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Determining the Factors that Affecting Confectionery Sunflower Yield: The Case of Erzurum Province

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ABSTRACT

Objectives of this study was to determine the factors affecting the yield in confectionery sunflower production in Pasinler district of Erzurum province. In the study, the number of questionnaires was determined by using the simple random sampling method based on the main population ratios. Overall, 84 questionnaires were administered to the households of 13 villages with the highest sunflower production in the district. In order to determine the factors affecting the confectionery sunflower yield in the study, the socioeconomic and demographic factors of the producers and factor analysis coefficients for the problems encountered in confectionery sunflower production were analyzed by using the ordinary least squares method (OLS). In conclusion, as the age of the producers and the amount of chemical pesticides use increase, a yield increase in confectionery sunflower is achieved, whereas the yield decreases as the entrepreneurship problems of the family and the amount of agricultural supports increase. In order to the farms to achieve a higher level of yield and make a more conscious production, courses should be organized by universities and agricultural research institutes in areas including input use, farming techniques, and entrepreneurship. In addition, a small amount of premium support should be given to the confectionery sunflower as applied to oil sunflower.

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Çerezlik Ayçiçeği Verimi Üzerine Etkili Faktörlerin Belirlenmesi: Erzurum İli Örneği

ÖZET

Bu çalışmanın amacı Erzurum ilinin Pasinler ilçesinde çerezlik ayçiçeği üretiminde verim üzerine etkili olan faktörleri belirlemektir. Çalışmada ana kitle oranlarına dayalı basit tesadüfi örnekleme yapılarak anket sayısı tespit edilmiştir. İlçede çerezlik ayçiçeği üretiminin en fazla yapıldığı13 köydeki hane halkının bireyleri örneklemeye dâhil edilerek 84 anket yapılmıştır. Çalışmada çerezlik ayçiçeği verimini etkileyen faktörleri belirleyebilmek için üreticilerin sosyo-ekonomik, demografik faktörleri ile çerezlik ayçiçeği üretiminde karşılaşılan sorunlara yönelik faktör analizi katsayıları En Küçük Kareler (EKK) yönteminde analize tabi tutulmuştur. Sonuç olarak üreticilerin yaşı ve kullanılan kimyasal ilaç miktarı arttıkça çerezlik ayçiçeğinde verim artışı sağlanırken, ailenin girişimcilik sorunları ve yapılan tarımsal desteklerin miktarı arttıkça verim azalmaktadır. İşletmelerin daha yüksek düzeyde verim elde etmesi ve daha bilinçli üretim yapmaları için üniversite ve tarımsal araştırma enstitülerince girdi kullanımı, yetiştirme teknikleri ve girişimcilik alanlarında bilgilendirme kursları düzenlenmeli ve yağlık ayçiçeğine uygulandığı gibi çerezlik ayçiçeğine de küçük miktarda da prim desteği verilmelidir.

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INTRODUCTION

The total agricultural area used for production to meet people's food needs in Turkey as of 2017 is about 38 million ha. Of which, 14.6 million ha is allocated for grasslands and meadows, 15.5 million ha for growing grains and other vegetable crops, 3.3 ha for fruit and beverage and spicy plants, 0.8 ha for vegetables, and 3.7 million ha is left as fallow. While the total agricultural lands of Turkey decreased by 3 million ha between 2001 and 2017, the population of the country increased by 11 million within the same period (TURKSTAT, 2018a). This shows that the yield of the decreasing agricultural lands should be increased so that the food needs of the growing population can be met. When planning and administering the methods and laws that will be utilized in boosting the yield, the focus should be both on the welfare of the society and on the protection of natural resources and human health. It is important to implement new agricultural technologies to maximize product yield and minimize product losses. These methods and technologies help develop disease-resistant plant varieties and determine appropriate irrigation, fertilization, and spraying levels (Parnell et al., 2016).

Fertilization is one of the most important factors that increasing the yield in grains and other cultivated plants. Today, fertilization is the most preferred and the fastest-acting input due to several positive effects bringing in plant composition along with the yield increase (Jankowski et al., 2014). As a supportive statement for this view, nitrogen fertilization also provides an important mineral nutrient for the soil. Such fertilizers may have a significant effect on the yield and quality of plants that are poor in nitrogen (Sainju et al., 2003). Col and Akinerdem (2017) reported the adverse environmental effects of widespread use of chemical fertilizers in agricultural products and emphasized that organic fertilizers should be preferred more because of their positive effects on both quality and the environment. According to TURKSTAT (2018b) data, while the amount of fertilizer used in Turkey was around 9 million tons in 2007, it increased to 14 million tons in 2016. Of the fertilizers used in Turkey, 64.7 % has nitrogen content, 33.8% phosphorus content, and 1.5% potassium content.

Chemical control (management) is considered to be the cheapest, easiest and fastest method to minimize yield losses in agriculture. Nevertheless, in the twenty-first century, the negative consequences of the growing chemical pesticide use on human health and the environment are increasing gradually. This has led to conducting studies on the necessity of reducing the use of chemical pesticides worldwide (Lechenet et al., 2017). Some studies suggesting that such an application would reduce the yield and farmer income (Cai, 2008; Zhang et al., 2011; Jess et al., 2014; Lamichhane et al., 2016). On the other hand, there are also studies emphasizing that the sustainability of natural resources and human health are more important than the yield and farmer income (Sitaramaraju et al., 2014; Cakır et al., 2018; Zhang, 2018). The use of pesticides in Turkey was 8,396 liter in 1979 (Altikat et al., 2009). According to Chakravarty (2014), this amount increased to 30.6 million liters in 2003 and to 48.7 million liters in 2007 according to TURKSTAT (2018b) data. While the use of pesticides was generally around 37.6-42.6 million liters from 2007 until 2016, it reached 50.0 million liters in 2016. Another words, the pesticide consumption per ha in Turkey between 1979 and 2016 rose from 0.0003 liters to 2.1 liters. According to the 2016 data, the pesticides used consisted of 41.0% Fungicides, 20.8% Insecticides, 20.1% is Herbicides, 4.1% Acaricides, and 14.0% other chemicals. In 2016, a total of 47.7 million tons of confectionery sunflowers was produced throughout the world. Of this total production, 5.5% was produced by China, 3.5% by Turkey, 3.2% by Hungary, and 2.5% by the USA. The yield ratio of confectionery sunflower across the world is 180.7 kg*ha^{-1}, and the leading countries in yield are Israel, Hungary, China, and Turkey, respectively. The yield ratio in these countries is around 250-280 kg*ha^{-1} (FAOSTAT, 2018).

The total sunflower production area in Turkey increased from 6.6 million da to 7.8 million da between 2014-2017. Meanwhile, the total confectionery sunflower production area decreased from 1.05 million da to 0.98 million da in the same years. In 2014, the confectionery sunflower production area was 16% of the total sunflower farming area, whereas it made up 13.5% of the total area in 2017. While the ratio of oil sunflower yield has been 260 kg*da^{-1} in the last 4 years in Turkey, the ratio has been around 160 kg*da^{-1} in the confectionery sunflower production for the same period. While the confectionery variety has not shown much yield increase over the years due to the lack of support for this variety, significant yield increases have been obtained from oil varieties. The confectionery sunflower is produced in 32 provinces in Turkey. The province of Denizli ranks the first with 19.8% production share followed by Ankara (16%), Kayseri (12%), Kahramanmaras (9.4%), Bursa (6.7%), Aksaray (6.2%), and Konya (5.2%). These seven provinces account for 75% of the total confectionery sunflower production. Erzurum ranks the 11th with 2.3% production share. The ratio of confectionery sunflower yield in Erzurum city was around 239 kg*da^{-1} in 2016 and 2017 (TURKSTAT, 2018b).

In 2017, of the 29,076 tons of confectionery sunflower, 79% were imported from China, 9.6% from Bulgaria, 5.0% from the USA, 3.5% from Argentina, and 2.2% from Ukraine. In the same year, of the 22,091 tons of confectionery sunflower, 33.4% was exported to

Germany, 21.7% to Algeria, 8.6% to Russia, 6.6% to Tunisia, and 2.4% to Bulgaria (TURKSTAT, 2018b). This means that there is an import surplus not only in oil sunflower but also in confectionary sunflower, which also shows that Turkey should increase its annual confectionery sunflower production by approximately 7,000 tons.

Although the use of fertilizers and pesticides in Pasinler district, which provides a large portion of the confectionery sunflower production of Erzurum province, is greater than the other districts, the average yield is not at the desired level. For this reason, the aim of this study was to determine the necessary steps and procedures to increase confectionery sunflower yield in Pasinler district of Erzurum province.

MATERIAL and METHOD

Material

The primary data of the study were provided through face-to-face interviews with household members who were engaged in confectionery sunflower production in 13 villages in Pasinler district of Erzurum province. Apart from the primary sources, domestic or foreign scientific publications and the data obtained from TURKSTAT and FAOSTAT were used as a secondary source in the study.

Method

The Formula Used in the Sampling

The sampling method used in this study was employed by Newbold (1995). The sampling size calculation in this method is shown in formula 1 below.

$$n = \frac{N*p(1-p)}{(N-1)\sigma_{px}^2+p(1-p)} \quad (1)$$

Where

n : sampling size,

N : the number of farms engaged in confectionery sunflower production in Pasinler district (650),

p : the proportion of producers who have knowledge about confectionery sunflower production (50%),

r : Standard deviation (10%),

$Z_{\alpha/2}$: Z table value at 90% confidence interval (1.96), and

σ_{px}^2 : Variance (0.0026)

$$\sigma_{px}^2 = \left(\frac{0.10}{1.96}\right)^2 = 0.002603$$

The Method Employed in The Sampling Phase

As a result of the preliminary study conducted through TURKSTAT web address in October 2015, it was found that 87% of the confectionery sunflower production area in the province of Erzurum was in Pasinler district. In addition, the villages engaged in the production of confectionery sunflower in this district were obtained from the records of the District Directorate of Agriculture. The 13 villages, making up 85% of confectionery sunflower production area, was chosen as study area purposely. The number of questionnaires administered for confectionery sunflower in each village is shown in Table 1.

Table 1. The number of questionnaires to be administered for confectionery sunflower in each village (unit)

Villages	Number of questionnaires	Villages	Number of questionnaires	Villages	Number of questionnaires	
Epsemce	2	Sunak	5	Ugumu	7	
Asitlar	2	Demirdoven	6	Alvar	9	
Kavusturan	4	Tepecik	6	Altınbasak	11	
Ardicli	4	Taskaynak	7	Centre	16	
Cogender	5					**Total**
Total Number of Farms						**84**

Source: Anonymous, 2015.

Statistical Methods Employed in The Study

OLS method, one of the most used methods for this purpose, was used to determine the statistically significant variables affecting the yield. In addition, production problems within the factors affecting yield are summarized by factor analysis for studying with fewer variables. In the study, the problems encountered by the farmers in confectionery sunflower production were grouped by factor analysis. Factors affecting the yield in confectionery sunflower production, the socio-economic and demographic variables of the individuals, and the coefficients obtained from the factor analysis were subjected to analysis as independent variables in the OLS method.

Factor Analysis

In the factor analysis, the aim was to obtain the main factors that make up the same common characteristics through the combination of factors with common characteristics. It allows working with few variables rather than more complex variables. In addition, this forms few main factors by getting similar scores in the Likert scale and by being named according to these common characteristics with factors forming the common characteristics of more variables (Oven and

Pakdemir, 2005; Uzundumlu et al., 2018).

While several other factors are employed in obtaining the factors, the most commonly used method is Principal Component Analysis, and it was also employed in this study. In this method, similar relationships between variables were grouped and the variances decrease from the top left to the bottom right and the first factor with the most variance is located at the top left corner. The remaining factors following the first factor move through the right direction in descending variance order (Field, 2000; Alpar, 2012; Oksuz, 2017). The variables with an eigenvalue greater than 1 indicate the number of main factors, and the sum of the variance weights of each main factor shows the percentage of representing the main population (Oksuz, 2017). In addition, Barlett's and Kaiser-Meyer-Olkin (KMO) statistics are used to test the fit of the data used in the study to factor analysis (Ness, 2000). In the social sciences studies, the percentage of total variance explained is desired to be at least 60 % (Karagoz et al., 2018).

The Ordinary Least Squares Method (OLS)

The OLS method, one of the methods used to estimate β_0 and β_1 parameters, is the most commonly employed method in statistical studies (Yavuz and Asik, 2017). When $\hat{\beta}_0$ and $\hat{\beta}_1$ the sampling estimations of β_0 and β_1 parameters in the OLS method, are involved in the calculation, the linear function with one variable is shown as in formula 2.

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 \chi_{1i}, \qquad i = 1,2,...,n \tag{2}$$

The basis of the OLS method is to obtain the value that makes the sum of the error squares a minimum while estimating $\hat{\beta}_0$ and $\hat{\beta}_1$ regression parameters. The less the differences between the observed Y_i and the expected $\hat{Y}_i$ values in the determination of this value, the closer the estimates are to the real values (Ryan, 1997).

In this method, in order to obtain the linear models of $\hat{\beta}_0$ and $\hat{\beta}_1$, separate derivatives are taken according to $\hat{\beta}_0$ and $\hat{\beta}_1$, and they are equated to zero. In this case, the values of $\hat{\beta}_0$ and $\hat{\beta}_1$ that make the sum of the error squares a minimum are obtained (Alma and Vupa, 2008).

RESULTS and DISCUSSION

The Explanations of Variables Employed in The OLS Method for Confectionery Sunflower

Table 2 shows the variables that were employed to determine the factors that had an effect on sunflower yield, their explanations, and the minimum-maximum mean and standard error values.

Table 2. Some features of the variables used in the analysis

Code	Explanations	Min	Max	M	SE
YIELD	Sunflower yield (kg*da^{-1})	67.00	300.00	207.49	34.382
LAND	Sunflower land stock (da)	5.00	250.00	31.94	30.28
INCOME	Annual agricultural income of the household (TRY 1,000)	8.00	350.00	40.51	47.08
AGE	Age of the interviewee (year)	17.00	70.00	40.77	12.47
UNIV	Education status of the household head (university graduate:1, others:0)	0.00	1.00	0.08	0.28
SUPPORT	The status of getting agricultural support in 2015 (yes:1, no:0)	0.00	1.00	0.80	0.40
PESTICIDE	Amount of spraying (200 ml and higher =1, others=0)	0.00	1.00	0.44	0.50
FERTILIZE	Amount of fertilizers (kg*da^{-1})	30.00	100.00	67.08	13.71
FACT1	Entrepreneurship and labor shortage (factor analysis coefficient)	-2.74	1.74	2*10^{-7}	1.00

Min: Minimum, **Max:** Maximum, **M:** Mean, **SE:** Standard Error

According to the variables presented in the table, the yield in the farms varied from 67 to 300 kg, and the average yield was 207.49 kg*da^{-1}. When sunflower production area size is taken into consideration, the households were found to have around 5 to 250 da sunflower fields and the average size of a sunflower field was determined to be 31.94 da. The examination of annual agricultural income of the households indicated that the annual income of the households was around TRY8,000-350,000. The average agricultural income was TRY 40.510. The age of the respondents varied between 17 and 70, and the average age was 40.77. The ratio of household heads with undergraduate and bachelor's degree was 8%. In 2015, 80% of the farms were found to benefit from agricultural subsidies. The rate of farms using 200 ml and higher spraying was 44% and the average amount of fertilizer consumption was 67.08 kg*da^{-1}. In addition, entrepreneurship and labor shortage was one of the main factor obtained from factor analysis.

OLS Analysis for Confectionery Sunflower and Discussion

Table 3 shows the explanations, mean values and, and the standard error of the variables used in confectionery sunflower production.

Table 3. Variables that had an effect on confectionery sunflower yield

Variables	Sunflower Yield	
	Coefficient	SE
CONSTANT	34.9470	41.32342
LAND	-0.03034	30.28
INCOME	0.00026	47,075.66
AGE	1.22802**	0.56108
UNIV	-27.5869	0.28
SUPPORT	-36.9592**	38.33
PESTICIDE	82.2297***	48.16
FERTILIZE	-0.77930	13.71
FACT1	-18.7033***	0.99
* ∝=0,10 ** ∝=0,05	*** ∝=0,01	

The desire to maximize crop production in farms leads an increase in main inputs including fertilizers, pesticides, seeds and etc. per unit area (Karaagac et al., 2018). It is necessary to increase the yield in sunflower production, however, it is also important to have a deep knowledge about inputs in order to protect the environment **and** human beings (Sabah et al., 2016). In Table 3, the ordinary least squares method was employed to determine the positive and negative effect of variables that had an effect on confectionery sunflower yield. Thus, only statistically significant variables were explained. In the study, 8 independent variables were taken into consideration, and 4 of which were found significant. Considering the sign and significance level of each of these variables, it was determined that experience in confectionery sunflower production increased as the age of the respondent increased, which made a positive effect on the yield ($p \leq 0.05$) According to Ozudogru et al. (2015), the deficiency payment support given to the farms directly affects the income obtained particularly from sunflower and similar products, while it has an indirect effect on the product quality and the yield increase of these products. In this study, the increase in age and the number of working individuals in the family was found to increase the rate of preferring the deficiency payment support by the households, and thus, this was determined to indirectly increase the sunflower production yield in these households. In an organic clover study by Nastis et al. (2012) concluded that as the agricultural production experience of small-scale enterprises producing organic clover increased, households grew technically more efficient products. Pekcan (2014) reported that using low-quality seeds and households' lack of experience in cultivation were responsible for the low yield of confectionery sunflower production in Turkey.

Sunflower yield decreased as the government support to the farmers increased ($p<0.05$). The most important reason for this was because the government grants were being used in animal production rather than vegetable productions including sunflower. For this reason, necessary maintenance and yield enhancing factors could not be achieved at the desired level, thus making the effect of the supports on the confectionery sunflower yield negative. According to the official newspaper data (2015 and 2016), because TRY15 contracted production support + TRY0.30 kg^{-1} premium support given for per 1,000 m^2 of the oil sunflower land in 2015, not for the production, did not create the desired effect, a TRY0.40 kg^{-1} of premium support + TRY0.06 contracted production support was given in 2016 and the payment was made in 2017. Nevertheless, no support was provided for confectionery sunflower. In a study in Erzurum province by Kumbasaroglu and Dagdemir (2010) classified the farms into two groups as those using machinery (1) and those not using machinery (2). They also determined that the state support increased the net income, particularly in machinery using farms. According to Ozudogru et al. (2015), deficiency payment support given to oil sunflower had an indirect positive effect on product quality and yield. Since the support was directly given to the oil sunflower, it can be concluded that it affected the yield positively. In addition, Semerci et al. (2012) concluded that sunflower price subsidy had no effect on sunflower cultivated area and production.

In this region, pesticides such as challenge600 and saniron are used for weeds including pigweed, chickweed, veronica, lamb's quarter, and barnyard grass. The average pesticide use is approximately 193.57 $ml*da^{-1}$. As the amount of application dose used in farms increases, confectionery sunflower yield also increases. In other words, the application dose for confectionery sunflower in the region is below the desired level ($p<0.01$). As stated in Shtienberg (1997), the return of confectionery sunflower is determined not only by the quantity of the product but also by the quality of the product. For this reason, quality, size of the seed, and taste are important factors for the high price of confectionery sunflower. Pesticide use is essential to maintain quality level and minimize production losses, especially for fungal diseases. Bagherzadeh and Kazemzadeh (2012) examined the effect of input prices on the yield and found that the liberalization policy in input prices had a negative effect on sunflower yield. Table 4 shows the factor analysis results for confectionery sunflower.

Table 4. Identification of factors with eigenvalues for confectionery sunflower

Entrepreneurship and labor shortage (F1)	**Score**	**% of variance**
Some jobs cannot find qualified workers	0.863	17.865
Lack of technical knowledge	0.836	
High labor costs	0.791	
Poor relationship with agricultural organizations	0.694	
Low working capital	0.653	
Negative conditions of the region (F2)	**Score**	**% of variance**
Very few varieties to be produced	0.820	12.213
Failure to reach the market	0.702	
I can't get support for forage crops because I haven't got title deed	0.592	
Adverse weather conditions	0.571	
Inadequate input usage (F3)	**Score**	**% of variance**
Inability to use enough pesticides	0.830	12.120
Inability to make enough hoeing	0.812	
Inability to make enough irrigate	0.744	
Inability to make enough fertilization	0.709	
Agricultural institutions don't produce quality seeds (F4)	**Score**	**% of variance**
Seeds are usually poor	0.853	9.683
Seeds aren't usually certified	0.834	
Agricultural organizations are irrelevant to agriculture	0.587	
Lack of support and credit (F5)	**Score**	**% of variance**
Not enough support	0.811	7.578
Inability to benefit from agricultural credit	0.700	
Non-organization (F6)	**Score**	**% of variance**
the same product producers do not act jointly	0.789	6.871
Fertilizer cost (F7)	**Score**	**% of variance**
Fertilizers are costly	0.882	6.296
KMO (Kaiser-Meyer-Olkin) statistic value	0.700	
Bartlett's Test of Sphericity Sig.	0.000	
Cumulative share of explained variance (%)	72.626	

According to factor analysis, only statistically significant Factor (1) was evaluated in OLS analyzes. As the entrepreneurship and labor force problem increased, the confectionery sunflower yield of the farms decreased ($p<0.01$). Gocer (2013) stated that there could be an increase in the quality of the goods and services production by using the available labor resources in the farms. In addition, he added that the farmers had significant progress in field crops production, particularly in wheat and sunflower, in the Thrace region, yet, they could not lay out the same success in other products.

CONCLUSION and RECOMMENDATIONS

The need for confectionery sunflower production in Turkey has increased in parallel with the population growth over the years, whereas the farming area and yield has not shown much of improvement. One of the most important reasons for this is that subsidies are directed to oil varieties, as more oil varieties were needed in Turkey. While this situation leads to an increase in the yield of oil variety, yet leads not much of change in confectionery variety. Turkey imported 29,000 tons of confectionery sunflowers and exported 22,000 tons in 2017 making approximately 7,000 tons of export deficit in Turkey. In order for the country to eliminate its export deficit and shift to an advantageous position, it needs to produce extra 7,000 tons of confectionary sunflower. In order to realize this production, it is necessary to increase the production area and/or the yield. Because there has not been much change in confectionary sunflower yield over the years, determining the factors affecting the yield increase was the aim of this study. For this reason, 8 variables that can be effective on the yield were analyzed using OLS method in the study and 4 variables were found statistically significant.

When the results of the analysis are taken into consideration, according to the first factor, as the age of the individuals engaged in sunflower production increased, their experience in confectionery sunflower increases, and this indirectly affects the yield positively. To improve the farming techniques and knowledge levels of farmers related to confectionery sunflower farming, courses should be organized by Agricultural Research Institutes, the Agricultural Faculties of universities, and the Ministry of Agriculture and Forestry and the participation of

farmers to these courses should be ensured. According to the second factor, as the state support has been taken by farms increase while the confectionery sunflower yield decreases. As individuals take the support for agricultural and animal products but not for confectionery sunflower production, they spend their effort for boosting the yield of other products. The increase encourages for oil varieties and reduces in confectionery variety leads to the emergence of a deficit in export-import balance on the favor of import. If the state support for growing confectionery variety is provided, it can have an effect on the yield increase. According to the third factor, as the chemical pesticides dose used increases in the farms confectionery sunflower yield increases as well. Since the use of pesticides in the region is not excessive, the sunflower yield can be increased by considering good agricultural practices in confectionery sunflower production and by determining optimum dose standards to minimize the pesticide damage and similar yield enhancers. According to the fourth factor, as the entrepreneurship and labor force problems decrease in farms, the confectionery sunflower yield of farms increases. If entrepreneurs who are engaged in sunflower production can manage risks and the labor organization within a good plan and program framework, sunflower yield will reach the desired levels. Therefore, the education of one or more of the individuals in the farm on entrepreneurship will be able to accelerate the achievement of the desired outcomes.

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REFERENCES

Alma OG, Vupa O 2008. The Comparison of Least Squares and Least Median Squares Estimation Methods Which are used in Linear Regression Analysis. Suleyman Demirel University Faculty of Arts and Science Journal of Science, 3(2): 319-329.

Alpar R 2012. Applied Statistics and Validity-Reliability with Examples from Sports, Health and Educational Sciences. Detay Publishing, Ankara.

Altikat A, Turan T, Torun FE 2009. Use of Pesticides in Turkey and its Effects on Environment. Journal of Ataturk Univ. Agricultural Faculty, 40(2): 87-92.

Anonymous 2015. Records of Erzurum Directorate of Provincial Agriculture and Forestry

Bagherzadeh A, Kazemzadeh F 2012. Analysis of the Effects of Agricultural Inputs Price Liberalization on the Production of Sunflower in Khoy Zone. International Journal of Agricultural Management and Development, 2(3): 149-155.

Cai DW 2008. Understand the Role of Chemical Pesticides and Prevent Misuses of Pesticides. Bulletin of Agricultural Science and Technology, 1(6): 36-38.

Cakir O, Yıldız H, Karatas N 2018. Comparison of Biodynamic and Organic Agriculture. Turkish Journal of Agriculture - Food Science and Technology, 6(4): 438-443.

Chakravarty S. 2014. World Agrochemical and Pesticide Market to Grow 8.7% annually from 2014 to 2018. Accessed Date: 25.12.2018. https://www.marketresearchreports.com/blog/2014/01/06/world-agrochemical-and-pesticide-market-grow-87-annually-2014-2018.

Col N, Akınerdem F 2017. The Effect of Humic Acid Applications in Different Quantities on The Yield and Some Yield Components on Potato Plant (*Solanum tuberosum L.*. Selcuk Journal of Agriculture and Food Sciences, 31(3): 24-32.

FAOSTAT 2018. Sunflower Production and Yield. http://www.fao.org/faostat/en/#data/QC. Accessed Date: 26.12.2018.

Field A 2000. Discovering Statistics Using SPSS for Windows. London: SAGE Publication.

Gocer H 2013. An Investigation on the Agricultural Structure and the Entrepreneurial Potential of Tekirdag Province. Namık Kemal University Graduate School of Natural and Applied Sciences, Master Thesis, Tekirdag.

Jankowski KJ, Kijewski Ł, Krzebietke S, Budzyński WS 2015. The effect of Sulphur Fertilization on Macronutrient Concentrations in the Post-Harvest Biomass of Mustard. Plant, Soil and Environment, 61(6): 266-272.

Jess S, Kildea S, Moody A, Rennick G, Murchie AK, Cooke LR 2014. European Union Policy on Pesticides: Implications for Agriculture in Ireland. Pest Management Science, 70(11): 1646-1654.

Karaagac HA, Bolat A, Saglam C, Yazgan E, Cil A 2018. Energy and Economic Analysis of Sunflower Production: Example in Adana Province. International Journal of Eastern Mediterranean Agricultural Research, 1(2): 1-12.

Karagoz Y, Bardakci S, Demir B, Arslan R, Yemez I 2018. Developing a Scale of Attitudes towards Mathematics for Economics and Administrative Sciences Faculty Students. The International Journal of Economic and Social Research, 12(2): 39-55.

Kumbasaroglu, H, Dagdemir, V. 2010. Production Cost of Potato, Sugar Beet and Sunflower in Farms Owning Agricultural Machinery and Renting Machinery in Erzurum Province. Journal of Adnan Menderes University Agricultural Faculty, 7(2): 15-24.

Lamichhane J.R, Dachbrodt-Saaydeh S, Kudsk P, Messéan A 2016. Toward a Reduced Reliance on Conventional Pesticides in European Agriculture. Plant Disease, 100(1): 10-24.

Lechenet M, Dessaint F, Py G, Makowski D, Munier-

Jolain N 2017. Reducing Pesticide Use While Preserving Crop Productivity and Profitability on Arable Farms. Nature Plants, 3: 1-6.

Nastis SA, Papanagiotou E, Zamanidis S 2012. Productive Efficiency of Subsidized Organic Alfalfa Farms. Journal of Agricultural and Resource Economics, 37(2): 280-288.

Ness M 2000. Multivariate Techniques in Marketing Research. Curso de Especializacion Postuniversitaria en Marketing Agroalimentario. CHIEAM, Spain.

Newbold P 1995. Statistics for Business and Economics. Prentice Hall Inc. USA. Pages 1016.

Official Newspaper 2015. Supports to Agricultural Products in 2015. http://www.resmigazete.gov.tr/eskiler/2015/04/20150408-13-1.pdf. Accessed Date: 26.12.2018.

Official Newspaper 2016. Supports to Agricultural Products in 2016. http://www.resmigazete.gov.tr/eskiler/2016/05/20160505-3.pdf. Accessed Date: 26.12.2018.

Oksuz ME 2017. Determination of Attitude and Behaviors of Farmers on Concerning Pesticide Used in Some Product of Pasinler District. Ataturk University, Graduate School of Natural and Applied Sciences, Master Thesis, Erzurum, Turkey.

Oven V, Pakdemir AD 2005. Investigation of Office Rent Determinants Using Factor Analysis. Journal of Istanbul Technical University, 4(2): 3-13.

Ozudogru T, Miran B, Taskaya Top B, Ucum I. 2015. Effect of Difference Payment Supports on Cotton, Sunflower and Soybean Production. Agricultural Economics and Policy Development Institute Publication Number: 262, Ankara, Turkey.

Parnell JJ, Berka R, Young HA, Sturino JM, Kang Y, Barnhart DM, DiLeo MV 2016. From the Lab to the Farm: An Industrial Perspective of Plant Beneficial Microorganisms. Frontiers in Plant Science, 7: 1-12.

Pekcan V 2014. The Effects of Irrigation, Nitrogen (N) Levels and Plant Population on Yield and Quality Characteristics in Confectionary Sunflower (*Helianthus annuus L.*. Namık Kemal University, Graduate School of Natural and Applied Sciences, Ph.D. Thesis, Tekirdag in Turkey.

Ryan TP 1997. Modern Regression Methods. John Wiley Sons, New York.

Sabah M, Demirtas M, Demirtas R, Ozturk HH 2016. Energy Use in Sunflower Production. XII. National Agricultural Economics Congress, 25-27 May 2016.

Sainju UM, Dris R, Singh B 2003. Mineral Nutrition of Tomato. Food, Agriculture & Environment, 1(2): 176-183.

Semerci A, Kaya Y, Sahin I, Citak N 2012. The Effect of Subsidizing Policy in Oil Crops Production over Sunflower Planted Areas and Producer Welfare in Turkey. Selcuk Journal of Agriculture and Food Sciences, 26(2): 55-62.

Shtienberg D 1997. Rhizopus Head Rot of Confectionery Sunflower: Effects on Yield Quantity and Quality and Implications for Disease Management. Phytopathology, 87(12): 1226-1232.

Sitaramaraju S, Prasad NVVSD, Reddy VC, Narayana E 2014. Impact of Pesticides Used for Crop Production on the Environment. Journal of Chemical and Pharmaceutical Sciences, 3: 75-79.

TURKSTAT 2018a. Turkey Statistical Institute of Population and Agricultural Land Available Statistical Tables. http://www.turkstat.gov.tr/PreTablo.do?alt_id=1003. Accessed Date: 26.12.2018.

TURKSTAT 2018b. Turkey Statistical Institute Confectionery Sunflower Production Yield, Export and Import Quantities. https://biruni.tuik.gov.tr/medas/?kn=92&locale=en. Accessed Date: 28.11.2018.

Uzundumlu AS, Bilgin K, Kurtoglu S, Ertek N 2018. Determining the Main Problems Encountered in Kiwi Growing with Factor and Probit Analyses: The Case of Rize Province. Journal of Business Economics and Management Research, 1(2): 54-75.

Yavuz AA, Asik EG 2017. Quantile Regression. International Journal of Engineering Research and Development, 9(2): 137-146.

Zhang W 2018. Global Pesticide Use: Profile, Trend, Cost/Benefit and More. Proceedings of the International Academy of Ecology and Environmental Sciences, 8(1): 1-27.

Zhang WJ, Jiang FB, Ou JF 2011. Global Pesticide Consumption and Pollution: with China as a Focus. Proceedings of the International Academy of Ecology and Environmental Sciences, 1(2): 125-144.