Cost and gross profit analysis in oily Sunflower *(Helianthus Annuus, L.)* Production: the case of Canakkale province, Turkey

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Abstract

World sunflower production in 2019 amounted to 56 million tons on an area of about 27 million ha. Turkey ranks 9th in sunflower cultivation areas worldwide and 7th in production quantity. However, the self-sufficiency rate in the country's oily sunflower is 60%. This situation causes Turkey to receive a 33% share of world oily sunflower imports. The aim of this research is to determine the physical production inputs used in rainfed conditions in agricultural enterprises in Canakkale province located in the European region of Turkey according to the enterprise size groups and to examine in detail the elements that make up the product cost. The data used in the research have been obtained through surveys from 75 agricultural enterprises determined by the " *Stratified Sampling Method* ". The enterprises examined in the research have been evaluated within 4 size groups according to their oily sunflower production areas. In order to obtain an average yield of 236.93 kg da^{-1} in oily sunflower production in the enterprises examined; 374.60 g seeds, 21.27 kg of chemical fertilizer, 297 cc of agricultural medicine, 147.58 minutes of machine labor force and 13.74 lt diesel input were needed. According to the enterprise average, the production cost of oily sunflower is $77.21 da^{-1}, and the lowest cost belongs to large enterprises with a figure of $74.17 da^{-1}. According to the research results, the average cost of oily sunflower per kg of enterprises has been determined as $0.33, and the lowest cost has been obtained from small businesses with a figure of $0.31 da^{-1}. In the general context of the enterprises, the production value of oily sunflower is $86.61 da^{-1}, gross profit is $33.60 da^{-1}, net profit has been calculated as $9.40 da^{-1}. In the study, the ratio of average gross profit value of oily sunflower to the production value of the product is 38.79%, and the relative profit ratio is1.12. In the study, it has been concluded that the average productivity value in sunflower production is 3.07 kg $$^{-1}$ and the break-even point value indicating land crossing in production is 208.68 kg da^{-1}. The results of the study reveal that government-provided supports in the studied enterprises can provide an increase of 24.97% in the income generated from the unit area in sunflower. The research conducted have also revealed that the criteria of yield value, production value, cost per kg, gross profit and net profit and relative profit ratio are the highest in the first group of enterprises. In other words, the research findings showed that among the studied enterprises, small-scale enterprises work more efficiently and productively than the enterprises in other groups, but also behaved more rationally in the use of input.

Keywords: Oily sunflower; Economic analysis; Cost; Gross profit; Relative profit; Productivity; Turkey.

1. Introduction

Sunflower (*Helianthus annuus L.)* is one of the significant oil plants of today. Sunflower oil occupies the first place among the preferred vegetable oils in terms of cooking quality. Accordingly, sunflower cultivation is carried out at the economic level in many countries around the world (Karata,1992).

It is observed that the sector of oil seeds, vegetable oils and products in the world and Turkey has gained great momentum in recent times. It is understood that the global oilseeds and vegetable oil market has been in a highly growing trend over the past years. However, the increase of bio fuel demand also positively affects oilseed production (Onat et al., 2017).

Oil production comes to the fro in the use of oilseeds for food purposes. In addition to oil production, some of these plants can also be used as additives to flour and other foodstuffs. Wastes resulting from the processing of these products are also utilized as feed raw materials or additives (Güleş, 2016).

In the 2018/2019 production year, sunflower cultivation was carried out on 26.3 million hectares in the world and 1.9 tons of yield per hectare were obtained. Production increased by 7.6% compared to the previous season. In the same season, a total of 51,300,000 tons of sunflower production took place in the world. It is predicted that 53,500,000 tons of sunflower will be produced in the 2019/2020 production period with an increase of 4.2% compared to the previous production period. Sunflower seed exports in the world are at a very low level compared to oil. The bulk amount of exports are made as crude oil after crushing process. Only 5.2% of sunflower seeds produced during the 2017 production period were exported (USDA, 2020).

Sunflower production in Turkey was at the level of 1,950,000 tons as of the end of 2019. In Turkey, among oilseed plants, sunflower occupies the first place in terms of planting area and production quantity. Nearly 50% of vegetable oils produced in Turkey are obtained from sunflower (TÜİK, 2020).

In Turkey, 69% of vegetable oil production, about 84% of total oil consumption, 32% of total oil consumption is covered from sunflower. However, due to the fact that sunflower oil produced in the country cannot meet the demand, a significant part of the demand is met by the import of sunflower seeds and oil (Gül et al., 2016).

According to 2019 data from the Food and Agriculture Organization of the United Nations (FAO), sunflower planting area has increased in the last 10 years. In 2019, the production area of oily sunflower reached 27.4 million ha, and the production amount reached

56,000,000 tons. According to the data of the same year, the Russian Federation takes the first place in the world oilseed sunflower planting areas with 8,410,000 ha, while Ukraine follows this country with 5,950,000 ha, and Turkey ranks 9th with 751.000 ha (FAO, 2021). Nevertheless, in terms of production amount, the Russian Federation is in the first place with 15,370,000 tons, Ukraine is in second place with 15.250.000 tons, and Turkey is in 6th place with 2,100,000 tons.

According to FAO data for 2019, Israel ranks first with 437.84 kg da^{-1} in terms of oily sunflower yields, Uzbekistan is second with 406.42 kg da^{-1}, while Turkey ranks 11th with 279.37 kg da^{-1} worldwide in yield value (FAO, 2021).

Although it is among the most important sunflower producing countries in the world, Turkey's qualification rating of this plant is 60.1% as for the year 2019 and the remainder part is met by import (TUIK, 2020). Even though Turkey's 2019 oily sunflower production was 2.1 million tons and the planting area was 752,632 ha, in the same year 568,306,000$ was paid for 1,239,492 tons of oily sunflower imports in order to meet the demand (FAO, 2021).

Turkey's oily sunflower production area in 2021 was 811.312 ha, production amount was 2,215,000 tons, and the yield was 273 kg da^{-1}. The province of Canakkale, which is determined as the research area, is in 7th place with a share of 2.70% in the country's oily sunflower planting areas and 8th place with a share of 2.81% in the production amount. The yield value in the production of oilseed sunflower of the province is 285 kg da^{-1}, which ranks 16th all across the country (TUIK, 2021).

With the help of the data obtained in this research, the production value of the product, variable costs, fixed costs, production cost, gross profit, net profit, relative profit ratio, production ratio, and break-even production amount have been calculated in sunflower production. The research findings calculated in the study have been examined and analyzed comparatively with the findings obtained from studies on the economics of oily sunflower production in different regions and countries where oily sunflower production is intensive. Based on the findings obtained as a result of the research, recommendations have been made to increase the yield value of oily sunflower production in the studied enterprises, to use inputs more rationally and to make a more profitable production.

2. Literature Review

Effective use of resources and efficiency in agricultural production are of great importance for the country's economy and producer welfare. Inasmuch as the optimal use of

production factors could significantly reduce production costs. Various studies have been carried out on the use of input and determination of resource efficacy in oilseed sunflower production worldwide (Badar et al. 2002; MousaviAvval et al., 2011; Lekunze et al. 2011; Bagherzadeh and Kazemzadeh, 2012; Suneetha and Illuru, 2014; Irugu et al., 2017; Sonawane et al., 2019). It is also understood that recent studies on economic analysis of oily sunflower production have also increased in the literature (Bosnjak and Rodic, 2004; Todorović et al., 2010; Knežević and Popović, 2011; Sethar et al., 2015; Khatun et al., 2016; Arya and Zechariah, 2018; Das and Rout, 2018; Ceran and Topak, 2020; Kamugisha et al., 2020; Sunandini and Devi, 2020; Slobodianyk et al., 2021). Information on research carried out in different regions and countries of the world in the production of oilseed sunflower is summarized at the bottom.

Oğuz and Altıntaş (2002) conducted an economic analysis of oilseed sunflower cultivation in Kırıkkale province with the help of data obtained from 95 agricultural enterprises. In the same study, the ratio of gross profit, net profit and relative profit were determined. In research conducted by Bayramoğlu et al. (2005), the share of changing costs in sunflower production was calculated as 42.10% and the share of fixed costs as 57.90%.

Todorović et al. (2010), in their study analyzed oily sunflower production in family businesses in Serbia. Within the scope of the study, enterprises were evaluated in 4 different size groups according to their yield values obtained from the unit area. The study revealed that the gross profit and net profit value were positive only in enterprises producing sunflower at 400 kg da^{-1} and above.

In a study conducted by MousaviAvval et al. (2011) the relationship between input costs and yield in sunflower production was determined with the help of functional analysis. For the yield of 162.65 kg da^{-1} in the research field; production value was determined as \$92.71 da^{-1}, product cost as \$82.26 da^{-1}, net profit as \$10.45 da^{-1} and benefit / cost ratio was calculated as 1.98. The study revealed that labor and machine inputs had the highest share in cost.

In another study conducted by Uzundumlu and Topçu (2012), it was found that the share of costs ranging from snack sunflower was 73% and it was concluded that among the varied factors, fertilizers, seeds and irrigation water were used the most. According to the results of the study, the share of variable costs in the cost of producing sunflower, snack sunflower was 73%, due to varying factors, fertilizers, seeds and irrigation water were used in excess, while the labor force used in maintenance work resulted in lower levels and this resulted in decreases in yield. Thus, the unit snack sunflower production cost was calculated

as \$1.05 kg^{-1}, and the product sales price was set as \$0.84 kg^{-1}. As a result of this, net profit was found to be \$-46.01 da^{-1}, as the total cost of production exceeded the total production value.

Semerci (2013a) found that in Turkey, which ranks 10^{th} worldwide in sunflower production, 55% of sunflower production is carried out in Thrace Region. Agricultural enterprises producing oilseed sunflowers in Thrace Region have been investigated economically. Semerci (2013b) studied the use of production factors in 3 different sunflower production depending on orobanche resistance in agricultural enterprises in Thrace Region.

In another study, the production costs and marketing structures of the main field crops were examined. The gross profit of oily sunflower was calculated as \$99.37 da^{-1} and the relative profit ratio was determined as 1.34. In the same study, variable costs accounted for 51.70% of production costs in sunflower production enterprises and fixed costs accounted for 48.30% (Alemdar et al., 2014).

In a study conducted by Aydın (2014) in Thrace, the oily sunflower production was calculated for the yield of 153 kg da^{-1}; variable costs were found as \$79.99 da^{-1}, fixed costs were \$102.92 da^{-1}, and production costs were \$182.92 da^{-1}. The cost of sunflowers per kg in the study was determined at \$0.836. In their study Sethar et al. (2015) determined production value, product cost and net profit values in oily sunflower production.

Top and Özükurr (2016) examined sunflower production in the provinces of Edirne, Tekirdag, Kirklareli, Adana and Canakkale from an economic point of view. The study evaluated in detail the support policies applied in oily sunflower production enterprises considering difference payment support, input support, single payment system and target price support policies, high yield, high profit, ease of payment and marketing.

In a study by Irugu et al. (2017), econometric analysis study of oily sunflower production was carried out. Das and Rout (2018) carried out the economic analysis of oily sunflower production within the scope of their project. Karaağaç et al. (2018), in their study, made an evaluation of energy balance and economic analysis of oily sunflower production carried in Adana in the year of 2017. In the economic analysis of sunflower production, it has been presented that the total input amount is \$91.38 da^{-1}, the output amount is \$133.33 da^{-1}, and the net income is \$41.94 da^{-1}.

In the research carried out by Unakıtan and Aydın (2018) in Tekirdağ province, Turkey, an economic analysis of the product was carried out by giving the amount of inputs used per unit area in the production of oily sunflower. In the research, the production cost was calculated as \$110.61 da^{-1}, including production value \$113.20 da^{-1}, variable costs \$48.38

da^{-1}, fixed costs \$62.24 da^{-1} for yield of 153.0 kg da^{-1}. The gross profit of oily sunflower was calculated as \$64.85 da^{-1}, net profit value as \$2.61 da^{-1}, cost per kg as \$1.39 and benefit/cost ratio as 1.02.

In a study carried out by Dalchiavon et al. (2019) in Brazil, cost of sunflower production for the year of 2018 was determined as R\$14570.1 da^{-1} and monetary value of the inputs as R\$10230.7 da^{-1}. In the study of Mgeni et al. (2019), welfare effects of the sunflower value chain for the rural economy in Tanzania were evaluated. The findings, primarily economic sectors were analyzed at the village level.

In the study carried out in Kırklareli province for oily sunflower in dry conditions, the gross profit value for the 2017/2018 production period was determined as \$81.08 da^{-1}, the net profit value as \$45.0 da^{-1} and the relative profit ratio as \$1.45 (Semerci, 2019a). In the same period and in dry conditions, in the study conducted in Tekirdag province in relation to oily sunflower, gross profit was determined as \$78.13 da^{-1}, net profit as \$41.57 da^{-1}, relative profit of \$1.43 (Semerci, 2019b). In a study conducted by Sonawane et al. (2019) in India, the data from 450 sunflower producers were obtained. The relationship between input and output in sunflower production was determined by econometric analysis.

In another study, it was noted that for the average oily sunflower yield of 311 kg da^{-1}, production cost was \$171.97 da^{-1} in total, variable costs were determined as \$130.48 da^{-1} and fixed costs as \$41.48 da^{-1}. In the study, for the production of oilseed sunflower, while the variable costs ratio in total expense per decara was determined as 75.88%, the ratio of fixed costs was determined as 24.12%. The cost of production of one kg of oily sunflower in the region was calculated as \$0.553. Since the sale price of oily sunflower (\$0.463 kg^{-1}) is lower than the cost, manufacturers make loss, but when the premium support (\$0.106 kg^{-1}) is included the manufacturer is able to make a profit. Due to this situation, gross profit in the production of oily sunflower was determined as \$13.05 da^{-1}, net profit including premium support as \$4.93 da^{-1} and relative profit as \$1.03 (Yüksek, 2019).

Ceran and Topak (2020) examined production value, product cost, net income and relative profit values in oily sunflower production by groundwater irrigation. Within the scope of the research, they also calculated the break-even point in sunflower production in enterprises.

In a study conducted by Düğmeci and Çelik (2020) in the province of Konya in Turkey, an economic analysis of oily sunflower production was performed using data from 62 agricultural enterprises during the 2018-2019 production period. In the study, for a yield of 450.21 kg da^{-1}, variable costs were determined as \$77.55 da^{-1} and fixed costs as \$67.17 da^{-1}.

The production value of oily sunflower in the reviewed enterprises was calculated as $203.12 da^{-1}, gross profit as $125.50 da^{-1} and net profit as $58.40 da^{-1}. The gross profit ratio was determined as 61.82% and the net profit as 28.75%. While the enterprise average costs for 1 kg of oily sunflower was $0.321, the net profit was $0.130. Relative profit ratio for the average of enterprises which amounts to output value obtained in return to input value of $'1 made for oily sunflower was determined as 1.40.

In a study conducted by Nategh et al. (2020) in Iran, for a yield of 211.43 kg da^{-1} the total cost was calculated as $75.56 da^{-1} and gross value as $95.80 da^{-1}, respectively. It was determined that the fixed cost had a ratio of 52% of the fixed cost and the variable cost elements had a share of 48% in the product cost. The benefit-cost ratio for sunflower production was determined as 2.62 and efficiency as 3.28.

Pilorgé (2020) examined the past evolutions, current status and potential development areas of the global sunflower sector. The Sunandini and Devi (2020) in their study aimed to determine the variable costs, fixed costs and total production cost of oily sunflower production in the state of Andhra Pradesh, which is located in the southeastern part of India.

Isinika and Jeckoniah (2021) examined the challenges and shortcomings faced by the sunflower sector in Tanzania. In their study Vasylkovsha et al. (2021) investigated the production and yield analysis in Ukraine considering the period of 2000-2019. Sandhya et al. (2021) made a cost analysis in oily sunflower production in their study and determined the benefit/cost ratio related to the product. In the study conducted by Nhundu (2022), the supply of sunflowers in South Africa using time series data from 1947 to 2016 was predicted.

Deepika et al. (2022) studied in detail the cost elements in the production of oily sunflower in their studies and interpreted it by calculating the benefit/cost ratio to reveal the profitability of the product. Similarly, in the research conducted by Oguz and Ogur (2022) on 51 oily sunflower production enterprises, productivity and benefit/expense ratio were calculated in sunflower production in addition to cost elements.

The production cost of sunflower per kg was found to be $0.61 in the production of oily sunflower in the enterprises studied in the research conducted by Semerci (2022a). In the research area, the production value of oily sunflower in the unit area was determined as $113.50 da^{-1} and the production cost as $92.90 da^{-1} whereas 59.67% of this value was variable costs and 40.33% of it was fixed costs. In terms of agricultural management, the relative profit value showing the ratio of income to the expenses incurred was determined as 1.22 in the research area.

In the research conducted by Semerci (2022b), about 9,490 tons of oily sunflower production was carried out in the enterprises examined in 3 size groups in an area of 53,500 da. Considering the general enterprise values, it is understood that the average yield value is 177.3 kg da^{-1}. The variable costs for the production of oily sunflower in the studied enterprises were calculated as \$57.49 da^{-1}, fixed costs as \$29.84 da^{-1}, and the production cost as \$87.33 da^{-1}. In the general context of the enterprises, the production value of oily sunflower is \$113.46 da^{-1} gross profit is \$55.97 da^{-1} and net profit has been calculated as \$26.14 da^{-1}. Considering the average of enterprises, the ratio of gross profit value of oily sunflower to production value was calculated as 49.33% and the relative profit ratio (benefit/cost ratio) as 1.30.

3. Materials and Methods

3.1. Materials

The main material of the research is the data for the production period of 2019 obtained through face-to-face survey application in period between January-February 2020 in Canakkale province. The secondary data of the research consists of firstly the publications and electronic media data of other external sources related to the subject, especially from the United Nations Food and Agriculture Organization (FAO), and data obtained countrywide from the Ministry of Agriculture and Forestry (MAF) and the Turkish Statistical Institute (TSI).

In the research conducted, agricultural supports applied in the production of oily sunflower were tabulated by examining official newspapers (Official Gazette, 2019,2020,2021). In the study, publications, dissertations and commission reports from various institutions and organizations at the national and international level related to oily sunflower (Anonymous, 2021 a, b; Başdemir, 2021; Anonymous, 2022 a, b) have been referred to.

3.2.Methods

3.2.1. Method Used in Sampling

The statistical formula proposed by Neyman from Stratified Sampling Methods has been used to determine the sampling framework and the number of surveys to be applied within the study (Yamane, 1967).

$$n = \frac{[\Sigma(Nh * Sh)]^2}{N^2 * D^2 + [\Sigma(Nh * Sh)]^2} \quad (1)$$

$$D^2 = \left(\frac{d}{t}\right)^2 \quad (2)$$

In equation 1; n: sample volume, N_h : number of enterprises in the sampling frame belonging to the h layer, S_h : standard deviation of the data in the h layer, S_h^2 : h the variance of the data in the h layer, t: the table value of t for a certain confidence interval, N: the total number of enterprises to the sampling frame, d: deviation from the average at a certain proportion (%).

The enterprises that make up the sample volume are divided into layers, considering the standard deviation and coefficients of variation (C.V.). The coefficient of variation refers to how many percent the standard deviation has varied in relation to the average. Low coefficient of variation means that unit values have less deviations from the average. In other words, it is indicated that the units studied are more homogeneous in terms of properties. A sample with a coefficient of variation greater than 33% does not present a normal population and indicates large differences among the data. The coefficient of variation is calculated as in Equation 3 (Oğuz and Karakayacı, 2017).

$$C.V. = \frac{s}{\bar{X}} \quad (3)$$

In equation 3; CV: refers to the coefficient of variation, S: standard deviation and $\bar{X}$: mean. Equation 4 has been used to distribute the sample volume into layers, and C.V. coefficients have also been taken into account when determining the layers.

$$n = \frac{(N_h * S_h) * n}{\sum(N_h * S_h)} \quad (4)$$

With the help of Equation 4, enterprises were divided into 4 groups as the following; 10.00-14.9 decar, 15.00-29.9 decar, 30.00-69.9 decar, 70.00 and above decar. After determining the homogeneous distribution of the layers, the sample numbers (n_h) entering each group are found with the help of Equation 5.

$$nh = \frac{Nh}{N} * \left(\frac{n}{\sum Nh * Sh}\right) \quad (5)$$

In the calculation made using the equation; there were 13 enterprises in the first group, 30 enterprises in the second group, 21 enterprises in the third group and 11 enterprises in the fourth group.

3.2.2. The Method Used in Determining the Production Cost of Oily Sunflower

In the enterprises involved in the research, labor force, machine pull force, input utilization levels, product and input prices and production quantities were taken into account in the calculation of the cost of oily sunflower.

Due to the application of partial budget analysis method in oily sunflower, the production value of the product was taken into account instead of the product's Gross Production Value. In the research, the alternative cost method was used in the production of oilseed sunflower in all stages from soil preparation to harvest stage of producers (Kıral et al., 1999).

When calculating labor costs, the wages paid to foreign workers in the locale were taken into account. The calculation of the pull force costs is made taking into account the unit land processing charges applicable in the area if the manufacturer uses his own machine.

The analysis of input usage in the enterprise was based on the quantities of seeds, fertilizers and agricultural pest control drugs used in production and the prices paid for them. Soil cultivation, seed and sowing, fertilizer and fertilizing, medicine and spraying, harvesting and transporting costs constitute variable cost items.

Land rent, management expenses and capital interest are considered as fixed expense items. Capital interest in oily sunflower production has been determined as the following; firstly subsidy portion has been deduced from the annual interest rate applied by Ziraat Bank of Turkey to crop production in 2019, which is 18%, then the half value of it has been taken into consideration, which is determined as 2.75%, and this value is multiplied by the variable costs. The cost of management expenses was calculated by taking 3% of the total costs. The total of expenses is determined by the collection of fixed and varying costs.

In determining the success levels of oily sunflower production activity, profitability per unit area was revealed. For this purpose, the gross profit and net profit values obtained in the unit area of oily sunflower production activity were calculated. Gross profit is derived from the gross production value (GPV) as a result of subtracting variable costs, while net profit is obtained by subtracting the total costs from the gross production value (GPV) (Kıral et al., 1999).

In the study, the production value (PV) of oily sunflower was taken into account when calculating gross profit and net profit, since the study was carried out through a single production branch. The production value (PV) of the oily sunflower production branch was

obtained by multiplying the yield of the product (kg da^{-1}) and the unit sales price of the product (\$ kg^{-1}). The relative profitability ratio was found by dividing the production value of oily sunflower by production costs.

Production Value: Product Yield Value (kg da^{-1}) * Product Sales Price (\$ kg^{-1})

Variable Costs: Soil Processing+ Planting and Seeds+ Fertilizer and Fertilizing+ Pesticide and Pest Control + Harvesting + Transportation Costs + Capital Interest (*)

(*) Capital Interest: *Capital interest in oily sunflower production; has been considered as the 2.75% value of the annual interest rate applied by T.C. Ziraat Bank to crop production in 2019 (interest rate remaining after deduction of subsidy portion), which is the share of oily sunflower production period.*

Fixed Costs: Land Rent (**) + Administrative Costs (***)

(**) Land Rent: (*):The rental value of the areas rented by the enterprise owners in oily sunflower production or the rental values of their own lands according to the alternative cost principle have been taken into consideration.

(***) Administrative Costs: *Administrative Costs: Total Costs * 3%*

Product Cost: Variable Costs + Fixed Costs

Gross profit is recognized as an important measure of success in determining the competitiveness of production activities. Gross profit and net profit values were calculated for both oily sunflower and other crops in the study. The method used in the calculation is given below.

Gross Profit: Production Value – Variable Costs

Net Profit: Production Value - (Variable Costs + Fixed Costs)

Relative Profit (Benefit / Cost Ratio): Production Value / (Variable Costs +Fixed Costs)

In the previous study, the efficiency value was calculated with the help of the formula given below.

Productivity: Sunflower Yield (kg da^{-1}) / Total Cost of Production (\$ da^{-1})

Breakeven point was calculated in the oily sunflower product within the scope of the research. The calculation used the formula given below (Layard and Glaister, 1994; García-García et al., 2004).

Breakeven point (kg da^{-1}) = (Sunflower Production Cost -\$ da^{-1})/Sales Price (\$ kg^{-1})

4. Results and Discussion

4.1. Production Pattern in Enterprises

The production pattern of the enterprises within the scope of the research is given in Table 1. Products grown on field land in the enterprises examined have been identified as wheat, sunflower, corn, clover, paddy, canola and barley. In enterprises, 38.60% of the total

operating land is used for wheat production, 30.66% for oily sunflower, 10.96% for barley, 9.32% for canola, 4.20% for paddy, 2.83% for oats, 1.83% for clover and 1.61% for corn cultivation.

Table 1: Pattern of vegetable products in enterprises

Products	Layer 1		Layer 2		Layer 3		Layer 4		Total	
	Area (da)	Share (%)	Area (da)	Share (%)	Area (da)	Share (%)	Area (da)	Share (%)	Area (da)	Share (%)
Wheat	396	44.59	1,067	43.34	1,388	44.25	625	24.81	3,476	38.60
Sunflower	149	16.78	653	26.52	916	29.20	1,043	41.41	2,761	30.66
Barley	213	23.99	453	18.40	243	7.75	78	3.10	987	10.96
Canola	30	3.38	91	3.70	480	30	238	9.45	839	9.32
Paddy	30	3.38	53	2.15	50	1.59	245	9.73	378	4.20
Oat	20	2.25	25	1.02	20	0.64	190	7.54	255	2.83
Clover	30	3.38	25	1.02	10	0.32	100	3.97	165	1.83
Corn	20	2.25	95	3.86	30	0.96	0	0.00	145	1.61
Total	888	100.00	2,462	100.00	3,137	100.00	2,519	100.00	9,006	100.00

Total land asset of the enterprises in the first group is 888 da and in 16.78% of this area, oilseed sunflower production is carried out. The total production area of the enterprises of the second group is 2,462 da and in 26.52% of this area, oily sunflower cultivation is carried out. In the 3rd group enterprises, the specified values were determined as 3,137 da and 29.20%, and in the 4th group enterprises as 2,519 da and 41.41% respectively (Table 1).

In the study conducted by Top ve Özdoğru (2016), the average sunflower planting area of producers was determined as 102.96 da and among the provinces examined it has been also determined that the province with the lowest the sunflower planting area (77.05 da) was Canakkale and the province with the highest planting area (145.01 da) was Kırklareli.

In another study it has been determined that 36.37% of the total operating land was reserved for grain corn, 32.82% for oily sunflower, 11.79% for wheat, 10.19% for barley, 5.58% for sugar beet, 1.44% for dry beans, 0.61% for silage corn, 0.61% for clover, 0.30% for hungarian wetch and 0.29% for snack zucchini (Düğmeci and Çelik, 2020). In another study, it was noted that wheat received a significant share with 50.38% in the total land asset of the enterprises. In enterprises, it was determined that the planting area of oily sunflower occupied the second place with a share of 45.17% (Semerci, 2019b).

4.2. The value of crop production in the investigated enterprises

The values of crop production of the studied enterprises are given in Table 2. The total value of crop production in the studied enterprises was determined to be about $992,000. While 37.90% of this value consists of wheat production, this product is followed by oily sunflower (24.37%), paddy (18.58%), canola (6.27%), barley (5.73%), corn (2.99%), oats (2.86%) and clover (1.30%) respectively. While in the first group enterprises, the share allocated to the oily sunflower in the production pattern was 15.38%, this proportion was determined as 27.56% in the 2nd group enterprises, 26.46% in the 3rd group enterprises and 23.34% in the 4th group enterprises, respectively.

Table 2: The Value of Crop Production in the Enterprises

Product	Layer 1		Layer 2		Layer 3		Layer 4		Total	
	Income ($)	Share (%)	Income ($)	Share (%)	Income ($)	Share (%)	Income ($)	Share (%)	Income ($)	Share (%)
Wheat	44,031.68	45,80	95,898.96	52.39	166,687.40	51.11	69,361.93	17,94	375,979.90	37.90
Sunflower	14,781.95	15.38	50,457.55	27.56	86,291.82	26.46	90,226.70	23.34	241,758.00	24.37
Paddy	3,294.12	3.43	6,485.71	3.54	6,890.76	2.11	167,600.80	43.35	184,271.40	18.58
Canola	3,428.57	3.57	3,529.41	1.93	34,554.18	10.60	20,721.96	5.36	62,234.13	6.27
Barley	21,306.55	22.16	4,380.62	2.39	23,478.05	7.20	7,638.82	1.98	56,804.05	5.73
Oat	1,738.32	1.81	2,684.87	1.47	1,811.77	0.56	23,391.60	6.05	29,626.55	2.99
Sweetcorn	5,038.99	5.24	17,809.80	9.73	5,554.59	1.70	0.00	0.00	28,403.38	2.86
Clover	2,521.01	2.62	1,815.13	0.99	840.34	0.26	7,697.48	1.99	12,873.95	1.30
Total	96,141.19	100.00	183,062.10	100.00	326,108.90	100.00	386,639.30	100.00	991,951.40	100.00

In the studied enterprises, the value of crop production increases as the size of the enterprise increases. This value was defined as $96,141 in group 1 enterprises, $183,062 in group 2 enterprises, $326,108 in group 3 enterprises, $386,639 in group 4 enterprises (Table 2).

In another study, it has been reported that while 44.48% of the crop production value in sunflower producing enterprises consists of grain corn production, this product is followed by sunflower (30.54%), sugar beet (8.94%), wheat (6.69%), barley (5.60%), dried beans (1.35%), clover (0.95%), silage corn (0.62%) and snack pumpkin (0.53%) (Düğmeci and Çelik, 2020).

4.3. Sunflower planting areas by years of enterprises

Among the enterprises, oily sunflower cultivation areas for were given in Table 3 as both realized for the years of 2018 and 2019, and as estimated for the year 2020. As it is seen in the same table, there have been increases in sunflower planting areas of enterprises as for the relevant years. The fact that oily sunflower purchase prices increase compared to other year results in a decrease in the use of human labor and machine pull power in its production is less, production in unirrigated land and decrease in the production cost of the product. This leads to the fact that enterprises give up other products and turn to oily sunflower.

Table 3: Sunflower planting areas by years in enterprises

Enterprise Groups	Number of Enterprise (Pieces)	2018 Year Sunflower Planting Area (da)	2019 Year Sunflower Planting Area (da)	2020 Year Sunflower Planting Area* (da)
1	13	137	142	149
2	30	639	654	653
3	21	910	920	916
4	11	916	947	1,043
Total	75	2,602	2,663	2,761

(*): Producers' Estimation.

As of the years, the oily sunflower planting areas per enterprise are 34.69 da in 2018, 35.51 da in 2019, and it is projected the the production area for 2020 to be 36.81 da. It shows that the declared production areas increased on average per enterprise each year compared to the previous year (Table 3).

4.4. Oily sunflower production in the investigating enterprises

Information regarding the production value obtained by the analyzed enterprises as a result of their activities for sugar beet production is given in Table 4. The production value obtained from the unit area was found by multiplying the yield value (kg da^{-1}) by the unit sales price of the product ($ kg^{-1}).

Table 4: Oily sunflower production value information

Layers	Production Area (da)	Production Amount (kg)	Yield (kg da^{-1})	Production Value of Oily Sunflower ($)	Average Production Value ($ da^{-1})

1	149	38,469	258.18	14,029.87	94.16
2	653	155,286	237.80	56,372.73	86.33
3	916	222,537	242.94	81,534.56	89.01
4	1,043	237,875	228.07	87,154.20	83.56
Total	2,761	654,167	236.93	240,777.43	87.21

The research showed that the oily sunflower yield was 236.93 kg da^{-1} and the production value was \$87.21 da^{-1} in the studied enterprises. When Table 4 is examined, it is understood that the highest oily sunflower production value obtained from the unit area is in the first group and the lowest value is in the fourth group.

4.5. Input usage level in enterprises

In today's conditions, agriculture carried out on big and large plots leads to machine agriculture in line with the possibilities considering the time and cost factors. Oily sunflower farming is a type of agricultural product that could be the best example of machine agriculture. In agriculture, aeration of the soil with the help of hoeing is an important factor in terms of yield. Even if all other conditions (planting, irrigation, etc.) are provided, the yield level of unventilated soil in a timely manner is low. Values for input usage in the studied enterprises are given in Table 5.

Table 5: The level of use of input in the cultivation of oily sunflower in the enterprises.

Production Operations	Operation Time	Number of Operations	Labor Force (min. da^{-1})		Material (kg-gr-cc-lt da^{-1})	Type	Explanation
			Human	Machine			
(A) Soil Cultivation and Planting							
Deep Ploughing	November	1	43.76	43.76	3.46	diesel (lt da^{-1})	
Doubling	February	1	20.54	20.54	1.87	diesel (lt da^{-1})	
Harrowing	April	1	17.16	17.16	1.38	diesel (lt da^{-1})	
Planting+ Fertilizing	April	1	17.05	17.05	1.82	labor force (min. da^{-1})	min. da^{-1}
Hoeing	April	1	16.12	16.12	1.69	diesel (lt da^{-1})	
Total			**114.63**	**114.63**			
(B)Maintenance Works							
Fertilizing	June	1	5.82	5.82	0	diesel (lt da^{-1})	min. da^{-1}
Spraying (Herbicide)	June	1-2	7.53	7.53	0.77	diesel (lt da^{-1})	pulverizator
Total			**13.35**	**13.35**			

(C) Harvest							
Harvest	September	1	9.17	9.17	1.79	diesel (lt da^{-1})	da (harvester)
Transportation	September	1	10.43	10.43	0.96	$ ton^{-1}	da^{-1}
Total			**19.46**	19.60			
(C) Various Inputs							
Seed	April	1	0	0	374.60	gr. da^{-1}	da
Base Fertilizer	April	1	0	0	21.27	kg. da^{-1}	da
Agricultural Pest Control (herbicide)	June	1	0	0	0.297	lt. da^{-1}	da

The research carried out reveals that 374.60 g seeds, 21.27 kg of chemical fertilizer, 297 cc of agricultural medicine, 147.58 minutes of machine labor and 13.74 lt of diesel input are needed in order to obtain an average of 236.93 kg da^{-1} oily sunflower product. It is understood that the diesel used and the machine labor force are used in tillage and planting activities.

4.6. Production cost of oily sunflower in enterprises

The average variable costs per decar for oily sunflower production in enterprises are \$53.01 da^{-1}, fixed costs are \$24.17 da^{-1} and production cost is \$77.21 da^{-1} (Table 6). According to the calculated values, the share of varying costs in the average oily sunflower production cost per decar was 68.66%, and this rate was determined as 31.34% for fixed costs.

Table 6: Production cost of oily sunflower in enterprises

Production Operations	OperationTime	Number of Operations	Cost per Unit Area ($ da^{-1})				
			Layers				
			1	2	3	4	Enterprise Average
(A) Soil Cultivation and Planting							
Deep Ploughing	November	1	9.88	9.50	10.00	9.15	9.63
Doubling	March - April	1	4.33	4.85	5.16	4.96	4.83
Harrowing	April	1	2.79	3.04	2.90	2.66	2.85
Planting + Fertilization	April	1	3.04	3.00	3.21	2.76	3.00
Hoeing	April	1	2.27	3.04	2.90	2.57	2.69
Total			22.30	23.42	24.18	22.11	23.00
(B)Maintenance Works							

Fertilizing	April	1	3.38	3.53	3.34	3.11	3.34
Spraying (Herbicide)	June	1--2	1.89	1.78	2.04	1.53	1.81
Total			5.27	5.31	5.38	4.64	5.15
(C) Harvest							
Harvest	September	1	5.76	5.63	5.90	5.93	5.81
Transportation	September	1	2.79	2.68	3.03	3.05	2.85
Total			8.56	8.31	8.93	8.98	8.66
(D) Various Inputs							
Seed	April	1	6.80	5.80	5.43	4.99	5.76
Bottom Fertilizer (pure)	April	1	7.19	7.14	7.04	7.33	7.18
Agricultural Pest Control (Herbicide)	June	1--2	1.89	1.78	2.04	1.53	1.81
Total ($ da^{-1})			15.88	14.72	14.52	13.85	14,74
Total Costs (A+B+C+D) ($ da^{-1})			52.00	51.76	53.01	49.58	51.59
Revolving Fund Interest (%2.75) ($ da^{-1})			1.43	1.42	1.46	1.36	1.42
Variable Costs Total (E) ($ da^{-1})			53.43	53.19	54.47	50.94	53.04
General Administrative Costs (3%) ($ da^{-1})			1.60	1.59	1.63	1.53	1.59
Field Rent ($ da^{-1})			24.11	22.69	21.93	21.70	22.58
Sum of Fixed Costs (F) ($ da^{-1})			25.71	24.28	23.56	23.22	24.17
General Sum of Costs (E+F)			79.15	77.47	78.03	74.17	77.21

In the research conducted, it was determined that the group in which the cost is the lowest in the average unit area of oily sunflower farming in the enterprises examined is the 4th group, and the highest group is the enterprises in the 1st group. The research results revealed that the average values of enterprises in oily sunflower production were \$23.0 da^{-1} for tillage and planting, \$5.15 da^{-1} for maintenance work, \$8.66 da^{-1} for harvesting work, and \$14.74 da^{-1} for various inputs.

Semerci (2022b), in his research, evaluated that the production value of oily sunflower in the unit area was \$113.5 da^{-1}, production cost was \$92.9 da^{-1} and determined that 59.67% of this value was variable costs and 40.33% of it was fixed costs. The gross profit value provided by the unit area in the enterprises participating in the research was determined as \$58 da^{-1}. The

relative profit value, indicating the ratio of income to expenses in terms of agricultural management, was calculated as 1.22 in the research field.

4.7. Evaluation of oily sunflower production from an economic point of view

It has been calculated that average table tomato yield is 236.93 kg da^{-1}, average product sales price is \$0.37 kg^{-1}, and PV for the unit area is \$86.61 da^{-1} in the examined enterprises. Cost per kg due to the quantity of products produced was determined as \$0.33. The average gross profit was \$33.60 da^{-1} for enterprises producing oily sunflower, net profit was \$9.40 da^{-1} and the relative profit ratio was calculated as 1.12 (Table 7).

Table 7: Gross profit and net profit values in oily sunflower production in enterprises

Units	Layers				
	1	2	3	4	Enterprise Average
Yield (kg da^{-1})	258.18	237.80	242.94	228.07	236.93
Product Sales Price (\$ kg^{-1})	0.36	0.36	0.37	0.37	0.37
Production Value (\$ da^{-1})	94.16	86.33	89.01	83.94	86.61
Cost (\$ da^{-1})	79.15	77.47	78.03	74.17	77.21
Cost (\$ kg^{-1})	0.31	0.33	0.32	0.32	033
Gross Profit (\$ da^{-1})	40.73	33.14	34.54	33.00	33.60
Net Profit (\$ da^{-1})	15.01	8.85	10.98	9.77	9.40
Relative Profit (\$ da^{-1})	1.19	1.11	1.14	1.13	1.12
Productivity (kg $\$^{-1}$)	3.26	3.07	3.11	3.07	3.07
Break-even Point (kg da^{-1})	219.86	215.19	210.89	200.46	208.68

As a result of the research, according to the average values of the enterprises studied, the production of oily sunflower production was 3.07 kg $\$^{-1}$ and the break-even point was calculated as 208.68 kg da^{-1}.

4.8. Supports given to oily sunflower production in turkey

Supports to agricultural production in Turkey are carried out under different practices (Anonymous, 2022a, b). Supports for oily sunflower production in the country are given in Table 8.

Table 8: Supports given to oily sunflower production in Turkey

Support Name	2019	2020	2021
Organic agriculture (category 2) (\$ da^{-1})	6.72	5.45	3.00

Fertilizer support ($ da^{-1})	0.67	0.54	0.60
Fuel support ($ da^{-1})	4.37	3.54	2.17
Difference payment support ($ kg^{-1})	0.07	0.07	0.04

However, 50% of the insurance policy in the production of oily sunflower is supported under agricultural insurance. In other words, half of the insurance premium made in the unit area is covered by the state.

When we examine Table 8, it could be said that among the support types for sunflower producers is the Difference payment supports in regards to sunflower producers. The average yield of enterprises in the research field was calculated as 236.93 kg da^{-1}. The detail on the sum of the oily sunflower income support calculated on the average yield value is given below.

*Total Support Revenue ($ da^{-1}) = Difference payment support (236.93 kg da^{-1} * $0.07 kg^{-1}) +*
Fertilizer support ($0.67 da^{-1}) + Fuel support ($4.37 da^{-1})

Total Support Revenue ($ da^{-1}) = 21.63

The research revealed that the oily sunflower production value ($86.61 da^{-1}) in the studied enterprises could increase to $108.24 da^{-1} with the support given ($21.63 da^{-1}). In other words, sunflower supports could provide a 24.97% increase in the income obtained from the unit area. A study on the subject showed that agricultural supports increase the production value of oily sunflower by 27.74% (Semerci, 2013a). Similarly, a study conducted in Kırklareli province showed that agricultural supports in oily sunflower production increased production value by 27.37% and by 21.62% in Tekirdağ province (Semerci, 2019a, b).

Research results showed that enterprises in the smallest group have higher values than other enterprise groups in terms of yield, production value, gross profit, net profit, relative profit ratio, productivity values. This has shown that small-scale enterprises use their resources more effectively, while medium and large enterprises cannot benefit from the positive aspects of scale economies (high bargaining power of enterprises during input supply and product marketing, etc.).

4.9. General review

In this section, the data obtained in this research were analyzed comparatively with other research findings obtained as a result of the literature review conducted. In this context, data for oily sunflower are analyzed comparatively in the following section under the headings; yield (kg da^{-1}), production value ($ da^{-1}), variable costs ($ da^{-1}), fixed costs ($ da^{-1}), production cost ($ da^{-1}), production cost per kg ($), gross profit ($ da^{-1}), net profit ($ da^{-1}), relative profit ratio (%), efficiency ratio (kg $$^{-1}$) and breakeven point (kg da^{-1}).

4.9.1.Yield amount

In the research carried out, the oily sunflower yield obtained from the unit area was calculated as 236.93 kg da^{-1}. The yield value obtained from the unit area was reported by the following studies as; Uzunöz et al. (2008) 223 kg da^{-1}, MousaviAvval et al. (2011) 162.65 kg da^{-1}, Aydın (2014) 153 kg da^{-1}, Parlakay et al. (2016) 200.27 kg da^{-1}, Unakıtan and Aydın (2018) 153 kg da^{-1}, Yüksek (2019) 311 kg da^{-1}, Ceran and Topak (2020) 325.59 kg da^{-1}, Düğmeci and Çelik (2020) 450.21 kg da^{-1}, Nategh et al., (2020) 211.43 kg da^{-1}, Abdikoğlu and Unakıtan (2021) in small scale enterprises (20-150 da) as 236.09 kg da^{-1}, in large scale enterprises 246.15 kg da^{-1}, and enterprise average was determined as 244.44 kg da^{-1}, Oğuz and Ogur (2022) 410.38 kg da^{-1} and by Semerci (2022b) as 177.3 kg da^{-1}. Differences have been observed between the values calculated by the research result in terms of the amount of yield and other research findings.This situation is due to the year in which the work was carried out, whether the production is carried out in watery or dry conditions and also due to the amount of resources used in the production.

It has been determined that the yield value per decar (236.93 kg) is higher than the values ascertained by Uzunöz et al. (2008), MousaviAvval et al. (2011), Aydın (2014), Parlakay et al. (2016), Unakıtan and Aydın (2018), Nategh et al., (2020) and Semerci (2022b) while it is lower than the values determined by the other researchers.

4.9.2. Production cost (variable costs and fixed costs)

It was determined that the variable costs for oily sunflower production in the enterprises examined in the study were $53.04 da^{-1}, fixed costs were $24.17 da^{-1} and

production cost was $77.21 da^{-1}. According to the calculated values, the share of varying costs in the average oily sunflower production cost per decar was 68.66%, and this rate was determined as 31.44% for fixed costs. In research conducted by Bayramoğlu et al. (2005), the share of changing costs in sunflower production was calculated as 42.10% and the share of fixed costs as 57.90%.

In the study conducted by Todorović et al. (2010) the following values have been obtained; for a product revenue of 200 kg da^{-1}, yield is €37.00 da^{-1}, varying costs are €38.70 da^{-1}, fixed costs are €20.67 da^{-1}, product cost is €59.37 da^{-1}, while for a product revenue of 250 kg da^{-1}, yield is €46.25 da^{-1}, variable costs are €41.40 da^{-1}, fixed costs are €20.67 da^{-1}, product cost is €62.67 da^{-1}. On the other hand for a product revenue for 300 kg da^{-1}, yield is €55.50 da^{-1}, variable costs are €44.10 da^{-1}, fixed costs are €20.67 da^{-1}, product cost is €64.78 da^{-1}, whereas for a product revenue of 350 kg da^{-1} yield is €64.75 da^{-1}, variable costs are €46.80 da^{-1}, fixed costs are €20.67 da^{-1}, product cost is €67.47 da^{-1} and for a product revenue of 400 kg da^{-1}, yield is €74.00 da^{-1}, variable costs are €49.51 da^{-1}, fixed costs are €20.67 da^{-1}, product cost is €70.17 da^{-1}.

Mousavi Avval et al. (2011) determined the product cost in oily sunflower as $82.26 da^{-1}. In another study conducted by Uzundumlu and Topçu (2012), it was found that the share of costs ranging from snack sunflower was 73% and it was concluded that among the varied factors, fertilizers, seeds and irrigation water were used the most. Semerci et al. (2011) determined the production cost of oily sunflower in their research area as $92.89 da^{-1}. Kanannavar et al. (2013) have found in their study that in the total cost of sunflower production, varying costs have a share of 75.55% and fixed costs have a share of 24.45%.

In another study, it was calculated that 51.70% of the production costs were changing costs and 48.30% of it were fixed costs (Alemdar et al., 2014). In his research carried out in Thrace region, Aydın (2014) calculated that the variable costs for oily sunflower production as $79.99 da^{-1} (43.73%), fixed costs as $102.92 da^{-1} (56.27%) and production costs as $182.92 da^{-1}. Sethar et al. (2015) determined the production value for oily sunflower as $79.70 da^{-1} and the production cost as $48.14 da^{-1}. In the study carried out by Parlakay et al. (2016), variable costs were determined as $77.27 da^{-1}, fixed costs as $39.96 da^{-1} and production cost as $117.23 da^{-1} in the enterprises examined.

Das and Rout (2018) determined the production cost of oily sunflower production as $56.4 da^{-1} in their study. In the study of Unakitan and Aydın (2018), sunflower production value was calculated as $113.20 da^{-1}, variable costs as $48.38 da^{-1} (43.74%), fixed costs $62.24 da^{-1} (56.26%) and production cost as $110.61 da^{-1}. In another study, it has been

defined that the variable costs for sunflower production were $130.48 da^{-1} and fixed costs were $41.48 da^{-1}. In the study, for the production of oilseed sunflower, while the variable costs ratio in total expense per decara was determined as 75.88%, the ratio of fixed costs was determined as 24.12% (Yüksek, 2019). In the study of Ceran and Toprak (2020), however, production value in oily sunflower was determined as $144.01 da^{-1} and production cost as $81.52 da^{-1}.

Düğmeci and Çelik (2020) have found varying costs as $77.55 da^{-1} (53.70%), fixed costs as $67.17 da^{-1} (46.30%) and production cost as $144.42 da^{-1}. In their study, Nategh et al. (2020), production cost in oily sunflower was determined as $75.56 da^{-1}. It was determined that the fixed costs had a share of 52% of the total cost and the variable costs had a share of 48%. Sunandini and Devi (2020) identified changing costs in oily sunflower production as RS261.315,1 da^{-1}, fixed costs as RS100.936,8 da^{-1} and product cost as RS36.2251,9 da^{-1} 70.21% of the product cost is covered by changing costs and 27.86% of it is covered by fixed costs.

Semerci (2022a) calculated the production cost of oily sunflower as $92.90 da^{-1} and estimated that 59.67% of the total cost accounted for variable costs and 40.33% for fixed costs. Again, in the research conducted by Semerci (2022b), the varying costs of oily sunflower production were calculated as $57.49 da^{-1} (65.83%), fixed costs as $29.84 da^{-1} (34.17%) and production cost as $87.33 da^{-1}. In the study by Oguz and Ogur (2022), varying costs for oily sunflower production were calculated as $57.41 da^{-1} (69.10%), fixed costs as $25.67 da^{-1}, production cost as $83.08 da^{-1} (30.90%). In the study, differences have been observed between the calculated cost and distribution of expenses. The main reason for this is that the amount of input used in each country and the input prices are different.

In this study, the production cost determined in the production of oily sunflower is $77.21 da^{-1}. This value is higher than the values estimated by Todorović et al. (2010), Sethar et al. (2015), Das and Rout (2018), Nategh et al. (2020) whereas it is at a lower level than the data obtained by the other researchers. Within the study it has been understood that the share of varying costs out of the total is at a higher level than the share estimated by Bayramoğlu et al. (2005), Alemdar et al. (2014), Aydın (2014), Düğmeci and Çelik (2020), Nategh et al. (2020) and Semerci (2022a,b).

4.9.3. Gross profit and net profit values

The average gross profit of enterprises in the production of oily sunflower in the enterprises studied within the scope of the research was $33.60 da^{-1}, and net profit was calculated as $9.40 da^{-1}. Todorović et al. (2010) have defined gross profit and net profit values for oily sunflower as follows; for a yield of 200 kg da^{-1}; €-1.70 da^{-1} and €-22.37 da^{-1}, for a yield of 250 kg; €4.85 da^{-1} and €-15.82 da^{-1}, for a yield of 300 kg da^{-1}; €11.40 da^{-1} and €-9.28 da^{-1}, for a yield of 350 kg da^{-1}; €17.95 da^{-1} and €-2.72 da^{-1}, and for a yield of 400 kg da^{-1}; €24.49 da^{-1} and €3.82 da^{-1}, respectively.

In another study, the gross profit of oils sunflower was determined at $99.37 da^{-1} (Alemdar et al., 2014). Sethar et al. (2015) determined the net profit value of oily sunflower as $31.50 da^{-1} in their research. Parlakay et al. (2016), in their study determined the production value of oily sunflower as $112.15 da^{-1}, gross profit as $34.88 da^{-1}, net profit as $-5.08 da^{-1} in the enterprises they examined. Das and Rout (2018) determined the production cost of oily sunflower production as $58.4 da^{-1} in their study.

In the study of Unakıtan and Aydın (2018), the gross profit of oily sunflower was determined as $64.85 da^{-1} and the net profit value as $2.61 da^{-1}. In the study carried out in Kırklareli province for oily sunflower in dry conditions, the gross profit value for the 2017/2018 production period was determined as $81.08 da^{-1}, the net profit value as $45.0 da^{-1} and the relative profit ratio as $1.45 (Semerci, 2019a). In the same period and in dry conditions, in the study conducted in Tekirdag province in relation to oily sunflower, it has been reported that gross profit is $78.13 da^{-1}, net profit is $41.57 da^{-1} (Semerci, 2019b). In the study conducted by Yüksek (2019), gross profit in oily sunflower production was determined as $13.05 da^{-1} and net profit including premium support as $4.93 da^{-1}. Ceran and Topak (2020) calculated the net profit value of oily sunflower as $62.49 da^{-1}.

Düğmeci and Çelik (2020) calculated the gross profit value of $125.50 and net profit as $58.40 da^{-1}, in relation to the production value of $203.12 da^{-1} in oily sunflower. In the same study the gross profit ratio was 61.82% and the net profit ratio was 28.75%. Nategh et al. (2020) determined the gross profit value of oily sunflower production as $95.80 da^{-1}. Sunandini and Devi (2020) identified gross profit value in oily sunflower as RS25,2541.6 da^{-1} and the net profit value as RS-18,171.6 da^{-1}.

Semerci (2022b) determined that gross profit as $55.97 da^{-1} and net profit as $26.14 da^{-1} in relation to the production value of $113.46 da^{-1} in the oily sunflower. Considering the average of enterprises, the ratio of gross profit value to the production value of the product

was determined as 49.33%. In their research, Oguz and Ogur (2022) determined sunflower production value as \$246.23 da^{-1}, gross profit value as \$188.82 da^{-1} and net profit value as \$163.15 da^{-1}.

The most significant criterion for which branches of activity of producers in agricultural production will take place in the production pattern of their enterprises is the gross production values of the branches of activity. Therefore, the study focused on the gross profit value per decare. It has been determined that the gross profit value (\$33.60) calculated per decare in the study carried out is higher than the values determined by Todorović et al. (2010) and Yüksek (2019) whereas it is at a lower level than the values obtained by other researchers.

It is understood that there are differences between the gross profit and net profit values calculated in this study and other research findings. The factors leading to this situation are the differences in input prices that occur depending on the input usage amount along with the purchase prices of oily sunflower.

4.9.4.Cost per kg

In the research conducted, the cost per kg of oily sunflower was determined as \$0.326. This value was determined by Todorović et al. (2010) as €0.297 kg^{-1} for a yield of 200 kg da^{-1}, as €0.248 kg^{-1} for a yield of 250 kg da^{-1}, as €0.216 kg^{-1} for a yield of 300 kg da^{-1}, €0.193 kg for a yield of 350 kg da^{-1} and €0.175 € kg^{-1} for a yield of 400 kg da^{-1} whereas Semerci et al. (2016) have found it as \$0.52 kg^{-1}, Aydın (2014) as \$0.836 kg^{-1}, Parlakay et al. (2016) as \$0.585 kg^{-1} and Unakıtan and Aydın (2018) as \$0.72 kg^{-1}. Oğuz et al. (2019) calculated the oily sunflower cost per kg for enterprises with 50 da, below 50 da, between 51-150 da and over 151 da areas as \$0.29 kg^{-1}, \$0.21 kg^{-1}, \$0.19 kg^{-1} and the average of enterprises was determined as \$0.20 kg^{-1}. The value determined has been calculated as \$0.553 kg^{-1} by Yüksek (2019), as \$0.25 kg^{-1} by Ceran and Topak (2020), as \$0.321 kg^{-1} by Düğmeci and Çelik (2020), as \$0.61 kg^{-1} by Semerci (2022a) and as \$0.14 kg^{-1} by Oguz and Ogur (2022).

The sunflower cost per kg (\$0.326) which has been calculated in this research is lower than the values determined by (2011), Aydın (2014), Parlakay et al. (2016), Unakıtan and Aydın (2018), Yüksek (2019) and Semerci (2022a), while it is higher than the values found by other researchers.

4.9.5. Relative profit ratio

According to the average data of enterprises, the relative profit ratio was calculated as 1.12. This value has been calculated as 1.38 by Bayramoğlu et al. (2005), as 1.99 by Choudhary et al. (2008), as 0.51 by Uzunöz et al. (2008), as 0.623 by Todorović et al. (2010) for a yield of 200 kg da^{-1}; as 0.745 for 250 kg da^{-1} yield, 0.857 for 300 kg da^{-1} yield, 0.960 for 350 kg da^{-1} yield and 1.054 for 400 kg da^{-1} yield. On the other hand, it has been calculated by MousaviAvval et al. (2011) as 1.98, by Kanannavar et al. (2013) as 1.67, by Shah et al. (2013) as 1.62, by Alemdar et al. (2014) as 1.34, by Habib (2016) as 1.86, by Joyo et al. (2016) as 2.57, byParlakay et al.

(2016) as 0.96, by Suchla et al. (2016) as 4.49, by Unakıtan and Aydın (2018) as 1.02 by Sonawane et al. (2019 as 1.79 for middle scale enterprises and as 2.01 for large scale enterprises. Oğuz et al. (2019) conducted a study on 51 enterprises under 3 groups of enterprises with an area of 50 and below da, with an area between 51-150 da and with area of 151 and above da. As a result of the research, the relative profit ratio was determined as 2.24, 3.06, 3.10, and the average of enterprises as 2.96, respectively. In other studies, the relative profit ratio has been determined as 1.45 by Semerci (2019a), as 1.43 by Semerci (2019b), as 1.03 by Yüksek (2019), as 1.77 by Ceran and Topak (2020), as 1.40 by Düğmeci and Çelik (2020), as 2.62 by Nategh et al. (2020), as 1.44 Sandhya et al. (2021), *as 1.22 by* Semerci (2022a), as 1.30 Semerci (2022b), as 2.96 by Oğuz and Ogur (2022). Relative profit ratio (1.12) calculated in this research has been found higher than the values determined by; Uzunöz et al. (2008), Todorović et al. (2010), Parlakay et al. (2016) (0.96), Unakitan and Aydın (2018), Yüksek (2019) (1.03) and it has been found lower than the values determined by other researchers.

4.9.6. Productivity

In the research, the production value [yield value (kg da^{-1}) / production cost ($ da^{-1})] has been measured as 3.069 kg $\$^{-1}$ in oily sunflower production. This value has been determined by Todorović et al. (2010) as 3.369 kg for yield of 200 kg da^{-1}, 3.989 kg for yield 250 kg da^{-1}, 4.631 kg for yield 300 kg/da, 5.187 kg for yield 350 kg da^{-1}, 5.670 kg for yield 400 kg da^{-1}, while it has been found by Mousaviavval et al. (2011) as 1.977 kg $\$^{-1}$, Aydin (2014) as 0.836 kg $\$^{-1}$, by Parlakay et al. (2016) as 1.708 kg $\$^{-1}$, by Unakitan and Aydın

(2018) as 1.383 kg $\$^{-1}$, by Ceran and Topak (2020) as 4.182 kg $\$^{-1}$, by Düğmeci and Çelik (2020) as 3.117 kg $\$^{-1}$, by Nategh et al. (2020) as 2.798 kg $\$^{-1}$, by Deepika et al. (2022) as 1.66 kg $\$^{-1}$, by Semerci (2022b) as 2.030 kg $\$^{-1}$, by Oguz and Ogur (2022) as 4.94 kg $\$^{-1}$.

Productivity value (3.069 kg $\$^{-1}$) which has calculated in the present study has been found lower than the values determined by Todorović et al. (2010), Ceran and Topak (2020), Düğmeci and Çelik (2020) and Oguz and Ogur (2022) while it has been found to be higher than the values determined by other researchers.

4.9.7. Breakeven point

In the research conducted, the break-even point for enterprises in the production of oily sunflower, in other words, the production amount in which profit is gained has been calculated as 208.68 kg da^{-1}. The break-even point has been determined by Todorović et al. (2010) as 320.92 kg da^{-1} for a yield of 200 kg da^{-1}, 335.51 kg da^{-1} for a yield of 250 kg da^{-1}, 350.11 kg da^{-1} for a yield of 300 kg da^{-1}, 364.70 kg da^{-1} for a yield of 350 kg da^{-1}, 379.35 kg da^{-1} for a yield of 400 kg da^{-1}, whereas it has been found by Parlakay et al. (2016) as 209.34 kg da^{-1}, by Ceran and Topak (2020) 185.61 kg da^{-1}, and by Oguz and Ogur (2022) 138.47 kg da^{-1}.

The break-even point (208.68 kg da^{-1}) which has been determined in this study has been found to be higher than the values found by Oguz and Ogur (2022) and Ceran and Topak (2020) while it has been found lower than the value calculated by other researchers.

The break-even point obtained as a result of the research seems generally in line with other research findings. However, it has been concluded that the differences between the calculated values may be natural, since the yield obtained from the unit area and the cost of the product differ in many countries and regions in the calculation of the break-even point.

Literature review has revealed that criteria such as yield, production value, production cost, gross profit, net profit, relative profit, productivity and break-even point differ in oily sunflower production. In other words, there seem to be significant differences between the minimum and maximum values of the criteria. The most important elements affecting the criteria related to yield and yield in the production of oily sunflower could be regarded as; production in watery conditions, alternation (rotation) in production, use of hybrid seeds, use of a variety resistant to orobansha, appropriate soil texture and structure, giving fertilizer at the desired time and quantity for the favor of the plant, timely conduct of the pesticide control, the use of modern input and instrument-equipment in production, state supports for

the production. The yield and economic indicators of oily sunflower of enterprises in areas or countries with these characteristics are higher than that of enterprises in other areas or countries.

Difference (premium) support is applied in addition to diesel and fertilizer support for oily sunflower production in Turkey. Therefore, while calculating the production value of the oily sunflower produced in the studied enterprises, premium support has been added to the product sales price per kg. However, the input quantities and input prices used by the enterprises producing oily sunflower may vary both between provinces within the country and from country to country.

It could be said that the findings obtained both in this research and other studies about the production of oily sunflower positively or negatively affect the production value as well as the cost of the product and also the cost of the product, depending on the structural characteristics of the enterprises and the production techniques applied to this product by the countries.

When an overall evaluation has been made; the oily sunflower production value determined in this study, product sales price, changing costs, fixed costs, production cost, as well as the gross profit and net profit value of the product and the relative profit ratio, productivity ratio and breakeven point results compared with other research findings (when maximum and minimum values are ignored) seem to be parallel and they are in line with the findings of other studies.

5. Conclusion and Recommendations

The importance of oilseed plants in agricultural production is gradually increasing. Oily sunflower is one of the important plants included in this group. According to FAO data for 2019, sunflower production area accounts for 14% of the world's oilseeds production area and 12% of the production quantity.

The use of inputs in accordance with the level of economic activity in the production of oily sunflower plays a significant role in reducing the cost of the product and increasing the level of profitability along with the yield obtained from the unit area. In this research, which is carried out in Canakkale province as one of the important oilseeds production centers of Turkey; the use of input used in the production of oily sunflower was examined, product cost, gross profit, net profit value, relative profit ratio, efficiency and point values were analyzed in detail and analyzed comparatively with other research findings.

In the research carried out, 374.60 g seeds, 21.27 kg of chemical fertilizer, 297 cc of agricultural medicine, 147.58 minutes of machine labor force and 13.74 lt of diesel input were used for about 237 kg da^{-1} oily sunflower product. As a result of the production, the average production cost of sunflower was determined as \$77.21 da^{-1}. The recent research showed that the cost of oily sunflower \$0.33 for the average values of enterprises per kg. With average values in the reviewed enterprises, the production value of oily sunflower has been determined as \$86.61 da^{-1} while gross profit has been found as \$33.60 da^{-1} and net profit as \$9.40 da^{-1}. In the research carried out, the relative profit ratio of oily sunflower production has been found as 1.12, the average productivity value as 3.07 kg $\$^{-1}$ and the profit point in production as 208.68 kg da^{-1}.

In the study, when the field, yield and production value related to the production of oily sunflower were examined, it has been found that 38,469 kg of products were obtained in total 149 da area in 13 enterprises in the first group, while the yield was determined as 258.18 kg da^{-1}. Enterprises in this group make more profit in relation to enterprises in other groups in terms of cost per kg, production cost, variable costs, fixed costs, gross profit, net profit, relative profit ratio and efficiency value. This indicates that as the size of the enterprises increases, the cost increases and the level of profitability decreases. These results indicate that small enterprises are more attentive to oily sunflower production than large enterprises, and as a result care to use input at a more rational level.

The production of oily sunflower in the research field is mainly carried out in dry conditions. In order for Turkey to cover the current deficit in vegetable oil, oily sunflower must be included in the production pattern in irrigated areas or areas newly opened for irrigation.

When we consider the cost of production of oily sunflower, it seems that tillage and planting costs are usually high, but producers usually go for a partial reduction in the cost of crops by doing these operations by themselves. The study shows that the majority of producers do not have insurance in the production of oily sunflower. Therefore, it has been found that both product and income loss have been experienced in fires, floods and hail rains.

The work which needs to be carried out in order to continuously make the production of oilseed sunflower with the desired quality of the market, to ensure price stability in the market and provide market guarantee to producers will be able to make the oily sunflower production activity more profitable in the studied enterprises.

In order to be able to increase both the yield obtained from the unit area and the oil ratio in the production of oilseed sunflower; emphasis should be given to the breeding of

varieties with higher oil content and higher reaction to water and fertilizer, and special attention should be given to the dissemination of these varieties. Private and public research institutions and organizations engaged in R&D activities in this regard must be supported.

Certified seed support is not applied to agricultural production made with hybrid seeds in Turkey. Research has shown that seed costs in oilseed sunflower production are 10.87% of the share of varying costs. In order to reduce the cost of sunflower production, the cost of seed used could be reduced by the legal regulation. In order to achieve this goal, the seed used in the production of oilseed sunflower, although it is hybrid seed, should also be included into support of the use of certified seeds.

As well as around the world, in Turkey, it has been witnessed that sunflower oil prices have increased steadily in recent years. For example, the war between Ukraine and the Russian Federation, which began in the spring of 2022, has caused significant troubles in some countries whose demand for wheat and sunflowers could not meet the supply. One of these countries is Turkey. The failure to close the supply deficit indicates that the price that Turkey pays for this product and its derivatives will increase steadily. Therefore, the production of oily sunflower must necessarily be encouraged within the country. In this context, diesel support ($2.17 da^{-1}), fertilizer support ($0.60 da^{-1}) and difference payment support ($0.04 kg^{-1}) which was given for 2021 oily sunflower production should be determined using more realistic methods. Because the income support of about $22 per decare in the country is not enough for sunflower producers. Besides, oily sunflower production will become a more profitable branch of activity if sunflower producers are trained in technical sense and supported in economic terms.

6. References

ABDİKOĞLU, D.İ.; UNAKITAN, G. An economic analysis of different size of farms in Turkey: The case of Trakya Region. *Custos e @gronegócio on line, vol.* 17, n. 3, p. 198-215. 2021.

ALEMDAR, T.; SEÇER, A.; DEMİRDÖĞEN, A.; ÖZTORNACI, B.; AYKANAT, S. Çukurova Bölgesi'nde başlıca tarla ürünlerinin üretim maliyetleri ve pazarlama yapıları. GTHB Tarımsal Ekonomi ve Politika Geliştirme Enstitüsü (TEPGE) (Proje No: Ç.Ü.-ZF2011BAP7). TEPGE Yayın No: 230. Haziran. Ankara. 134 p. 2014.

ANONYMOUS. Ürün masaları-Ayçiçeği Bülteni. Sayı: 18, Ekim 2021. Tarım ve Orman Bakanlığı, Bitkisel Üretim Genel Müdürlüğü, Tarla ve Bahçe Bitkileri Daire Başkanlığı. Ankara. 4 p. 2021a.

ANONYMOUS. Durum tahmin, Ayçiçeği-2021. Tarım ve Orman Bakanlığı, Tarımsal Ekonomi ve Politika Geliştirme Enstitüsü, TEPGE YAYIN NO: 345, Kasım 2021, Ankara. 36 p. 2021b.

ANONYMOUS. Tarım ürünleri piyasaları-Ayçiçeği-, (Agricultural Products Market-Sunflower). *Agricultural Economics and Policy Development Institute / AEPDI* . Republic of Türkiye Ministry of Agriculture and Forestry. Ankara. 2 p. 2022a.

ANONYMOUS. Ürün Masaları-Ayçiçeği Bülteni-. Sayı: 20, Mayıs 2022. Tarım ve Orman Bakanlığı, Bitkisel Üretim Genel Müdürlüğü, Tarla ve Bahçe Bitkileri Daire Başkanlığı. Ankara. 4 p. 2022b.

ARYA. B.; ZECHARIAH, J. An economic analysis of production and marketing of sunflower in Raigarh district of Chhattisgarh. *Journal of Pharmacognosy and Phytochemistry*, vol. 7, n. 5, p. 1844-1846, 2018.

AYDIN, B. Trakya Bölgesi'nde faaliyet gösteren tarım işletmelerinin yapısal özellikleri ve etkinliklerinin belirlenmesi. Namık Kemal Üniversitesi Fen Bilimleri Enstitüsü Tarım Ekonomisi Anabilim Dalı. Doktora Tezi. 138 s. Tekirdağ. 2014.

BADAR, H.; JAVED, M.S.; ALI, A.; BATOOL, Z. Production and marketing constraints limiting sunflower production in Punjab (Pakistan). *International Journal of Agriculture & Biology, vol.* 4, n. 2, p. 267-271, 2002.

BAGHERZADEH, A.; KAZEMZADEH, F. Analysis of the effects of agricultural Inputs price liberalization on the production of sunflower in Khoy Zone. *International Journal of Agricultural Management & Development*, vol. 2, n. 3, p. 149-155, 2012

BAŞDEMİR, Ş. Development and evaluation of agricultural support payments for agricultural land and plant products in turkey in the period 2001-2020. T.C. Marmara Üniversitesi, Sosyal

Bilimler Enstitüsü, Maliye Anabilim Dalı, Mali İktisat Bilim Dalı. Master Thesis. 173 p., İstanbul. 2021.

BAYRAMOĞLU, Z.; GÖKTOLGA, Z.G.; GÜNDÜZ, O. Tokat ili Zile ilçesinde yetiştirilen bazı önemli tarla ürünlerinde fiziki üretim girdileri ve maliyet analizleri. *Tarım Ekonomisi Dergisi*, vol. 11, n. 2, p. 101-109, 2005.

BOSNJAK, D.; RODIC, V. Economic effects of sunflower production in Vojvodina. Processing, Technology and New Uses. Proc. 16th International Sunflower Conference, Fargo, North Dakota, USA. Vol. 2, p. 835-840, 2004. (Access: https://www.isasunflower.org/fileadmin/documents/aaProceedings/16thISCFargo-vol2/fargo835-840.pdf, date: 14.09.2022) 2004.

CERAN, R.; TOPAK, R. Economic analysis for groundwater-ırrigated oily sunflower farming in Konya Region. *Selcuk Journal of Agriculture and Food Sciences*, 34(1), 7-13. 2020.

CHOUDHARY, M.A.; LODHI, A.S.; AHMAD, M.; AHMED, M. A Comparative study of cost of production and decision making analysis in case of onion and sunflower crops in Quetta district. *Sarhad J. Agric., vol.* 24, n. 3, p. 469-478, 2008

DALCHIAVON, F.C.; LORENZON, L.A.; PERINA, R.A., OLIVEIRA, R.A.; SANTOS, J.A. Economic opportunity for ınvestment in soybean and sunflower crop system in Mato Grosso, Brazil. *Journal of Experimental Agriculture International*, vol. 29, n. 5, p. 1-12 (Article no.JEAI.45695), 2019.

DAS, L.K.; ROUT, R.K. Economic analysis of sunflower enterprise in Western Odisha. *Int. J. Pure App. Biosci*, vol. 6, n. 4, p. 498-505, 2018.

DEEPIKA, C.L.; SINGH, R.; REDDY, V.S.N. Response of different levels of nitrogen and sulphur on production and economics of sunflower (*Helianthus annuus* L.). *International Journal of Plant & Soil Science*, vol. 34, n. 13, p. 87-92, 2022.

DÜĞMECİ, H.Y.; ÇELİK, Y. Konya ili Çumra ilçesinde yağlık ayçiçeği üretim maliyetinin tespiti üzerine bir araştırma. *Türk Tarım ve Doğa Bilimleri Dergisi* . vol 7, n. 3, p. 682–690, 2020.

FAO. Birleşmiş Milletler Gıda ve Tarım Örgütü. FAOSTAT. (Access: http://www.fao.org/faostat/en/#data, date: 10.02.2020). 2021.

GARCIA-GARCIA, J.; ROMERO, P.; BOTIA, P.; GARCIA, F. Cost-benefit analysis of almond orchard under regulated defcit irrigation (RDI) in SE Spain. *Span J Agric Res*, vol. 2, n. 2, p. 157–165, 2004.

GÜL, V.; ÖZTÜRK, E.; POLAT, T. Günümüz Türkiye'sinde bitkisel yağ açığını kapatmada ayçiçeğinin önemi. *Alınteri Zirai Bilimler Dergisi*, vol. 30, n. 1, p. 70-76, 2016.

GÜLEŞ, H. K. Ayçiçeğinin stratejik ürün kapsamına alınmasına ilişkin araştırma raporu. Konya Gıda ve Tarım Üniversitesi. (Access:(https://www.bysd.org.tr/uploads/raporlar/aycicegi.pdf., .date: 09.11.2019,) 2016.

HABIB, N. Relative profitability analysis of sunflower in district Swabi and Mardan. *Pakistan J. Agric. Res*., vol. 29, n. 4, p. 415-420, 2016.

ISINIKA A.C.; JECKONIAH, J. The political economy of sunflower in Tanzania: A case of Singida Region. *Future Agricultures Consortium* , APRA 49: 002. 2021.

IRUGU,S.D.; SUHASINI, K.; PRABHAKAR, B.N. Resource Use efficiency of sunflower in Kurnool district of Andhra Pradesh. *Research Journal of Agricultural Sciences*, vol. 8, n.1, p. 91-94. 2017.

JOYO, M.A.; RAM, N.; KOONDHAR, M. A.; ABBASI, F. Impact analysis: Farmer's knowledge and economics of sunflower production in Golarchi district of Badin Sindh province of Pakistan (June 2, 2016, Access SSRN: https://ssrn.com/abstract=2788424, date: 14.09.2022) 2016.

KANANNAVAR, P.S.; CHILUR, VASANTHGOUDA,R.; RAVINDRA, B.R.; NAGARAJ, D.M. The economic analysis of sunflower production. *Internat. J. Agric. Engg*., vol. 6, n. 1, p. 227- 230, 2013.

KAMUGISHA, P.P.; LEONARD, A.; MHANGA, S.F. Investment analysis of sunflower farming and prospects of raising household income in Iramba district, Tanzania. *International Journal of Environment, Agriculture and Biotechnology, vol.* 5, n. 4, p. 1062-1069, 2020.

KARAAĞAÇ, H. A.; BOLAT, A.; SAĞLAM, C.; YAZGAN, E., ÇİL, A. Ayçiçeği yetiştiriciliğinde enerji kullanım etkinliğinin belirlenmesi: Adana ili örneği. *International Journal of Eastern Mediterranean Agricultural Research*, vol. 1, n. 2, p. 1-12, 2018.

KARAATA H. Ayçiçeği sulaması. Köy Hizmetleri Atatürk Araştırma Enstitüsü Müdürlüğü Yayınları. Genel Yayın No:32, Bülten No:6. 1992.

KHATUN, M.; HOSSAIN, T. M.; MIAH, M. M.; KHANDOKER, S.; RASHID, M. Profitability of sunflower cultivation in some selected sites of Bangladesh. *Bangladesh Journal of Agricultural Research*, vol. *41, n.* 4, p. 599–623, 2016.

KIRAL, T.; KASNAKOĞLU, H.; TATLIDİL, F.F.; FİDAN, H.; GÜNDOĞMUŞ, E. Tarımsal ürünler için maliyet hesaplama metodolojisi ve veri tabanı rehberi (Cost calculation methodology for agricultural products and database guide). Tarımsal Ekonomi Araştırma Enstitüsü Yayın No: 37, Ankara, Türkiye. 1999.

KNEŽEVIĆ, M.; POPOVIĆ, R. Economics of sunfl ower production in Serbia. *Field Veg. Crop Res.,* ,vol. 48, n. 213-218, 2011.

LAYARD, R.; GLAISTER, S. Cost-benefitt analysis. *Cambridge University Press*, Cambridge, p 497. 1994.

LEKUNZE, J.; ANTWI, M.A.; OLADELE, O.I. Socio-economic constraints to sunflower production in Bojanala farming community of the North-West province, South Africa. *Life Science Journal*, vol. 8, n. 2, p. 502-506, 2011.

MGENI, C.; MULLER K.; SIEBER S. Sunflower value chain enhancements for the rural economy in Tanzania: A village computable general equilibrium-cge approach. *Academic Open Access Publishing*, vol. 11, n. 1, p. 75, 2019.

MOUSAVIAVVAL, S.H.; RAFIEE, S.; JAFARI, A., MOHAMMADI, A. Econometric modeling and sensitivity analysis of costs of inputs for sunflower production in Iran. *International Journal Of Applied Engineering Research*, ,ol. 1, n. 4, p. 759-766. 2011.

NATEGH, N.A.; BANAEIAN, N.I.; GHOLAMSHAHI, A.I NOSRATI, M. Optimization of energy, economic, and environmental indices in sunflower cultivation: A comparative analysis. *Environ. Prog. & Sustainable Energy.* 2020e13505. (Access: https://doi.org/10.1002/ep.13505, date: 20.09.2022). 2020.

NHUNDU, K.; GANDIDZANWA, C.; CHAMINUKA, P.; MAMABOLO, M.; MAHLANGU S.; MAKHURA, M. N. Agricultural supply response for sunflower in South Africa (1947–2016): The partial nerlovian framework approach. *African Journal of Science Technology Innovation and Development*, vol. 14, n. 2, p. 49-44. 2022.

OGUZ, C.; ALTINTAŞ, Ö. Kırıkkale ilinde çerezlik ve yağlık ayçiçeği yetiştiriciliğinin üretim maliyeti ve fonksiyonel analizi**.** *Selçuk Ün. Ziraat Fakültesi Dergisi, vol.* 16, n. 29, p. 39-47, 2002.

OĞUZ, C.; KARAKAYACI, Z. Tarım ekonomisinde araştırma ve örnekleme metodolojisi. Atlas Akademi Yayınları, Konya. 185 p. 2017.

OĞUZ, C.; OGUR, A.Y. Energy productivity and efficiency in sunflower production. *J. Agr. Sci. Tech. vol.* 24, n. 4, p. 767-777, 2022.

ONAT, B.; ARICIOĞLU, H.; GÜLLÜOĞLU, L.; KURT, C.; BAKAL, H. Dünya ve Türkiye'de yağlı tohum ve ham yağ üretimine bakış. *KSU J. Nat. Sci.*, vol. 20 (Özel Sayı), p. 149-153, 2017.

PARLAKAY, O.; GÖZENER, B.; SAYILI, M. Production cost and technical efficiency in the enterprises producing sunflower in dry conditions: A case study of Edirne, Turkey. *Custos e @gronegócio on line, vol.* 12, n. 4, p. 19-33, 2016.

PILORGÉ, E. Sunflower in the global vegetable oil system: situation, specificities and perspectives. *OCL, vol.* 27, p. 34- 11, 2021.

OFFICIAL GAZETTE. 2019 Yılında Yapılacak Tarımsal Desteklemelere İlişkin Karar. Resmi Gazete, Karar Sayısı: 1691, Sayı:30928, Tarih: 24.10.2019. 2019.

OFFICIAL GAZETTE. 2020 Yılında Yapılacak Tarımsal Desteklemelere İlişkin Karar. Resmi Gazete, Karar Sayısı: 3190, Sayı:31295, Tarih:05.011.2020.

OFFICIAL GAZETTE. 2021 Yılında Yapılacak Tarımsal Desteklemeler ve 2022 Yılında Uygulanacak Gübre ve Sertifikalı Tohum Kullanım Desteklerine İlişkin Karar. Resmi Gazete, Karar Sayısı: 4760, Sayı:31656, Tarih:11.011.2021.

SANDHYA, G.; SINGH, R.; SINGH, E. Effect of biofertilizers and levels and sources of sulphur on yield and economics of sunflower (*Helianthus annuus* L.) *The Pharma Innovation Journal*, vol. 10, n. 11, p. 1822-1825, 2021.

SEMERCİ, A.; KAYA, Y.; SAHİN, I.; CİTAK, N. Evaluation of the changes in the cost factors of sunflower produced in Thrace on the basis of the provinces in the research field and of the sizes of enterprise. *Helia*, vol. 34, n. 54, p. 147-158, 2011.

SEMERCİ, A. The effects of agricultural subsidies on sunflower cultivation and farmers' income: evidence from Turkey *Pak. J. Agri. Sci.,* vol. 50, n. 1, p. 139-145, 2013a.

SEMERCİ, A. Economic analysis of sunflower production in the view of orobanche resistance conditions. *Pak. J. Agri. Sci., vol. 50, n. 3, p. 499-504*, 2013b.

SEMERCİ, A. The place and importance of cultivating sunflower (Helianthus annuus L.) in agriculture enterprises in Turkey: a case study of Thrace region. *Custos e @gronegócio on line, vol.* 10, n. 2, p. 84-204, 2014.

SEMERCİ, A. Yağlık ayçiçeği üretiminin ekonomik analizi: Kırklareli ili örneği. *Türk Tarım ve Doğa Bilimleri Dergisi,* vol. 6, n. 4, p. 616–623, 2019a.

SEMERCİ, A. Cost analysis of oily sunflower production: The case of Tekirdag province, Turkey. *Custos e @gronegócio on line*, vol. 15, n. 2, p. 167-191, 2019b.

SEMERCİ, A. Tarımsal üretimde kaynak kullanım etkinliğinin belirlenmesi: yağlık ayçiçeği (*Helianthus annuus, L.*) üretimi örneği. *Türk Tarım ve Doğa Bilimleri Dergisi,* vol. 9, n. 2, p. 263-281, 2022a.

SEMERCİ, A. Yağlık ayçiçeği (Helianthus annuus, L.) üretiminde işletme büyüklük gruplarına göre girdi kullanım etkinliğinin analizi. *Türk Tarım ve Doğa Bilimleri Dergisi,* vol. 9, n. 2, p. 227-243, 2022b.

SETHAR, A.A.; NOONARI, S.; MEMON, I.N.; MEMON, Z.;PATHAN, A.; MANZOOR, A.; PATHAN, M. Comparative economic analysis of hybrid v/s conventional sunflower production Sindh Pakistan. *Industrial Engineering Letters*, vol. 5, n. 7, p. 34-42, 2015.

SHAH, N.A.; AUJLA, K.M.; ISHAQ, M.; FAROOQ,A. Trends in sunflower production and its potential in increasing domestic edible oil production in Punjab, Pakistan. *Sarhad J. Agric., vol.* 29, n. 1, p. 7-13, 2013.

SLOBODIANYK, A.; ABUSELIDZE, G.; LYMAR, V. Economic efficiency of oilseed production in Ukraine. E3S Web of Conferences 234, 00001, *ICIES 2020.* (Access:https://doi.org/10.1051/e3sconf/202123400001, date:13.09.2022). 2021.

SONAWANE, K.G.; POKHARKAR, V.G.; NIRGUDE, R.R. Sunflower production technology: An economic analysis. *Journal of Pharmacognosy and Phytochemistry*, vol. 8, n. 3, p. 2378-2382, 2019.

SUCHLA, E. G.; CATAPAN,A.; BONFIM, B. L. S.; CATAPAN, M. F.; SIMÕES, O. A. Sunflower production in Brazil: Sensitivity of the financial viability in the cultivation in farms through Monte Carlo Simulation**.** *Bulgarian Journal of Agricultural Science, vol.* 22, n. 6, p. 869–874, 2016.

SUNANDINI, G.P.; DEVI, I. S. Economics and profitability of sunflower production in Andhra Pradesh. *International Journal of Agricultural Science and Research*, vol. 10, n. 5, p. 33–40, 2020.

SUNEETHA, K.; ILLURU, N.K. Production and profitability of sunflower in Andhra Pradesh- An analysis. *International Journal of Multidisciplinary Educational Research*. Vol. 3, n. 12(2), p. 242-254. 2014.

TOP, B.T.; ÖZÜDOĞRU,T. Türkiye'de ayçiçeği destekleme politikalarının tercihinde etkili olan faktörler. *Tarım Ekonomileri Araştırma Dergisi*, vol. 2, n. 2, p. 1-10, 2016.

TODOROVIĆ, S.; FILIPOVIĆ, N.; MUNĆAN. M. Economic analysis of sunflower production on family farms in The Republic of Serbia. *Research Journal of Agricultural Science*, vol. 42, n. 3, p. 833-837, 2010

TÜİK. Türkiye İstatistik Kurumu, Bitkisel Üretim İstatistikleri. (Access https://biruni.tuik.gov.tr/medas/?kn= 104&locale=tr, date :10.10.2020). 2020.

TÜİK. Türkiye İstatistik Kurumu, Bitkisel Üretim İstatistikleri. (Access: https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr, date: 10.12.2021). 2021.

UNAKITAN, G.; AYDIN, B. Comparison of energy use efficiency and economic analysis of wheat and sunflower production in Turkey: A case study in Thrace Region. *Energy, vol.* 149, p. 279-285, 2018.

USDA.(Access:http://www.Ers.Usda.Gov/Topics/Farmeconomy/Farmsectorincomefinances/2016-Farm- Sectorincome-Forecast.Aspx. date: 09.11.2020). 2020.

UZUNOZ, M.; AKCAY, Y.; ESENGUN, K. Energy input-output analysis of sunflower seed (H*elianthus Annuus l.*) oil in Turkey. *Energy Sources, Part B: Economics, Planning, and Policy*, vol. 3, n. 3, p. 215-223, 2008.

UZUNDUMLU, A.S.; TOPCU, Y. Erzurum ilinde çerezlik ayçiçeği üretim maliyeti. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, vol. 2 (2, Ek:A): p. 33-40, 2012.

VASYLKOVSHA, K.; ANDRIIENKO O., VASYLKOVSKYI, O.; ANDRIIENKO, V. P.; MALAKHOVSKA, V. Dynamics of export potential of sunflower oil in Ukraine. *Helia*, vol. 44, n. 74, p. 115-123, 2021.

YAMANE, T. Elementary sampling theory. Englewood Cliffs, New Jersey: Prentice-. Hall, Inc., pp.405. USA. 1967.

YÜKSEK, E. Adana ilinde yağlık ayçiçeği üretim faaliyetinin ekonomik analizi. Kahramanmaraş Üniversitesi Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi. *38 p.*, 2019.

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