

## THE ECONOMIC ANALYSIS OF BEEKEEPING ENTERPRISE IN SUSTAINABLE DEVELOPMENT: A CASE STUDY OF TURKEY

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### ABSTRACT

*Turkey has been amongst the principal honey producers worldwide for years. In recent years, Turkey has ranked as the fourth largest honey producer only after China, USA and Argentina. According to SIS (Prime Ministry State Institute of Statistics) figures, 61,000 tons of honey from 4.1 million colonies are harvested annually in Turkey and approximately 50% of Turkish honey production is obtained from Aegean Region, Black Sea Region and Mediterranean Region in 2001. During 2001 production period the estimated average honey production per colony was 16 kg in Turkey. This figure is under world average of 20 kg (Anonymous, 2003c). Honey consumption per capita for year was 0.98 kg in 1992, after reaching 1.02 kg in Turkey in 1998.*

*Although recent developments, beekeeping sector in Turkey still has faced to some important problems with respect to high chemical use in the hives and marketing and export problems caused by quality of honey, mix harvest, and so on.*

*The aim of this research is to analyze of apiaries' technical and economical aspects in Turkey. The total numbers of surveyed of apiaries in two important provinces (Izmir and Mugla) of Aegean Region of Turkey are 60 in 2002 production period. Together these two provinces represent 26.68% of the Aegean Region honey production and 2.79% of the national honey production in Turkey.*

*First of all, technical, social and economical aspects of apiaries are given under three sub-groups by the numbers of colonies ( $100 \geq$ ,  $101-150$ ,  $150 <$ ) Then, physical input-output relationships and annual activity results (total honey production value, variable and fixed costs, net returns and unit costs of honey production) of these apiaries are examined. These apiaries were movable and used at least 2-3 honey flows during one production season. The provincial differences in costs and returns of beekeeping enterprise are determined and it is estimated the number of colonies which is economically profitable.*

### INTRODUCTION

Turkey is one of the most important honey producer countries. Although Turkey has 4.1 million colonies, the honey yield per colony is limited as 16 kg (SIS, 2002a), however, in China, USA, Canada, Argentina yield per colony is between 50-100 kg (Senger, 2001), 30.5 kg, 64 kg and 40 kg (Anonymous, 2003a), respectively. In Turkey, The main reasons of low honey yield per colony are insufficient management conditions, lack of beekeeper education. On the other hand, the market for honey in Turkey has fluctuated due to climatic conditions and the impact of some bee disease

and pest like varroa and export demand in previous years. As a result of positive improvements in last two years (constant controls, using soft chemicals and organic acids against varroa, course on beekeeping given by Turkish Agricultural Government) beekeeping is undertaken an important role in Turkish agriculture and is increased the chance of exports.

Although many research have been made on economics of honey production (Cicek, 1993, Akdemir et al., 1993; Habibullah, 1995, Wenning, 2001, Chaudhary, 2001), there is still need for research, especially in national and international level. The focus of this research is to evaluate, the socio- economic and technical characteristics of beekeepers under the light of survey in terms of honey production, costs and returns, organization, marketing problems in Izmir and Mugla provinces of Turkey and the solutions were given as well.

## **MATERIALS AND METHODS**

This research aims to analyse 60 apiaries in Mugla and Izmir province of Turkey. The importance of honey production in Turkey, the technical and economical aspects of honey production, socio-economic features of selected apiaries, annual activity results are given. A total of 60 beekeepers in two provinces are surveyed. These apiaries are distinguished into sub-three groups according to number of colonies and the year of 2002 production activities are determined by periods. Individual analyses, group averages by province and number of colonies.

Total gross income of beekeeping enterprise, production costs, and unit cost of honey, net return within apiaries and provinces were calculated. The cost items of honey production were classified into variable and fixed. The variable costs associated with honey production were all inputs that directly related to the production of honey and included sugar, drugs and chemicals, labour, fuel-oil or transport, water, marketing, forage access rent etc. costs. Variable costs were calculated by using current input prices and labour wages. Fixed costs included paid capital interest, depreciation and other fixed costs. Interest on total investment and interest on variable costs were calculated by charging a rate of 2.5% (annual average nominal interest rate for euro) (SIS, 2002b) on one-half of total investment and variable costs. Administrative costs were estimated to be 3% of total variable costs (Kiral et al., 1999). Depreciation was estimated using the straight-line method and the depreciation rate for beekeeping equipment, beekeeping shelter was accepted %10 and for hives was accepted 2.5% (Wilde, 1997). In the light of findings it is found that honey production is advantageous according to both absolute profit and relative profit. Fixed costs plus variable costs equal total production costs. In this study, total production costs were subtracted from total gross revenue to calculate net return and the unit cost of extracted honey is obtained by dividing the total production costs of extracted honey by the number of units produced.

## **RESULTS AND DISCUSSIONS**

### **SOCIO-ECONOMIC CHARACTERISTICS OF THE BEEKEEPERS SURVEYED**

The average age of the beekeeper was 43.35 and they had an experience about 16.08 years of beekeeping. Also beekeepers had approximately 6 years education

and family population per apiary was over 4 persons (Table 1). Total land was 32.52 hectares in these apiaries and 90.59 % of total land was own property of beekeepers in general average. Honey production has important place, other important agricultural products after honey are found olive, wheat and barley in this study. Average number of colonies changes from 72.85 and to 264.78 by groups. In these apiaries, average colony size was 158.57 (Table 2).

**Table 1.** Age of Beekeepers, Education, Beekeeping Experience and Family Population of The Apiaries Surveyed

Socio-economic indicators of beekeepers	Group 1 ≥100 colonies	Group 2 101-150 colonies	Group 3 150 < colonies	General
Age of beekeeper	43.04	43.64	43.57	43.35
Education level (year)	5.65	5.55	6.09	5.80
Experience on beekeeping (year)	12.81	17.91	18.91	16.08
Family population (person)	4.54	4.45	3.83	4.25
Total land (hectare)	44.20	7.05	31.50	32.52

**Table 2.** The Distribution of Colonies by Size Groups

Group numbers	Size of apiary (Number of colony)	Number of beekeepers	%	Total number of colonies	%	Average number of colonies
1	≥100	26	43.34	1894	19.91	72.85
2	101-150	11	18.33	1530	16.08	139.10
3	150<	23	38.33	6090	64.01	264.78
Total		60	100.00	9514	100.00	158.57

The study shows that beekeeping is a main source of income (72.73%) for beekeepers who own more than 150 colonies. While first group beekeepers with less than 100 hives earns up 46% of total income from beekeeping, Third group earns up 60.87% of total income from only beekeeping. Generally, these apiaries are semi-specialized (Table 3).

**Table 3.** Specialization in Apiaries Surveyed

Groups	Group 1 ≥100 colonies	%	Group 2 101-150 colonies	%	Group 3 150 < colonies	%	General	%
Beekeeping	12	46.15	8	72.73	14	60.87	34	56.67
Beekeeping +other agricultural activities	14	53.85	3	27.27	9	39.13	26	43.33
Total	26	100.00	11	100.00	23	100.00	60	100.00

### Technical Aspects of Honey Production

In this study, some technical characteristics showed that races placed in Ege Region was Izmir strain which is Anatolian and Italian crossbred generally (45%). The Mugla strain like as Italian race followed the Izmir Strain as 16.67%. These strains are adapted different ecologic conditions for their some physiological characteristics in races (Dogaroglu, 1999).

Age of queens are two in average (Table 4). In these regions beekeepers replacement queens after 2 years. With this method, wintering loss could be minimized and in spring the better colony population condition get in guaranteed (Dogaroglu, 1999).

**Table 4.** Technical Characteristics of Honey Production in Apiaries Surveyed

Groups	Group 1	%	Group 2	%	Group 3	%	Genera l	%
<b>Races</b>								
Local	6	23.08	1	9.09	-	-	7	11.67
Izmir	8	30.77	6	54.55	13	56.52	27	45.00
Mugla	2	7.69	1	9.09	7	30.44	10	16.66
Other	4	15.38	2	18.18	3	13.04	9	15.00
Unknown	6	23.08	1	9.09	-	-	7	11.67
<b>Total</b>	<b>26</b>	<b>100.00</b>	<b>11</b>	<b>100.00</b>	<b>23</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>
<b>Age of queen (year)</b>								
1.year	7	26.92	5	45.45	3	13.04	15	25.00
2.year	12	46.15	5	45.45	14	60.87	31	51.67
3 year	2	7.69	1	9.10	5	21.74	8	13.34
4.year	2	7.69	-	-			2	3.33
5 year	2	7.69	-	-			2	3.33
Unknown	1	3.85	-	-	1	4.35	2	3.33
<b>Total</b>	<b>26</b>	<b>100.00</b>	<b>11</b>	<b>100.00</b>	<b>23</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>
<b>Increasing type of colonies</b>								
Queen	1	3.85	1	9.09	-	-	2	3.33
Divided	23	88.46	9	81.82	21	91.30	53	88.34
Queen+divided	2	7.69	1	9.09	2	8.70	5	8.33
<b>Total</b>	<b>26</b>	<b>100.00</b>	<b>11</b>	<b>100.00</b>	<b>23</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>
<b>Average number of frame</b>								
1-5	7	26.92	2	18.18	9	39.13	18	30.00
6-10	19	73.08	9	81.82	13	56.52	41	68.33
11-15	-	-	-	-	1	4.35	1	1.67
<b>Total</b>	<b>26</b>	<b>100.00</b>	<b>11</b>	<b>100.00</b>	<b>23</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>
<b>Feeding type</b>								
Sugar Syrup Patties	12	46.15	7	63.64	10	43.48	29	48.33
Syrup+-	1	3.85	1	9.09	2	8.70	4	6.67
Patties	11	42.31	2	18.18	5	21.73	18	30.00
Nonfeeding	2	7.69	1	9.09	6	26.09	9	15.00
<b>Total</b>	<b>26</b>	<b>100.00</b>	<b>11</b>	<b>100.00</b>	<b>23</b>	<b>100.00</b>	<b>60</b>	<b>100.00</b>

By dividing population, artificial swarms gets into for multiplying colony population. Beekeepers give a chance to hive for rearing their own queens (88.34 %), instead of giving queen (3.3%). Average frame size is approximately from 6 to 10 in autumn season (68.33%). In these warm regions it can be accepted as an optimal for preparing colony wintering.

Most of beekeepers use sugar syrup feeding (48.33%) because of the warm climatic conditions. In these regions long honey flow season begins at the end of April up to the November. So, bees easily found pollen and nectar for their hives in very much nectary flora. In İzmir, citrus, cotton, linden, thyme, eucalyptus, chestnut honey get until the end of summer season, The end of August most of beekeepers migrate their colonies to the Mugla for pine honey which is mostly produced in the world. Pine Honey exported to the world else where. It has highly mineral content and also very therapeutic for gastro-intestinal problems (Dogaroglu, 1999).

After pine honey extraction, beekeepers gave sugar syrup for autumn feeding to the colonies. 30% of beekeepers on these regions prefer sugar syrup patties feeding to gether. 15% of them not need feeding their colonies. But sometimes it can be caused weakness and losses of colonies.

### Honey Production, Yield and Marketing

In this study, honey production changed from 1628.81 kg to 6089.65 kg per operation by size of colonies and average honey production per operation was 3660.85 kg for 158.57 colonies during 2002 production year (Table 5). The average honey yield was determined to be 23.08 kg per colony which is considerably above the stated national average (16 kg).

**Table 5.** Honey Production and Yield in Apiaries Surveyed

Groups	Average number of colony	Honey production (kg)	Yield per colony (kg)
Group 1 ≥100 colonies	72.85	1628.81	22.36
Group 2 101-150 colonies	139.10	3385.46	24.34
Group 3 150< colonies)	264.78	6089.65	22.99
General	158.57	3660.85	23.08

When honey yield per hive was compared among the groups by size of colony, it ranged from 22.36 kg for Group 1 to about 24.34 kg for Group 2, 22.99 kg for Group 3 (Table 5).

Honey yield per colony is found 24.85 kg for Mugla and 16.22 kg for Izmir Province (Table 6). All of these apiaries (hives) were movable and used at least 2-3 honey flows during 2002 year. Especially Mugla Province plays an important role in Turkey's pine honey production. the color and flavour of honey differ depending on the bees' nectar source in this province.

**Table 6.** Number of Colonies, Total Honey Production and Yield per Colony in Mugla and Izmir Province/Turkey

Provinces	Number of beekeepers	Number of colonies	Average colonies per beekeeper	Total honey production (kg)	Yield per colony (kg)
Izmir	20	1,945	97.25	31,545	16.22
Mugla	40	7,569	189.23	188,106	24.85
General	60	9,514	158.57	219,651	23.08
%					
Izmir	33.33	20.44	-	14.36	-
Mugla	66.67	79.56	-	85.64	-
General	100.00	100.00	-	100.00	-

In this study, a beekeeper at the the average level has 158.57 colonies that produces 23.08 kg of honey per colony (hive) during 2002 production period. It provides total 3660.85 kg of honey to the apiary.

According to results of this study; 70.77% of these beekeepers sell honey to dealer at farm gate, 10.77 % of beekeepers take it to local market (Izmir and Mugla) for retail sales directly to consumers. While 9.23 % of them sell honey to beekeeping cooperative, 9.23% of them sell it to exporter firm (Table 7). Generally they have packaged honey into glass jars (1-1.5 kg) or tins (27-28 kg) and they haven't any label for sales.

**Table 7.** The Chains of Honey Marketing of Apiaries Surveyed

Marketing Chains	Group 1 ≥100 colonies	%	Group 2 101-150 colonies	%	Group 3 150< colonies	%	General	%
Exporter firm	3	10.34	1	7.69	2	8.70	6	9.23
Dealer	18	62.07	9	69.24	19	82.60	46	70.77
Cooperative	3	10.34	2	15.38	1	4.35	6	9.23
Retail sales	5	17.25	1	7.69	1	4.35	7	10.77
TOTAL*	29	100.00	13	100.00	23	100.00	65	100.00

\*There are plural answers for this question

Most of these beekeepers produce extracted honey. Honey production has exporting potential for food industry. But it still has some problems in the production and marketing. Therefore it can be stated that with the efficient marketing system, these problems can be overcome.

The average producer prices (wholesale price) for extracted honey determined in 2002 in surveyed apiaries are given in Table 8 by groups and provinces. The beekeepers gained the highest of extracted honey price (approximately 5.14 €/kg) when they sold directly to the consumer in packaged of glass jars, but honey producer prices in wholesales are lower than retail producer prices in apiaries surveyed. In Mugla and Izmir Province, the producer prices (wholesale price) for extracted honey is € 1.56 and € 2.12 per kg respectively.

**Table 8.** The Average Producer Prices of Extracted Honey Sold in 2002 of These Apiaries (€/Kg)

Groups	Extracted honey (wholesale price)	Province	Extracted honey (wholesale price)
Group 1 (≥100 colonies)	1.82	Mugla	1.56
Group 2 (101-150 colonies)	1.72	İzmir	2.12
Group 3 (150<colonies)	1.65	-	-
General	1.65	-	1.65

### HONEY PRODUCTION VALUE AND PRODUCTION COSTS

In this section firstly physical input-output relationships and annual activity results (total honey production value, variable and fixed costs, net returns and then unit costs of honey production) of these apiaries are examined.

Honey production costs and returns were analysed with 100≥colonies, 101-150 colonies, 150<colonies. Variable and fixed costs associated with honey production per colony are given in Table 9 by size groups and by provinces. For reader convenience, the figure listed in fifth column of Table 9 is the the percentage amount that each item represent of total production costs. For example, variable costs were 46.85% of total production costs while fixed costs were 53.15% of total production costs.

**Table 9.** Honey Production Costs per Colony of The Apiaries Surveyed (€)

Cost items	Groups			General	% of cost	Provinces	
	Group1	Group 2	Group3			Mugla	Izmir
1. Feed costs (Sugar Syrup)	2.92	1.87	1.84	2.06	6.68	2.28	1.21
2. Drugs and chemicals	0.84	0.47	0.32	0.45	1.46	0.38	0.72
3. Water	0.22	0.05	0.21	0.18	0.58	0.21	0.08
4. Fuel oil / transport	4.78	6.16	4.81	5.02	16.29	4.95	5.32
5. Hired labour	1.70	1.40	1.04	1.23	4.00	1.38	0.67
6. Forage access rent	0.68	0.69	0.66	0.66	2.14	0.67	0.64
7. Tins and glass jars	1.05	1.39	1.14	1.20	3.90	1.15	1.43
8. Stock replacement	3.00	3.00	3.00	3.00	9.73	3.00	3.00
9. Machinery repairs	0.22	0.04	0.38	0.30	0.97	0.33	0.15
10. Interest on variable costs (2.5%)	0.40	0.39	0.33	0.34	1.10	0.36	0.33
<b>A. Total Variable Costs</b>	<b>15.81</b>	<b>15.46</b>	<b>13.73</b>	<b>14.44</b>	<b>46.85</b>	<b>14.71</b>	<b>13.55</b>
11. Depreciation for buildings (%10)	0.07	0.08	0.05	0.06	0.20	0.06	0.05
12. Depreciation for machinery and equipment (10%)	0.57	0.46	0.32	0.33	1.07	0.37	0.25
13. Depreciation for hives (2.5%)	0.18	0.24	0.16	0.18	0.58	0.17	0.18
14. Administrative costs (%3)	0.49	0.48	0.41	0.41	1.33	0.44	0.40
15. Interest on investment	0.82	0.78	0.53	0.56	1.82	0.60	0.48
16. Unpaid labour	16.75	17.44	11.44	14.84	48.15	15.38	10.20
<b>B. Total Fixed Costs</b>	<b>18.88</b>	<b>19.48</b>	<b>12.91</b>	<b>16.38</b>	<b>53.15</b>	<b>17.02</b>	<b>11.56</b>
<b>Total Production Costs</b>	<b>34.69</b>	<b>34.94</b>	<b>26.64</b>	<b>30.82</b>	<b>100.00</b>	<b>31.73</b>	<b>25.11</b>

(A+B)							
Total extracted honey production (kg) per colony (C)	22.36	24.34	22.99	23.09	-	24.85	16.22
Unit cost per kg (A+B)/C=D	1.55	1.44	1.16	1.34	-	1.28	1.55
Producer Price per kg (E)	1.82	1.72	1.65	1.74	-	1.56	2.12
Net income per kg (E-D)	0.27	0.28	0.49	0.40	-	0.28	0.57
Relative income per kg (E/D)	1.17	1.19	1.42	1.30	-	1.22	1.38

Variable costs per hive in general average was € 14.44, when fixed costs were added € 16.38 to variable costs, average total production costs € 30.82 per hive and € 1.34 per kilogram of honey products. Sugar syrup cost was 14.27% of total variable costs and 6.68% of total production costs. In a study done in Manitoba, Canada, sugar syrup cost is calculated approximately 11% of total production costs (Blawat and Dixon, 1997).

In generally these beekeepers begin feeding 1:1 sugar water and patties at least six weeks prior to the onset of the first major nectar flow. This would encourage the production of bees that will be at the appropriate age for foraging by the time the main nectar flow. In addition, drugs and chemicals costs and fuel oil/transport costs were 1.46% and 16.29% of total production costs, respectively.

The cost of honey production per kg changes by size groups and by provinces. Our analysis shows that size of colony increases, unit cost of honey decreases. In the third group, unit cost of honey was calculated to be € 1.16 as the lowest unit cost. Unit cost of honey was determined to be € 1.28 in Mugla and € 1.55 in Izmir. However, honey cost per kg was determined to be € 2.13 or \$ 1.96 in Alberta/Canada (Chaudhary, 2001). Net income per kg was € 0.40 and relative income per kg 1.30 in general.

Gross income per colony was determined to be € 38.10 per colony. Total honey production costs were determined to be € 30.82. Therefore, net income was calculated to be € 7.28 per hive (Table 10). By size groups, net income per hive was € 5.57 for first group and € 7.64 for second group and € 9.67 for third group. By province, net income per hive was € 7.06 for Mugla and € 10.31 for Izmir. On the other hand, our analysis indicates that large sized apiaries with 150< colonies are found economically profitable (Table 10).

**Table 10.** Net Income per Colony of The Apiaries Surveyed (€)

Items	Group1	Group2	Group3	General	Mugla	Izmir
Gross income of extracted honey (1)	40.26	42.58	36.31	38.10	38.79	35.42
Total production costs (2)	34.69	34.94	26.64	30.82	31.73	25.11
Net income per colony (1-2)	5.57	7.64	9.67	7.28	7.06	10.31
Total Investment per colony	15.64	17.20	11.43	13.19	13.03	13.83
Net income/Total Investment (%)	35.62	44.42	84.60	55.19	54.18	74.55

## CONCLUSION

As a result, honey production is very important role as a source of increasing rural income in sustainable development in Turkey. But beekeeping sector faced many problems as quality, variety, mix harvest, sugar, and residues. Generally residues



and mix harvest are the most important problems for honey production and export of Turkey and food safety. According the results of a research in Mugla province, honeydew honeys was found to be mixed with spring honeys and determined figures of analysis were higher levels than the ones in TSE (Institute of Turkish Standards)' honey standards (Tolon, 1999). On the other hand, the results of mineral matter analysis of the same study showed the residue levels of Mugla province had increased with the distance of hives to the thermal power plant and to highway in 1997.

Despite of some important production and marketing problems, honey production is found profitable enterprise for beekeepers in this study. Beekeepers must be careful about honey production technics, because certain export markets are requesting control and severe limits on pesticide residues (min. residue limits) in hives. In recent years antibiotics found in Chinese honey in early 2002 has caused a world shortage of honey in export markets with the resultant price rise. Turkey could benefit from this situation if favourable climatic conditions prevail for 2003 production season (Anonymous, 2003d).

In 2003, Turkish government policy will encourage bee raising and honey production and will give a financial support (€ 2.6) per hive (Anonymous,2003b).The Central Union of Beekeepers is established this year. If the beekeepers will a member of this union, the quantity of financial support that will be given per hive is € 4. With replacement of selected queen bees, annual honey yield could be increased from 16 kg to 30 kg. It has also been said that Turkish government will continue to control the quality and residue limits of honey and the other bee products. Last year Turkey exported 15,000 tons of honey to European Union Countries, three times greater than exports (5,000 tons) in previous years(Anonymous, 2003d).

As a conclusion, Turkish beekeeping sector will take a better place in world market, providing governmental financial support and high quality management techniques.

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