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Evaluation of The Changes in The Cost Factors of Sunflower Production in Turkey

A. Semerci

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İzmit – Kocaeli/TURKEY

In Turkey, which ranks the 10th country worldwide in the sunflower (*Helianthus annuus L.*) production, 60% of the production is carried out in the Thrace Region. Therefore, agricultural enterprises in Thrace, situated in the European part of Turkey, have mastered in producing sunflower, and have become the centre of vegetable oil industry in the region owing to the produced raw material.

In this study, it has been aimed to investigate the yield and income of the enterprises producing sunflower in Thrace Region in Turkey, and besides this whether the factors affecting the production are different. In the final section of the study, cost analysis has been explained in detail on the basis of the sizes of sunflower production area.

The data used in the study have been gained from 571 agricultural enterprises which are determined so as to represent the whole Thrace Region with the 'Stratified Random Sampling' method.

At the end of the study, although the cities where the study has been conducted, have the same climate features and production technologies, it has been introduced that in addition to the income and yield obtained in per unit area, in terms of land rent, pesticide, fertilizing and seed which directly affect the cost have shown differences among cities statistically.

Key Words: Sunflower, yield, income, crop cost.

Ayçiçeği Üretiminde Maliyet Faktörlerindeki Değişimin İncelenmesi (Trakya Bölgesi/Türkiye Örneği)

Dünya ayçiçeği (*Helianthus annuus L.*) üretiminde 10. sırada yer alan Türkiye'de üretimin %60'lık bölümü Trakya'da üretilmektedir. Bu nedenle, Türkiye'nin Avrupa bölümünü oluşturan Trakya'da tarım işletmeleri ayçiçeği üretiminde uzmanlaşmış ve bölge, sağladığı hammadde nedeniyle, ülkenin bitkisel yağ sanayi merkezi olmuştur.

Bu çalışmada Trakya'da ayçiçeği üreten işletmelerin verim ve gelir durumları yanında, üretimi etkileyen faktörler arasında farklılık olup olmadığı araştırılmıştır. Çalışma sonunda, işletmelerin ayçiçeği üretim alanı büyüklükleri baz alınarak maliyet unsurları ayrıntılı olarak açıklanmıştır.

Çalışmada kullanılan veriler "Tabakalı Tesadüfi Örnekleme Yöntemi"ne göre Trakya'nın tamamını temsil edecek şekilde belirlenen 571 tarım işletmesinden elde edilmiştir.

Çalışma sonunda, araştırmanın yürütüldüğü illerin benzer iklim özelliklerine ve üretim teknolojilerine sahip olmalarına rağmen, iller arasında birim alandan elde edilen gelir ve verim yanında, doğrudan maliyeti etkileyen arazi kirası, tarımsal mücadele ilacı, gübreleme ve tohum faktörleri yönünden istatistiki açıdan farklılıklar olduğu sonucuna varılmıştır.

Anahtar Kelimeler: Ayçiçeği, verim, gelir, ürün maliyeti.

Introduction

Vegetable oils are one of the main sources of energy necessary for human nutrition. Today, oily seeds from which vegetable oils are obtained have been produced to provide the calorie that is necessary for human nutrition and also as a raw material of bio-fuel. With 37.5% of cultivation field of oily seeds and 32.13% of production amount, soybean takes first place around the world. Sunflower is in the third rank in the production of oilseeds throughout the world and the most important oilseed in Turkey (Kolsarici et al. 2005). Turkey, which takes the 10th rank among the biggest sunflower producing countries in the world, owns the 2.04% of sunflower cultivation area and 2.56% of sunflower production (Anonymous, 2009a).

Oily seeds and vegetable oils are one of the most important groups of products of which Turkey has a demand deficit and this deficit could only be met by means of import. Turkey's foreign trade of agricultural products was US$24.5 billion in 2008. The proportion of export on the total scale of foreign trade was US$11.5 billion whereas the proportion of import was US$13 billion. The import value of vegetable and animal oil, which increased 2 fold in 2008 compared to 2007, was totally US$1.7 billion consisting a US$1.5 billion of vegetable oils import. When oily seeds are added to this figure, the import of this group reached 23% of total agricultural products with 3 billion US$ (Anonymous, 2009b).

Thrace is in the most important central position in sunflower which has the biggest proportion in the production of oily seeds in Turkey. Five cities (Edirne, Kirklareli, Tekirdag, Canakkale and Istanbul provinces) constituting the Thrace Region make up the 59.51% of cultivation fields of sunflower, 62.04% of production amount in Turkey (Anonymous, 2009c). Sunflower plant, the most important product alternating the wheat in Thrace, is one of the most significant sources of income of the producers in the region. Due to the proportion that it holds in the vegetable production pattern, producers have mastered in producing sunflower and vegetable oil industry has developed in the region significantly.

There are few studies in economic analysis of sunflower production in Turkey and they are mainly related to determination of sunflower production cost and input use in sunflower (Pirinccioglu, 1973; Oguz and Altintas, 2002; Semerci et al, 2007). With this research, some inputs used for per unit area among the cities producing sunflower in Thrace have been investigated with their monetary sizes and tested whether there are differences statistically among the cities. Additionally, in this study cost of the sunflower has been calculated according to the sizes of the production area.

Material and Method

Thrace Region which was determined as research area has 24378 km^2 land and it covers 2.99% of Turkey (Semerci, 1998). Trakya Region is the most important region of sunflower and the region has the largest area of oil seed production of Turkey (Semerci et al., 2011). The primary data used in the research have been obtained from the agricultural enterprises in Edirne, Kirkareli, Tekirdag and the other enterprises which are situated on the Thrace part of Istanbul and Canakkale producing sunflower. These enterprises have been determined with the "Stratified Random Sampling Method". The data which lay the basis of sampling on the level of settlement have been gathered from Provincial Directorate of Agriculture of the cities mentioned above and Ministry of Agriculture and Rural Affairs, General Directorate of Agricultural Production and Development. The lists of "Supporting Premium of Sunflower for Oil" of 2007 have been used in order to collect data for cultivation fields of sunflower on the basis of farmer.

The research data depend on the project of "The Determination of Efficiency of Subsidizing Policies and Productivity in Sunflower Production (TAGEM-08/AR-GE/06)" which was supported by the Ministry Agriculture and Rural Affairs. The formula for "Stratified Random Sampling Method" used in the research is given below (Yamane, 1967).

$$n = \frac{\sum (NhSh)^2}{N^2 D^2 + \sum Nh(Sh)^2}$$

In the formula;

n : volume of sample

N_h : unit number (frequency) in the layer of h

S_h : standard deviation (SD) in the layer of h

N : the number of total units

D : d/z

d : the deviation of the average with a definite ratio (1% - 5%, 10%, etc.)

z : t- the value of the degree of unconstraint in the distribution chart (N-1) and a particular reliance limit (90%-95%-99% etc).

In the scope of the research, 571 surveys (Tekirdag province 233 surveys, Edirne province 175 surveys, Kirklareli province 116 surveys, Istanbul 26 surveys, and Canakkale 21 surveys) have been conducted in the enterprises producing sunflower. The cross section data gathered by means of surveys are belonging to the production year in 2009. In determining settlements that the survey has been conducted, 95% of reliance interval and 4% of deviation from average has been considered. In determining the number of

surveys conducted 95% of reliance interval and 1% of deviation from average have been considered (Erkan and Cicek, 1996).

It has been determined by means of the "test of ANOVA" whether there are differences from the point of factors affecting the cost of sunflower among cities where this survey is conducted. And between which variables these differences occur has been determined by means of "Turkey HSD test" (Ural and Kilic, 2006; Altunısık et al. 2007; Green et al., 2000). For this reason, multiple comparisons have been made among cities. Below and above limit values in 95% reliance interval, the importance level of differences and standard mistakes belonging to the used variable, have been given in the charts of the multiple comparisons which have been created.

In the research, the cost of sunflower produced in the surveyed enterprises has been calculated on the basis of both cities and sizes of enterprises. For this reason, the enterprises have been divided into 5 groups according to their size such as: 0.1-1.9 ha $^{-1}$, 2.0-4.9 ha $^{-1}$, 5.0-9.9 ha $^{-1}$, 10.0-19.9 ha $^{-1}$, and >20 ha $^{-1}$. The criteria used in calculating the production cost of sunflower is given below with their formulas (Erkus and Demirci, 2007; Anonymous, 2009d; Perin et al., 1976).

*Total Gross Production Value (TGPV): Yield (kg ha^{-1})*Product Sale Price (including subsidizes),*

Net Profit (NP): TGPV-(Variable Expenses+Constant Expenses)

Gross Profit (GP): TGPV - Variable Expenses

Variable Expenses(VE): Soil Preparation + Planting + Fertilizing + Harvest + Transportation + Seed + Fertilizer + Chemicals

Constant (Fixed) Expenses (CE): Land Rent + Other Expenses + Capital Interest + Administrative Expenses

*Other Expenses(OE): Total Cost (Variable Expenses+Constant Expenses) * 0.05*

*Capital Interest(CI): (Total Cost + Other Expenses + Land Rent) * (Interest rate of production period) 0.07*

*Administrative Expenses(AE): (Total Cost + Other Expenses + Land Rent) * 0.03*

Results and Discussion

The Component cost of sunflower production

In respect of the conducted survey, it has been determined that in the distribution of sunflower cost, land rent is 20.62%, soil preparation is 30.80%, input use is 7.19%, care and harvest process 22.12% (Safak, 1981). In another research of the same area, it has been seen that in the production of sunflower cost factors are distributed like these; soil preparation 30.97%, care works 29.50%, land rent 31.18 %and the rest is the cost of harvest and trashing 8.35% (Anonymous, 2001).

In this study, it has been determined that cost of land rent and soil cultivation form nearly the half of the total production cost (49.13%). The other cost components are fertilizing price, harvesting price, interest on capital and planting cost.

The Cost based on the size of sunflower planting area

In this study it was determined that average gross income obtained in per unit area is 58.49 US$ ha $^{-1}$ and the average net income is 21.03 US$ ha $^{-1}$. While the highest gross income in per unit area in terms of sunflower planting area has been obtained from the smallest enterprises group (0.1–1.9 ha), it is seen that as the size of the enterprises increases, the gross income obtained from them becomes less.

There are also similar cases for net income, obtained in per unit area. As the size of enterprises increases, gross and net income decrease and along with the decrease in yield value in per unit area, flexible high costs have an important role on increasing of cost (Table 1).

Table 1. The cost based on the size of sunflower planting area.

CROP BUDGET	Units	Sizes of Sunflower Planted Areas					
		1-19 (ha^{-1})	20-49 (ha^{-1})	50-99 (ha^{-1})	100-199 (ha^{-1})	200+ (ha^{-1})	Aver. (ha^{-1})
	Numb. of Enterprise	45	155	191	131	49	571
	Area (ha^{-1})	547.50	4988.00	12533.00	16865.00	18564.00	53497.50
	Prod.(ton)	100.49	927.21	2255.29	3064.89	3139.20	9487.07
A.Income							
1.Yield	kg ha-1	183.54	185.89	179.95	181.73	169.10	177.34
2.Crop Price (including subsidizes)	US$ ha^{-1}	0.64	0.64	0.64	0.64	0.64	0.64
3.Crop Income (TGPV)	US$ ha^{-1}	116.67	118.16	114.39	115.52	107.49	113.92
B.Total Expenses	US$ ha^{-1}						
B.1 Variable Expenses	US$ ha^{-1}	56.10	58.97	57.11	58.25	56.09	55.42
Deep ploughing	US$ ha^{-1}	7.78	6.91	6.83	6.91	6.56	6.63
Double harrowing	US$ ha^{-1}	4.52	4.70	4.28	4.25	3.95	4.11
Harrowing	US$ ha^{-1}	3.09	3.75	3.18	3.19	3.15	3.13
Planting + Fertilizing	US$ ha^{-1}	4.80	5.11	5.00	5.06	4.56	5.40
Chemicals Application	US$ ha^{-1}	1.49	1.69	1.77	1.91	1.69	1.77
Hoeing	US$ ha^{-1}	4.90	7.39	5.92	6.75	5.02	4.93
Harvest	US$ ha^{-1}	6.46	6.59	6.59	6.48	6.54	6.47
Transportation	US$ ha^{-1}	4.92	4.84	4.77	4.70	4.70	4.05
Seed	US$ ha^{-1}	7.13	7.22	6.92	7.19	6.80	6.76
Fertilizer (20.20.0)	US$ ha^{-1}	9.20	9.17	10.16	9.80	10.51	10.06
Chemicals	US$ ha^{-1}	1.82	1.60	1.70	2.01	2.61	2.09
B2.Constant Expenses	US$ ha^{-1}	38.47	38.00	37.56	37.00	37.53	37.46
Land Rent	US$ ha^{-1}	27.93	27.30	27.01	26.42	27.05	26.81
Other Expenses	US$ ha^{-1}	2.64	2.64	2.64	2.64	2.64	2.77
Capital Interest	US$ ha^{-1}	6.07	6.22	6.08	6.11	6.00	5.95
Administrative Expenses	US$ ha^{-1}	1.84	1.84	1.84	1.84	1.84	1.93
Total Gross Production Value (TGPV)	US$ ha^{-1}	116.67	118.16	114.39	115.52	107.49	113.92
Total Variable Expenses (TVE)	US$ ha^{-1}	56.10	58.97	57.11	58.25	56.09	55.43
Total Constant Expenses (TCE)	US$ ha^{-1}	38.47	38.00	37.56	37.01	37.54	37.46
Total Production Cost (TPC) [(TCE + TVE)]	US$ ha^{-1}	94.57	96.97	94.67	95.26	93.62	92.89
Gross Profit (TGPV-TVE)	US$ ha^{-1}	60.57	59.19	57.28	57.27	51.41	58.49
Net Profit (TGPV-TPC)	US$ ha^{-1}	22.10	21.19	19.72	20.26	13.87	21.03
Cost	US$ ha^{-1}	94.57	96.97	94.67	95.26	93.62	92.89
Cost	US$ kg^{-1}	0.52	0.52	0.53	0.52	0.55	0.52

Differences belonging to seed cost paid for unit area of sunflower

According to the conducted variance analysis, it has been determined that there is a 5% difference in importance level statistically in the aspect of average seed cost (US$ ha^{-1}) for per unit area among the cities (Table 2).

Table 2. General variance analysis belonging to sunflower seed cost among the cities.

	Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Between Groups	88.50	4	22.13	2.90	.02
Within Groups	4324.59	566	7.64		
Total	4413.09	570			

Table 3. Multiple comparative variance analysis belonging to sunflower seed cost among the cities.

(I) Provinces	(J) Provinces	Mean Difference (I-J)	Std. Err. (SE)	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Canakkale	Istanbul	2.41 (*)	.82	.03	.17	4.65
	Kirkareli	1.82(*)	.66	.05	.02	3.61

* P< 0.05

Table 3. General variance analysis belonging to sunflower fertilizer cost among the cities.

	Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Between Groups	14119.58	4	3529.90	66.86	.00
Within Groups	29883.18	566	52.80		
Total	44002.77	570			

The average sunflower seed cost of the cities are like these: Kirkareli 6.52 US$ ha^{-1}, Canakkale 6.69 US$ ha^{-1},Tekirdag 6.69 US$ ha^{-1}, Edirne 6.88 US$ ha^{-1} and Istanbul 7.74 US$ ha^{-1}. In the research area, the average seed cost paid for sunflower types used in per unit area is higher in Istanbul compared to the average of the other four cities. The main reason of this difference is the usage of the only IMI and genetically durable sunflower seeds in this city.

In respect of the conducted survey, there has been a 5% difference in the importance level statistically among only the cities Canakkale-Istanbul-Kirkareli in the average seed cost among the cities (Table 3).

Differences belonging to fertilizer cost paid for per unit area of sunflower

According to the conducted variance analysis, it has been determined that there is a 5% difference in importance level statistically in the aspect of average fertilizer cost (US$ ha^{-1}) for per unit area among the cities (Table 4).

In respect of the conducted survey, there has been a 5% difference in the importance level statistically among the other cities in the average fertilizer cost among the cities except from Canakkale-Istanbul and Istanbul-Tekirdag cities (Table 5).

The average sunflower fertilizer costs of the cities used for per unit area are as below: Edirne 5.09 US$ ha^{-1}, Kirkareli 9.37 US$ ha^{-1}, Tekirdag 12.14 US$ ha^{-1}, Istanbul 13.38 US$ ha^{-1} and Canakkale 16.09 US$ ha^{-1}. These values (figures) show that the amount of the fertilizer cost paid for sunflower production in Canakkale has tripled the amount in Edirne.

Table 4. Multiple comparative variance analysis belonging to sunflower fertilizer cost used for unit area among the cities.

(I) Provinces	(J) Provinces	Mean Difference (I-J)	Std. Err. (SE)	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Canakkale	Istanbul	4.05	2.15	.33	-1.84	9.93
	Kirkareli	10.05(*)	1.72	.00	5.34	14.76
	Edirne	16.44(*)	1.68	.00	11.85	21.03
	Tekirdag	5.89(*)	1.66	.00	1.36	10.42
Istanbul	Kirkareli	6.00(*)	1.60	.00	1.62	10.38
	Edirne	12.39(*)	1.55	.00	8.14	16.65
	Tekirdag	1.85	1.53	.75	-2.34	6.03
Kirkareli	Edirne	6.39(*)	.87	.00	4.02	8.77
	Tekirdag	-4.15(*)	.82	.00	-6.41	-1.90
Edirne	Tekirdag	-10.55(*)	.73	.00	-12.54	-8.56

* P < 0.05

Table 5. General variance analysis belonging to sunflower herbicide cost among the cities.

	Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Between Groups	503.78	4	125.95	17.60	.00
Within Groups	4051.96	566	7.16		
Total	4555.74	570			

Differences belonging to herbicide cost paid for per unit area of sunflower

According to the conducted variance analysis, it has been determined that there is a 5% difference in importance level statistically in the aspect of average herbicide cost (US$ ha^{-1}) for per unite area among the cities (Table 5).

In respect of the conducted survey, there has been a 5% difference in the importance level statistically among the cities Canakkale-Istanbul-Kirkareli, Istanbul-Edirne-Tekirdag, Kirkareli-Edirne-Tekirdag in the average herbicide cost (Table 6).

The average sunflower herbicide costs of the cities used for per unit area are like these: Canakkale 0.25 US$ ha^{-1}, Tekirdag 1.16 US$ ha^{-1}, Edirne 1.35 US$ ha^{-1}, Kirkareli 2.49 US$ ha^{-1} and Istanbul 2.89 US$ ha^{-1}. The basic reason of the difference in herbicide cost amounts used for per unit area is the usage of herbicides in different characteristics (herbicides which have different characteristics) with respect to their durability to orobanchaceae for seeds used in the production of sunflower. Unit prices of the herbicides used in struggle with orobanchaceae and wild plants that are accepted as one of the biggest problems especially in sunflower production show a range between 4.01-5.358 US$ lt^{-1} and 43.49-53.53 US$ lt^{-1} in herbicide market. This situation may cause diversities in costs for per unit area in sunflower production.

Table 6. Multiple comparative variance analysis belonging to sunflower herbicide cost used for per unit area among the cities.

(I) Provinces	(J) Provinces	Mean Difference (I-J)	Std. Err. (SE)	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Canakkale	Istanbul	-3.94(*)	.79	.00	-6.11	-1.77
	Kirkareli	-3.34(*)	.63	.00	-5.07	-1.60
	Edirne	-1.64	.62	.06	-3.33	.05
	Tekirdag	-1.35	.61	.18	-3.02	.32
Istanbul	Kirkareli	.60	.59	.85	-1.01	2.22
	Edirne	2.30(*)	.57	.00	.73	3.86
	Tekirdag	2.59(*)	.56	.00	1.05	4.13
Kirkareli	Edirne	1.70(*)	.32	.00	.82	2.57
	Tekirdag	1.99(*)	.30	.00	1.16	2.82
Edirne	Tekirdag	.29	.27	.81	-.44	1.03

* P < 0.05

Table 7. Variance analysis belonging to average land rent cost for per unit area of sunflower among the cities.

	Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
Between Groups	1786.73	4	446.68	4.29	.00
Within Groups	58949.27	566	104.15		
Total	60736.00	570			

Differences belonging to average land rent cost for per unit area of sunflower

According to the conducted variance analysis results, it has been determined that there is a 5% difference in importance level statistically in the aspect of average land rent cost (US$/ha^{-1}) for per unit area among the cities (Table 7. ; F: 4.289).

In respect of the conducted survey, there has been a 5% difference in the importance level statistically among Kirkareli-Edirne and Edirne-Tekirdag cities in the average land rent cost for average per unit area among the cities (Table 8).

The average land rent costs of the cities for average per unit area of sunflower are like these: Edirne 25.27 US$ ha^{-1}, Istanbul 25.94 US$ ha^{-1}, Kirklareli 27.63 US$ ha^{-1}, Tekirdag 27.82 US$ ha^{-1} and Canakkale 28.52 US$ ha^{-1}.

Conclusion

Thrace Region is one of the leading places where the production of sunflower is intensely carried out. Thanks to its suitable climate conditions and modern agricultural methods, Thrace is not only a centre of sunflower production for Turkey but also for Europe. In the agricultural enterprises in Thrace, sunflower planting area has 43% proportion in vegetable production pattern and 20% in agricultural income. Among the cities where the survey conducted, there has been a 5% difference in significance level statistically in terms of seed, fertilizer, chemicals and land rent which affect the cost of sunflower along with the income and yield obtained in per unit area.

The cost of Turkey's sunflower production is about 80% more than the top 5 countries in sunflower production (Russian Federation, Ukraine, Argentina, China and India). This fact causes vegetable oil industry, which is under research field, to turn towards importing. The main reason for this is the fact that importing cost is more reasonable along with the high production cost in domestic markets.

When the cost of sunflower produced in research field to be examined, it can be seen that land rent and soil cultivating cost constitute the biggest portion with a percentage of 43.13%. Average yield of the per unit area has been determined as 177.34 kg ha^{-1}, gross income 59.49 US$ ha^{-1}, net income 21.03 US$ ha^{-1} in research field.

Contrary to the general expectation, the highest gross income and net income has been obtained from smallest sized enterprises group. In the research it has been observed that as the sunflower planting area increases, there has been a decrease in yield and an increase in cost factors.

Table 8. Multiple comparative variance analysis belonging to average land rent cost for per unit area of sunflower among the cities.

(I) Provinces	(J) Provinces	Mean Difference (I-J)	Std. Err. (SE)	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Kirkareli	Edirne	3.52(*)	1.22	.03	.18	6.85
	Tekirdag	-.29	1.16	.99	-3.45	2.88
Edirne	Tekirdag	-3.81(*)	1.02	.00	-6.60	-1.01

* P < 0.05

The production in Turkey is highly expensive and less profitable branch of production when compared to other crops. The result of the research has shown that the production of sunflower in Turkey, which is among the top 10 countries in world's sunflower production, is not profitable. To develop an identity of competitiveness in the world sunflower market, the cost components of sunflower should be reduced around the level of 200 US$ / ton by using various methods which are not contrary to the constantly changing and developing agribusiness dynamics and regulations. Moreover, input use should be provided under more appropriate conditions in sunflower production.

To meet the existing oil deficit in Turkey, firs of all, seed which is high in oil should be used technically and production of sunflower should certainly be made under irrigated conditions. For this reason both works of R&D should be supported in seed improvement and every kind of support should certainly be given for irrigation infrastructure.

In the study, it is concluded that to meet the existing vegetable oil deficit of Turkey in the aspect of sunflower, it is not only necessary to make some technical changes (to support the usage of the genres high in oil, to increase the opportunities of irrigation, etc.), but also production of oily seeds in Agricultural Support System needs to be supported by establishing a different budget and decision mechanism.

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