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Research Article

# Contribution of Different Production Methods to Producer Income: Strawberries Production in Turkey

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**ABSTRACT**
The aim of this study is to compare the profitability of two different strawberry production methods and reveal their contribution to producer income. In this study, face-to-face interviews were made with 100 producers producing strawberries in open-field and greenhouse in Mersin province. 62 of these producers produce strawberries open-field, 38 of them greenhouses (high tunnel). The profitability of the producers has been calculated and compared with the t-test according to their production methods. Results show that there are statistically significant differences between open-field and greenhouses according to cost element (variable, fixed and total cost), gross product value, profit elements (gross profit and net profit) and breakeven point. Strawberry production in greenhouses has resulted in higher gross profit, net profit and breakeven point. According to results, it can be said that strawberry production in greenhouses was more profitable than open-field production.
**Keywords:** Strawberry, cost, profit, Turkey, production
**JEL CODE:** Q12, M41

# Farklı Üretim Yöntemlerinin Üretici Gelirine Katkısı: Türkiye'de Çilek Üretimi

**ÖZ**
Bu çalışmanın amacı iki farklı çilek üretim yönteminin karlılığını karşılaştırarak üretici gelirine katkısını ortaya koymaktır. Çalışma kapsamında Mersin ilinde açıkta ve örtüaltında çilek üretimi yapan 100 adet üretici ile yüz yüze görüşülmüştür. Bu üreticilerin 62'si açıkta, 38'i örtüaltında (yüksek tünel) çilek üretimi yapmaktadır. Üreticilerin karlılıkları hesaplanmış ve üretim yöntemlerine göre t-testi ile karşılaştırılmıştır. Araştırma sonuçlarına göre açıkta ve örtüaltında yetiştiricilik yapmak arasında masraf unsurları (değişken, sabit ve toplam masraf), brüt ürün değeri (brüt ve net kar) ve başabaş noktası bakımından istatistiki olarak önemli farklar bulunmaktadır. Örtüaltında çilek yetiştiriciliği daha yüksek brüt kar, net kar ve başabaş noktasına sahiptir. Araştırma sonucunda örtüaltında çilek üretimi yapmanın açıkta üretim yapmaya göre daha karlı olduğu söylenebilir.
**Anahtar Kelimeler:** Çilek, maliyet, karlılık, Türkiye, Üretim

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## Introduction

Strawberry is one of the most popular and commonly consumed berries in the world in the human diet and also one of the best sources of vitamin C. It is also nutritious, attractive and flavorful. A cup of strawberries will supply more than the recommended human daily requirement of vitamin C with only 55 calories (Dickerson, 2004). Strawberries have high antioxidant activity, which has been linked to the content of their phenolic compounds. The phenolic compounds in strawberry extract exhibit high levels of antioxidant capacity against superoxide radicals, hydrogen peroxide, hydroxyl radicals, and singlet oxygen free radicals (Zhang et al., 2008).

Strawberry is produced without using high-level input after investment and marketed as raw material and as proceed in the food industry. An increase in strawberry production contributes to the growth of the industries that use the product as raw material and thus, this creates new employment opportunities in the rural area (Kaya et al., 2016). In Turkey, the Ministry of Agriculture and Forestry supports greenhouse production to provide agricultural and social development, improve agricultural and non-agricultural employment and create new income opportunities, increase income –giving priority for women and youth – within the "Rural Development Investment Program" between 2016 and 2020. In this programme, producers are granted a certain amount of money (REGA, 2016). Also, The Ministry of Agriculture and Forestry has supported the production of strawberry via some other instruments. One of the most important instruments was certified strawberry seedling support to provide a certain quality. Besides this support instrument, indirectly, field-based supports such as fuel oil support, fertilizer support and soil analysis are given.

In Turkey, especially in Mersin, strawberries production has witnessed an important increase recently. In this area, strawberries production is quite important to be offered to the market, although other fruits in this area are not even common in the market, as a result of this, it has been convenient for small family farming to thrive in strawberries production and to have export potential. In Mersin, strawberries are produced by using two different methods. These are open-field and greenhouses. Between 2000 and 2016, the production of strawberries has increased from 130 000 tons to 415 150 tons. During this period, the amount of strawberries export increased from 10 000 tons to 29 000 tons. Strawberries are substantially produced in Mersin, in Turkey (40%). In Mersin between 2000 and 2016, strawberries production went up from 61 685 tons to 164 988 tons. During this period in Mersin, the rate at which people produce strawberries in greenhouse increased from 4.41% to 38.6%.

The production of strawberry in greenhouses between July-September has given room for good business opportunities and this reduces the excessive supply of strawberries during the peak season. The avoidance of over-supply would result in higher and more stable selling prices and more efficient use of machinery and labour resources on family farms. A regular supply of strawberries from early spring until the end of the year would also assist in the development of markets (Türemiş, 2002). Despite its high capital and labour input, out of season strawberry production has the potential to increase farm income and to provide new employment opportunities in rural areas (Njavro and Duralija, 2006). Greenhouse strawberry production is becoming popular for commercial purpose, especially because of its effect on precocity and fruit quality. High tunnels are the most common type of protected cultivation followed by mini tunnels. Plastic greenhouses are used for the production of early fruits in late winter and early spring (Serce and Özgen, 2018). The average size of strawberry farms is very small in Turkey. In the literature, there are some studies on the strawberries market (Aygören et al., 2014; Nacar, 2012; Akbulut et al., 2016; Gecer et al., 2016: Ertürk et al., 2016; Güneş et. al., 2017, Kafkas, 2017; UİB, 2017; Serçe ve Özgen, 2018). Otherwise, Sarılı (2010) and Ağır et al. (2014) aimed to reveal strawberries production cost in certain regions in Turkey. Ağır et al. (2014) investigated the risk factors and strategies in strawberry production in the Menemen district, İzmir. Tok et al., (2014) focused on factors affecting the decision of producers of

strawberries production in Aydın district. Also, Polat (2005) and Akın (2008) dealt with the possibilities growing organic strawberry in Aksehir and Ayas districts, respectively. This literature review shows that there is no study to reveal strawberry production costs of production systems (open-field and greenhouses) in Turkey. The aim of this study is to examine the contribution of strawberry production to produce income by comparing strawberries production profit in these two ways of calculating costs and benefits.

The aim of this study is to analysis contribution of different strawberry production methods to producer income in Turkey

## Materials And Methods

### Material

The basic material was the primary data collected from the surveys answered by the producers of strawberries. The study was conducted between the 2016-2017 production seasons. The data were gathered in July and August 2017. The questionnaire was divided into 3 parts to collect necessary information about farmers' demographic characteristics, farms' general characteristics and cost elements

**Area of study:** The study was carried out in Mersin. In 2016, the province has 40% of strawberries production in Turkey (TURKSTAT, 2017). Mersin is a large province and a port on the Mediterranean coast of southern Turkey. The city occupies an estimated area of 15 853 km2 and the population of the province is 1 773 852 (TURKSTAT, 2017).

The total agricultural land in Mersin is 406 000 hectares. 65% of this land is reserved for dry agriculture and 35% is reserved for irrigated agriculture. A wide range of products is grown in Mersin. Field plants are mainly produced due to the density of dry agricultural fields and the number one product is wheat, which is widespread in the counties of Tarsus and Mut. Citrus, banana, apricot, strawberry, apple and cherry are mainly grown in irrigated fields. Strawberry harvest season, which is around 4 months in Turkey, has been extended to 8 months in Silifke. The microclimatic climate of Anamur enables the growth of a sub-tropic greenhouse product named the Anamur banana. One-third of Turkey's yearly banana needs are provided by Anamur (CKA, 2014).

**The Method to Define Sample Size:** The research area was defined as Mersin that meets 36.3% of Turkey's strawberry production in 2015. Anamur and Silifke districts were selected by the "Purposive Sampling Method", based on their shares in total area planted and production in this province. These two districts accounted for 98.5% of total strawberry cultivation areas and 98.4% of total strawberry production in Mersin (TURKSTAT, 2017). The villages were selected in the purposive sampling method according to their shares in the total strawberries area and production (9 villages in Anamur and 8 villages in Silifke).

Strawberries producers in these villages consisted of a frame list of the study. The number of samples of producers was determined as 100 persons with a 10% margin of error and 95% confidence limits by using the "Stratified Sampling Method". Neyman approach was employed in distributing the sample farms to the strata. With this approach, 62 farms for open-field and 38 farms for greenhouse strawberry producers were randomly selected and interviewed (Table 1). Fallowing equations were used in stratified sampling:

$$n = \frac{\left(\sum N_h S_h\right)^2}{N^2 D^2 + \sum N_h {S_h}^2} \qquad (1)$$

$$D = \frac{d}{z} \qquad (1a)$$

$$n_h = n * \frac{N_h S_h}{\sum N_h S_h} \qquad (2)$$

where, n is the total number of samples required; N is the total number of enterprises; Nh is the number of enterprises in the relevant layer; Sh is the variance of the relevant layer; D is the desired variance; d is the allowable deviation from the mean; z indicates the value corresponding to the selected sensitivity level.

**Table 1.** Distribution of Farms Strawberries Area Width Groups

| Open-field | Nh | ni | Greenhouse | Nh | ni |
|---|---|---|---|---|---|
| **0-10** | 419 | 18 | **0-5** | 219 | 19 |
| **11-50** | 183 | 22 | **6-20** | 48 | 10 |
| **50<** | 46 | 22 | **20<** | 7 | 9 |
| **Total** | 648 | 62 | **Total** | 274 | 38 |

**Method to Analyze the Economic Structure of Farms:** The results were presented in the form of tables for each farm size group separately and one table was prepared for the whole sample.

Production costs consist of fixed and variable expenses (İnan, 2006). Farmland rent and administrative overhead were calculated as the fixed cost components. Variable expenses cover costs for seeds, fertilizers, pesticides, labor, water, machinery lease, crop sale and transportation. The analysis covers physical quantities of inputs such as fertilizers, seeds and chemical pesticides, and the costs which are paid for these inputs. In calculating costs, enterprise, budget analysis was employed. When the own sources of the farm are used, these sources are priced based on the alternative cost (opportunity cost) principle. All prices were exchanged from the Turkish Lira to Euro with the exchange rate in 2017 mid-year. The exchange rate was 1 €=4 TL.

An agricultural loan interest rate of Ziraat Bank of the Turkish Republic was used for calculating the interest cost of circulating capital. This interest rate was determined as 10% for 2017. It was assumed that variable expenses are distributed homogenously and interest cost was calculated for the crop growing period. According to interviews with producers and intermediates, the withholding rate was defined as 13% in the area.

General administrative expenses consist of the costs of common services such as management, administration, and all production activities. Generally, 3% of total production expenses is calculated as administrative overhead in the field of agricultural management (Kıral et al., 1999).

In the study, depreciation for greenhouse structures and equipment was calculated using Eq. (1):

Depreciation = (Purchase Price - Salvage Value) /Number of Years of Life ……. (1)

- Gross Production Value (GPV) was the total value of the main product and by-products obtained from strawberry.
- Gross profit was calculated as GPV minus variable costs;
- Net profit was calculated as GPV minus total production costs.
- Relative profit was obtained by dividing the gross production value of the cost of production.
- The Breakeven level of efficiency was obtained by dividing production costs by sales prices.

Gross margin and Net Profit analyses were used to determine and compare the profitability levels for both greenhouse and open-field strawberry production systems. The Breakeven point is quite important since it shows the lowest production level protecting the producer against the losses and helps to choose the most profitable crop combinations. In addition to these, a t-test was carried out to determine the statistical difference of computing gross margins and net profits per decare between the open-field and greenhouse strawberry growers. It is revealed that there is a difference between production systems. At this point, the hypothesis of the research are given below,

Hypothesis 1: Variable cost is different between open-field areas and greenhouses.

Hypothesis 2: Fixed cost is different between open-field area and greenhouses.

Hypothesis 3: Total cost is different between open-field areas and greenhouses.

Hypothesis 4: Gross Product value is different between the open-field areas and greenhouses.

Hypothesis 5: Gross profit is different between open-field areas and greenhouses.

Hypothesis 6: Net profit is different between open-field areas and greenhouses.
Hypothesis 7: Breakeven Point is different between open-field areas and greenhouses.

## RESULTS

In the research area, strawberries producers' age, education level, household size, agricultural experience duration, farm size and strawberries planted area were given in Table 2. In the open-field strawberries area, producers were 50.7 years old and have education 8.6 years averagely. In this production system, the average farm size was 49.9 da and strawberries' land size was 36.8 da. In other words, the share of the strawberries land area in total farm size was 73.7%. In the greenhouses strawberries area, producers were 51.5 and have education 8.3 years. The average farm size and strawberries land size are quite different from the open-field production system. These were defined as 99.8 da and 61.9 da, respectively. Namely, the share of strawberries land size occurred at 62.0% of total farmland.

**Table 2.** Comparison of Strawberry Farmers' Socio-Economic Characteristics

| Characteristic | Open-field | | | | Greenhouse | | | |
|---|---|---|---|---|---|---|---|---|
| | **<10** | **11-50** | **50<** | **Mean** | **<5** | **6-20** | **20<** | **Mean** |
| **Producer age** | 46.8 | 49.4 | 55.2 | 50.7 | 52.4 | 45.2 | 56.5 | 51.5 |
| **Education level (years)** | 9.8 | 8.5 | 7.5 | 8.6 | 7.7 | 9.1 | 8.5 | 8.3 |
| **Household size** | 3.3 | 3.7 | 3.2 | 3.4 | 3.8 | 4.2 | 4.2 | 4.0 |
| **Farm size (da)** | 17.9 | 30.9 | 95.3 | 49.9 | 15.7 | 19.6 | 366.6 | 99.8 |
| **Strawberry land size (da)** | 8.8 | 23.5 | 73.2 | 36.8 | 4.3 | 13.6 | 231.1 | 61.9 |
| **Agricultural production experience (years)** | 27.6 | 30.3 | 32.4 | 30.3 | 30.0 | 28.0 | 34.6 | 30.6 |
| **Strawberry production experience (years)** | 22.3 | 27.8 | 30.5 | 27.2 | 25.7 | 20.0 | 29.6 | 25.4 |

All characteristics except for total farm size and strawberry land size between two production systems were similar averagely. However, according to the t-test, there was no statistically significant difference in terms of socio-economic characteristics between open-field and greenhouses strawberry production systems.
A study conducted in the Emiralem District at İzmir Province producers' age was 48.26 years in open-field production while 51.55 years in the green-houses; strawberry production experience was 27.2 years in open-field production while 25.4 years in the green-houses (Ağır et al., 2014). These indicators are higher than the research area.
Comparing the Cost of greenhouse and open-field strawberry production: The total cost of outdoor strawberry production in the research area was determined as 2 693.80 €. To provide the production variable cost was 2 237.10 €, while the fixed cost was 456.70 €. Accordingly, the average cost of 1 kg of strawberries production is 0.72 €. The cost of strawberry production in greenhouses is 3 362.70 € per decare. Within this cost, the variable cost was 2 801.50 € and the fixed cost was 561.20 €. Thus, the cost of producing 1 kg of strawberry is 0.73 €. As the farm size increases, the production costs per decare and the unit quantity decrease.
In the research area, strawberries' cost (variable, fixed and total), yield, selling price, income and revenue (gross margin and net profit) in open-field farms and greenhouses were presented averagely in Table 3.

**Table 3.** Cost Elements of Strawberry Production (Euro/da)

| Cost Elements | Open-field | | | | Greenhouse | | | |
|---|---|---|---|---|---|---|---|---|
| | **<10** | **11-50** | **50<** | **Ort.** | **<5** | **6-20** | **20<** | **Ort.** |
| Machine Power | 38.76 | 65.45 | 53.87 | 53.59 | 63.68 | 61.63 | 64.27 | 63.28 |
| Labor Cost | 821.02 | 802.01 | 798.03 | 806.12 | 1 035.17 | 1 055.97 | 1 082.08 | 1 051.55 |
| Seedling | 417.28 | 410.92 | 418.63 | 415.5 | 414.16 | 416.21 | 418.63 | 415.76 |
| Fertilizer | 200.57 | 209.56 | 211.28 | 207.56 | 205.03 | 195.52 | 205.89 | 202.73 |
| Plant Protection | 46.62 | 47.15 | 47.12 | 46.98 | 46.78 | 47.05 | 47.29 | 46.97 |
| Plastic mulching | - | - | - | - | 164.15 | 166.9 | 167.55 | 165.68 |
| Irrigation system | 20.78 | 17.17 | 11.66 | 16.26 | 26.6 | 33.04 | 22.13 | 27.24 |
| Irrigation | 143.38 | 143.38 | 143.38 | 143.38 | 143.38 | 143.38 | 143.38 | 143.38 |
| Electricity | 18.9 | 10.89 | 8.9 | 12.51 | 32.09 | 38.14 | 33.45 | 34 |
| Fuel oil | 20.82 | 17.09 | 15.32 | 17.54 | 21.7 | 29.34 | 22.1 | 23.8 |
| Transportation | 19.94 | 14.75 | 14.55 | 16.19 | 21.57 | 38.8 | 25.6 | 27.06 |
| Agricultural loan interest | 193.09 | 191.83 | 189.8 | 191.48 | 257.16 | 267.91 | 268.35 | 262.64 |
| Withholding | 309.54 | 310.28 | 311.44 | 310.93 | 327.54 | 349.58 | 346.62 | 337.86 |
| **Variable Cost** | **2249.89** | **2239.89** | **2223.80** | **2237.10** | **2758.12** | **2843.23** | **2846.72** | **2801.50** |
| General Administrative Expenses | 82.08 | 80.64 | 79.95 | 80.81 | 99.16 | 103.06 | 102.08 | 100.88 |
| Field Lease | 404.16 | 367.01 | 361.42 | 375.89 | 448.21 | 489.06 | 453.83 | 460.32 |
| **Fixed Cost** | **486.24** | **447.65** | **441.37** | **456.70** | **547.37** | **592.12** | **555.91** | **561.20** |
| **Total Cost** | **2736.12** | **2687.89** | **2665.16** | **2.693.80** | **3305.49** | **3435.34** | **3402.63** | **3362.70** |
| Yield (kg/da) | 3734.83 | 3706.18 | 3744.95 | 3728.26 | 4545.58 | 4695.00 | 4700.56 | 4617.92 |
| **Cost per kg (€/kg)** | **0.73** | **0.73** | **0.71** | **0.72** | **0.73** | **0.73** | **0.72** | **0.73** |

In the open-field strawberries farms, the total cost was defined as 2 693.80 €/da. The share of variable and fixed costs in the total cost was 83.05% and 16.95%, respectively. In these farms, the yield was 3 728.30 kg/da and the selling price 0.825 €/kg. Thus, the gross product value was calculated as 3 081.28 €/da. While in the greenhouses strawberries farms, the total cost was 3 362.70 €/da and of which 83.31% variable cost and 16.69% fixed cost. In this production system, farmers had 3 873.73 €/da gross product value, depending on the yield 4 617.90 kg/da and the selling price 0.839 €/kg (Table 4).

**Table 4.** Cost and profitability comparison of Strawberry Farmers

| Parameters | Open-field | | | | Green house | | | |
|---|---|---|---|---|---|---|---|---|
| | **<10** | **11-50** | **50<** | **Mean** | **<5** | **6-20** | **20<** | **Mean** |
| **Total variable costs (€/da)** | 2 249.89 | 2 239.89 | 2 223.80 | 2 237.10 | 2 758.12 | 2 843.23 | 2 846.72 | 2 801.50 |
| **Total fixed costs (€/da)** | 486.24 | 447.65 | 441.37 | 456.70 | 547.37 | 592.12 | 555.91 | 561.20 |
| **Total cost (€/da)** | 2 736.12 | 2 687.89 | 2 665.16 | 2 693.80 | 3 305.49 | 3 435.34 | 3 402.63 | 3 362.70 |
| **Yield (kg/da)** | 3 734.8 | 3 706.2 | 3 745.0 | 3 728.30 | 4 545.6 | 4 681 | 4 700.6 | 4 617.9 |
| **Price (€/kg)** | 0.830 | 0.826 | 0.824 | 0.825 | 0.834 | 0.847 | 0.838 | 0.839 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gross Product value (€/da)** | 3 102.00 | 3 060.29 | 3 085.33 | 3 081.28 | 3 791.90 | 3 966.65 | 3 943.24 | 3 873.73 |
| **Income-stoppage (€/da)** | 2 698.74 | 2 662.45 | 2 684.23 | 2 680.70 | 3 298.95 | 3 450.99 | 3 430.62 | 3 370.14 |
| **Gross profit (€/da)** | **448.85** | **422.56** | **460.44** | **443.64** | **540.83** | **607.76** | **583.89** | **568.64** |
| **Net profit (€/da)** | **-37.38** | **-25.44** | **19.07** | **-13.11** | **-6.54** | **15.64** | **27.99** | **7.48** |
| **Relative Profit** | **1.13** | **1.14** | **1.16** | **1.14** | **1.15** | **1.15** | **1.16** | **1.15** |
| **Breakeven Point (€/da)** | **3 296.53** | **3 254.10** | **3 234.42** | **3 265.21** | **3 963.42** | **4 055.89** | **4 060.42** | **4 007.99** |

Profitability in agricultural production is expressed by a wide range of measures which are generally gross profit, net profit, relative profit and breakeven point. In the open-field farms, profitability was found 443.64 €/da as gross profit, -13.11 €/da as net profit, 1.14 as relative profit and 3 265.21 €/da as the breakeven point. In the greenhouses farms, the measures were found 568.64 €/da, 7.48 €/da, 1.15 and 4 007.99 €/da, respectively (Table 4).

A previous study in Izmir by Ağır et al. (2014) shows that the ratio of variable costs is 62.38% in open costs and 62.42% in greenhouses. In a study conducted in Meghalaya, the rate of variable costs in the open-field was found to be 96.10%. This study is similar to other studies conducted in Turkey.

Producers' cost (variable cost, fixed cost and total cost) and profitability (gross profit, net profit, relative profit and breakeven point) parameters were compared between open-field and greenhouses production systems. According to the results, there were statistically significant differences between two production systems in all parameters (Table 5).

**Table 5.** Statistical Analysis of Strawberry Production Systems

| **Parameter** | **t-ratio** | **Sig.** |
|---|---|---|
| **Variable costs** | 47.77 | 0.00 |
| **Fixed costs** | 12.81 | 0.00 |
| **Total cost** | 47.68 | 0.00 |
| **Gross product value** | 49.15 | 0.00 |
| **Gross profit** | 13.72 | 0.00 |
| **Net profit** | 4.17 | 0.00 |
| **Breakeven Point** | 46.03 | 0.00 |

According to the findings, the hypotheses are evaluated at below. Results show that there are statistically significant differences between open-field areas and greenhouses according to cost element (variable, fixed and total cost), gross product value, profit elements (gross profit and net profit) and breakeven point (Table 6).

**Table 6.** Evaluation of the Hypotheses

| **Hypotheses** | **Evaluation** |
|---|---|
| Hypothesis 1: Variable cost is different between open-field areas and greenhouses. | Accepted |
| Hypothesis 2: Fixed cost is different between open-field area and greenhouses. | Accepted |
| Hypothesis 3: Total cost is different between open-field areas and greenhouses. | Accepted |
| Hypothesis 4: Gross product value is different between the open-field area and greenhouses. | Accepted |
| Hypothesis 5: Gross profit is different between open-field areas and greenhouses. | Accepted |

| | |
|---|---|
| Hypothesis 6: Net profit is different between open-field areas and greenhouses. | Accepted |
| Hypothesis 7: Breakeven point is different between the open-field area and greenhouses | Accepted |

**Discussion and Conclusion**

Strawberries export has an increasing tendency and makes it considerable for both export revenue and income in the rural population. Mersin has the biggest share of total strawberry planted area and production. Strawberry is produced in an open-field area traditionally and in greenhouses recently. In the study, costs and profits (gross profit, net profit, relative profit and breakeven point) were defined to make comparisons between these production systems.

As a result of the study, the farmers had similar average age, education, household size farm size, agricultural production experience and strawberries production experience. However, the strawberries land size was quite different between the two production systems. So, it is much higher in greenhouses than open-field area.

Variable and fixed costs were higher in greenhouses than open-field area. Production in greenhouses needs more fixed costs (building greenhouse) and variable cost (especially labor cost). Consequently, the total cost was higher in greenhouses. The yield was 1.24 times higher in greenhouse farms than in open-field farms. Also, the selling price was higher in greenhouse farms than in open-field farms. This difference came from harvesting seasons of these production systems. Strawberries in the greenhouses are harvested 2 or 3 months earlier than the product in open-field areas. Since the supply is a few quantities, consumer demand results in higher prices than the normal season.

Thus, strawberry production in greenhouses has resulted in higher gross profit, net profit and breakeven point. These indicators were found statistically significant between the production systems. According to results, it can be said that strawberry production in greenhouses was more profitable than open-field production. In other words, all hypotheses are accepted according to both cost and profit indicators.

Although the research area, the farmers have reasonable prices, yield and gross profit, there are some important problems such as high input prices and the prevalence of small scale farming. Producing organizations about using input (seedling, fertilizer or machinery) may present easier input availability to farmers. When the problem of high input prices on small scale farms is solved, rural development can be provided.

Net profit was calculated as negative and as the scale of the farms grows, the relative profit increases. Therefore, practices and policies to increase the farm scales will lead to an increase in producer revenues.

Contract farming helps farmers to provide input, credit and new technologies. It also specifies price in advance and reduces price risk. Especially small farmers can have benefit from this system. Promoting contract farming for production, processing and export purposes may contribute to strawberry farmers' income and rural development.

There are different technological technics used in strawberry growing. Strawberry is mainly grown in the soil under open field conditions. A significant area is left bare between strawberry rows in such production systems. It is grown with other crops such as lentils, lettuce, radish, onion. Turning strawberry monocultures into sustainable food and farming systems provide increased farm income and efficiency of capital. It is thought (estimated) that producers know differences in income between two production systems. Notwithstanding, 60% of the total open field area is used for the strawberry production. This preference resulted from higher costs of both operation and production, and also the difficulties in financing it. Therefore, the support to the farmer that produces strawberry through the financing of their production will help them to cover their cost of production. In this case, the income of strawberry producers will increase in the region.

Training and extension studies aimed at raising the awareness of the technical knowledge levels about the production of strawberry will lead to

an improvement in the yield and quality of the strawberry in the region, thus improving the incomes.

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