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THE USE OF BUMBLE BEE IN GREENHOUSE VEGETABLE PRODUCTION AND BUMBLE BEE MARKETING IN TURKEY

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ABSTRACT

The primary aim of this paper is to explore bumble bee use in greenhouse vegetable production and examine the main factors affecting bumble use in Turkey. The marketing structure of bumble bee is also discussed in the study. In the frame work of bumble bee marketing, and thus production and marketing structure of the companies and their marketing problems are determined.

The use of bumble bee has made remarkable progress in Turkey. Six years ago, it hardly existed, and now almost 26000 colonies are used in nearly 1200 hectares of greenhouse area. Currently three commercial companies produce and import bumble bee in Turkey. It can be pointed out that bumble bee use for the pollination has adopted by farmers. However it is not without problems. The research results indicate that companies consider the knowledge level of producers and heating of greenhouses as the most important factors for their business. It is observed that determination of colony prices as foreign exchange and uncertainties in the prices of greenhouse vegetables create hesitations for farmers in terms of using bumble bee in their greenhouses.

INTRODUCTION

The industrialisation of agriculture and development of synthetic chemicals have allowed growers to increase yields. The advantage of increased yield and the easiness of application chemicals on the greenhouses have reached the point of overuse. In the early 1980's growing concern for the human health and environment has lead to try to find some alternatives to chemicals. Bumble bee for the greenhouse pollination instead of using hormone seems one of the alternatives as the sustainable production techniques.

Approximately 20 years ago, after understanding the importance of bumble bees in greenhouse production and achieving production of colonies by the companies in Netherlands and Belgium, the use of bumble bees has been started to expand in the world. The use of bumble bee, Bombus

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terrestris, in greenhouse pollination has been started in 1987 in the Netherlands, Belgium and France. The other countries such as USA, Japan, UK, and Turkey are the relatively beginner countries for using bumble bee as pollinators in the greenhouse vegetables. However, the use of bumble bee in the greenhouse vegetables shows rapid expansion in Turkey. At the present, bumble bees are used in all continents more than 35 countries for pollination of 25 cultivated plants in which tomatoes take the first place (Anonymous, 2002; Gurel, 2001). Currently, yearly 900000 commercial bumble bee is produced annually with the value nearly 50 million dollars is estimated (Goodwin and Stainer, 1997).

Greenhouse production depends on intensive input use. This agricultural production system is tried to be improved by the use of nature friendly and healthy new agricultural techniques. One of the most important elements of these agricultural techniques is natural input usage. Since the presence of bumble bees in a greenhouse puts limitations on the use of insecticides. The aim of bumble bee usage for pollination instead of hormone in the greenhouse vegetables can also be considered within this context.

Bees belonging to Bombus species live in a widespread geography in the world. From these point of view natural conditions are not limiting the use of bumble bee. Also, being calm and individual, not having developed communication abilities like honey bees (Paxton and Banda, 1991), having an ability to work year-round in low light intensity and low temperatures (Yeninar, 1997) can be mentioned as important characteristics of bumble bees

It can be claimed that limitation of intensive and unconscious pesticide use in the greenhouse production is the most important benefit of bumble bee. Producers used bumble bee in the production have to show more care and conscious during the pesticide use. Hence, a positive aspect of the introduction of commercial bumble bee pollination is the stimulation it gave to biological control. The bumble bees have a number of characteristics that make them important pollinators. The use of bumble bee in pollination removes hormone labour and hormone usage. It is reported the cost of hand pollination of 1600 hectares of tomatoes in the Netherlands is roughly US 18 million and it is also estimated that manual pollination takes 40 hours per ha per week to pollinate tomato flowers properly (Eijnde et al, 1991). However for tomato growers reduction of pollination costs is the only one criterion. The use of bumble also provides positive effects on yield by the increases in fruit flesh thickness, seed formation and fruit weight, and increases the quality of fruit as improvements on homogeneity,

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resistance and taste in quality (Fisher and Pomeroy, 1989, Navez and Budin, 1990; Eijende, 1992; Porporaro et al, 1993; Eijende, 1994; Porporato et al 1995; Ikeda and Tahauchi, 1995; Ozden, 1997; Ercan et al., 1999). As a result, bumble bee provides important advantages in marketing hence it provides increase at the farmers' income level.

The aim of this paper is to explore bumble bee use in greenhouse and examine the main factors affecting bumble use in Turkey. The production and marketing structure of the bombus, companies and trading problems of the companies is also determined.

MATERIAL AND METHODS

In this study, data are collected from three bumble bee producer and importer companies located in Antalya province. There are at least two important reasons for selecting Antalya as a study area since it is the centre place both bumble bee marketing and greenhouse production in Turkey. As of 2002, 66 % of the sold colonies is realised in Antalya and the share of the Antalya in the total glass and plastic house is 81.8 % and 48.5 %, respectively. The data is compiled and analysed by taking the Likert type scale ranging from one (not important) to five (most important). In addition previous research reports and various national and international studies related to bumble bee were also used. In the paper firstly, bumble bee use in Turkey and its development are briefly given. Secondly, bumble bee production and marketing structure is discussed. Finally, conclusions and suggestions in relation to bumble bee usage are highlighted.

RESULTS AND DISCUSSION

Bumble bee use in Turkey and Developments

Turkey is an important country in terms of greenhouse production. As of 1999, the area of greenhouse production was 18994 hectares of which 95 % is devoted to greenhouse vegetables. Therefore use of the bumble bees in greenhouse has been examined and after a few years' introduction works the use of bumble bees for pollination have started in Turkey in 1997. Three commercial companies in Turkey by making collaboration with the bumble bee producer companies located in Netherlands, Belgium and Israel imported bumble bee. The Ministry of Agriculture and Rural Affairs (MARA) has given limited import permission and requested the production of the bumble bees in Turkey as soon as possible (Gurel, 1997). Unfortunately, some people dug out young bumble bee nets, put them in boxes and sold them. However, this was stopped by the MARA

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It can be said that bumble bee use for pollination in the greenhouses has adopted by growers. Therefore, the amount of colony used is being increased rapidly year by year. A colony including 50-60 worker bees can be used for two months in a greenhouse. A large scale use of bumble bee has been started in 1997-98 production season with the 3500-4000 colonies used in 150-200 hectares greenhouse area. In 2002 these figures, by increasing 6 times have reached 26000 colony and 1200 ha greenhouse area. As of 1999, the share of greenhouse area used bumble bee in the total greenhouse area is 2 % (Table 1). As 94 % of total greenhouse area devoted to vegetable production is taken into account, the size of bumble bee use potential in Turkey can be easily understood. In other words, there is a huge potential market for bumble bee colonies available all year round in Turkey.

Table (1):The number of bumble bee colony and used area in Turkey

Production Period	Bumble bee colony used (number)	The value (1000$)	Greenhouse area used bumble bees (ha)	The share in the total vegetables area (%)
1997 –1998	3500-4000	400-500	150-200	%1.05
1998 –1999	7000-8000	800-900	350-400	%2.00
1999 –2000	11000-12000	1000-1200	500-600	-
2000 –2001	17000-18000	1600-1800	850-900	-
2001 –2002*	26000	2400	1200	-

Source: Gurel, F., 2001. (*: estimation)

Bumble Bee Production and Marketing

As of 2002, production and import of bumble bee are realised by the Koppert, Antilsan and Sinerji companies in Turkey. The Koppert limited company was established in 1997 together with the Netherlands Company and Turkish company located in Antalya. This company once operated as importer and now the company operate both producer and exporter. The Antilsan Company imported and distributed the bumble bee colonies from its partner company (Biopest) that is in Belgium. The centre of the Antilsan established in 1991 is Antalya. The Antilsan has been dealing with bumble bee trade since 1998. The centre of Sinerji Company is Mersin. At the beginning years, the company operated as importer however in recent years it has started to produce bumble bee. Bumble bee sales constitute of the whole annual turnover of Koppert Company. The sales of bumble bee take 20 % share in the annual turnover of Antilsan. While pesticide sales and other activities account for 70 % and 10 %, respectively. The Sinerji Company obtains 80 % of its annual turnover from bumble bee sales and the remaining part (20 %) come from beneficial insect production.

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25 people are working in the Koppert Company including 1 manager, 1 accountant, 2 administrative staffs, 18 agricultural engineers and 3 workers. 11 people are working related to bumble bee in the Antilsan Company including 2 general managers, 1 accountant, 2 administrative staffs, 4 agricultural engineers and 2 workers. Regarding the Sinerji Company; 9 people are working in the company including 2 managers, 5 agricultural engineers and 2 workers.

The managers were asked to explain the most important factors affecting their business and the responses were analysed by using a Likert scale from one (not important) to five (most important). The research results showed that the most important factors affecting the business are knowledge level (4.7), know-how (4.3), qualified staff (4.3), structures of the company's capital and credit (4.3), producer supports (applied 30%) (4.3), and changes on production areas (3.7). However, importance level of competitive between the companies (2.3) and brand choice of producers (2.3) are found very low.

These results indicate that companies consider the knowledge level of producers and heating of greenhouses as the most important factors for their business. It may be pointed out that this view stems from use of bumble bee for pollination which is a relatively new application and these factors have great effect on the marketing strategies of the companies. For this reason, companies generally try to contact with the producers directly by their staff. On the other hand, greenhouse temperature is mentioned as crucial factors since temperature is of great importance in terms of the use of bumble bee and its performance for pollination. Since bumble bees can not work efficiently at the low temperature of greenhouse. Greenhouse is heated mainly in Turkey to protect crops from frost damage not obtaining high yield in a good quality.

Second group factors were found as having inadequate know-how and lack qualified staff. The know-how and qualified staff factors are affecting commercial activities of the companies that do not have enough technical knowledge level and difficulties of bumble bee production as technically. It can be stressed that low importance level competition among the companies and choice of brand by the producer is caused from the rapid expansion of the bee marketing and existence of the insufficient company number in the bee marketing.

As of 2002, it is estimated that the marketing shares of the Koppert, Antilsan and Sinerji in Turkish bumble bee market will be 84.6 %, 10.4 % and 5 %, respectively. With this situation, bumble bee market shows a monopolistic structure. Although bumble bee colony price is formed in the

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free market conditions, it is greatly influenced by the Koppert Company. Once a 30 % price subsidy was applied to the use of bumble bee but now there is no any direct intervention of the government to the bee prices.

The most important factors considered by the companies in determining the price of a colony are mentioned as market demand (4.7), income level of the producer (4.3), inflation (4.3), cost of colony production or import prices (4.0), labour wages (4.0), bee prices of rival companies (4.0), devaluation (3.3) and competitive situation (3.0).

The real prices of colony fluctuated year by year between the 1997 and 2002 production season (Table 2). Foreign exchange rates have played an important role in these fluctuations. In 2001-2002 production season, average colony price is expected to be 130 million (approximately 100$) Turkish Liras.

Table (2): Developments of Bumble bee colony prices

Production Period	Colony price (Million TL)	WPI (1994=100)	Reel price (With 2002 fix prices)	Index
1997-1998	27.5	844.1	164.1	100.0
1998-1999	37.5	1308.4	144.4	88.0
1999-2000	50.8	2059.8	124.2	75.7
2000-2001	70.0	3103.2	113.6	69.2
2001-2002	130.0	5036.5	130.0	79.2

As mentioned previously bumble bee market as a young industry depends on import. Export amount of the bumble bee colonies of the companies dealing with bee trade is illustrated in Table 3. The Biopol Company, given in the table, stopped its bumble bee trade in 2001.

Table (3): Export quantity of Bumble bee Colony

Years	Antilsan		Koppert		Biopol		Sinerji		Total	
	Colony number	%	Colony number	%	Colony number	%	Colony number	%	Colony number	%
1998	1116	34.1	1244	38.0	658	20.1	259	7.9	3277	100.0
1999	1851	50.4	1212	33.0	608	16.6	-	-	3671	100.0
2000	1705	36.0	3000	63,4	30	0.6	-	-	4735	100.0
2001	3703	100.0	-	-	-	-	-	-	3703	100.0
2002	2722	100.0	-	-	-	-	-	-	2722	100.0

Source: Anonymous 2002a. Provincial Directorate of Antalya records.

As can be seen from Table 3, the total colony import is relatively stagnant except 2000 and 2002. After 2000, particularly the Koppert Company has shifted its activities from colony import to queen bee import.

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The import of bumble bee was affected importantly by the queen bee import. For example, the import quantity of the queen bee by the Koppert Company in 1999, 2000, 2001 and 2002 were 16650, 41500, 58450 and 91000, respectively (Anonymous 2002). On the other hand, the Koppert has started to the bumble bee export. As a result, the Koppert Company has gained a power in relation to domestic production of bumble bees.

Bumble Marketing Channels

Antalya is the center of bumble bee marketing in Turkey. According to 2001-2002 production season, 66 % of the colony sales of the companies has been realised in Antalya. It is followed by Mugla (21,2 %), Mersin 8,5 % and other provinces (4,2 %). The bumble bee marketing is emerged in Antalya and it is extended from Antalya to the other provinces.

Imported or produced bumble bee colonies by the companies are sold to producers by using four different marketing channels (Figure 1). The first marketing channel can be called direct selling. In this channel bees are sold to producers directly by the company staff (agricultural engineers or technicians). Since the majority of the bees are used in Antalya, the companies located in Antalya use this marketing channel along with the other channels. It is estimated that about 25.4 % of the total colony is subjected to this marketing channel. Second marketing channel includes selling of the colonies by the retailer agents such as chemical agents, credit co-operatives and brokers. The share of this marketing channel is 59.2 % and this channel is used by all producer and/or importer companies. The third and fourth marketing channel includes selling of the colonies by a distributor company affiliated with the producer and/or importer companies. In this marketing channel, distributor company can deliver directly to the producers by its staff (3rd channel) or retailers (4th channel). The shares of the 3rd and 4th channels are 12.3 % and 3.1 %, respectively.

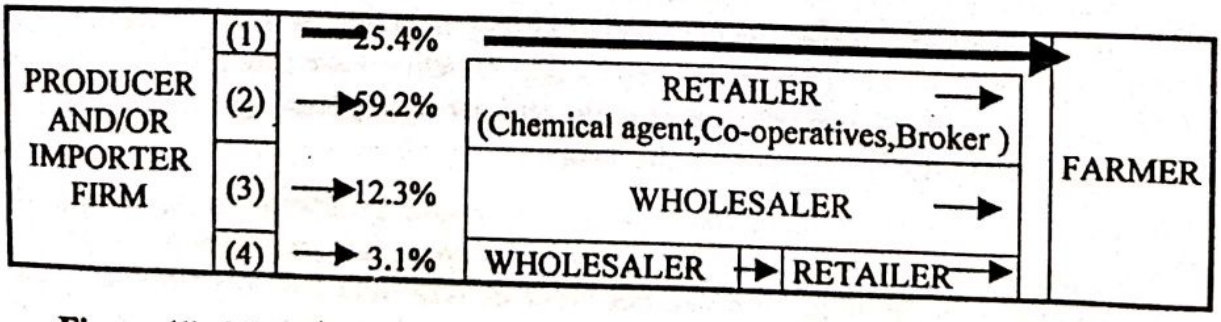


Figure (1): Marketing channels of bumble bee

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The chemical agents, agricultural credit cooperatives and commission agents receive 10-15 % from the sale prices as a retailer margin. Sales through the chemical agents are used by all the companies and it constitutes of 41.1 % of the total colony. Agricultural credit cooperatives and commission agents are used as distributor by only one company. The share of cooperatives and commission agents are 12.7 % and 8.5 % respectively. This marketing structure indicates that producer and/or importer companies of the bumble bee benefit from existed middle-men in the greenhouse input and market. However, it can be pointed out that companies use their staff (marketing and technical staff) widely in the marketing process even though middle-men availability. Because sold colonies are delivered to producers generally by the company staff despite existence of middle men in the marketing channels. Companies give a special importance to visit farmers by distribution and marketing staff within the context of marketing development activities. The staff of company use notice boards, signal flags and brochures as promotion elements.

The sold colonies are put into greenhouse by the selling and distribution staff. Communication address and brochures are given to farmers by the sale and distributor staffs. The brochures cover information about recommended pesticide and its application to pest and diseases. In addition, working quarantine for bumble bee is given to producers. Generally three days is considered as enough time for adaptation of bumble bees to greenhouse conditions. After this adoption period, if any problem arise related to the work of bumble bee, then colony is changed by the company. In addition, companies present post selling services to farmers such as controlling of the colony, giving information about pesticide use in a periodic time periods.

The company employ agricultural engineers or technicians for the introducing, selling and distribution of bumble bees. These staffs know the working conditions of farmers well and they also live in their working area. Regions in which greenhouse production is realised are grouped and certain number of staff is employed at these regions. Companies generally employ their staff with premium plus the salary.

Companies have faced with the various problems in marketing of bumble bee. In fact some problems come from farmers' applications. For example the bumble bees can not work at very high and low temperatures. Therefore, farmers should control the inner temperature of greenhouse otherwise they will obtain low yield due to the lack of pollination. Also company staffs do not have enough knowledge about use of bumble bee for

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the pollination and because of this they do not provide enough technical support to producers. As a result, bumble bee use in the greenhouse for pollination can be affected negatively. Furthermore, it is observed that producers do not use thermometer to check inside and outside temperatures of the greenhouses. It is also reported that chemical agents do not pay the value of bumble bees to the company although the chemical agents, as a distributor of the company, receive the value of the bees from the farmers on time. Determination of colony prices as foreign exchange and uncertainties for prices of greenhouse vegetables create hesitations for farmers in terms of using bumble bee for pollination in their greenhouses.

Support Policies For Bumblee Bee

In Turkey, so far, there was not any independent policy applied for only bumble bee. However, bumble bee use is supported until 2002 in the frame of the pesticide supports. This support policy is based on the dated 29.04.1987 and 87/11706 decree of the council of ministers. Support ratio has rearranged through the 99/1 official bulletin of Money and Credit Committee and published in the 28/05/1999 dated and 23708 numbered official gazette. As of biological control agents such as parasitoids, predators, biological agents and pollinator bees are supported with paying 30 % of the bill value. These support payments are paid by the Agricultural Bank. Payments are realised as two months periods in February, April, June, October and December. The financial source for the support payments is provided from Support and Price Stabilisation Found and its audit is made of by the Ministry of Agriculture and Rural Affairs and Agricultural Bank of Turkey.

However, this policy is ceased with the transition to direct income support policy in 2002. The whole input subsidies pursued in the agriculture have been removed by the new policies. The support policies applied has played an important role for the adaptation of bumble bee use and rapidly expansion of the bumble bee market. Ending of the support to bees may affect bumble bee market in short term, but it can be claimed that developments of the bee market will continue in the long term.

CONCLUSION AND SUGGESTIONS

The use of bumble bee for pollination instead of hormone is important in terms of application for biological control in the greenhouse production. The use of bumble bee leads to decreases of the fungal diseases such as Botrytis seen in the greenhouse tomatoes after hormone applications due to the high humidity and many pesticides can not be used by farmers because of their damages to bees. As a result, greenhouse tomatoes are

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produced without hormone and low level pesticide usage which is so important for human health.

In Turkey, at the present bumble bee can not be produced in the laboratory conditions. Therefore queen bee production should be encouraged and dependency to foreign companies for the queen bee must be decreased by providing support to the universities and domestic companies. The use of bumble bee in the greenhouses is affected negatively partly because of the inadequate knowledge of agricultural staff in terms of the work conditions of bumble bees in the greenhouses and because of inadequate technical assistance provided to producers by the agricultural staffs who are employed by the companies as distributors and sellers. Furthermore, the use of thermometers by farmers to measure inner and outside temperature of the greenhouses should be provided by producers.

Currently there is a monopoly marketing structure, therefore, it is considered as a monopoly company that determines the market price. It is suggested that free market conditions should be established in the bumble bee marketing and the monopoly power tendency must be prevented. Current support system pursued in bumble bee encourages the bumble bee use therefore it is recommended that this policy should be continued with respect to increase the adoption and expansion level of bumble bee use in the greenhouse vegetable production.

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