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Araştırma Makalesi

Comparative Analysis of Soil Analysis Practices and Fertilization Habits of Agricultural Enterprises in Edirne and Tekirdağ Provinces

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ABSTRACT
In this study, the differences between the socio economic characteristics and agricultural applications of the producers who had soil analysis and those who did not were determined in Edirne and Tekirdağ provinces, and a comparative analysis was done in terms of fertilization and soil analysis applications. In each province, 3 laboratories which had the most sample acceptance number for soil analysis were selected. In 2015, a total of 200 producers were interviewed, including 60 producers from 20 producers who applied to the laboratories and benefited from soil analysis subsidies, and 40 producers with similar characteristics who did not benefit from soil analysis subsidies in the same regions. The differences between the socio-economic characteristics of the producers were determined by non-linear canonical correlation analysis. It was seen that the education level of the producers, the total size of the land they cultivated, having non-agricultural income and having agricultural insurance were the most important variables in the differences between the producers who had soil analysis and those who did not.
Keywords: Agricultural applications, fertilization, non-linear canonical correlation, soil analysis, subsidy

Edirne ve Tekirdağ İllerinde Tarım İşletmelerinin Toprak Analizi Uygulamalarının ve Gübreleme Alışkanlıklarının Karşılaştırmalı Analizi

ÖZ
Bu çalışmada Edirne ve Tekirdağ illerinde toprak analizi yaptıran ve yaptırmayan üreticilerin sosyo ekonomik özellikleri ve tarımsal uygulamaları arasındaki farklar belirlenmiş olup, gübreleme ve toprak analizi uygulamaları açısından karşılaştırmalı analizi yapılmıştır. Laboratuvar seçimi toprak analizi için numune kabul sayısı en fazla olan laboratuvarlar arasından üçer tane gayeli olarak yapılmıştır. 2015 yılında laboratuvarlara başvuran ve toprak analiz desteğinden yararlanan üreticilerden 20'şer kişiden toplamda 60 kişi ile yine aynı yörelerde, benzer özelliklere sahip toprak analizi desteğinden yararlanmamış olan 40 üretici olmak üzere, toplamda 200 üretici ile görüşülmüştür. Üreticilerin sosyo ekonomik özellikleri arasındaki farklar doğrusal olmayan kanonik korelasyon analizi ile belirlenmiştir. Üreticilerin eğitim düzeyi, işledikleri toplam arazi büyüklüğü, tarım dışı gelir sahibi olma ve tarım sigortası yaptırma durumlarının toprak analizi yaptıran ve yaptırmayan üreticiler arasındaki farklılıklarda en önemli değişkenler olduğu belirlenmiştir.
Anahtar kelimeler: Tarımsal uygulamalar, gübreleme, doğrusal olmayan kanonik korelasyon, toprak analizi, destekleme

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Comparative Analysis of Soil Analysis Practices and Fertilization Habits of Agricultural Enterprises in Edirne and Tekirdağ Provinces

Introduction

The sustainability of agricultural production is only possible with the application of appropriate agricultural methods. The increase in the food requirements of the increasing population and the size of the economic value of the resulting market cause some environmental damage. Misapplications made during the farming stages reach the implementers indirectly, and the negative consequences occur over time (Sönmez et al., 2008).

The fact that the limit of agricultural areas has been reached in the world, the continuous decrease in the rural population, the increase in the world population, and in parallel with this increase, the scarcity and inadequate nutrition problems occurring especially in the underdeveloped and developing countries, it has become a necessity to increase the possibilities of obtaining the highest yield from the unit area. In all agricultural countries, besides important factors such as irrigation, mechanization, spraying, good seeds, and training of the farmer, the use of fertilizers has gained great importance.

Excessive chemical fertilization application is one of the most important factors causing environmental pollution in agricultural processes. Nitrate pollution in groundwater, toxicity caused by phosphorus compounds, and destruction of ammonia in the atmosphere can be counted as an example of environmental problems caused by excessive fertilization applications (Onho and Erich, 1990; Wang et al., 2013). Good fertilization is done by determining the type and amount of fertilizer that the plant needs and giving this fertilizer to the soil at the right time in accordance with its technique.

Balanced fertilization is one of the most important elements of obtaining high-quality and abundant products from the unit area in plant production. Balanced fertilization is to give all the plant nutrients that are deficient in the soil at the appropriate time, in appropriate amounts and forms and in an appropriate manner, depending on the soil characteristics. Which fertilizer will be given when in what form and in what amount is determined as a result of soil analysis? Soil analyzes make very important contributions to the protection of the productivity potential of the soil, the nutrition and health of humans and animals, and the prevention of environmental pollution, in addition to the increase in yield and quality in plant production with balanced fertilization (Gezgin, 2011).

In this study, the differences between the basic characteristics and attitudes of the producers who had soil analysis and those who did not were determined in Edirne and Tekirdağ provinces. The fertilization and soil analysis applications of the producers in both groups were examined, a comparative analysis of the producer groups was performed and some suggestions were developed towards the results obtained.

Materials and Methods

The primary data of the research consists of the data obtained from the survey studies conducted with the producers who had soil analysis in 2015 in the laboratories that accepted the most sampling for soil analysis and gave fertilizer advice in the provinces of Edirne and Tekirdağ, which had the largest number of laboratories in the Thrace Region.

In the provinces determined in the research, 3 laboratories were selected among the laboratories with the highest number of sample acceptances for soil analysis. For each province, total of 60 producers who applied to the laboratories in 2015 and who utilized from soil analysis subsidies, and total of 40 producers with similar characteristics (land size, product pattern, etc.) who did not utilize from soil analysis subsidies and consequently, total of 200 producers were interviewed.

The compiled data were coded, loaded into the computer and evaluated with the widely used SPSS program. Descriptive statistics and cross tables were used in the analysis of the data obtained. Whether there was a difference between the groups in terms of fertilization and soil analysis practices and opinions of the producers who had soil analysis and those who did not, was determined by a chi-square test, and the differences between the socio-economic characteristics of the producers were determined by non-linear canonical correlation analysis (NLCCA). Nonlinear canonical correlation analysis is a technique used to examine relationships between sets of two and more than two variables. The fact that it does not have assumptions like other multivariate analysis techniques and can be applied to categorical data enables the analysis to be used in many areas. The most basic feature of nonlinear canonical correlation analysis is that the user can choose the scale levels of the variables (Van De Geer, 1987). As the analysis can be applied to categorical data, the numerical variable is categorized and included in the analysis.

Classical Linear Canonical Correlation Analysis (CCA) forms the basis of NLCCA. CCA, which was developed by Hotelling in 1936, is one of the multivariate statistical analysis techniques that reveal the degree of relationship (correlation) between the set of independent variables and the set of dependent variables (Tekin, 1993). There are some assumptions required for performing CCA. These assumptions are; the variables show a multivariate normal distribution, the amount of data in the sets is high enough for the analysis result to be reliable, there are no outliers in the data set, there should not be more than enough and irrelevant variables in the data matrix, and there should not be a full correlation between the variables (Filiz and Kolukısaoğlu, 2012). In addition, in CCA, the variables should be equally spaced or scaled proportionally (Süt, 2001). If one or more of these assumptions are not met, NLCCA is used (Gifi, 1989). The solution technique of nonlinear canonical correlation analysis (overalls) was first introduced by Gifi and redeveloped in 1984 by Van Der Burg, De Leew and Verdagaal and in 1987 by Gfi. The analysis examines two or more sets of variables and investigates how similar the clusters are to each other (Hsieh, 2001). NLCCA is designed for the problems of categorical variables with variable sets.

As a result of the analysis, the degree of relationship between dimensions is interpreted with the canonical correlation coefficient. This value is between 0 and 1 and is expressed as a percentage value. The canonical correlation coefficient cannot be seen after the analysis, but it can be obtained by the following formula.

Canonical Correlation = [(Number of Sets * Eigenvalue) – 1) / (Number of Sets - 1)]

In the NLCCA application results, there is no test value other than the canonical correlation coefficient.

The variable sets and scaling levels created for NLCCA are given in Table 1. In the nonlinear canonical correlation analysis, the number of variable sets was taken as two. In the first variable set, soil analysis, age, education level, number of family members, agricultural experience, and total land size variables, in the second variable set, seed type, agricultural insurance, non-agricultural income, type of activity and contract production variables took place. The socio-economic characteristics of the producers were evaluated in Set 1 and their agricultural practices were evaluated in Set 2.

Table 1. Variable list and optimal scaling levels

	Optimal Scaling Name and Level	Categories
1	Soil analysis	(1) Having soil analysis (2) Not having soil analysis
	Age	(1) Young (20-40 years old) (2) Middle-aged (41-60 years old) (3) Elder (61 years and above)
	Education level	(1) Primary school (2) Secondary School (3) High School (4) University
	Number of family members	(1) Few individuals (1-3) (2) Moderate number of individuals (4-5) (3) Multi-individual (6 and above)
	Agricultural experience	(1) Less than 25 years (2) 25 years and above
	Total land size	(1) 0-25 ha (2) 25 ha and above
2	Seed type	(1) Certified (2) Conventional
	Agricultural insurance	(1) Yes (2) No
	Non-agricultural income	(1) Yes (2) No
	Type of activity	(1) Vegetative (2) Vegetative + Animal
	Contracted production	(1) Yes (2) No

Results and Discussion

In this part of the study, by non-linear canonical correlation analysis, the differences between the producer groups who had soil analysis and those who did not were presented and the results were interpreted.

Descriptive statistics of the variables are given in Table 2. 60.83% of the producers who had soil analysis and 56.25% of the producers who did not have soil analysis were in the middle-aged class. While 17.50% of the producers who had soil analysis were college/university graduates, this ratio was found as 5% in the producer group who did not have soil analysis. The ratio of the producers who were high school/university graduates in the enterprise group that had the analysis was higher than the producers in the enterprise group that did not have the soil analysis. In another the study conducted by Gülaç (2011) in Sivas province, it was determined that the education level of the producers who had soil analysis was higher than those who did not. In the study conducted by Güldal (2016) in Konya province, the ratio of university graduates in the enterprise group that had soil analysis was higher than the producers who did not have soil analysis. The study was conducted by Tanrıverdi (2017) determined that the ratio of producers who stated that they were primary school graduates in enterprises that had soil analysis was lower than those who did not have analysis. The result of the research was similar to the literature of Gülaç (2011), Güldal (2016) and Tanrıverdi (2017).

It was determined that the families of more than half of the producers in both groups consisted of 4-5 people, and it was seen that the producers who stated that their families consisted of 1-3 people were predominantly in the farm group

that did not have soil analysis. It was seen that 46.67% of the producers who had the analysis and 33.75% of the producers who did not have the analysis had less than 25 years of agricultural experience. In the study conducted by Güldal (2016), it was determined that 30.16% of the producers who had soil analysis and 14.28% of those who did not have soil analysis had less than 20 years of agricultural experience, which was similar to the research result.

While 74.17% of the producers in the farm group that had the analysis stated that the total size of the land, they cultivated was higher than 25hectars, this ratio was found to be 40% in the producer group that did not have soil analysis. In the study conducted by Gülaç (2011) it was determined that 38% of the producers who had soil analysis had a land size of more than 40 hectares and this ratio was found as 16% in the producer group that did not have soil analysis.

While 95% of the producers who had the analysis stated that they used certified seeds, the ratio of the producers who stated that they used certified seeds in the producer group who did not have the analysis was found to be 83.75%. 75.83% of the producers who had the analysis and 63.75% of the producers who did not have the analysis stated that they had agricultural insurance.

The ratio of producers who stated that they had non-agricultural income in both producer groups was quite close to each other. 80.83% of the producers who had the analysis and 66.25% of the producers who did not have the analysis stated that they only engaged in vegetative production. It was seen that livestock activities were more common in the producer group that did not have soil analysis.

10.83% of the producers who had soil analysis and 6.25% of the producers who did not have soil analysis stated that they performed contracted production.

In terms of the variables discussed, it was seen that the education level of the producers who had the analysis, the size of the land they cultivated, certified seeds usage, agricultural insurance, having non-agricultural income and contracted production were higher (Table 2).

The average loss values for the considered NLCCA sets were found as 0.269 for the first dimension and 0.294 for the second dimension (Table 3). The loss value being close to zero indicates that the explanatory power of the solution is high. By subtracting the average losses from 1, the amount of the relationship shown in the dimensions, that is, the eigenvalue is obtained. The amount of the relationship shown in the first dimension was found to be 0.731 and the amount of the relationship shown in the second dimension was 0.706. The total fit value for the analysis was calculated as 1.437. Since the highest value of the fit was 2 in the analysis, it was concluded that the value found (1.437/2 (71.85%)) was within the acceptable range (Table 3). The canonical correlation coefficients calculated for NLCCA were 0.462 for the first dimension and 0.412 for the second dimension. These values indicated that the sets were in a moderate level in the first dimension and in the second dimension, and that the sets had a positive relationship in terms of the variables considered.

Table 2. Descriptive statistics of variables

Variables	Soil Analysis		No Soil Analysis	
	Number	%	Number	%
Age				
Young (20-40 years old)	14	11.67	13	16.25
Middle-aged (41-60 years old)	73	60.83	45	56.25
Elder (61 years and older)	33	27.50	22	27.50
Education level				
Primary school	45	37.50	35	43.75
Secondary school	16	13.33	20	25.00
High school	38	31.67	21	26.25
University	21	17.50	4	5.00
Number of family members				
Few individuals (1-3)	33	27.50	35	43.75
Moderate number of individuals (4-5)	67	55.83	40	50.00
Multi-individual (6 and above)	20	16.67	5	6.25
Agricultural experience				
Less than 25 years	56	46.67	27	33.75
25 years and above	64	53.33	53	66.25
Total land size				
0-25 ha	31	25.83	48	60.00
25 ha and above	89	74.17	32	40.00
Seed type				
Certified	114	95.00	67	83.75
Conventional	6	5.00	13	16.25
Agricultural insurance				
Yes	91	75.83	51	63.75
No	29	24.17	29	36.25
Non-agricultural income				
Yes	69	57.50	44	55.00
No	51	42.50	36	45.00
Type of activity				
Vegetative	97	80.83	53	66.25
Vegetative + Animal	23	19.17	27	33.75
Contracted production				
Yes	13	10.83	5	6.25
No	107	89.17	75	93.75

Table 3. Concordance values for the analysis

		Dimension		
		1	2	Total
Loss Function	Set 1	0.269	0.294	0.564
	Set 2	0.269	0.294	0.563
	Average	0.269	0.294	0.563
Eigen Value		0.731	0.706	
Fit				1.437

The weights, which are the coefficients used in obtaining the canonical variables, also show the contribution of the variables to the fit of the dimensions. The highest contributions were non-agricultural income (0.629), agricultural insurance (0.403), total land size (0.353), education level (0.341) for the first dimension and the number of family members (0.570), agricultural experience (0.514), non-agricultural income (0.482), total land size (0.462) for the second dimension. It was possible to mention that these variables were the factors that created the main difference between the producers who had soil analysis and those who did not (Table 4)

Table 4. Weight loads of the variables

Set	Variables	Dimension	
		1	2
1	Soil analysis	-0.089	-0.233
	Age	-0.241	-0.439
	Education level	0.341	-0.188
	Number of family members	0.242	-0.570
	Agricultural experience	-0.088	0.514
	Total land size	0.353	0.462
2	Seed type	-0.302	-0.081
	Agricultural insurance	-0.403	-0.439
	Non-agricultural income	0.629	-0.482
	Type of activity	-0.081	0.134
	Contracted production	-0.300	-0.339

Variables considered in the component loads graph (Figure 1) are expected to be as far from the origin as possible. It was seen that the education level of the producers, the total size of the land they cultivated, having non-agricultural income and having agricultural insurance were the most important variables in the differences between the producers who had soil analysis and those who did not.

The main characteristics of producers using certified wheat seeds developed by the public or private sector in the Polatlı district of Ankara province and the factors causing differences between them were determined by non-linear canonical correlation analysis by Köksal and Cevher (2015) and it was determined that these factors were the frequency of use of certified wheat seeds by the producers, the land size and having crop insurance, which was similar to the results of the research.

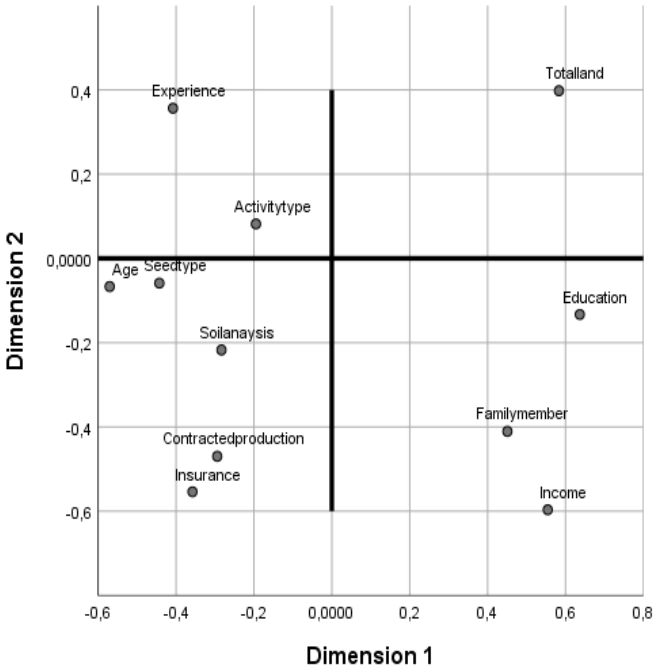

Figure 1. Representation of component loads of variables

When the graph of the categories of the variables was examined, it was seen that the young and middle-aged producers in the enterprise group that had soil analysis were university graduates, had agricultural insurance, the total size of the land they cultivated was more than 25 hectares, and they used certified seeds. It was seen that the producers in the elder group in the enterprise group that did not have soil analysis did not have agricultural insurance, the total size of the land they cultivated was less than 25 ha, they did not make contracted production and they used conventional seeds (Figure 2).

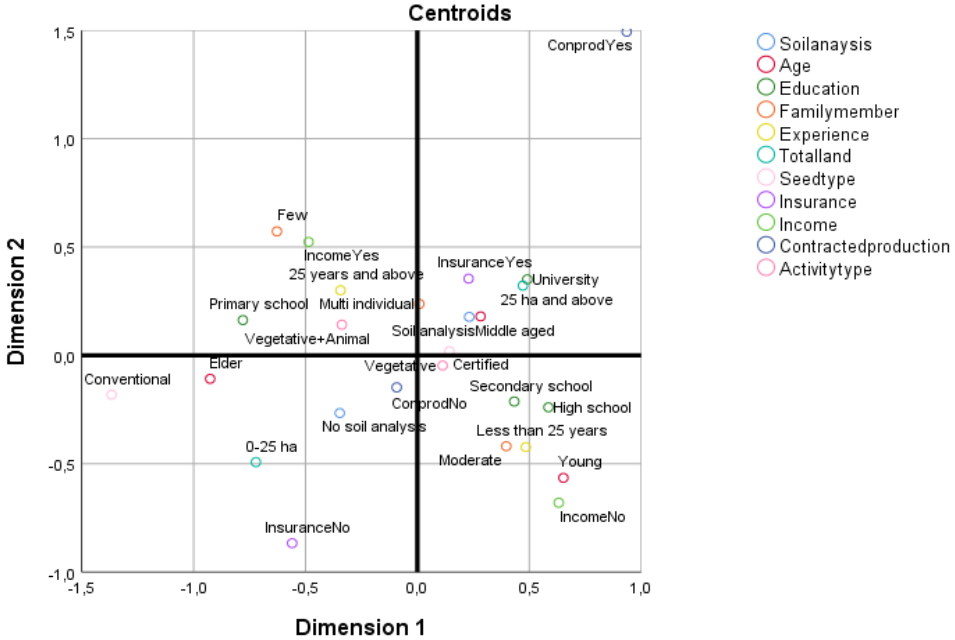

Figure 2. Graphical representation of variable categories

The distribution of producers according to their training on fertilization is given in Table 5. 41.67% of the producers who had soil analysis and 33.75% of the producers who did not have soil analysis stated that they received training on fertilization. As a result of the chi-square test, it was determined that the training status of the producers on fertilization did not change according to the producer groups.

In the study conducted by Yılmaz et al. (2009), it was determined that the majority (78.57%) of the producers and in the study conducted by Tanrıverdi (2017), it was determined that the majority (92.68%) of the producers did not receive training on fertilization, which was similar to the result of the research.

Table 5. The training status of producers on fertilization

Fertilization training	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Yes	50	41.67	27	33.75	77	38.50
No	70	58.33	53	66.25	123	61.50
Total	120	100.00	80	100.00	200	100.00
Chi-square: 1.271	p: 0.260					

Producers were also asked under which conditions they would have a soil analysis done regularly, and their distribution according to the answers they gave is given in Table 6. It was determined that the most effective factor for the producers in both groups to have a soil analysis done regularly was the free-soil analysis. Producers in both groups stated that they would have soil analysis done if the state supported the fertilizer received by the farmer who used fertilizer according to the soil analysis and if the soil analysis was made compulsory, respectively. Apart from these conditions, the producers in both groups declared that they would have the soil analysis done regularly if the fertilizer was not sold to the farmer who did not have the analysis, the analyzes were made in a short time, and the producer was trained on taking soil samples, respectively.

In the study conducted by Yilmaz et al. (2009), the producers declared that they would have soil analysis regularly if the state supported the fertilizer purchased by the farmer who used fertilizer according to the soil analysis, the soil analyzes were made compulsory, the analyzes were made in a short time, the producers were trained in taking soil samples and the analyzes were carried out free of charge, respectively. In the study carried out by Gülaç (2011), the producers who had soil analysis and those who did not declared that they would have soil analysis done regularly if the analyzes were made in a short time, the analyses were carried out free of charge, the producers were trained on taking soil samples, no fertilizer sales were made to the producers who did not have the analysis, and support was given to the farmer who bought fertilizer according to the soil analysis, respectively. In the study conducted by Küçükkaya and Özçelik (2014), the producers declared that they would have a soil analysis done regularly if the soil analyzes were made free of charge, if the state supported the fertilizer purchased by the farmer who used fertilizer according to the soil analysis, and if the fertilizer was not sold to the farmer who did not have the analysis. In the study conducted by Çönoğlu et al. (2016), producers stated that they would have soil analysis in the future if they were given information about taking soil samples, if soil analyses were carried out at a more affordable price, if the state supported the fertilizer purchased by the farmer who used fertilizer according to soil analysis, if fertilizer sales were not made to farmers who did not have an analysis, and if analyses were carried out in a short time, respectively.

Table 6. Conditions of producers to have soil analysis regularly

Conditions for regular soil analysis	Soil Analysis		No Soil Analysis		Total*	
	Number	%	Number	%	Number	%
If soil analyzes are done free of charge	79	65.83	50	62.50	129	64.50
If the state supports the fertilizer bought by the farmer who uses fertilizer according to soil analysis	68	56.67	44	55.00	112	56.00
If soil analyzes are made mandatory	43	35.83	30	37.50	73	36.50
If fertilizer is not sold to the farmer who does not have an analysis,	27	22.50	13	16.25	40	20.00
If the analyzes are done in a short time	15	12.50	14	17.50	29	14.50
If training is given on taking soil samples	10	8.33	14	17.50	24	12.00
Other	12	10.00	4	5.00	16	8.00

* More than one option marked

The distribution of the producer's fertilizer types prefer is given in Table 7. All of the producers in both groups stated that they used chemical fertilizers during the plant growth stage. It was determined that in the producer group who had soil analysis, the preferred types of fertilizers, apart from chemical fertilizers, were foliar fertilizer, organic fertilizer and farmyard manure, respectively, while in the producer group who did not have the analysis, they were organic fertilizer, farm manure, foliar fertilizer and green manure, respectively. In the study conducted by Kızıloğlu and Kızılaslan (2017) in Kahramanmaraş, it was determined that the producers who had soil analysis and those who did not, and in the study conducted by Yüzbaşıoğlu (2020) in the province of Tokat, they were determined the producers primarily preferred chemical fertilizers during agricultural production which is similar to the present research results.

Table 7. Fertilizer types preferred by producers

Types of fertilizers	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Chemical fertilizers	120	100.00	80	100.00	200	100.00
Organic fertilizer	7	5.83	12	15.00	19	9.50
Farm manure	6	5.00	10	12.50	16	8.00
Foliar fertilizer	10	8.33	6	7.50	16	8.00
Green manure	0	0.00	1	1.25	1	0.50

* More than one option marked

The fertilizer application methods of producers were also investigated (Table 8). 92.50% of the producers who had soil analysis and 88.75% of the producers who did not have soil analysis stated that they fertilized by spreading. 79.17% of the producers who had the analysis and 70% of the producers who did not have the analysis stated that they applied fertilization to the base with planting. In both producer groups, the ratio of application of fertilization with drip irrigation to both the bottom and the top was quite low, and this ratio was determined as 4% compared to the average of the enterprises.

Table 8. Fertilizer application methods of producers

Fertilizer application methods	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Spreading	111	92.50	71	88.75	182	91.00
With the sowing	95	79.17	56	70.00	151	75.50
Both bottom and top with drip irrigation	6	5.00	2	2.50	8	4.00

* More than one option marked

The distribution of the producers according to fertilizer supply locations is given in Table 9. It was determined that the fertilizer dealer and the agricultural credit cooperative took the first two ranks in terms of the place where the producers who had soil analysis and those who did not, got fertilizer. Apart from that, it was concluded that the producers in both groups supplied fertilizer from agricultural development cooperatives, agricultural sales cooperatives, oilseeds cooperatives and beet cooperatives at low rates. In the study conducted by Kızıloğlu and Kızılaslan (2017) in Kahramanmaraş, it was determined that the majority of the producers who had soil analysis or not, obtained the fertilizer from the dealers, which was similar to result of the study.

Table 9. Fertilizer supply locations of producers

Fertilizer supply locations	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Fertilizer dealer	106	88.33	59	73.75	165	82.50
Agricultural credit cooperative	57	47.50	42	52.50	99	49.50
Agricultural development cooperative	9	7.50	7	8.75	16	8.00
Agricultural sales cooperative	5	4.17	3	3.75	8	4.00
Oily seeds cooperative	5	4.17	1	1.25	6	3.00
Beet cooperative	1	0.83	1	1.25	2	1.00

* More than one option marked

The criteria for determining the amount of fertilizer used by the producers were also determined (Table 10). It was determined that the criteria that the producers who had soil analysis considered when determining the amount of fertilizer were having soil analysis, fertilizing with old habits and consulting the soil analysis laboratory and the provincial-district directorate of agriculture, consulting the place where the fertilizer was purchased, consulting a research institute and getting ideas from the neighbours, respectively. In the producer group that did not have the analysis, it was determined that the criteria for determining the amount of fertilizer were fertilizing with old habits, consulting the provincial-district directorate of agriculture, getting ideas from the neighbours, consulting the place where the fertilizer was purchased, consulting the laboratory and consulting the research institute, respectively.

While the farmers who met the criteria for soil analysis were among the first in their group to do so, it should be noted that those who did not primarily fertilized in accordance with their previous practises.This situation indicated that the producers who had the analysis were more conscious about fertilization. The study was conducted by Gülaç (2011) determined that the producers who had soil analysis consulted the provincial-district directorate of agriculture about the use of fertilizers. In the group of producers who did not have soil analysis, the ratio of the producers who stated that they consulted the provincial-district directorate of agriculture before using fertilizer was found to be slightly higher than those who had soil analysis. Güldal (2016) reported that, the ratio

of the producers who stated that they fertilized based on their own experience in the farm group that did not have soil analysis was found to be higher than those who had soil analysis. Yilmaz et al. (2009) and Kızıloğlu and Kızılaslan (2017) reported thatthe majority of producers determined the amount of fertilizer according to their own knowledge and experience. Similar studies were conducted in Konya province by Şahinli et al. (2016) and Tanrıverdi (2017), it was determined that the producers who had soil analysis and those who did not, primarily fertilized according to old habits. The result of the present research are similar to Yılmaz et al. (2009), Gülaç (2011), Güldal (2016), Şahinli et al. (2016) and Kızıloğlu and Kızılaslan (2017)' foundlings.

Table 10. The criteria for determining the amount of fertilizer by the producers

The criteria for determining the amount of fertilizer	Soil Analysis		No Soil Analysis		Total*	
	Number	%	Number	%	Number	%
Fertilizing with old habits	87	72.50	75	93.75	162	81.00
Having soil analysis	90	75.00	0	0.00	90	45.00
Consulting with the provincial-district directorate of agriculture	49	40.83	34	42.50	83	41.50
Consulting the laboratory	52	43.33	14	17.50	66	33.00
Consulting where fertilizer is purchased	29	24.17	27	33.75	56	28.00
Getting ideas from the neighbour	20	16.67	31	38.75	51	25.50
Consulting the research institute	23	19.17	7	8.75	30	15.00

* More than one option marked

Producers were also asked about their opinions on requiring soil analysis for fertilizer support (Table 11). While 29.17% of the producers who had soil analysis had a positive opinion on the necessity of soil analysis for fertilizer support, this ratio was determined as 36.25% in the producer group who did not have the analysis. As a result of the chi-square test, it was determined that the opinions of the producers about the necessity of soil analysis for fertilizer support did not change according to the producer groups.

In the studies conducted by Gülaç (2011) and Yüzbaşıoğlu (2019), it was determined that the majority of the producers who had soil analysis and those who did not did not look at the soil analysis condition positively in order to benefit from fertilizer support, which was similar to the research result. Küçükkaya and Özçelik (2014) indicated the majority of the producers who had soil analysis stated that soil analysis was necessary in order to benefit from fertilizer support. The study was conducted by Tanrıverdi (2017) shown that 50.94% of the producers who had soil analysis stated that soil analysis should be mandatory for fertilizer support, while this ratio was found to be 10.34%, which was quite low in the group of producers who did not have analysis.

Table 11. Producers' opinions on the necessity of soil analysis for fertilizer supplementation

	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
It's right to enforce	35	29.17	29	36.25	64	32.00
It's not right to enforce	85	70.83	51	63.75	136	68.00
Total	120	100.00	80	100.00	200	100.00
Chi-square: 1.107 p: 0.293						

The distribution of the producers according to the purpose of using the fertilizer support is given in Table 12. An average, 61.67% of the producers who had soil analysis and 47.50% of the producers who did not have soil analysis stated that they used the fertilizer support to buy fertilizer. While 36.67% of the producers who had soil analysis stated that they used fertilizer support other than fertilizer but also in agricultural production, this ratio was determined as 48.75% in the producer group that did not have the analysis. The ratio of the producers who stated that they used fertilizer subsidies outside of agriculture in both producer groups was quite low, and this value was found as 2.50% according to the average of the enterprises. As a result of the chi-square test, it was determined that the purpose of the producers to use fertilizer support did not change according to the producer groups.

In the study conducted by Gülaç (2011), it was determined that the majority of the producers who had soil analysis used the fertilizer subsidy in the purchase of fertilizer compared to the producers who did not, and it was similar to the research result. Küçükkaya and Özçelik (2014) and Tanrıverdi (2017) determined in their studies that the majority of the producers who had soil analysis used the fertilizer subsidy other than fertilizer, but also in agricultural production. Güldal (2016) and Aydın and Özkan (2017) concluded in their studies that the majority of the producers who utilized from fertilizer and soil analysis subsidies used fertilizer subsidies outside of agriculture, and it differed with the research result.

Table 12. Purposes of producers to use fertilizer support

Uses of fertilizer support	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
To get fertilizer	74	61.67	38	47.50	112	56.00
Apart from fertilizer but still in agricultural production	44	36.67	39	48.75	83	41.50
Out of agriculture	2	1.67	3	3.75	5	2.50
Total	120	100.00	80	100.00	200	100.00
Chi-square: 4.228 p: 0.121						

The opinions of the producers on the effect of fertilization applied according to soil analysis on yield were also asked (Table 13). It was determined that 84.17% of the producers who had soil analysis and 71.25% of the producers who did not have analysis stated that fertilization based on soil analysis would increase the yield. While 13.33% of the producers who had the analysis stated that the yield would not change, this ratio was found to be 27.50% in the producer group who did not have analysis. As a result of the chi-square test, it was determined that the opinions of the producers about the yield as a result of the fertilization applied according to the soil analysis changed according to the producer groups. In the study conducted by Güldal (2016), 47.62% of the producers who had soil analysis stated that fertilization according to soil analysis would increase the yield, while this ratio was quite high in the producer group that did not have soil analysis and was found to be 85.71%.

Table 13. Producers' opinions on yield as a result of fertilization according to soil analysis

Yield status	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Decreases	3	2.50	1	1.25	4	2.00
Constant	16	13.33	22	27.50	38	19.00
Increases	101	84.17	57	71.25	158	79,00
Total	120	100.00	80	100.00	200	100.00
Chi-square: 6.360	p: 0.042					

The opinions of the producers regarding the effect of fertilization applied according to soil analysis on product quality were also asked (Table 14). 85% of the producers who had soil analysis and 70% of the producers who did not have soil analysis stated that fertilization based on soil analysis would increase product quality. While 14.17% of the producers who had the analysis stated that the product quality would not change, this ratio was found to be 30% in the producer group who did not have the analysis. As a result of the chi-square test, it was determined that the opinions of the producers about the product quality as a result of the fertilization applied according to the soil analysis changed according to the producer groups.

Table 14. Opinions of producers on product quality as a result of fertilization according to soil analysis

Product quality status	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Gets worse	1	0.83	0	0.00	1	0.50
Constant	17	14.17	24	30.00	41	20.50
Gets better	102	85.00	56	70.00	158	79,00
Total	120	100.00	80	100.00	200	100.00
Chi-square: 8.121	p: 0.017					

The opinions of the producers about the effect of fertilizer applied according to the soil analysis on the condition of the soil were also asked (Table 15). 90% of the producers who had soil analysis and 73.75% of the producers who did not have analysis stated that the fertilization applied according to the soil analysis protected the soil. While 10% of the producers who had soil analysis stated that the condition of the soil would not change, this ratio was found as 26.25% in the producer group who did not have the analysis. As a result of the chi-square test, it was determined that the opinions of the producers about the condition of the soil as a result of the fertilization applied according to the soil analysis changed according to the producer groups.

Table 15. Producers' opinions on the condition of the soil as a result of fertilization according to soil analysis

Soil condition	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Constant	12	10.00	21	26.25	33	16.50
Protected	108	90.00	59	73.75	167	83.50
Total	120	100.00	80	100.00	200	100.00
Chi-square: 8.058	p: 0.005					

The opinions of the producers on the effect of fertilization applied according to soil analysis on water resources were also asked (Table 16). In general, 81.67% of the producers who had soil analysis and 70% of the producers who did not have soil analysis stated that fertilization

based on soil analysis would protect the water resources. While 16.67% of the producers who had the analysis stated that the structure of water resources would not change, this ratio was found to be 28.75% in the producer group who did not have the analysis. As a result of the chi square test, it was determined that the opinions of the producers on the effect of fertilization applied according to the soil analysis on water resources did not change according to the producer groups.

Table 16. Producers' opinions on water resources as a result of fertilization according to soil analysis

Water resources situation	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Gets dirty	2	1.67	1	1.25	3	1.50
Constant	20	16.67	23	28.75	43	21.50
Protected	98	81.67	56	70.00	154	77.00
Total	120	100.00	80	100.00	200	100.00
Chi-square: 4.096 p: 0.129						

The opinions of the producers on the effect of fertilization applied according to soil analysis on profitability were also asked (Table 17). 82.50% of the producers who had soil analysis and 71.25% of the producers who did not have soil analysis stated that fertilization based on soil analysis would increase profitability. While 15% of the producers who had the analysis stated that the profit obtained would not change as a result of the fertilization applied according to the soil analysis, this ratio was found to be 27.50% in the producer group who did not have the analysis. As a result of the chi square test, it was determined that the opinions of the producers on the effect of fertilization applied according to soil analysis on profitability changed according to the producer groups.

Table 17. Producers' thoughts on profitability as a result of fertilization according to soil analysis

Profitability status	Soil Analysis		No Soil Analysis		Total	
	Number	%	Number	%	Number	%
Decreases	3	2.50	1	1.25	4	2.00
Constant	18	15.00	22	27.50	40	20.00
Increases	99	82.50	57	71.25	156	78.00
Total	120	100.00	80	100.00	200	100.00
Chi squared: 4.841 p: 0.089						

Conclusions and Recommendations

When the results were evaluated, it was determined that the producers who had soil analysis were more educated than the producers who did not have the analysis, and the size of the land they cultivated was higher. It was determined that the ratios of having agricultural insurance, getting training on fertilization, using certified seeds, and making contracted production in the producer group who had soil analysis were higher than in the producer group who did not have soil analysis. It was observed that there were more producers who fertilized with old habits in the producer group who did not have soil analysis. The ratio of producers who stated that fertilization according to the results of soil analysis would increase yield and profitability, improve product quality, and protect soil and water resources was higher in the group of producers who had soil analysis. According to the results, it is possible to say that the producers who had soil analysis were more conscious as expected.

The small size of the land of the producers who did not have soil analysis can be considered as

one of the factors limiting the utilization of soil analysis subsidy. The small and fragmented land obliged producers to have separate soil analyses for each land and it was possible to say that the producers did not have soil analysis, because this process increased the cost.

It was seen that extension studies on fertilizer and soil analysis were carried out in the research area, but the application was not at sufficient level. Extension activities using more effective extension methods will increase the dissemination and adoption of soil analysis.

It was seen that some of the producers who had soil analysis did not comply with the recommended fertilization program according to the soil analysis results. It is thought that it would be appropriate to introduce the soil analysis condition in fertilizer sales or the soil analysis condition in fertilizer support for lands of 50 decades or more, as well as the requirement to purchase fertilizer according to the analysis results in order to increase the use of fertilizers of the producers according to the results of the analysis report.

About 40% of the producers stated that they used fertilizer subsidies other than fertilizer, but also in agricultural production. Fertilizer subsidy times should be arranged according to the conditions of the region in order to prevent the fertilizer subsidies from coinciding with the fertilization time during the production period and to prevent the use of the support other than fertilizer purchase. It is thought that it would be beneficial to give support given for fertilizer as fertilizer, not money, to be tested in a pilot region and applied according to the results.

More than half of the producers in both groups stated that they would have regular soil analyses if the state provided support for the fertilizer purchased by farmers who use fertilizers according to soil analysis and about 1/3 of them stated that they would have regular soil analyses if soil analyses were compulsory. In Turkey, where the average land size is approximately 6 ha, the requirement to have soil analysis on lands of 5 ha and above reduces the interest of producers in soil analysis. Soil analysis application should be seen as a goal rather than a tool, and for this purpose, it is important to increase the necessary training and extension services. Also, a support model should be developed to ensure that soil analysis is mandatory.

In the producer group who did not have soil analysis, livestock activities were higher than in the group of producers who had soil analysis. Different training programs can be put into practice for producers who continue their production mainly on livestock.

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