The Influence of Scale on the Profitability of Honey Beekeeping Enterprises in Eastern Part of Turkey

1Ibrahim Yıldırım and 2Sinan Ağıran
1Department of Agricultural Economics, Faculty of Agriculture, University of Yuzuncu Yil, Van, Turkey
2Expert Working for Presidency of Scientific Research Projects of University of Yuzuncu Yil, Van, Turkey

Abstract: The aim of this study was to compare the profitability of 58 small, medium and large-scale beekeeping enterprises in Balıkesir, a town in Van Province, Turkey. The data, from the 2002 production period, was updated in 2005 using the agriculture wholesale price index. Honey yield per beehive was 10.72 kg. The single most important cost item in the total production cost was the permanent labour costs, which represented 31.42% of the total. The economic profitability rate increased according to enterprise size being the lowest with 1.42% for small-scale and the highest with 3.77% for large-scale enterprises. The Coob-Douglas production function test showed that by increasing the major inputs one-fold, the large scale enterprises could increase the honey quantity 1.73 times against 1.29 times of small-scale enterprises.

Key words: Profitability, honey, beekeeping enterprises

INTRODUCTION

A reasonable and sustainable level of profitability is essential for the feasibility and continuity of an enterprise (Yıldırım, 2006). Honey yield per beehive is a major factor, which affects the profitability of beekeeping enterprises (Jones, 2004). Rich floral resources (Güler and Temir, 2005); bee races (Akyol and Kaftanoglu, 2001) colony size (Tucaik et al., 2004) and resource management (Jong, 2000) are effective on a higher and sustainable level of profitability.

Beepkeeping enterprises in Turkey provide benefits in terms of income, employment, decrease in population migration, pollination of crops and conservation of biodiversity.

The major motivation to keep bees in Turkey has to a great extent been honey production. With its 4,400,000 beehives and 73,929 tons of honey production (2004) per year (TSI, 2006), Turkey is the fourth biggest honey producer after China, USA and Germany (FAO, 2006). The average yearly increase rate of beehive numbers and honey production quantity has been 1.20 and 1.67%, respectively between 1994-2004 years. Taking into consideration the 1994-2004 data, honey production is expected to reach 77,899 tons in 2010. Despite great potential in honey production, the export rate is relatively low with 7.19, 20.24, 21.25 and 7.70%, respectively for the years 2001, 2002, 2003 and 2004 (FAO, 2006). The honey yield per beehive was 16.80 kg in 2004 (TSI, 2006) and the average yearly increase between 1994-2004 years has been 0.47%. However, honey yield per hive in Turkey is still lower than the World average (22.56 kg in 2003).

The aim of this study was to compare the profitability of small, medium and large-scale beekeeping enterprises. The hypothesis was that the large-scale beekeeping enterprises were more
efficient in terms of production costs per beehive and would have higher profitability rates compared to small-scale enterprises. The other hypothesis was that in all groups, irrespective of size, profitability would be positive.

The previous studies indicated that the beekeeping activity provided benefits in terms of employment, pollination of crops and conservation of biodiversity (Didas, 2005) and generated incomes through hive products (Jones, 2004) and renting the bee colonies to pollinate crops (Gates, 2000). Ecological conditions and the floral composition (Tučak et al., 2004); queen quality (Cobey, 2001) and resource management (Jong, 2000) were cited among the major factors, which affect the profitability of beekeeping enterprises.

Beekeeping potential was reported to be great in Turkey given the economically valuable honey bee races, varied geography and rich floral resources in the country (Güler and Demir, 2005). Central Anatolia region of Turkey with its natural advantages preserved some original honey bee populations despite the extensive use of replacement queen bees and migratory beekeeping (Geneşer and Piratlı, 1999). Ak yol and Kaftanoglu (2001) reported that the most common and popular bee races in Turkey were Caucasian bees native to Northeastern Anatolia and Mugla bees native to South-western Anatolia. Mugla genotype was stated to be superior to the other genotypes in terms of the development of colony population, brood rearing activity, wax building activity and honey yield (Güler and Kaftanoglu, 1999). The researches conducted in different part of Turkey showed that honey yield per beehive ranged from 8.5 kg in South-Eastern region to 24.85 kg in Egean Region of the country (Saner et al., 2005; Dajdemir and Topçu, 2003; Kutlu and Sezen, 1999; Özbilgin et al., 1999; Kuruva and Özktüt, 1998; Çiçek, 1993).

MATERIALS AND METHODS

Pioneer honey beekeepers in 12 villages involved in honey beekeeping activities were determined around Bahçesaray town in Van Province, which is a major honey production center in the region. The total number of honey beekeepers in the research area was 63. Initially, it was aimed to include all beekeepers in the research population, which would mean a complete census. However, 5 of the 63 beekeepers could not be reached. So, the sample size consisted of 58 beekeepers. Taking into account the percentage distribution of beehive numbers, the enterprises were classified into three groups. The small-scale (1-35 beehives), medium-scale (36-80 beehives) and large-scale (more than 80 beehives). This resulted in 15, 24 and 19, enterprises in each category, respectively. The beekeepers were interviewed by means of questionnaires. The data belong to 2002 production period. However, the part of data related to production costs and incomes was updated to the 2005 production period using agriculture wholesale price index (rate of change on average over a twelve months base) (TSI, 2006).

Family labour potential was expressed in terms of man-days using generally accepted coefficients (Erikş et al., 1995; Rehber and Çetin, 1998). The production costs were classified as variable and fixed costs (Yıldırım and Oktay, 1995). Gross and net profit was calculated by subtracting the variable and production costs, respectively from gross production value (Iran, 1999; Oktay, 1988). The economic profitability was calculated by dividing the net return to total assets (Kiral et al., 1999). The cost of 1 kg honey was calculated by dividing total production costs by the honey quantity produced.

In order to determine the relationship between honey quantity and the major inputs the Coob-Douglas production function was used. The One-Sample Kolmogorov-Smirnov procedure was used to test the null hypothesis that the sample came from a normal distribution. One-way variance analysis method was applied to compare the differences for some variables between small, medium and large-scale enterprises (Miran, 2003).
RESULTS

Some Information on Beekeeping Enterprises

The average number of persons per household was 5.83. Family labour potential was 1,092.2 man-days but only 44.4% were exploited. Of the total labour used in the enterprises 96.6% was provided by family. The average age of the beekeepers was 40.5 years. The experience period of the beekeepers in apiculture was 13.7 years, being 8.5 years for small-scale and 19.3 years for large-scale enterprises.

Number of Beehives and Honey Yield

The average number of bee hives per enterprise was 67.10 and increased in proportion to the enterprise size being the lowest with 21.70 for small-scale and the highest with 113.50 for large-scale enterprises. Modern type bee hives made up 90.31% of total bee hives with the remainder being traditional bee hives.

Honey yield per modern bee hive was 10.72 kg for overall enterprises being the highest with 11.49 kg for medium-scale and the lowest with 10.11 kg for small-scale enterprises. Average honey quantity per enterprise was 685.60 kg and increased in parallel to enterprise size ranging from 214.00 kg for small-scale and 1,118.42 kg for large-scale enterprises (Table 1). Of the total honey quantity 94.77% was obtained from modern bee hives. Comb honey from modern bee hives accounted for 77.25% of total honey production followed by strained honey from modern bee hives and comb honey from primitive bee hives with 17.52 and 5.23%, respectively. The difference between small, medium and large-scale enterprises was statistically significant from the point of view of the number of bee hives (p<0.01) and honey quantity per enterprises (p<0.001). Small scale and medium-scale enterprises differed significantly (p<0.01) in regard of honey yield per bee hive.

Labour Demand

The average daily labour demand per bee hive was 0.08 h for overall enterprises. This figure decreased in proportion to enterprise size ranging from 0.18 h for small-scale and 0.06 h for large-scale enterprises (Table 1). The small, medium and large-scale enterprises differed significantly (p<0.001) from labour demand per bee hive point of view.

Production Costs and the Cost of 1 kg of Honey

Production costs per enterprise were $2,927.55 and increased according to enterprise size ranging from $1,192.85 for small scale to $4,650.43 for large-scale enterprises (Table 2). The fixed and the variable costs consisted of 60.20 and 39.80% of total production costs, respectively. The single most important cost item in the total production costs was the permanent labour costs with 31.42% followed by amortization of bee hives including bee with 18.32% and purchased queen bee during the year with 10.48% (Table 2). The production costs per bee hive were $43.63 and decreased in

| Table 1: Number of bee hives, honey yield per bee hive, honey production per enterprise and labour demand per bee hive |
|---------------------------------|----------------|----------------|----------------|----------------|
| Major physical aggregates      | Small-scale enterprises (1-35 bee hives) | Medium-scale enterprises (36-80 bee hives) | Large-scale enterprises (81+ bee hives) | Overall enterprises |
| No. of bee hives per enterprise (Modern and traditional) | 21.70*** | 58.70*** | 113.50*** | 67.10 |
| Honey yield per modern bee hive (kg) | 10.11*** | 11.49*** | 10.30 | 10.72 |
| Honey production quantity per enterprise (kg) | 214.00*** | 637.71*** | 1,118.42*** | 685.60 |
| Labour demand per bee hive (h) | 0.18*** | 0.09*** | 0.06*** | 0.08 |

**p<0.01, ***p<0.001
Table 2: The percentage distribution of production costs and the costs of 1 kg of honey

<table>
<thead>
<tr>
<th>Cost items</th>
<th>Small-scale enterprises (1-35 bees)</th>
<th>Medium-scale enterprises (36-80 bees)</th>
<th>Large-scale enterprises (81+ bees)</th>
<th>Overall enterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>%</td>
<td>$</td>
<td>%</td>
</tr>
<tr>
<td>Frame</td>
<td>31.35</td>
<td>2.63</td>
<td>67.83</td>
<td>2.56</td>
</tr>
<tr>
<td>Honeycomb</td>
<td>29.04</td>
<td>2.43</td>
<td>95.25</td>
<td>3.60</td>
</tr>
<tr>
<td>Can and plastic box</td>
<td>32.11</td>
<td>2.69</td>
<td>116.15</td>
<td>4.39</td>
</tr>
<tr>
<td>Sugar</td>
<td>42.81</td>
<td>3.59</td>
<td>103.15</td>
<td>3.90</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>42.20</td>
<td>3.54</td>
<td>108.75</td>
<td>4.11</td>
</tr>
<tr>
<td>Hired labour costs</td>
<td>32.14</td>
<td>2.69</td>
<td>77.05</td>
<td>2.91</td>
</tr>
<tr>
<td>Queen purchased during the year</td>
<td>88.49</td>
<td>7.42</td>
<td>277.48</td>
<td>10.48</td>
</tr>
<tr>
<td>Rent for straining machine</td>
<td>-</td>
<td>-</td>
<td>16.78</td>
<td>0.63</td>
</tr>
<tr>
<td>Interest for operating assets</td>
<td>73.72</td>
<td>6.18</td>
<td>371.17</td>
<td>10.46</td>
</tr>
<tr>
<td>Total variable costs</td>
<td>371.87</td>
<td>31.17</td>
<td>1074.07</td>
<td>40.56</td>
</tr>
<tr>
<td>Administrative costs</td>
<td>11.16</td>
<td>0.94</td>
<td>32.22</td>
<td>1.22</td>
</tr>
<tr>
<td>Permanent labour costs</td>
<td>374.39</td>
<td>31.39</td>
<td>862.23</td>
<td>32.56</td>
</tr>
<tr>
<td>Amortization of buildings</td>
<td>253.83</td>
<td>21.28</td>
<td>224.26</td>
<td>8.47</td>
</tr>
<tr>
<td>Amortization of machines</td>
<td>4.64</td>
<td>0.39</td>
<td>16.89</td>
<td>0.62</td>
</tr>
<tr>
<td>Amortization of bee hive including bee box</td>
<td>176.98</td>
<td>14.84</td>
<td>438.53</td>
<td>16.56</td>
</tr>
<tr>
<td>Total fixed costs</td>
<td>820.98</td>
<td>68.83</td>
<td>1573.73</td>
<td>59.44</td>
</tr>
<tr>
<td>Total production costs</td>
<td>1192.85</td>
<td>100.00</td>
<td>2647.79</td>
<td>100.00</td>
</tr>
<tr>
<td>Production costs per bee hive ($)</td>
<td>54.97</td>
<td>45.11</td>
<td>40.97</td>
<td>43.63</td>
</tr>
<tr>
<td>The cost of 1 kg of honey ($)</td>
<td>5.57</td>
<td>4.15</td>
<td>4.16</td>
<td>4.27</td>
</tr>
</tbody>
</table>

Table 3: Gross production value, gross profit, net profit, net return ($) and economic profitability (%)

<table>
<thead>
<tr>
<th>Major profit items</th>
<th>Small-scale enterprises (1-35 bees)</th>
<th>Medium-scale enterprises (36-80 bees)</th>
<th>Large-scale enterprises (81+ bees)</th>
<th>Overall enterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per enterprise</td>
<td>Per bee hive</td>
<td>Per enterprise</td>
<td>Per bee hive</td>
</tr>
<tr>
<td>Gross production value</td>
<td>1890.48</td>
<td>87.12</td>
<td>5220.42</td>
<td>88.93</td>
</tr>
<tr>
<td>Gross profit</td>
<td>1518.61</td>
<td>69.98</td>
<td>4146.35</td>
<td>70.64</td>
</tr>
<tr>
<td>Net profit</td>
<td>697.63</td>
<td>32.15</td>
<td>2572.62</td>
<td>43.83</td>
</tr>
<tr>
<td>Economic profitability per enterprise</td>
<td>1.41</td>
<td>3.25</td>
<td>3.77</td>
<td>7.77</td>
</tr>
</tbody>
</table>

The proportion to enterprise size ranging from $54.97 for small-scale to $40.97 for large-scale enterprises. The cost of 1 kg of honey was $4.27 for overall enterprises, being the highest for small-scale enterprises with $5.57 and the lowest with $4.15 and $4.16 for medium and large-scale enterprises, respectively (Table 2).

**Gross Production Value, Gross and Net Profit and Economic Profitability**

Gross production value per enterprise was $5,721.57 and increased according to enterprise size. The gross production value per bee hive was $85.27, being the highest for medium-scale enterprises with $88.93 and the lowest for large-scale enterprises with $82.64 (Table 3).

Gross and net profit per enterprise was $4,556.33 and $2,794.02, respectively for overall enterprises and increased in parallel to enterprise size. Gross profit per bee hive was $67.90, being the highest for medium-scale enterprises at $70.64 and the lowest for large-scale enterprises at $65.84. Net profit per bee hive was $41.64, being the highest for medium-scale enterprises at $43.83 and the lowest for the small-scale enterprise at $32.15. Economic profitability rate was 3.14% for overall enterprises and increased according to enterprise size being the lowest at 1.41% for small-scale and the highest at 3.77% for large-scale enterprises (Table 3).
Cobb-Douglas Production Function

Cobb-Douglas production function was as follows:

For small-scale enterprises

\[ Y = 1.097X_1^{0.614}X_2^{0.378}X_3^{0.195}X_4^{0.749}X_5^{0.182} \]

For medium-scale enterprises

\[ Y = -0.244X_1^{0.021}X_2^{0.879}X_3^{1.216}X_4^{0.905}X_5^{0.256} \]

For large-scale enterprises

\[ Y = 0.759X_1^{0.072}X_2^{1.040}X_3^{1.020}X_4^{0.315}X_5^{0.056} \]

And for overall enterprises

\[ Y = 0.033X_1^{0.893}X_2^{0.594}X_3^{0.812}X_4^{0.298}X_5^{0.214} \]

Where:

\( Y \) = Honey quantity per enterprise obtained from modern beehive (kg)
\( X_1 \) = Number of modern beehives
\( X_2 \) = Labour quantity (h)
\( X_3 \) = Bee value ($)
\( X_4 \) = Sugar value ($)
\( X_5 \) = Honeycomb value ($)

Total production elasticities of inputs were 1.288, 1.517, 1.728 and 1.449, respectively, for small-scale, medium-scale, large-scale and overall enterprises. The determination coefficient (R²) was 0.99, 0.91, 0.76 and 0.98, respectively, for small-scale, medium scale, large-scale and overall enterprises being statistically significant (p<0.001). The production elasticities of \( X_1 \) and \( X_2 \) for small scale; \( X_3 \) and \( X_4 \) for medium-scale; \( X_4 \) for large-scale and \( X_5 \), \( X_6 \), \( X_7 \), \( X_8 \) for overall enterprises were statistically significant (p<0.05).

DISCUSSION

Honey production per beehive in this study (10.72 kg) was lower than the results reported for different parts of Turkey, namely, 15.89 kg in Bingöl (Kutlu and Sezen, 1999); 17.4 kg in Çukurova Region (Kumova and Özkütük, 1988); 16.22 and 24.85 kg, respectively in İzmir and Muğla (Saner et al., 2005); 13.44 kg for Aegean Region (Özbilgin et al., 1999); 18.7 kg in Tokat (Çiçek, 1993) and 16.80 kg in Turkey (TSI, 2006) but higher than that of 8.5 kg in South Eastern Region of Turkey (Dağdemir and Topçu, 2003). The low yield could mainly be attributed to insufficient operating capital, relatively unsuitable geography and poor floral resources, settled type of beekeeping and lack of education and extension services.

The permanent labour costs, which are primarily provided from family and no cash payment is made for it, was the single most important cost item. Saner et al. (2005) reported this ratio as 36.61% for İzmir beekeeping enterprises, which is in line with 31.42% calculated in this study. The alternative use of family labour is low in the region. So, family labour is expected to be used in beekeeping enterprises extensively, which is essential for the sustainability and feasibility of beekeeping enterprises in the region.
Large-scale beekeeping enterprises were more efficient in terms of labour demand and production costs per beehive than the small-scale beekeeping enterprises. Although total production elasticities of inputs were larger than 1 (one), which means increasing return to scale for all size enterprises, the coefficient for large scale enterprises was 34.16% higher than that of small-scale enterprises. It is expected that by increasing the major inputs one-fold, the large scale enterprises would increase the honey quantity 1.73 times against 1.29 times of small-scale enterprises. Economic profitability of large-scale enterprises (3.77%) was 2.67 times higher than that of small-scale enterprises (1.41%). The large-scale enterprises were also 34.37% more efficient in producing 1 kg of honey than the small-scale enterprises. Therefore, we recommend the large-scale enterprises for sustainability and continuity of the beekeeping enterprises in the region.

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