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Turkish greenhouse industry: past, present, and future

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Abstract This paper examines the current status of the Turkish greenhouse industry and highlights issues important for its competitiveness. The greenhouse industry is the fastest-growing segment of agriculture in Turkey, mainly because of favourable climatic conditions. However, in recent years the greenhouse industry has been forced to adopt an increasingly competitive place in the market. The competitive market environment for greenhouse produce does not necessarily provide growers with any assurances about sales volume, a sufficient price, or favourable financial outcome. Currently, greenhouse operators in Turkey face problems such as declining crop prices, price fluctuations based on over-supply, poor market systems and sales uncertainty, and lack of grower cooperatives. These problems have resulted in income uncertainty and market risks for greenhouse operators. In addition, strong dependency on imported inputs and excessive use of chemicals are other weaknesses of the Turkish greenhouse industry.

Keywords greenhouse industry; greenhouse economics; competitiveness; Turkey

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INTRODUCTION

Greenhouse production is very important for several reasons. First, greenhouse production provides fresh produce for consumers on a year-round basis. Therefore, it plays an important role in feeding people. Second, it provides income for small-scale farmers. Third, it requires intensive labour and input use in the production process and as a consequence it encourages labour efficiency. Furthermore, the greenhouse industry creates important employment opportunities and adds value by means of marketing and processing stages of greenhouse products. The industry is also very important in creating a demand for subsectors that provide inputs for greenhouse production such as seed, fertilisers, pesticides, glass, etc (Yilmaz 1994).

The purpose of this paper is to review the Turkish greenhouse industry. The current status of the greenhouse industry, production structure, factors affecting the industry's development, and competitiveness of the industry are discussed, as are the main problems facing the greenhouse industry and the possible solutions.

DISCUSSION

Production structure of the greenhouse industry and developments

Greenhouse production in Turkey began in the 1940s and its subsequent development can be described in three phases (Struck 1986; Yilmaz 1994; Sevgican 1999). The first phase occurred between 1940 and 1965 during which development was slow with production concentrated mainly in the Antalya and Izmir provinces.

The second phase (1965–75) was the expansion phase. Development of a transportation network between production and consumption centres and the use of plastic contributed to the rapid expansion of the industry (Abak et al. 1986). The third phase (post-1975) has been characterised by the maturing of the industry and a shift by growers from low-level

greenhouse technology to modern production techniques. During this phase, the improvements in the construction quality of greenhouses and yield of crops have occurred.

Total greenhouse area has increased from 1003 ha in 1960 to 24 458 ha in 2002 (Table 1). The annual growth rate indicates that there was a steady decrease in expansion up to 1990 but in recent years the rate of growth has increased.

In the reviewed period, annual growth rate was 6% and 9% for glasshouses and plastic houses, respectively. The likely reason for the higher growth rate of the plastic houses is that they have lower investment costs per unit area compared with glasshouses. However, the growth rate of plastic houses has declined in recent years. Greenhouses made up 52.3% of the total glasshouse share in the 1960s but declined up to the 1980s. However, since the 1980s this trend has reversed and is expected to continue.

In Turkey, greenhouse production is generally located on the coast that extends from Istanbul to the Hatay province. About 96% of the greenhouse production area is concentrated in the Mediterranean and Aegean regions. Antalya is the leading greenhouse production province with 53% of total greenhouse area. Its dominant position is explained by climatic factors and by technological and infrastructure advantages (Brumfield et al. 1997; Ozkan et al. 1997).

Icel and Mugla provinces contain 24% and 12% respectively of greenhouse area, with such provinces as Izmir, Samsun, Yalova, and Aydin accounting for most of the remaining area (Table 2). Greenhouse production also occurs in some inland regions where geothermal energy is available, and increasing development in such areas is projected.

Vegetable production constitutes 94% of the total greenhouse area followed by ornamental plants (5%; mainly cut flowers) and fruits (1%) (Tuzel 1997). Cut flower production tends to be centred mainly in Yalova and Izmir, whereas vegetable production dominates the other provinces. Tomato, cucumber, pepper, eggplant, squash, and bean are the major vegetable crops grown in greenhouses.

In 2000, 1.37 million t tomatoes, 1.04 million t cucumber, 0.33 million t pepper, 0.18 million t eggplant, 0.080 million t squash, and 0.04 million t bean were produced under cover in Turkey (Anon. 2002a). These quantities represent 15% for tomato, 57% for cucumber, 23% for pepper, 20% for eggplant, 31% for squash, and 8% for bean of Turkey's total vegetable production.

Main factors affecting developments of the greenhouse Industry

Natural factors

Natural factors such as climate, soil structure, and irrigation facilitates are the main factors that determine suitability of a region to greenhouse production. The North Mediterranean Basin is one of the most suitable areas in the world for greenhouse production in terms of climatic factors. Temperature and radiation values during winter indicate that the Mediterranean coast of Turkey is quite favourable for greenhouse production. For example, in Antalya the long-term minimum average temperature for January is 9.9°C. Daily average sunshine duration and daily average total sunshine intensity values are lowest in December with 4 h 58 min and 7.8 MJ/m^2, respectively (Anon. 2001a).

The length of the Mediterranean coast of Turkey is 2800 km (Anon. 2003; Physical structure of Turkey. http://www.yurdum.com/Turkiye/turkiye/fiziki_yapi.htm (accessed 15 December 2003)). From this point of view, there are large areas that are suitable for greenhouse production but the majority of these areas are still unused. However, it should

Table 1 Developments of greenhouse production area in Turkey.

	Glasshouse		Plastic house		Total	
Years	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	Annual growth rate (%)*
1960	525	52.3	478	47.7	1003	–
1970	976	38.3	1572	61.7	2548	9.8
1980	925	18.5	4072	81.5	4997	7.0
1990	2000	23.3	6600	76.7	8600	5.6
2000	5656	27.6	14825	72.4	20481	9.1
2002	6420	26.25	18039	73.75	24458	9.3

*Annual growth rate: in total greenhouse area over the preceeding 10 years.

be pointed out that while favourable ecological conditions are necessary they are not sufficient alone to produce profitable production.

Domestic market dynamics

Economic factors rather than climatic ecological factors determine the profitability of greenhouse production. Of these, domestic market dynamics are important. The existence of a large domestic market in Turkey is an important factor in development of the greenhouse industry. In particular, the high population, together with relatively high population growth and increasing per capita income create demand for greenhouse produce.

High crop returns make greenhouse production an attractive proposition. The average return for greenhouse tomatoes and peppers were 2–3 and 3–5 times higher, respectively, than for crops grown outdoors (Table 3).

The domestic market is relatively more important, particularly in the early days of marketing greenhouse produce since the price differential between greenhouse and outdoor tomatoes is at a maximum at the start of the season, but declines during the season as more outdoor tomatoes become available (Ozkan et al. 1998). However, the domestic market has reached saturation in meeting domestic demand. It means that the greenhouse industry has been forced to adopt an increasingly competitive place in the market. Hence, it can be claimed that production increases can decrease domestic price, and producers are disadvantaged as a result. At this point, export of greenhouse produce appears important in preventing domestic price decreases.

Table 2 Breakdowns of greenhouse area of Turkey by regions and provinces, 2002.

Regions and provinces	Glasshouse		Plastic house		Total	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Mediterranean	5783	90.08	14001	77.62	19784	80.89
Antalya	5306	82.65	7544	41.82	12850	52.54
Icel	464	7.22	5463	30.29	5927	24.23
Others	14	0.21	993	5.51	1007	4.12
Aegean	630	9.82	3019	16.74	3649	14.92
Mugla	620	9.65	2203	12.21	2823	11.54
Izmir	7	0.10	669	3.71	676	2.76
Aydin	3	0.05	106	0.59	109	0.45
Others	1	0.01	1428	7.92	1429	5.84
Blacksea	1	0.01	561	3.11	562	2.30
Samsun	0	0.00	416	2.31	417	1.70
Others	1	0.01	145	0.80	145	0.59
Marmara	3	0.04	369	2.05	372	1.52
Yalova	2	0.04	163	0.90	165	0.68
Others	0	0.00	206	1.14	207	0.84
Central Anatolia	0	0.00	41	0.23	41	0.17
East Anatolia	0	0.00	27	0.15	27	0.11
South-east Anatolia	3	0.04	20	0.11	23	0.09
Total	6420	100.00	18 039	100.00	24 458	100.00

Table 3 Prices of tomato and pepper produced in greenhouse and open areas (TL/kg). (TL, Turkish Lira (US$1 equals 1 500 000 TL in August 2004.)

Years	Tomato prices			Pepper prices		
	Greenhouse	Open field	Average ratio	Greenhouse	Open field	Average ratio
1981–84	70	26	3.26	162	31	5.92
1985–89	364	133	2.95	802	231	3.96
1990–94	5157	1924	2.81	9005	2803	3.46
1995–99	68 333	32 197	2.31	149 377	51 279	3.06
2000–03	390 610	184 021	2.31	390 129	156 318	2.70

Foreign market dynamics

Increases in the production capacity of greenhouse crop production will be influenced by the success of exports. The export value of total protected production in 2001–02 was c. US$ 63.6 million (Table 4). Tomatoes and peppers were the dominant crops followed by cucumber, eggplants, squash, melons, and beans.

Government support policies pursued in the greenhouse industry

The main player in the agricultural information system in Turkey, in the production and processing of information and the dissemination of information to farmers including greenhouse operators, is the Ministry of Agriculture and Rural Affairs (MARA; largely responsible for the greenhouse operation in Turkey). The activities of producing, organising, and disseminating information to farmers have thus been mainly conducted by the public sector, but the universities, private firms, and NGOs (producer organisations and farmers' unions) also play limited roles (Ozcatalbas et al. 2004). However, there is no effective communication between public agricultural research and extension institutions. This poor structure has hindered the generation and dissemination of new technologies.

On the other hand, extension services conducted by private firms have not reached a desirable level considering the size of Turkish agriculture. It is expected that the role of private firms in the greenhouse and export-oriented production sectors will gain ground rapidly in the near future.

There is no direct government support policy for greenhouse production in Turkey. However, greenhouse producers benefit from the general support policies pursued in agricultural production. Greenhouse procedures are supported by agricultural investments, and input and export support within the context of government support policies.

The most apparent support policy was "support of resource use" that started in 1984. Through this policy 25–50% of the investment cost was paid back to farmers. However, this investment support ceased in 1996. The Agricultural Bank of Turkey has provided investment and special project credits to support greenhouse producers. Furthermore, short-term credit support (in kind and cash) is provided to greenhouse producers by Agriculture Credit Cooperatives (ACC). Greenhouse producers have also gained some benefit from general input subsidy applications such as fertiliser, pesticide, and credit etc. However, general input subsidy policy was lifted in Turkey in 2000 and direct income support policy (DIS) has started. Currently, DIS is pursued in agriculture and greenhouse producers, like other producers, gain from this policy.

However, according to the Turkish Agricultural Strategy, it is planned to cease DIS support to greenhouse producers starting from the 2006–10 period. A new support policy called rural development supports will be implemented covering the support on investment and credits for fruit and vegetable producers. The main impetus for the new support policies is the adoption of EU Common Agricultural Policy.

Main problems facing the Turkish greenhouse industry

Farm structure

In Turkey, greenhouse production is generally carried out by small family-owned enterprises. The number of large enterprises using modern technology is rather limited. For example, the average size of the farms producing greenhouse vegetables in Antalya province is 1.3 ha and the average

Table 4 Export of greenhouse products (t and US$ million).

	1999–2000		2000–01		2001–02		
Crops	Quantity	Value	Quantity	Value	Quantity	Value	Percentage
Tomato	53 896	22.8	114 885	36.5	128 043	45.0	70.8
Pepper	10 966	8.6	15 339	9.0	14 984	10.5	16.5
Cucumber	3478	1.5	5806	2.1	11 152	3.8	6.0
Eggplant	1573	1.1	3119	1.5	2348	1.8	2.8
Squash	2271	1.2	2613	1.1	2081	1.5	2.4
Melon	250	0.1	3296	0.8	1764	0.6	0.9
Bean	228	0.2	379	0.3	199	0.2	0.3
Others	916	0.2	1651	0.3	751	0.2	0.3
Total	73 578	35.7	147 088	51.6	161 322	63.6	100.0

greenhouse area is 0.3 ha. The average greenhouse size is 785 m^2 for glass and 833 m^2 for a plastic house in Antalya (Yilmaz 1994). Other research studies conducted in the Antalya province indicate that average greenhouse size is 2180 m^2 with greenhouses ranging from 910 to 3990 m^2 (Ozkan 2000; Goldey et al. 2001). Average greenhouse size is far from being economic in scale and this creates several problems in relation to production and marketing, e.g., the small scale hinders the use of modern production technologies (Yilmaz 1994; Ozkan 2000a,b; Ozkan et al. 2000; Goldey et al. 2001).

Greenhouse construction

Ventilation, particularly roof ventilation, is not at the desired level in many Turkish greenhouses. The area of roof ventilation is suggested to be 20% of the greenhouse floor area for good greenhouse ventilation (Sevgican et al. 2000). In Turkey, the roof ventilation area is generally between 1% and 4% of the floor area. Furthermore, since most of the plastic houses do not have roof ventilation it is difficult to control humidity and temperature. Growers try to control humidity and temperature using side ventilation, but this is done manually (Sevgican et al. 2000). Because of poor ventilation, pest and disease control is difficult, resulting in increased production costs and lower yields.

Heating

Greenhouse heating systems tend to be designed to protect the crops from frost rather than to maintain adequate temperature for growing (Yilmaz 1994; Sevgican 1999; Ozkan 2000a). As a consequence, potential crop yields are not being obtained.

Two production systems, double and single crop production, have evolved from the reluctance of growers to invest in greenhouse heating systems. In double crop production, production occurs in autumn (September–December) and spring (March–July) (Yilmaz 1994; Sevgican et al. 2000; Goldey et al. 2001; Ozkan et al. 2002a).

In the single production system, most production occurs from November to June. Growers consequently face high heating costs and as a result prefer the double crop production system. However, production costs of the double crop systems other than heating are actually higher than in the single crop system. These cost differences are in the order of 45% for greenhouse tomatoes, 41% for plastic house tomatoes, 19% for glasshouse cucumbers, and 36% for plastic house cucumbers (Yilmaz 1996, 1997).

Dependency on imported inputs

The Turkish greenhouse crop seed industry cannot meet the requirements of the domestic greenhouse industry. The private sector dominates (99.7%) in local vegetable seed production. Although private firms are involved in vegetable seed production, the majority of seeds are imported, mainly from Israel, the Netherlands, and the Unites States. For example, in 1999, 302 t vegetable seed was imported whereas only 63 metric t vegetable seed was exported (Anon. 2002c). Over 92% of hybrid seed used in vegetable production was imported (Anon. 2001b). About 69% of the chemical firms in Turkey are importers, with c. 90% of the chemical inputs for the greenhouse industry (Anon. 2001c). Similarly, most fertilisers are imported.

Excess pesticide and fertiliser use

The main inputs used in greenhouse production are pesticides, fertilisers, and other chemicals. Some of these inputs may have negative effects on human health and may cause environment pollution. Recent studies conducted in the Antalya province show that there is excessive pesticide and fertiliser use in greenhouse production. Yilmaz et al. (2000) reported that c. 69% of growers applied pesticides as soon as they saw pests in their greenhouse whereas only 7% applied pesticides in relation to the economic threshold of the pest. About 32% of respondents reported that they exceed the recommended application rate of the pesticides they use. Ozkan et al. (2002b) observed that excess use of pesticide occurs in the production of greenhouse tomatoes, peppers, and cucumbers and that the cost of this excess use accounts for between 25% and 55% of total production cost. When excess use is examined from an economic point of view, econometric studies show that pesticide use is not compatible with the technical optimum point in some greenhouse crops (Aytac 1990; Yilmaz et al. 2000). The pesticide residue on the crops will be an important issue affecting future export opportunities.

Growers also use excess fertiliser in greenhouse production, resulting in salinity problems in soils and nitrate pollution of the aquifers. A study conducted in the Antalya province showed that salinity problems exist in greenhouse soils and that 50% of wells contain nitrates exceeding permitted levels (Kaplan et al. 2000).

Financial problems

Greenhouse production requires more intensive inputs than other agricultural crops. This intensive

input usage can lead to financial problems for growers. This problem is exaggerated because mainly small-scale farms are operated in the greenhouse industry.

The main credit sources for growers are the Agricultural Bank, credit cooperatives, chemical agents, and brokers. Credit facilities from chemical agents are generally confined to obtaining such inputs as insecticide, fertiliser, and seed. Growers can receive a cash loan from a broker usually before the production period as an advance. Evidence suggests, however, that growers' bargaining power is adversely affected by receiving a loan from the chemical agents and brokers.

Poor marketing and organisation structure

Wholesale markets are the main point of sale for vegetable crops. Although important developments have occurred in the production of vegetable crops in Turkey, marketing of these crops is still far from effective.

In Turkey, growers deliver their products to brokers in the wholesale centres who in turn sell the product on the grower's behalf. In this marketing system, growers do not have any marketing power. This marketing structure generally acts against the growers' interest with the growers' share of final consumer price being as low as 10% for some crops (Hatirli 1992; Gunes et al. 1996; Ozkan et al. 1999).

Sometimes it is possible to sell products outside this structure, e.g., selling of limited products directly to consumers by growers, selling of products to be used in the food industry, exporting of products, and selling by cooperative (Yilmaz & Yilmaz 2002).

Another problem is unregistered sales (Kaptangil 1980; Gunes et al. 1986; Ozkan et al. 1999). According to the law, fresh fruit and vegetables must be brought to the wholesale markets for registration before selling. The unregistered sales lead to unfair competition and loss of tax income by the government.

In addition to these problems, lack of standardisation of fresh fruits and vegetables in domestic markets and inefficient control for the fresh products create some important health problems for consumers.

Turkey has considerable potential to expand its export of vegetables but may be unable to realise this potential. Turkey's high vegetable production is not reflected in its low exports. The main impediment to export growth is a lack of a cooperative marketing organisation involving growers and exporters. Such an organisation could establish and promote a single brand name. It is well established that marketing of products under a single brand has great benefits in the market development activities, such as quality standards and promotion. Another problem for the export market is the lack of direct links between exporters and the wholesalers and retailers operating in the export markets. The most important results of this are that there is no harmony with foreign markets and there is inefficiency in following foreign market quality standards. In this regard particularly, residue problems on fresh fruit and vegetables limit exports to the EU.

Poor marketing of fresh produce in the domestic and export markets limits the production and economic benefits of these crops. A new approach needs to be established in the Turkish vegetable industry from production to marketing to overcome the current problems and to become compatible with world conditions (Ozkan et al. 1999).

The lack of a growers' organisation is an important problem in the Turkish greenhouse industry. There are many reasons for lack of growers' organisations in Turkey, the most important of which are: (1) Structural characteristics of farm holdings; Turkey has 4.1 million farm holdings and they are small and over-fragmented. (2) Characteristics of the growers themselves, such as low levels of education and lack of awareness of the advantages of growers' organisations. (3) Lack of necessary legal infrastructure in the field of growers' organisations. (4) Lack of required incentives to growers to join industry organisations.

Many problems and challenges faced by growers could be solved by grower organisations. Within the context of the organisation, cooperatives and growers' associations could play an important role in solving, in particular, the marketing problems of growers. The success of organisations will likely depend on active participation of growers' and on government support.

CONCLUSION AND SUGGESTIONS

The review of the Turkish greenhouse industry shows that the greenhouse industry is very important in both domestic consumption and potential export. It makes efficient use of land and meets the out-of-season fresh produce requirements of consumers while creating employment opportunities and contributing to the economy of the country.

Currently, Turkish greenhouse operators are facing serious problems such as declining crop prices,

price fluctuations based on over-supply, a poor market system and sales uncertainty, and a lack of grower cooperatives. These problems are resulting in income uncertainty and market risk for growers. The key challenge facing growers will be the maturity of the domestic markets in the near future. Furthermore, the greenhouse industry has been forced to adopt an increasingly competitive place in the market. The competitive market environment for greenhouse production does not necessarily provide growers with any assurances about sales volume, a sufficient price, or favourable financial outcome. In addition, strong dependency on imports and excessive use of chemicals are other causes of increasing costs. As a result, competitiveness of the Turkish greenhouse industry will be influenced by numerous regulatory and environmental issues. It is suggested that Turkish greenhouse growers and exporters must meet international standards for food safety, environmental protection, and product quality to overcome the current problems and to meet consumer expectations.

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