^{Bb}	18.92 ± 1.72^{Bc}
Whiteness	53.73 ± 0.91^{Aa}	54.15 ± 0.90^{Aa}	65.86 ± 0.88^{Ab}	55.18 ± 0.39^{Aa}	54.66 ± 0.38^{Aa}	64.75 ± 0.59^{Ab}	55.10 ± 1.99^{Aa}	53.46 ± 0.73^{Aa}	39.12 ± 4.26^{Bb}

*Different capital letters show the difference between the different group, the same process step and the same parameters, different small letters show the difference between the same group, the same parameter and different process steps ($p<0.05$).

REFERENCES

Alçiçek, Z. (2011). The effects of thyme (Thymus vulgaris L.) oil concentration on liquid-smoked vacuum-packed rainbow trout (Oncorhynchus mykiss Walbaum, 1792) fillets during chilled storage. *Food Chemistry*, *128*(3), 683–688. https://doi.org/10.1016/j.foodchem.2011.03.087

Alçiçek, Z., & Balaban, M. Ö. (2012). Development and application of "the Two Image" method for accurate object recognition and color analysis. *Journal of Food Engineering*, *111*(1), 46–51. https://doi.org/10.1016/j.jfoodeng.2012.01.031

Alçiçek, Z., & Balaban, M. Ö. (2015). Characterization of Green Shelled Mussel Meat. Part I: Quantification of Color Changes During Brining and Liquid Smoke Application Using Image Analysis. *Journal of Aquatic Food Product Technology*, *24*(1), 2–14. https://doi.org/10.1080/10498850.2012.751566

Ayvaz, Z., Balaban, M. O., & Kong, K. J. W. (2017). Effects of Different Brining Methods on Some Physical Properties of Liquid Smoked King Salmon. *Journal of Food Processing and Preservation*, *41*(1), e12791. https://doi.org/10.1111/jfpp.12791

Ayvaz, Z., Çakır, F., Gündüz, H., & Erdağ, M. (2017). The Use of Computer-Based Image Analysis on Colour Determination of Liquid Smoked Trout (Oncorhynchus mykiss) Treated with Different Dry Salt-Sugar Mixtures. *Turkish Journal of Agriculture - Food Science and Technology*, *5*(12), 1528. https://doi.org/10.24925/turjaf.v5i12.1528-1535.1446

Balaban, M. O., Aparicio, J., Zotarelli, M., & Sims, C. (2008). Quantifying Nonhomogeneous Colors in Agricultural Materials. Part II: Comparison of Machine Vision and Sensory Panel Evaluations. *Journal of Food Science*, *73*(9), S438–S442. https://doi.org/10.1111/j.1750-3841.2008.00967.x

Bohra, P., Waman, A. A., Roy, T. K., & Shivashankara, K. S. (2019). Blood fruit (Haematocarpus validus (Miers.) Bakh. f. ex Forman): a novel source of natural food colourant. *Journal of Food Science and Technology*, 1–9. https://doi.org/10.1007/s13197-019-04064-2

Diehl, H. (2008). Physics of Color. In Z. E. Sikorski (Ed.), *Food Colorants Chemical and Functional Properties* (pp. 3–21). New York: Taylor & Francis Group, LLC. https://doi.org/10.1201/9781420009286.sec1

Guimarães, R., Barros, L., Barreira, J. C. M., Sousa, M. J., Carvalho, A. M., & Ferreira, I. C. F. R. (2010). Targeting excessive free radicals with peels and juices of citrus fruits: Grapefruit, lemon, lime and orange. *Food and Chemical Toxicology*, *48*(1), 99–106. https://doi.org/10.1016/J.FCT.2009.09.022

Luzuriaga, D. A., Balaban, M. O., & Yeralan, S. (1997). Analysis of Visual Quality Attributes of White Shrimp by Machine Vision. *Journal of Food Science*, *62*(1), 113–118. https://doi.org/10.1111/j.1365-2621.1997.tb04379.x

Mayeli, M., Mehdizadeh, T., Tajik, H., Esmaeli, F., & Langroodi, A. M. (2019). Combined impacts of zein coating enriched with methanolic and ethanolic extracts of sour orange peel and vacuum packing on the shelf life of refrigerated rainbow trout. *Flavour and Fragrance Journal*, ffj.3527. https://doi.org/10.1002/ffj.3527

Oliveira, A. C. M., & Balaban, M. O. (2006). Comparison of A Colorimeter with a Machine Vision System in Measuring Color of Gulf of Mexico Sturgeon Fillets. *Applied Engineering in Agriculture*, *22*(4), 1–5.

Rahman, S. (2007). *Handbook of food preservation*. (S. Rahman, Ed.) (Second). London: CRC Press. Retrieved from https://www.crcpress.com/Handbook-of-Food-Preservation/Rahman/p/book/9781574446067

Ünal Şengör, G. F., Balaban, M. O., Topaloğlu, B., Ayvaz, Z., Ceylan, Z., Doğruyol, & Hande. (2018). Color assessment by different techniques of gilthead seabream (Sparus aurata) during cold storage. *Food Science and Technology*. https://doi.org/10.1590/fst.02018

Varlet, V., Serot, T., & Prost, C. (2010). Smoke Flavoring Technology in Seafood. In L. M. L. Nollet & F. Toldra (Eds.), *Handbook of Seafood and Seafood Products Analysis* (1st Editio, pp. 233–254). Boca Raton: CRC Press. Retrieved from https://www.taylorfrancis.com/books/e/9780429139161

Yildiz Oguzhan, P. (2019). Influences of Citrus Peel Oils on Shelf Life of Rainbow Trout (Oncorhynchus mykiss) Fillets. *Journal of Limnology and Freshwater Fisheries Research*, *5*(1), 17–26. https://doi.org/10.17216/limnofish.423440

(ORAL PRESENTATION)

Foot-Nail Diseases in Cattle and Their Harms to Businesses

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Abstract

Foot-nail diseases in cattle are a serious problem of welfare and cause significant economic losses. In addition, losses caused by the foot and nail problems for businesses (economic losses, early extraction, treatment costs, decreases in milk and meat yields, deterioration of reproductive efficiency) also lead to great losses through the harms they give to the economy. In this study, the effects of foot diseases on cattle breeding, milk yield and some behaviors, the causes of foot and nail problems, important nail diseases (base ulcer, heel decay, white line disease, interdigital dermatitis, foot rot, laminitis) and nail anomalies are discussed. In addition, the issues to be considered in the prevention of foot diseases and nail problems (foot care and nail cut, shelter and floor construction, foot bath application, regular and balanced feeding, separation of animals with a greater propensity to foot diseases) are addressed.

Key Words: Cattle, Disease, Foot, Harm, Nail

1-INTRODUCTION

One of the most important causes of economic losses in cattle farms is foot - nail problems. Closed and semi-closed system applied in cattle breeding organizations in order to increase the efficiency has been becoming more widespread. Foot diseases are encountered more commonly as a result of nail deformations caused by irregular wear when the necessary nail care is not performed in high-yielding, heavy-bodied culture cattle that are fed in closed stables and not left to pasture (Sındak ve ark., 2003). The main losses caused by foot diseases are expressed as live weight loss, decrease in weight gain, premature leaving of production, treatment costs, decrease in lactation time and milk yield and infertility (Alkan et al., 1994, Sağlıyan and Ünsaldı. 2002, Sprecher et al., 1997). It is emphasized that foot diseases cause higher economic losses than expected in dairy cattle breeding where the risk of catching diseases increases as productivity increases (İzci, 1998, Yavru et al., 1989, Yücel, 1982). The rate of incidence of foot diseases varies depending on the breed of the cattle, breeding method, climate and geographical region (Abid et al., 1989, Hassall et al., 1993, Ormancı and Belge 2001). Causes such as genetic predispositions, structural disorders, nutrition, season, environmental factors, lactation, age and nail disorders affect the incidence of foot diseases (Alkan et al., 1993, Boosman et al., 1991, Galindo et al., 2000).

2. SOME IMPORTANT NAIL DISEASES

It can be argued that cattle whose natural habitat is meadows and pastures are forced to spend most of their lives on concrete floors due to intensive breeding programs, which is the main cause of lameness and foot problems. The main causes of foot and nail problems are genetic (hereditary), environmental and unbalanced diet (Tümer, 2013). Some of the important nail diseases that result from these are as follows:

2.1. Sole Ulcers: It occurs mostly with lesions seen at the junction of the nail base and heel area. Unbalanced nails, excessively long nails, malnutrition, stress, standing on concrete floors for a long

time and bad nail cutting are the main causes of this. The diseased nail is dressed with local antibiotics during the treatment process and tar is applied to prevent water from entering the dressed area (Tümer, 2013).



Figure 1. Sole Ulcer

2.2. Heel Caries: It occurs as a result of the irregular erosion of the horny nail in the heel area and deep clefts. Fertilizers accumulated in their beds, general nail health and laminitis are the main risk factors leading to the emergence of the disease. In addition, prolonged inactivity, unhygienic housing conditions trigger disease formation. Deep clefts occurring as a result of this disease in the heel area cause pain with pressure during walking. In the treatment of this disease, the long nail and cleft parts are cut, dressed with antiseptic solutions and the animal is rested (Tümer, 2013).



Figure 2. Heel Erosion

2.3. White Line Disease: It is a disease caused by abscesses caused by damage of the connective tissue in the region called white line where the side and front walls of the nail meet the base of the nail. These abscesses are usually caused by stones, sand and hard objects stuck there. There are a number of conditions in this region that increase the risk of disease. These are overgrown and unbalanced nails, excessive wear of the horny nail layer, bad nail cutting, feeding disorders, slippery floors and long-distance walking; greater care and required precautions should be taken to prevent these situations (Tümer, 2013).



Figure 3. White Line Disease

2.4. Interdigital Dermatitis: The infection caused by the bacteria on the skin between the nails and the soft heel area. The bacteria causing this disease are diclelobacter nodous. This disease is infectious. No symptoms are seen at the beginning of the disease, but symptoms develop when infection progresses. When standing, the animals raise and shake their hind legs to ease the pain. Damp and dirty barn conditions and zinc and vitamin A deficiency are important causes of the disease. Necrophorus type bacteria that cause interdigital dermatitis can also cause foot decay (Yavru et al., 1989)



Figure 4. Interdigital Dermatitis

2.5. Foot Decay: This disease usually occurring in the hind legs is accompanied by symptoms such as swelling of the skin and soft tissues, redness and hair loss between the fingers. The swelling gradually increases and creates a smelly discharge. This disease is an infectious disease and is caused by the bacteria fusabacterium necrophorum. It is an infectious disease. It is capable of spreading in a short time. Antibiotic treatment should be applied early otherwise it may progress to deeper tissues (Yavru et al., 1989).

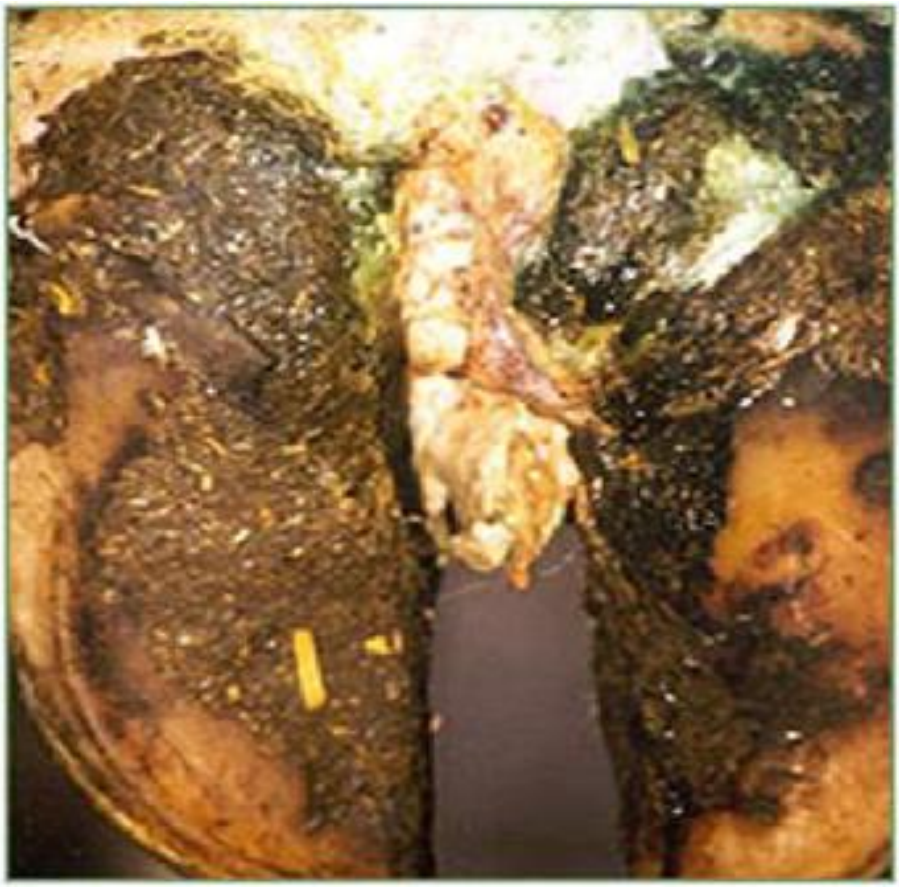


Figure 5. Foot Decay

2.6. Digital Dermatitis: It is a bacterial disease that usually occurs in the skin between the nails of the hind legs and is caused by a bacterium called spirochete. In this disease, the symptoms are swelling, redness and limping, but these conditions are lighter and the skin infection is more superficial. It is an infectious disease. It is mostly seen in neglected crowds and stables where urine and manure are together (Yavru et al., 1989).



Figure 6. Digital Dermatitis

2.7. Laminitis: It is a non-contagious foot infection that manifests itself with Lameness. The sensitive part of the nail can be inflamed for any reason. Usually short and incorrectly cut nails, overheating of the nail during the cut, deterioration of the rough coarse feed rate, fine chopping of coarse forage, drinking cold water while sweaty, blood poisoning, acidosis, some hormonal disorders are conditions that cause this disease (İzci, 1994).

Due to this inflammation, the nail that hangs down can be pierced and can cause sole ulcers. Bleeding may occur with the pressure of bone to this sensitive area. The foot with laminitis is painful and feels warm when touched. This disease requires serious and long-term treatment, so it is more economical to protect from the disease (İzci, 1994)



Figure 7. Laminitis

3. IMPORTANT FACTORS IN FOOT DISEASES

3.1. Breed Factor: Dark nails are more resistant than light nails.

3.2. Season Factor: Nails soften during very wet and rainy seasons; in dry and hot seasons, nails are more likely to break and crack.

3.3. Feeding Factor: High protein diets cause abnormal nail growth. Attention should be paid to this.

3.4. Stress Factor: Stiff floors, rocky terrain, and keeping animals in the barn for a long time are factors of stress. Because the hind legs of the animals standing in the barn encounter more urine, the front nails are harder.

3.5. Pregnancy Factor: Pregnancy causes both weight gain and impaired bone metabolism in animals. Lactation has similar effects. Abnormal steps during these periods may cause nail disorders.

3.6. Individual Changes: The causes of the deterioration of nail structure may be caused by changes unique to an individual animal. Animals' unique ways of stepping on the ground is an example to this (Kamiloğlu, 2018)

4. ISSUES TO BE CONSIDERED FOR PROTECTION AGAINST FOOT DISEASES AND NAIL PROBLEMS

4.1. Foot Care and Nail Cutting: Cattle nail care should be done at least twice a year.

When nail care is carried out, whether there is a disease or foreign element should be checked before cutting the nail. Particular attention should be paid to the hairless skin between the two nails. The use of tripods to fix cattle during nail cutting allows for a more comfortable operation. Tools such as nail cutter, nail clipper, nail scissors, nail files and carvers are used in nail cutting (İzci, 2018). Washing and cleaning the nail will make nail cutting easier and safer and less risky. Nails are roughly cut with nail scissors and pliers. Then, with a nail file and a carver, final shape is given. Nail elongation is more in the spring months, so more attention should be paid in these months (İzci, 2018).

4.2. Shelter and Ground Construction: Animal shelters should be more like their natural habitats. There should be walking areas and these areas should be covered with soil. .

4.3. Foot Bath Application: One of the important ways to combat foot diseases in a cattle ranch is to take a foot bath. The foot baths can be made at the entrance and exit of a barn so that cattle have to step on it while entering or exiting or in the form of foot baths in which cattle stand.

10% -20% Copper sulphate solution (eye stone) is used as disinfectant in the foot bath. Also 3-5% formaldehyde solution can be used with caution (İzci and Avki 1997).

4.4. Regular and Balanced Diet: If the ration prepared for cattle has a high rate of roughage or low rate of roughage, acidosis problem and consequently laminitis will occur. For this reason, it is critical to keep the rate of roughage in the range of 60-40% in the diet. In addition, moldy or rotten feeds result in the same problems. (İzci and Avki, 1997).

5. HARMS GIVEN BY FOOT AND NAIL PROBLEMS TO THE BUSINESS

5.1. Effect on Fertility

Reproduction performance has come to the forefront due to the increase in animal husbandry in recent years. Foot and nail problems play an important role in this regard. According to the studies conducted in the USA, where cattle breeding is relatively more intense, infertility rate was found to be 26.7%, mastitis rate 26.5%, and rate of foot and nail problems 15%. This is a rate that needs to be taken into consideration. The rate of the foot and nail problems in Turkey ranges from 13% to 50% (Yaylak, 2008).

Animals suffering from foot and nail problems are slowing their ovary functions due to the stress of this condition and problems are experienced as a result of the emergence of anger symptoms. Lameness may occur in the animal with foot disease and lameness affects reproduction as the lame animals cannot jump on each otherduring natural mating. At the same time, the time between birth and conception was found to be longer in animals with foot diseases than in normal animals. This is another effect of foot diseases on reproduction (Yaylak, 2008).

5.2. Effect on Milk and Meat Yield

In order to get the highest yield in a dairy cow business, it is necessary to provide a comfortable environment for the animals. As the comfort of the environment decreases, foot and nail problems arise. Significant decreases are seen in the yield levels of animals with foot and nail problems. It was found in studies that milk yield decreased by 20-25% in animals with foot and nail disease and there was a decrease up to 100 kg in live weight (Canbolat and Bulut, 2003)

Decrease in milk and meat yield is caused by a decrease in feed consumption of animals due to foot disease and lameness. Dry matter consumption decreases by 16% in animals with foot disease. The reason for this is that the animals cannot reach the manger because of their pain and lameness (Canbolat and Bulut, 2003)

High yielding dairy cows consume more feed to produce this yield, so they stand more when eating. This causes foot and nail problems. In order to prevent this, soft mats should be used at the feeder stops to reduce the pressure on the foot.

6. RESULTS

The most important problems that lead to the inadvertent expulsion of animals from the herd in modern cattle breeding businesses, together with reproduction and mastitis, are the problems of foot and nail which usually arise with lameness.

The economic dimension of the issue in Turkey is poorly understood and the number of businesses giving regular nail care to their animals is almost negligible. Many breeders around the world see that nail care is not an investment for the future of the herd, but an additional burden.

Unless treated, the problem in feet and nails disturbs animals, may prevent them from walking, eating, wandering in pastures, and may lead to decrease in milk, meat and offspring yields of animals, or even death.

Today, our cattle do not generally go to the pasture in medium and large scale enterprises. However, pasture is allocated to animals in well-organized enterprises. Animals that do not go out to the pasture are experiencing low productivity because their poor quality of living conditions is a source of stress. Another cause of low yield seen in animals not using pasture is that foot and nail problems are more common among cattle living in closed stalls.

Foot diseases in cattle result in losses in the national economy as a result of decreases in fertility, milk and meat yields. Regular foot and nail care of animals in enterprises will allow these enterprises to get rid of both treatment costs and loss of efficiency. Healthy animals in enterprises are happy animals, happy animals are productive animals.

REFERENCES

Abid TA., Eshoue SM., Badrany M., 1989. Slaughter House Survey of Bovine Foot Disorders. Indian Vet. J. 66: 154-157.

Alkan İ., Bakır B., Belge A., Gençcelep M., 1994. Sığır Ayak Hastalılarında Lokal Oxytetracyclin (Primamycin/LA Pfizer) Uygulamaları. YYÜ. Vet. Fak. Derg. 5, (1-2): 23-28.

Alkan İ, Boynukara B, Gençcelep M 1993. Van ve Yöresinde Sığır Ayak Hastalıklarının Yayılışı, Nedenleri ve Sağaltımı Üzerine Bir Araştırma. YYÜ. Vet. Fak. Derg. 4, (1-2): 87- 95.

Boosman R., Mutsaers CWAM., Klarenbeek A., 1991. The Role of Endotoxin in the Pathogenesis of Acute Bovine Laminitis. Veterinary Quarterly. 13, 3: 155-162.

Canpolat, İ., Bulut, S., (2003). Elazığ ve çevresinde sığırlarda görülen ayak hastalıklarının insidansı üzerine gözlemler. Fırat Üniversitesi Sağlık Bilimleri Veteriner Dergisi, 17(3),155-160

Galindo F., Broom DM., Jackson PGG., 2000. A Note on Possible Link Between Behaviour and Occurence of Lameness in Dairy Cows. Applied Animal Behaviour Science. 67: 335-341

Hassall SA., Ward WR., Murray RD., 1993. Effects of Lameness on the Behaviour of Cows

During the Summer. Vet. Rec. 132: 578-580.
İzci,C., Avki,S. 1997. Sığır Yetiştiriciliğinde Ayak Banyoları., Trakya Bölgesi II. Hayvancılık Sempozyumu. Trakya Üniv. Tekirdağ Ziraat Fak., 9-10 Ocak, Tekirdağ.
İzci C., 1998. Sığır Ayak Hastalıkları. S.Ü. Vet. Fak. Sarışen Offset. Konya.
İzci, C. 2018.Sığırlarda Ayak Hastalıkları ve Topallık Kontrolü. Güneş Tıp Kitabevi. 396s. ISBN:9789759679118. İstanbul.
Kamiloğlu, A.. 2018 Çiftlik Hayvanlarında Ayak Hastalıkları Ders Kitabı Medipres p:270-275. 376.
Ormancı S., Belge A., 2001. Van ve Yöresinde Süt Sığırlarında Ayak Hastalıklarının Nedenleri, Dağılımı ve Sağaltımı Üzerinde Çalışmalar. YYÜ. Sağl. Bil. Derg. 7, (1-2): 139-145.
Sağlıyan A., Ünsaldı E., 2002. Tunceli ve Yöresindeki Sığırlarda Karşılaşılan Ayak Hastalıklarının İnsidansı Üzerine Gözlemler. F.Ü. Sağl. Bil. Derg. 16, 1: 47-56.
Sındak, N. Keskin, O. Selçukbiricik H, Sertkaya H 2003. Şanlıurfa ve Yöresinde Sığır Ayak Hastalıklarının Prevalansı YYÜ. Vet. Fak. Derg. 14 (1):14-18 14.
Sprecher DJ., Hostetler DE., Kaneene JB., 1997. A Lameness Scoring System that Uses Posture and Gait to Predict Dairy Cattle Reproductive Performance. Theriogenology, 47: 1179- 1187.
Tümer,S. 2013. Eğitim Bröşürü.Erişim: https://arastirma.tarimorman.gov.tr/etae/Belgeler/EgitimBrosur/101-ciftcibro.pdf
Yavru N., Özkan K., Elma E., 1998. Ayak Hastalıkları ve Ortopedi. SÜ. Vet. Fak. Konya. Basım Ofset Matbaası. Ankara.
Yaylak E. 2008. Süt Sığırlarında Topallık ve Topallığın Bazı Özelliklere Etkisi. Hayvansal Üretim 49(1): 47-56.
Yücel R., 1982. İstanbul ve Tekirdağ Bölgesindeki Sığırlarda Görülen Ayak Hastalıklarının Toplu Bir Değerlendirilmesi. İÜ. Vet. Fak. Derg. 8, 1: 47-61.

(ORAL PRESENTATION)

THE ESTIMATION OF CATTLE FARMS BY THE OBSERVER

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Abstract

It is possible to have an idea and regulation on cattle breeding with many issues. However, in order to do this, it is necessary to have experienced and technical knowledge. Under this heading, external determinations and simple tests will be examined. Morphological evaluations of animal feed and feed information about the ration can be commented on. If there are circumstances that need to be corrected, the operator is notified. Pre-feed, feed order and post-feed observations can be made in enterprises. These observations give us clues about the farmer in the enterprise. When the enterprise is entered, the management of the feed, the general behavior of the animal, the stance and walking of the animal: stall, stool examination and scoring are the points to be considered. In addition, body condition score is very important. Very weak, weak, normal, lubricated, highly lubricated grouping and feeding errors should be considered.Critical points are determined in general investigations and can be intervened accordingly. and this is returns to the enterprise as profitable. In this study, the issues that need to be considered in the estimation of the enterprises with the eyes of the observers are emphasized.

***Key Words**: Feed management, outward appearance, ration, stool examination.*

INTRODUCTION

An enterprise can be evaluated morphologically by an observer. This evaluation can be an idea about animal feeding. As a result of observation can be commented on the ration. If there are situations that need to be corrected, the operator is informed about this.
1-) Feeder Management: Storage conditions, general appearance of the feed, animals' interest in eating / appetite, the way of preparation and Service issues are evaluated. Score 0: No feed available, Score 1: Very small amount of feed (less than 5% of feed given), Score 2 (ideal Score): There is a thin layer of feed (5-10% of feed given), Score 3 : There is a feed layer of about 5-8 cm (approximately 25% of the given feed), Score 4: If there is more than 8 cm of feed left (about 50% of the given feed), Score 5: Never consumed.

2-) General Behavior of the Animal: A healthy cow, bright, elastic and taut skin, full stomach and should be reactive and strong against the environment. A cow spends 7-10 hours a day ruminating

(Göncü Karakök, 2007). Chewing during each rumin varies between 40 and 70 times (Göncü Karakök and Görgülü, 2008). The rumen should be filled with bait. When the animal is viewed from the side, the rumen should appear protruding on the left side. If the Romanian part is pressed and pushed firmly, movement can be felt 10-12 times in 5 minutes. The normal respiratory rate of a healthy cow is 40-70 times / min. If more frequent breathing is detected, there is a pain or stress factor (Göncü, & Görgülü, 2011).The condition of the animal again provides important clues for an expert observer in assessing the feeding status of the flock.

3-) Animal Posture and Gait: The shape of the animal's body while standing and walking is the precursor of foot and leg disorders. A healthy cow behaves in a straight line while standing and walking. Disruption, or avoid walking from using your foot is a harbinger of poor foot health (Göncü, and Görgülü, 2011). In suitable uncut nails, the animal gives the same symptoms. Especially if there are swelling, wounds, hair loss or irritation symptoms in the neck of the animal, it is an indication that there is a problem with the height of the iron or the height of the feeder (Özkütük et al., 2007). Especially in the majority of the cows who do not lie at the bedside and stand with two legs in the stall should be accepted as a sign of the problem and the arrangement should be made.

4-) Stable Floor: The condition of the fertilizer on the floor should be monitored in terms of being very solid or very liquid, whether it is blistered, and whether it carries signs of disease such as mucus or blood (Göncü et al, 2009). In addition, the presence of undigested grain in the fertilizer should also be regarded as a precursor to the need to control rations and their preparation. In addition, there are cases such as inflammatory discharge, bloody stools and remnants of the cara that leave a scar on the floor where the animals lie.

5-) Fecal Examination and Scoring: In dairy cattle farms, the amount of fertilization and general appearance of the animals can be controlled by checking whether the feed is sufficient and how much feed is offered for consumption. Three criteria (stool washing, scoring and color) can be considered in the examination of feces (Hutjens, 2002).
Fecal examination; in the examination of feces; stool washing, scoring and color can be considered (Hutjens, 2002).

Fecal washing; Some fresh feces are placed on a square plate of 15-20 cm and washed under continuous running warm water for 30 seconds. When the remaining feed particles are examined;

- The presence of barley or corn grains and white starch parts in pieces indicates that the feed is not used economically (Hutjens, 2002). If the grains and starch are of a hard consistency, it is understood that the feed is not suitable for microbial or enzymatic digestion in the rumen or further parts of the digestive tract, so a preliminary milling is required for such feeds.
- Corn grains in the feces behind the introduction of silage by the cow silage by chewing and digestion shows that the event is difficult.

- Monitoring of cotton seeds in whole condition or soybean in broken state (half the size of the grain) in the washed stool indicates loss of nutrients. This indicates that the grains are not retained by the rumen and therefore not sufficiently ruminated. If the roughage piece size is less than 2.5 cm, sufficient rumining will not occur. Therefore, it is important to provide the appropriate roughage particle size (Bartussek, H., 2002).

Fecal scoring; The researchers scored fresh feces between 1 and 5 according to the type of feed offered to the animal's consumption, the rate of passage through the digestive tract and the water and cellulose content in the feces (Hutjens, 2002).

Score 1: Quite juicy and soup-like. Excess protein or starch, excess minerals or cellulose deficiency may cause such defecation (Jones and Hutjens, 2010).

Score 2: As in Score1, it has a watery appearance and is stacked. The height of the stool is about 2.5 cm from the ground and when it hits the ground it splashes around. Low level of cellulose in the diet may cause defecation with this score.

Score 3: It is the most suitable score for dairy cows. The appearance of the faeces is mushy, with a height of 3 to 5 cm from the ground, with a pronounced annular shape and a slightly collapsed central part. It has a typical sound when the concrete hits the floor and has a slightly sticky consistency.

Score 4: The height of the feces above the ground is 5 cm.

Score 5: The stool is ball-shaped. Feeding and dehydration with high rations of straw may cause this stool scoring. Again, the faeces of the cows that have congestion in the digestive tract are in this style.

The color of feces; The color of feces is influenced by feed, the amount of bile produced during digestion and the rate of passage through the digestive tract. The stool color is brown in dry grass weighted feeding. Grain-rich rations feed color is gray. Decrease in the rate of transition in the digestive tract causes the color to darken and the mucus layer on the upper surface to be bright. A score of 1 makes the color faint. Bleeding in the small intestine causes dark, tar-like feces, while rectum-induced bleeding changes from red to brown (Dupchak, 2008).

6-) Body Condition Score: Objective determination of body fat reserve in the cow by ultrasound or subjectively with body condition score may help to increase the efficiency of milk and offspring yield. Cattle Body Condition (VK) scoring can be done by visual and palpation methods in certain areas of the body to determine the fat state of the cow. The waist of the animal is seized and the fingers are pressed lightly and the fat tissue on the processus transversus is felt and body condition is scored (Koçyiğit, 2017).

In dairy cows, there are three, four, seven and nine scale systems in the scoring system. 1 weak animal, 5 score means that the animal is very fat. Condition scoring can be done with 0.5 and 0.25 scales in cattle. (Diler and Aydın 2015; Diler, 2011; Arrived and Thompson, 2011). In cows with low VCS, it is possible that the expected peak milk yields in the next lactation cannot be realized and as a result, they do not reach the expected milk yield. Cows with high body condition may be more susceptible or susceptible to various metabolic diseases, while cows with poor body condition may face problems such as non-conception.The body condition score, which is appropriate for the absence or prevention of such problems, must be determined and maintained.

BCS (Body Condition Score) 1: Very weak ribs and lumbar vertebrae very prominent spinal and tranvers extensions sharp lumbar vertebrae bones shelf-like protruding thighs and thighs depressions vulva quite pronounced



Figure 1. Body Condition Score 1 (Anonymous,2019)

BCS 2: Spinous and transverse protrusions of the weak-looking lumbar vertebrae can be felt, but not sharp thighs and thighs depressions less lumbar vertebrae are visible, but not very pronounced vulva is less pronounced.



Figure 2. Body Condition Score 2 (Anonymous,2019).

BCS 3: In normal condition, short ribs can be felt with a slight pressure and the short ribs appear flat on top. Shelf appearance is not remarkable anal area is full but not oily appearance



Figure 3. Body Condition Score 3 (Anonymous,2019).

BCS 4: Highly ribbed, short ribs are not felt at all vertebrae, short ribs.



Figure 4. Body Condition Score 4 (Anonymous,2019).

BCS 5: The hip bone cannot be observed. The coccyx is completely filled with oil.



Figure 5. Body Condition Score 5 (Anonymous,2019).

7-Status of Implementation of Herd Health Control Programs Health status of all animals in cattle holdings should be kept under control. Developments, treatments and vaccinations should be recorded. In small family businesses, registrations can be kept in specific individual cards. However, in commercial enterprises larger than 10 animals, records should be kept with the help of computer programs. The health records of the animals in the establishments should be kept individually and continuously. The date on which the animals become ill, the diagnosis and treatment results of the diseases should be recorded regularly, as well as the dates of death of the animals and, if any, the autopsy results should be recorded as data.
An annual vaccination program for the herd should be carried out and meticulously applied. The quantity and quality of drinking water is very important in an animal's healthy life. Drinking water quality in front of the animals should always be sufficient in water. General and microbial quality analyzes of operating water should be performed at least once a year. If there is a problem of quality and disease risk in drinking water, necessary measures should be taken as soon as possible (Anonymous, 2018).

CONCLUSION

When going to a cattle farm; General evaluation should be made by examining feeder management,

general behavior of animals, posture and walking of animals, barn floor, stool examination, body condition scores and herd health control programs.

The importance of nutritional behavior methods in ruminant animals should be put forward. Observations can be made before, during and after feeding. These observations give us tips about the business, the animal, the caregiver. Based on these observations, we may be able to know a little about the ration content. The posture and movements of the animal, the shape and content of the feces give us information about feeding. In case of a problem by evaluating them, timely intervention will return to the enterprise as economic gain.

REFERENCES

Anonymous, 2019. Access: https://www.ketolution.com/tr/bcs-body-condition-scoring/

Anonymous, 2019.Access: https://www.tarimorman.gov.tr/HAYGEM/Belgeler/Hayvancılık/Büyükbaş%20Hayvancılık/ Süt%20Sığırcılığı%20Sürüyönetimi.pdf.

Bartussek, H., 2002. How to measure animal welfare. Federal Research Institute in Alpine Regions, BAL Gumpenstein, A 8952 Irdning, Austria.

Diler, A., 2011. Mikrobiyal Yem Katkı Maddesi ve Enzim Kombinasyonunun Esmer Sığırlarında Süt Verimi, Süt Kompozisyonu ve Vücut Kondisyon Skoru Üzerine Etkileri. Atatürk Üniversitesi, Fen Bilimleri Enstitüsü, Erzurum, Doktora Tezi, 69 s.

Diler, A., Aydın, R., 2015. Mikrobiyal Yem Katkı Maddesi Ve Enzim Kombinasyonunun Esmer Sığırlarda Süt Verimi, Süt Kompozisyonu Ve Vücut Kondisyon Skoru Üzerine Etkileri. Tekirdağ Ziraat Fakültesi Dergisi. 12 (1): 97-104.

Göncü Karakök, S., 2007. Sığır Davranışları Ders Notu.

Göncü Karakök, S, Görgülü, M., 2008. Kaliteli Hayvansal ürün elde Edilmesinin Temel Koşulları. Hasad Dergisi, Eylül-Ekim, Yıl:24 Sayı281, 22-28s.

Göncü Karakök S, Uslucan B, Tapki I, Gokce G. 2009. The effect of straw bedding usage in loose housing systems on behavior and milk production of Holtein Dairy cows. Journal of Animal and Veterinary Advances 8 (9), 1824-1828.

Göncü, S., Görgülü,M..2011. Süt Sığırcılığı İşletmelerinde Sağmal İnek ve Sürü Yönetim Takibi. Tüsedad Dergisi, Kasım-Aralık,24-25s

Hutjens, M. F. 2002. A blueprint for evaluating feeding programs. Access: http://www.wcds.afns.ualberta.ca/ Proceedings/2002/Chapter%2012%20Hutjens.htm.

Koçyiğit, R. 2017. Süt Sığırlarında Vücut Kondisyon Skorunun (VKS) Belirlenmesi ve Sırt Yağ Kalınlığının Ölçülmesinde Ultrason Kullanımı Atatürk Üniv. Ziraat Fak. Derg., 48 (2): 139-144. ISSN : 1300-9036.

Özkütük, K., Göncü Karakök, S., Gökçe, G., 2007. Süt Sığırı Barınak Tasarımında Sığır Refahı. Hasad Dergisi 2007, Yıl:23, Sayı:32; 32-37s.

Serin, G., 2004. Sütçü İneklerde Beden Kondisyon Skorunun Reprodüktif Performans Üzerine Etkisi. Kafkas Üniv. Vet. Fak. Derg. 10 (2): 221-225.

Varışlı, Ö., Tekin, N. 2011. Holştayn İneklerde Vücut Kondisyon Skorunun Fertilite Ve Bazı Reprodüktif Parametrelere Etkisi. Ankara Ünv Vet. Fak Derg. 58 111-115.