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# ECONOMIC ANALYSIS OF GREENHOUSE STRAWBERRY PRODUCTION: A CASE STUDY OF AYDIN PROVINCE, TURKEY

**Vecdi DEMIRCAN, Asli DALGIC, Tugba GULSEVER, Bektas KADAKOGLU**

Isparta University of Applied Sciences, Faculty of Agricultural Sciences and Technologies, Department of Agricultural Economics, Isparta-Turkey, Phone: +902462118601, Fax: +902462118696, Emails: vecdidemircan@sdu.edu.tr, aslidlgc07@gmail.com, bektaskadakoglu@isparta.edu.tr

***Corresponding author***: vecdidemircan@sdu.edu.tr

***Abstract***

*The purpose of the study was to carry out an economic analysis of strawberry production in the Aydın province of Turkey which has a significant potential for strawberry production. The main material of the study was comprised of data acquired via survey method from 59 greenhouse strawberry producers in the Sultanhisar and Köşk districts of the Aydın province. The producers were classified according to their size as Group I (1-10 decares; 17 farms), Group II (11-25 decares; 20 farms), Group III (26-50 decares; 14 farms) and Group IV (>50 decares; 8 farms). Average strawberry land presence in establishments was 27.19 da and the share of strawberry lands in total land presence was calculated as 52.64 %. The ratio of producers using certified seedling was observed to be highest in Group IV (100 %) and lowest in Group I (47.06 %). The strawberry varieties produced most frequently were determined as Rubygem, Fortuna and Festival. Establishment costs per decare according to the total producer average was calculated as 4955.07 TL. Seedling costs (42.86 %) were determined to have the highest share among the establishment costs. Production costs according to all farm groups average was determined as 3101.56 TL/da. It was determined that labor cost is ranked number one among the total production costs (29.91 %). It was determined that the gross, net and relative return per decare according to farm groups increases with increasing farm size. It was observed that larger farms are more advantageous with regard to economic criteria.*

***Key words:*** *greenhouse strawberry, production cost, profitability*

## INTRODUCTION

Strawberry (*Fragaria vesca*) is a fruit included in the berry fruits group with a beautiful appearance, color, nice odor and taste the production of which is increasing due to the newly developed methods of production and its newly developed cultivars [1]. In addition to its consumption as a fresh fruit, strawberry is also used for making jams, jellies, ice cream, fruit yoghurt, fruit juice, liquor, wine with its dried form used in making cakes and grain flakes. It can be stated that strawberry is an important fruit with a wide production area in the world due to the fact that it can adapt to the preferences of both the consumers and the food industry [2]. Turkey is ranked number five in the world with a strawberry production of 400,167 tons after China (3,724,647 tons), USA (1,449,280 tons), Mexico (658,436 tons) and Egypt (407,240 tons) [8].

Strawberry production in the modern sense started during the 1970's in Turkey [10]. While strawberry was produced only in Istanbul, Bursa and Karadeniz Ereğlisi regions until recently, its production has been gaining popularity [6]. Mersin province is the leading province with regard to strawberry production in Turkey. The Mersin province meets 35 % of the total strawberry production in Turkey. The Aydın province where the present study has been carried out in is ranked number two after Mersin. Aydın province makes up about 15 % of the total strawberry production in Turkey with 63,843 tons [14].

The purpose of this study was to carry out the economic analysis of greenhouse strawberry production in Aydın province which has an important potential in Turkey with regard to strawberry production. For this purpose, general features of greenhouse strawberry producers such as population, age, education level, experience, production pattern, average

producer land size as well as success criteria such as cost items for strawberry establishments and production, gross product value, gross profit, net profit and relative return have been determined after which these criteria were compared according to farm groups for determining which of the farm groups are more advantageous. Studies carried out in Turkey are focused more on the technical aspect of strawberry production. The number of studies evaluating the economical aspect of strawberry production is limited. It is expected that the findings acquired from the study shall be beneficial for all strawberry producers, researchers and related institutions.

## MATERIALS AND METHODS

The main material of the study was comprised of original data acquired via survey method from greenhouse strawberry production farms at the Sultanhisar and Köşk districts of Aydın province. Similar studies made by various related individuals and institutions as well as reports and statistics were also used. The survey data covers the 2015 production period.

Ten villages from the Sultanhisar and Köşk districts where strawberry production is carried out intensely were selected as the study area based on the information obtained from records on strawberry production prepared by technical staff of Aydın Provincial Directorate of Food, Livestock and Agriculture. All agricultural farms in these districts and villages that operate in line with the purpose of the study comprised the population of the study. The districts selected as the study area make up about 77% of the Aydın province with regard to strawberry production [14]. Hence, it can be stated that the study region represents the strawberry producer agricultural farms in the Aydın province.

Neyman Method from among the layered sampling methods was used for determining the number of samples to be included in the survey [15]. The number of samples was calculated via equation 1.

$$n = \frac{(\sum Nh\ Sh)^2}{N^2\ D^2 + \sum Nh\ Sh^2} = \frac{(2{,}088.98)^2}{507^2 * 0.488^2 + 12{,}975.80} = 59 \quad (1)$$

where:
n: Sample size
N: Total number of units in the population
Nh: Number of units in group h
Sh: Standard deviation of group h
$Sh^2$: Variance of group h
$D^2$: $d^2 / z^2$
$d^2$: Allowed error from population average (19.16 da) (5 % deviation from the average)
$z^2$: Value of the allowed safety limit (%95) in the distribution table (1.96).

The number of samples for representing the main population was calculated via Equation 1 as 59. The farms to be subject to the survey were selected randomly. Since the land presence of the farms differs, it was decided to classify the farms into groups in order to ensure that the population is homogeneous. Accordingly, the farms were classified as Group I (1-10 decares; 17 farms), Group II (11-25 decares; 20 farms), Group III (26-50 decares; 14 farms) and Group IV (>50 decares; 8 farms). The data acquired via surveys from the determined farms were uploaded to the computer and evaluated by way of calculations and tables in Microsoft Excel and SPSS software.

Foreign labor fees In the study area were taken into as basis for calculating family labor fees. General administrative costs were calculated as 3% of the total variable costs. Revolving fund interest was calculated by multiplying the variable costs with half of the interest rate applied by T.C. Ziraat bank on plant production credits (4%). The interest for bare land value was calculated as 5% of the bare land value in the study region. Establishment costs yearly depreciation share was calculated by dividing the total establishment costs during the production period to the economic life of the establishment (4 years). A 5% interest was applied on the total establishment costs half value [11]. Gross product value was calculated by multiplying the amount of products obtained as a result of strawberry production activities with the sales price. Gross profit was calculated by subtracting the variable costs from gross product value while net profit was calculated by subtracting the

production costs from gross product value. Gross product value was divided by production costs for determining relative return [13].

## RESULTS AND DISCUSSIONS

Table 1 presents the data on the age, education level, population, membership in cooperative, strawberry cultivation training and involvement in farmer registration system. It was determined that the age averages of the producers vary between 41.5-48.14 years according to the farm groups, that the duration of education they received varies between 6.57-8.50, that their agricultural experience varies between 17.88-24.75 years and that their level of experience in strawberry cultivation varies between 12.50-17.30 years. Based on the acquired data, it was observed that the population of the families of the producers varies between 3.06-4.14 people according to the farm groups with an average of 3.46 people. It was also put forth that the membership in cooperative ratios for the producers range between 11.76 % and 50 %, that the ratios of producers trained in strawberry cultivation varies between 21.43 % and 41.18 % and that the ratio of producers involved in the farmer registration system varies between 58.82 % and 87.50 %.

Land presence of farms is provided in Table 2. Accordingly, it was determined that the total land size varies between 22.85 da and 105.88 da according to farm groups with an average of 51.65 da. Strawberry land size was observed to vary between 5.91 da and 89 da with an average value of 27.19 da. The share of strawberry land size in total land size was calculated as 52.64 %. The shares of property land and rent land in total land size were determined as 45.73 % and 54.27 % respectively.

Product pattern in farms is presented in Table 3. The share of strawberry cultivation area in total land presence of farms was determined to vary between 25.87 % and 84.06 % with an average value of 52.63 %. It can be observed that the share of average strawberry cultivation area and strawberry cultivation area in total land presence of the farm increases with increasing sizes of the farm groups. While strawberry is ranked number one with a share of 52.64 % in total land presence according to farm averages, it was followed respectively by olive (17.60 %), corn (14.54 %), and fig (3.90 %).

Certified seedling use of strawberry farms and their supply places are given in Table 4. The ratio of certified seedling user producers varies between 47.06 % and 100 % according to the farm groups. It was determined that Group IV has the highest ratio of certified seedling use (100%) while Group I has the lowest ratio (47.06 %). It was determined that the farms supply the highest number of seedlings mostly from firms (64.41 %) and the lowest number from cooperatives (6.78 %). The ratio of farms supplying seedlings from firms was highest in Group IV (87.50 %) and lowest in Group I (47.06 %).

Table 5 presents the different strawberry varieties produced in farms and the ratios of the farm groups that produce these varieties. It was determined based on the farm groups' average that Rubygem variety is the most frequently cultivated strawberry variety followed by Fortuna and Festival varieties. The ratios of farms cultivating Rubygem, Fortuna and Festival varieties were determined respectively as 83.5 %, 44.07 % and 33.90 %. It was observed that the highest ratio of Rubygem variety is in Group IV (100%) while the lowest ratio is in Group I (65.71 %) farms. While the Fortuna variety ranked number two according to its cultivation percentage in farm groups was observed to be cultivated at most in Group IV (62.50 %) and lowest in Group I (17.65 %) farms.

Strawberry production is comprised of establishment and production periods.

However, different from other perennial crops, strawberry starts to produce yield during its first establishment year. Establishment and production costs are calculated separately when calculating the strawberry cost.

Table 1. Producers' features

| Features | Farm groups (da) | | | | Average |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Age (year) | 46.06 | 47.10 | 48.14 | 41.50 | 46.29 |
| Education level (year) | 7.94 | 7.65 | 6.57 | 8.50 | 7.59 |
| Agricultural experience (year) | 21.35 | 24.75 | 22.00 | 17.88 | 22.19 |
| Experience in strawberry production (year) | 13.76 | 17.30 | 17.29 | 12.50 | 15.63 |
| Population (person / family) | 3.06 | 3.25 | 4.14 | 3.63 | 3.46 |
| Membership of cooperative (%) | 11.76 | 50.00 | 50.00 | 25.00 | 35.59 |
| Strawberry cultivation training (%) | 41.18 | 30.00 | 21.43 | 37.50 | 32.20 |
| Involvement in farmer registration system (%) | 58.82 | 70.00 | 64.29 | 87.50 | 67.80 |

Source: Own calculation.

Table 2. Land presence of farms

| Land presence (da) | Farm groups (da) | | | | Average |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Total land size | 22.85 | 53.76 | 52.63 | 105.88 | 51.65 |
| Strawberry land size | 5.91 | 15.86 | 33.88 | 89.00 | 27.19 |
| Property land | 19.74 | 20.725 | 38.49 | 13.13 | 23.62 |
| Rent land | 3.12 | 33.03 | 14.14 | 92.75 | 28.03 |

Source: Own calculation.

Table 3. Grown products in farms (da/farm, %)

| Products | Farm groups (da) | | | | | | | | Average | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I | | II | | III | | IV | | | |
| | da | % | da | % | da | % | Da | % | da | % |
| Strawberry | 5.91 | 25.87 | 15.86 | 29.49 | 33.88 | 64.38 | 89 | 84.06 | 27.19 | 52.63 |
| Vegetable | 0.21 | 0.90 | - | - | - | - | - | - | 0.06 | 0.11 |
| Maize | - | - | 21.15 | 39.35 | 1.43 | 2.71 | - | - | 7.51 | 14.54 |
| Watermelon | 0.56 | 2.45 | 2.00 | 3.72 | 1.29 | 2.44 | 5 | 4.72 | 1.82 | 3.53 |
| Mandarin | 0.29 | 1.29 | - | - | - | - | - | - | 0.08 | 0.16 |
| Fig | 3.82 | 16.73 | 0.90 | 1.67 | 2.57 | 4.89 | - | - | 2.02 | 3.90 |
| Orange | 0.18 | 0.77 | 0.15 | 0.28 | 2.14 | 4.07 | 1.25 | 1.18 | 0.78 | 1.51 |
| Chestnut | 0.59 | 2.57 | 2.00 | 3.72 | 0.36 | 0.68 | - | - | 0.93 | 1.80 |
| Peach | - | - | 0.15 | 0.28 | - | - | 1.25 | 1.18 | 0.22 | 0.43 |
| Olive | 11.29 | 49.42 | 5.80 | 10.79 | 10.96 | 20.83 | 9.375 | 8.85 | 9.09 | 17.60 |
| Alfalfa | - | - | 5.75 | 10.70 | - | - | - | - | 1.95 | 3.77 |
| Total | 22.85 | 100.00 | 53.76 | 100.00 | 52.63 | 100.00 | 105.875 | 100.00 | 51.65 | 100.00 |

Source: Own calculation

Table 4. Certified seedling use and supply places of farms (%)

| Are strawberry seedlings certified? | Farm groups (da) | | | | Average |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Yes | 47.06 | 80.00 | 78.57 | 100.00 | 72.88 |
| No | 52.94 | 20.00 | 21.43 | 0.00 | 27.12 |
| Total | 100.00 | 100.00 | 100.00 | 0.00 | 100.00 |
| Seedling supply places | | | | | |
| Firm | 47.06 | 65.00 | 71.43 | 87.50 | 64.41 |
| Dealer or other producers | 35.29 | 10.00 | 7.14 | 12.50 | 16.95 |
| Own production | 29.41 | 10.00 | 28.57 | 0.00 | 18.64 |
| Cooperative | 0.00 | 15.00 | 7.14 | 0.00 | 6.78 |

Source: Own calculation.

Table 5. Different strawberry varieties and usage rates in farms (%) *

| Strawberry varieties | Farm groups (da) | | | | Average |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Rubygem | 65.71 | 85.00 | 92.86 | 100.00 | 83.05 |
| Festival | 17.65 | 45.00 | 35.71 | 37.50 | 33.90 |
| Portola | - | 5.00 | - | - | 1.69 |
| Fortuna | 17.65 | 55.00 | 50.00 | 62.50 | 44.07 |
| Camarosa | 5.88 | 5.00 | - | 12.50 | 5.08 |
| Fresh chilled | 5.88 | 10.00 | 21.43 | 12.50 | 11.86 |
| Sabrina | 5.88 | - | 14.29 | 50.00 | 11.86 |

*percentages are higher than 100 because of multiple choice
Source: Own calculation.

Establishment costs for strawberry production are comprised of seedling costs, fertilizer costs, drip irrigation system costs, planting seedlings cost, costs of nylon used for mulching, iron, rope and wood pile costs. Strawberry establishment costs in farms are

given in Tables 6 and 7. It was observed that there are no significant differences between strawberry establishment costs with regard to farm groups. Establishment cost per farm per decare was observed to be highest in Group III with (5,036.67 TL/da) and lowest in Group I with (4,761.51 TL/da). Establishment costs per decare according to all establishments average was calculated as 4,955.07 TL. It was determined that seedling costs had the highest share among all establishment costs (42.86 %). Seedling costs were followed by nylon (24.18 %) iron (14.21 %) and labor (planting seedlings and greenhouse establishment: 11.72 %). Ağır and Saner (2014) [2] carried out a study in which greenhouse strawberry establishment costs were determined as 4,889.06 TL/da and Balcı (2005) [4] carried out a study in which open-field strawberry production establishment costs were determined as 2,162.75 TL/da.

Cost items for strawberry production were classified as fixed and variable costs after which they were subject to analyses. The variable costs are those that increase or decrease subject to production volume. Whereas fixed costs are those that do not change subject to production volume or in other words they are expenses that are present regardless of whether production is carried out or not [9]. Tables 8 and 9 present the strawberry production costs and the shares of costs in strawberry production. It was determined that the strawberry production costs per decare range between 2,830.06 TL to 3,323.13 TL subject to farm groups. Production costs were observed to be lowest in Group II and highest in Group I. Production cost according to all farm groups' average was determined as 3,101.56 TL/da. The share of variable costs in production costs was calculated as 48.93 % and the share of fixed costs was calculated as 51.07 %. While labor costs were ranked in the first place among total production costs (29.91 %), they were followed by strawberry establishment depreciation share, land rent and machinery rent.

Gross profit is an important criterion for success in determining the competition strength of production activities with regard to the use of current sparse production factors. In other words, gross profit is an important criterion indicating the success of the establishment organization [7]. Table 10 presents the gross profit, net profit and relative return in farms per decare in the study region according to farm size groups. It was determined that gross profit per decare increases proportionally with farm size according to farm groups. Gross profit for farms in Groups I, II, III, and IV were determined respectively as 10,524.35, 10,965.77, 11,791.26 and 12,137.31 TL. Net profit per decare in the studied farms was 8,891.51 TL for Group I farms, 9,686.23 TL for Group II farms, 10,215.40 TL for Group III farms and 10,596.59 TL for Group IV farms. Accordingly, it is observed that net profit per decare increases with increasing farm groups. Relative return is another criterion for measuring strawberry production success. It was determined that relative return increases with increasing farm size. Relative returns were determined as 3.68, 4.42, 4.48 and 4.68 for Groups I, II, III and IV respectively. It was observed based on these results that profitability increases with increasing farm size. Ağır and Saner (2014) [2] carried out a study in which it was reported that greenhouse strawberry production is more profitable than open-field strawberry production. Lille et al. (2003) [12] carried out a study in Estonia comparing different strawberry varieties with regard to yield and profitability using hay mulch and plastic mulch techniques. It was determined as a result of the study that hay mulching method increases yield and profitability more. Atasay (2007) [3] carried out a study in which yield, quality and vegetative characteristics of certain nutritional applications were examined for conventional and organic production. It was determined that farm fertilizer + green fertilizer + clinoptilolite + sea weed application had the highest value for net profit. Daniel et al. (2008) [5] carried out a study in the Florida State of USA in which greenhouse organic, greenhouse conventional and open-field strawberry production were

compared with regard to profitability. It was determined as a result of the study that greenhouse organic strawberry production is 9.5 times more profitable than open-field conventional strawberry production and that greenhouse conventional production is 1.5 times more profitable than open-field production.

Table 6. Strawberry establishment costs in farms (TL/da)

| Cost items | Farm groups (da) | | | | Average | P-value |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Seedling | 1,905.88[a] | 2,241.75[b] | 2,151.79[ab] | 2,155.63[ab] | 2,111.95 | 0.070* |
| Fertilizer | 83.13 | 98.22 | 87.07 | 112.41 | 93.15 | 0.872 |
| Drip irrigation system | 150.29 | 153.00 | 157.21 | 150.00 | 152.81 | 0.137 |
| Planting seedlings | 196.18[a] | 212.50[ab] | 226.61[b] | 220.22[b] | 212.19 | 0.001*** |
| Nylon | 1,155.14[a] | 1,159.39[b] | 1,241.62[b] | 1,309.20[b] | 1,197.99 | 0.003*** |
| Iron | 803.53[a] | 678.22[b] | 677.85[b] | 603.46[c] | 704.10 | 0.000*** |
| Rope | 51.18[a] | 51.74[a] | 52.65[ab] | 58.01[b] | 52.65 | 0.005** |
| Wood pile | 57.67 | 68.65 | 68.78 | 40.58 | 61.71 | 0.352 |
| Greenhouse establishment labour | 358.52 | 369.14 | 373.08 | 380.20 | 368.52 | 0.140 |
| Total | 4,761.51 | 5,032.62 | 5,036.67 | 5,029.71 | 4,955.07 | 0.169 |

TL: Turkish Lira; 1USD=2.72 TL in 2015 (average); *: p<0.10; **: p<0.05; *** p<0.01
[abc] means with different superscripts on the same row are different.
Source: Own calculation

Table 7. Share of cost items in strawberry establishment (%)

| Cost items | Farm groups (da) | | | | Average |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Seedling | 40.03 | 44.54 | 42.72 | 42.86 | 42.62 |
| Fertilizer | 1.75 | 1.95 | 1.73 | 2.23 | 1.88 |
| Drip irrigation system | 3.16 | 3.04 | 3.12 | 2.98 | 3.08 |
| Planting seedlings | 4.12 | 4.22 | 4.50 | 4.38 | 4.28 |
| Nylon | 24.26 | 23.04 | 24.65 | 26.03 | 24.18 |
| Iron | 16.88 | 13.48 | 13.46 | 12.00 | 14.21 |
| Rope | 1.07 | 1.03 | 1.05 | 1.15 | 1.06 |
| Wood pile | 1.21 | 1.36 | 1.37 | 0.81 | 1.25 |
| Greenhouse establishment labour | 7.53 | 7.34 | 7.41 | 7.56 | 7.44 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source: Own calculation.

Table 8. Production costs in farms (TL/da)

| Cost items | Farm groups (da) | | | | Average | P-value |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Temporary labour | 714.81[a] | 605.26[b] | 605.35[b] | 585.81[b] | 634.21 | 0.013*** |
| Fertilizer | 204.16 | 173.49 | 191.72 | 188.70 | 188.72 | 0.968 |
| Pesticide | 56.73 | 38.49 | 42.57 | 34.68 | 44.20 | 0.467 |
| Irrigation | 150.29 | 153.00 | 157.21 | 150.00 | 152.81 | 0.245 |
| Machinery rent | 499.27 | 520.64 | 312.32 | 330.91 | 439.33 | 0.201 |
| Revolving fund interest | 65.01 | 59.64 | 52.37 | 51.60 | 58.37 | 0.497 |
| Total variable costs(A) | 1,690.29[a] | 1,550.52[b] | 1,361.54[b] | 1,341.70[b] | 1,517.63 | 0.147 |
| Permanent labour | 337.46 | 285.75 | 285.79 | 276.56 | 299.41 | 0.013*** |
| Land rent | 536.18 | 550.98 | 542.14 | 525.00 | 541.10 | 0.988 |
| Administrative costs(A*0.03) | 50.71 | 46.52 | 40.85 | 40.25 | 45.53 | 0.497 |
| Depreciation of establishment | 644.08 | 620.04 | 642.80 | 635.36 | 634.45 | 0.170 |
| Greenhouse capital interest (1/2*0.05) | 64.41 | 62.00 | 64.28 | 63.54 | 63.44 | 0.170 |
| Total fixed costs (B) | 1,632.84 | 1,279.54 | 1,575.86 | 1,540.71 | 1,583.93 | 0.788 |
| Total production costs (A+B) | 3,323.13 | 2,830.06 | 2,937.40 | 2,882.41 | 3,101.56 | 0.144 |

[ab] means with different superscripts on the same row are different. *** p<0.01
Source: Own calculation.

Table 9. Share of cost items in strawberry production (%)

| Cost items | Farm groups (da) | | | | Average |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Temporary labour | 21.51 | 21.39 | 20.61 | 20.32 | 20.45 |
| Fertilizer | 6.14 | 6.13 | 6.53 | 6.55 | 6.08 |
| Pesticide | 1.71 | 1.36 | 1.45 | 1.20 | 1.42 |
| Irrigation | 4.52 | 5.41 | 5.35 | 5.20 | 4.93 |
| Machinery rent | 15.02 | 18.40 | 10.63 | 11.48 | 14.16 |
| Revolving fund interest | 1.96 | 2.11 | 1.78 | 1.79 | 1.88 |
| Total variable costs (A) | 50.86 | 54.79 | 46.35 | 46.55 | 48.93 |
| Permanent labour | 10.16 | 10.10 | 9.73 | 9.59 | 9.65 |
| Land rent | 16.13 | 19.47 | 18.46 | 18.21 | 17.45 |
| Administrative costs (A*0.03) | 1.53 | 1.64 | 1.39 | 1.40 | 1.47 |
| Depreciation of establishment | 19.38 | 21.91 | 21.88 | 22.04 | 20.46 |
| Greenhouse capital interest (1/2*0.05) | 1.94 | 2.19 | 2.19 | 2.20 | 2.05 |
| Total fixed costs(B) | 49.14 | 45.21 | 53.65 | 53.45 | 51.07 |
| Total production costs (A+B) | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source: Own calculation.

Table 10. Gross profit, net profit and relative return in farms

| Values | Farm groups (da) | | | | Average | P-value |
|---|---|---|---|---|---|---|
| | I | II | III | IV | | |
| Yield (kg/da) | 4782.35 | 4712.50 | 4892.86 | 4687.50 | 4772.03 | 0.848 |
| Price (TL/kg) | 2.55 | 2.66 | 2.69 | 2.88 | 2.65 | 0.393 |
| Strawberry production value (TL/da) | 12209.07 | 12511.69 | 13149.55 | 13476.56 | 12645.89 | 0.857 |
| Agricultural supports (TL/da) | 5.57 | 4.60 | 3.25 | 2.44 | 4.27 | 0.401 |
| Gross product value (TL/da) | 12214.63 | 12516.29 | 13152.81 | 13479.00 | 12650.16 | 0.845 |
| Variable costs (TL/da) | 1690.29 | 1550.52 | 1361.54 | 1341.70 | 1517.63 | 0.124 |
| Production costs (TL/da) | 3323.13 | 2830.06 | 2937.40 | 2882.41 | 3101.56 | 0.120 |
| Gross profit (TL/da) | 10524.35 | 10965.77 | 11791.26 | 12137.31 | 11132.52 | 0.775 |
| Net profit (TL/da) | 8891.51 | 9686.23 | 10215.40 | 10596.59 | 9548.60 | 0.796 |
| Relative return | 3.68 | 4.42 | 4.48 | 4.68 | 4.08 | 0.503 |

Source: Own calculation.

## CONCLUSIONS

In conclusion, it was determined that the average ages of producers were 46 years, their durations of education were 8 years and their agricultural experience in strawberry production was 16 years, cooperative membership share was 36 %. It was observed that more than half of the average land presence (%52.64) is comprised of strawberry fields, that the majority of producers use certified seedling and that Rubygem, Fortuna and Festival are the most frequently used strawberry varieties. Seedling costs were ranked number one among all strawberry establishment costs per decare in farms, while labor was ranked number one among all production costs. It was determined as a result of the present study that gross profit, net profit and relative return per decare increases with increasing group size. Therefore, it was determined that larger farms are more advantageous than smaller farms with regard to economic criteria.

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