Türk Tarım ve Doğa Bilimleri Dergisi 9(2): 387–395, 2022

https://doi.org/10.30910/turkjans.1072284

TÜRK
TARIM ve DOĞA BİLİMLERİ
DERGİSİ

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TURKISH
JOURNAL of AGRICULTURAL
and NATURAL SCIENCES

www.dergipark.gov.tr/turkjans

Research Article

Farmers' Approaches to Drip Irrigation Applications and the Factors Affecting the Utilization from Drip Irrigation Subsidies: Case of Adana and Niğde Provinces

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Received: 12.02.2022 Received in revised: 08.04.2022 Accepted: 08.04.2022

Abstract

In this study, the socio-economic structure of the agricultural enterprises that utilized from the in-field drip irrigation subsidies or not, was determined, a comparative analysis of their knowledge levels and opinions about drip irrigation method was made in Adana and Niğde provinces. Besides, the factors affecting the benefit of the producers from drip irrigation subsidies were determined. A survey was conducted with a total of 26 producers, 10 of which utilized drip irrigation subsidies in Adana and 16 of which utilized drip irrigation subsidies in Niğde. In order to make a comparison between the groups, a survey was conducted with the same number of producers who did not utilize drip irrigation subsidies. The continuous data obtained were subjected to the t test and the discrete data to the chi-square test to determine whether there was a difference between the producer groups. The tendency of the producers to utilize from drip irrigation subsidies was determined using binary logistic regression analysis. It was determined that the age of the producers, the number of family members, their non-agricultural income and the type of activity they were engaged in affected the drip irrigation subsidies negatively, while the education period, the size of the irrigated land and the number of family members working in agriculture had a positive effect. Considering that the purpose of drip irrigation subsidies is to ensure more effective use of limited water, to increase productivity, to reduce labor and production costs, and to increase the prevalence of drip irrigation systems, it is possible to say that drip irrigation subsidies was applied in accordance with its purpose.

Key words: Drip irrigation, subsidy, producer opinion

Üreticilerin Damla Sulama Uygulamalarına Yaklaşımı ve Damla Sulama Desteklemelerinden Yararlanma Durumunu Etkileyen Faktörler: Adana ve Niğde İlleri Örneği

Özet

Bu çalışmada, Adana ve Niğde illerinde tarla içi damla sulama desteğinden yararlanan ve yararlanmayan tarım işletmelerinin sosyoekonomik yapısı belirlenmiş, üreticilerin damla sulama yöntemi ile ilgili bilgi düzeyleri ve düşüncelerinin karşılaştırmalı analizi yapılmış ve üreticilerin damla sulama desteğinden faydalanma durumunu etkileyen faktörler tespit edilmiştir. Adana ilinde damla sulama desteği alan 10, Niğde ilinde damla sulama desteği alan 16 üretici olmak üzere toplam 26 üretici ile anket çalışması gerçekleştirilmiştir. Gruplar arası karşılaştırma yapabilmek amacıyla aynı sayıda damla sulama desteği almayan üretici ile de anket çalışması yapılmıştır. Elde edilen sürekli veriler t testine, kesikli veriler ise ki kare testine tabi tutularak üretici grupları arasında farklılık olup olmadığı tespit edilmiştir. Üreticilerin damla sulama desteği alma eğilimleri ikili lojistik regresyon analizi kullanılarak belirlenmiştir. Üreticilerin yaşlarının, aile birey sayılarının, tarım dışı gelir sahibi olma durumlarının ve uğraştıkları faaliyet türünün damla sulama desteği alma durumunu negatif yönde etkilediği, eğitim sürelerinin, sahip oldukları sulanan arazi büyüklüğünün ve tarımda çalışan aile birey sayısının ise pozitif yönde etkilediği tespit edilmiştir. Damla sulama desteğinin amacı, kısıtlı olan suyun daha etkin kullanımını sağlamak, verimliliği artırmak, işgücünü ve üretim maliyetlerini azaltmakla birlikte damla sulama sistemlerinin kullanım yaygınlığını artırmak olduğu düşünüldüğünde damla sulama desteğinin amacına uygun bir şekilde uygulandığını söylemek mümkündür.

Anahtar kelimeler: Damla sulama, destekleme, üretici

Introduction

The agricultural sector, which meets the increasing food requirement of the world, provides raw materials to other sectors and creates employment opportunities, maintains its feature as one of the main dynamics of sustainable development with its social and economic dimensions. The high share of the agricultural sector in overall employment increases the importance of this sector.

The importance of the labor operating in the agricultural sector in Turkey has started to stand out more and more with the increase in the degree of integration of agriculture with industry. Labor productivity, measured by dividing total production by labor force, is at a low level in the sector. The level of technology that determines the rate at which production factors will be used is also relatively low in the agricultural sector in Turkey. Therefore, low technology level pulls the sector's effective labor force level down. In such an environment, transferring agricultural subsidies to rural development is important in terms of promoting technology (Şahin, 2008).

In general, agricultural subsidy is supporting a certain group by using various means from the economic resources owned by the state. Payments to support the agricultural sector are used to increase the agricultural sector's income level and increase production, productivity and product diversity in the agricultural sector (Yıldız, 2017).

The Rural Development Investments Support Program is a rural development program that provides grant support in order to encourage the investments to be made by real and legal persons in their economic activities in order to ensure economic and social development in the rural area, and the investments with projects based on capital stock to be made in the fields of pressurized irrigation systems (Anonymous, 2022).

Within the scope of the "Rural Development Investments Support Program", the Support Program for the Purchases of Machinery and Equipment aimed to support the expenditures to purchase of certain agricultural machinery and equipment in rural areas through grant financing at certain rates. After 2016, the supports given in this context started to be given under Supporting Individual Irrigation Systems within the Scope of Rural Development Supports.

In Turkey, the expansion of irrigated agricultural lands and the more rational use of existing water resources have gained more importance in recent years. For this reason, pressurized irrigation systems that increase the efficiency of water use have been widely used. The widespread use of drip irrigation method, one of the pressure irrigation systems, will be decrease water loss in agriculture and the use of the saved water in other sectors. In this respect, pressurized irrigation methods are an important tool for the protection, and sustainability of water resources (Aküzüm et al., 2010). Compared to surface irrigation methods, drip irrigation minimizes the losses caused by surface runoff and deep infiltration and by this means, irrigation efficiency can be between 70-95%. For this reason, drip irrigation allows plant production to be made in areas where the water required for surface irrigation is not available, and allows more income to be obtained with one unit of water (Westarp et al., 2003).

Drip irrigation systems have increased through the various subsidies in Turkey. It is important to investigate the efficiency of these supports and get the farmers' opinions in terms of understanding the utility of the supports and guiding future supports.

Many researches were conducted on agricultural supports. Işık et al. (2009) determined the factors affecting the benefiting status of dairy cattle enterprises from the subsidies. Aşkan and Dağdemir (2015) determined the factors affecting the production value of dairy cattle enterprises benefiting from state subsidies. Abay et al. (2017) determined the situation of the producers benefiting from agricultural subsidies in Turkey, and Tan et al. (2017) determined the factors affecting the farmers' benefit from organic farming subsidies. Ağır and Akbay (2018) determined the factors affecting the farmers' benefit from beef cattle subsidies and Doğan et al. (2018) determined the factors affecting the level of benefit from young farmer subsidies in Turkey, Beşen et al. (2021) determined the status of benefiting from the subsidies of the young farmer project in the TR61 region and Candemir et al. (2021) determined the situation of benefiting from drip irrigation support of producers producing grain corn in Kahramanmaraş province.

In this study, the socio-economic structure of the agricultural enterprises that utilized the in-field drip irrigation subsidies in Adana and Niğde provinces and that did not, were determined. A comparative analysis of their knowledge levels and opinions about drip irrigation method was made. In addition, the factors affecting the benefit of the

producers from drip irrigation subsidies were determined in the study.

Material and Method

The main material of the study consisted of survey studies conducted with the producers who utilized drip irrigation subsidies in Adana and Niğde provinces and who did not. The relevant domestic and foreign studies and statistics composed the secondary data of the study.

A survey was conducted with 26 producers, 10 of which utilized drip irrigation subsidies in Adana and 16 of which utilized drip irrigation subsidies in Niğde. In order to make a comparison between the groups, a survey was conducted with the same number of producers who did not utilize from drip irrigation subsidies.

Descriptive statistics were used in the analysis of the obtained data. The t test was used in the analysis of continuous data, and the chi-square test was used in the analysis of discrete data, and it was determined whether there was a difference between the groups that utilized the subsidies and those that did not.

Logistic regression allows classification under probability rules by calculating the estimated values of the dependent variable as probabilities, and it can also determine the effect sizes of the independent variables that are effective on the change of the dependent variable (Akgül and Çevik, 2003; Özdamar, 2009).

The odds ratio is used in logistic regression. The odds ratio is defined as the occurrence probability to nonbeing probability ratio. Odds is the ratio of the probability of success or occurrence "P", to the probability of failure or non-occurrence "1-P". Odds ratio is the ratio of two odds to each other and a summary measure of the relationship between two variables. In logistic regression, $OR = \exp(\beta)$ is calculated. A superiority ratio greater than 1 indicates that the likelihood of the event occurring increases, while a superiority ratio of less than 1 indicates that the likelihood of the event occurring decreases (Morgan and Teachman, 1988).

In logistic regression analysis, superiority ratios are the most important coefficients explaining the relationship between dependent and independent variables, and G statistics with chi-square distribution are used to determine whether the model obtained is suitable or not. Whether the model obtained as a result of logistic regression analysis is suitable or not is tested with Hosmer-Lemeshow statistics, and whether the presence of each independent variable in the model is significant is tested with Wald statistics.

The dependent variable was utilizing drip irrigation subsidies, and the producers who utilized the subsidy were given a value (1), and the producers who did not utilize subsidy (0). The independent variables of the model were age of the producer (years), education period of the producer (years), number of family members (number), number of family members working in agriculture (number), agricultural experience period (years), size of irrigated land (da). In the model, the variables of having the non-agricultural income (0: no, 1: yes), type of activity (1: crop production, 2: crop + animal production), having agricultural insurance (0: no, 1: yes) were also included in the model as discrete variables.

Results and Discussion

General information about the producers

The socio-economic characteristics of the producers are given in Table 1. The average age of the producers was 45.15, the education period was 10.69 years, the number of individuals in their families was 3.58, the number of individuals working in agriculture in their families was 2.04, and their agricultural experience was 18.62 years in the producer group that utilized from drip irrigation subsidies. The average age of the producers who did not utilize the subsidies was 53.62 years, the education period was 8 years, the number of individuals in their families was 3.85, the number of individuals working in agriculture in their families was 1.54, and their agricultural experience was 24.54 years.

The cultivated land size in the producer group that utilized drip irrigation subsidies was 143.04 da and the irrigated land size was 138.08 da whereas the cultivated land size in the non-supported producer group was 79.35 da and the irrigated land size was 78.27 da. When the producers were examined whether they had any work or income sources other than agricultural activities, it was determined that 53.85% of the producers who utilized the subsidies and 80.77% of the producers in the other group had any work other than agriculture.

It was determined that there was a difference at 1% significance level in the age of the producer groups, at 5% significance level between their education period, the number of individuals working in agriculture in their families and their non-agricultural activities, and at 10% significance level between their agricultural experience.

Table 1. Socio-economic characteristics of producers

Socio-Economic Characteristics	Drip Irrigation Subsidy	No Subsidy	P
Age (years)	45.15	53.62	0.003***
Education period (years)	10.69	8.00	0.011**
Number of family members	3.58	3.85	0.472
Number of individuals working in agriculture	2.04	1.54	0.011**
Agricultural experience (years)	18.62	24.54	0.062*
Irrigated land size (da)	138.08	78.27	0.121
Land size (da)	143.04	79.35	0.100
Non-agricultural income (%)	53.85	80.77	0.039**

* Significant at 10% significance level, ** Significant at 5% significance level, *** Significant at 1% significance level

The producers' adoption and implementation of agricultural innovations were also examined (Table 2). While 65.32% of the producers who utilized the subsidies stated that they had agricultural insurance, this ratio was below 50% (42.31%) in the other producer group. 46.15% of the producers who utilized the subsidies and 23.08% of the producers who did not utilize, stated that they applied good agriculture. While 61.54% of the producers who utilized the subsidies stated that they had soil analysis, 38.46% of the producers in the other group stated that they had soil analysis. The ratio of producers who stated that they used certified seeds in both producer groups were below 50%.

As a result of the chi-square analysis, a significant relationship was found at a 10% significance level between the status of the producers utilizing from drip irrigation subsidies and the status of having agricultural insurance, good agricultural practices and soil analysis.

Table 2. The state of adopting and applying agricultural innovations by the producers

		Drip Irrigation Subsidy		No Subsidy		Total		P
		Number	%	Number	%	Number	%	
Agricultural insurance	Yes	17	65.38	11	42.31	28	53.85	0.095*
	No	9	34.62	15	57.69	24	46.15	
Good agricultural practices	Yes	12	46.15	6	23.08	18	34.62	0.080*
	No	14	53.85	20	76.92	34	65.38	
Soil analysis	Yes	16	61.54	10	38.46	26	50.00	0.096*
	No	10	38.46	16	61.54	26	50.00	
Certified seed	Yes	12	46.15	9	34.62	21	40.38	0.397
	No	14	53.85	17	65.38	31	59.62	

* Significant at 10% significance level, ** Significant at 5% significance level, *** Significant at 1% significance level

Opinions of the producers about drip irrigation applications

The opinions of the producers in both groups regarding the drip irrigation method were examined. A 5-point Likert scale was used in the evaluation, and their answers are given in Table 3. The judgments that "the irrigation period is short" for the producers who utilized the subsidies, and "the energy costs are low" for the producers who did not utilize the subsidies, were determined as the most effective factors. Among the benefits of the drip irrigation method, the judgment that "the need for irrigation water is low" was determined as the second factor (4.62) for the producers utilizing the subsidies. The judgment that "the use of drip irrigation is easy and the irrigation labor is at a minimum level" was also found to be the second most effective factor (4.62) for the producers who did not utilize subsidies. The judgment that "irrigation can be done with salty and problematic waters" was the least effective factor for both producer groups. Madhava Chandran et al. (2005) stated that with drip irrigation, the need for water and labor was less and energy savings were achieved. In the study conducted by Saçtı (2016), the majority of the producers stated that drip irrigation had a positive effect on the protection of water resources and soil. The study conducted by Kaya (2017), determined that the setup cost was high in enterprises that applied drip irrigation.

Table 3. Opinions of the producers on drip irrigation method

Producers' Opinions on Drip Irrigation Method	Drip Irrigation Subsidy	No Subsidy	Average
The need for irrigation water is low	4.62	4.27	4.44
Irrigation period is short	4.65	4.27	4.46
Efficiency increase is provided	4.42	4.08	4.25
Provides high quality and uniform product	4.23	4.42	4.33
Fertilizer utilization rate of the plant increases	4.19	4.27	4.23
Farming can be performed in salty soils by drip irrigation method	3.46	3.27	3.37
Irrigation can be done with salty and problematic waters	2.42	1.85	2.13
Irrigation water can be applied in the desired amount and with the best control.	4.31	3.88	4.10
The use of drip irrigation is easy and irrigation labor is at a minimum level	4.50	4.62	4.56
It can be used safely on all kinds of soil slopes	3.81	3.58	3.69
Weed control is easier	3.58	3.62	3.60
Some agricultural operations can be done easily as the soil is not completely wetted during irrigation	4.19	4.04	4.12
Spraying can be done with drip irrigation	4.12	2.04	3.08
In the drip irrigation method, the available irrigation water is utilized at the highest level	4.23	4.46	4.35
Energy costs are low	4.58	4.69	4.63
Drip irrigation has a positive effect on the protection of water resources	4.42	4.27	4.35
Drip irrigation has a positive effect on soil protection	4.42	4.27	4.35
Initial installation costs are quite high in drip irrigation	3.50	3.73	3.62
Using drip irrigation needs technical knowledge	3.12	3.27	3.19
Drippers are clogged in drip irrigation	3.12	2.58	2.85

1. Strongly disagree 2. Disagree 3. Undecided 4. Agree 5. Strongly agree

The opinions of the producers regarding the contribution of the drip irrigation system to agricultural production are shown in Table 4. The suggestions that “the number of employees and workload decreased with drip irrigation” was determined as the most effective factors for the producers who utilized the subsidies and those who did not, respectively. The least effective factor for both groups was the statement "the amount of cultivated land increased with drip irrigation". It was determined that the producers in both groups adopted all other judgments. In the study conducted by Keskin and Bostan Budak (2010), the majority of the producers declared that they obtained yield increase, quality increase and labor savings with drip irrigation. In the study conducted by Suresh Kumar and Palanisami (2010), it was determined that the producers who applied the drip irrigation method provided savings in resource use, reduction in production costs and yield increase. In the study conducted by Joshi (2013), producers stated that they provided yield and quality increase, and decrease in water and labor costs with the use of drip irrigation.

Table 4. Producers' judgments on the contribution of drip irrigation to agricultural production

Contribution of Drip Irrigation to Agricultural Production	Drip Irrigation Subsidy	No Subsidy	Average
Production costs decreased with drip irrigation	4.38	4.54	4.46
Workload decreased with drip irrigation	4.65	4.62	4.63
Product quality increased with drip irrigation	4.31	4.35	4.33
My agricultural income increased with drip irrigation	4.23	4.35	4.29
The number of employees decreased with drip irrigation	4.65	4.65	4.65
The amount of land cultivated with drip irrigation has increased	3.04	3.19	3.12
The use of new technology has increased with drip irrigation	4.27	3.85	4.06
Drip irrigation contributes to the protection of the environment	4.46	4.12	4.29

1. Strongly disagree 2. Disagree 3. Undecided 4. Agree 5. Strongly agree

Factors affecting the benefit from drip irrigation subsidies

Whether multicollinearity between the independent variables examined in revealing the differences between the groups was determined by considering the tolerance and variance increase factors (VIF) values (Table 5). A tolerance value of 0.10 or less, and a VIF value of 10 or higher indicate a multicollinearity problem. As a result of the analysis, tolerance values of all variables were greater than 0.10 and VIF values less than 10. This showed that there was no multicollinearity problem between the variables, and logistic regression analysis was performed with all selected variables.

Table 5. Tolerance and VIF values of independent variables

Variables	Tolerance	VIF
Age	0.602	1.660
Education period	0.646	1.548
Agricultural experience	0.533	1.877
Number of family members	0.808	1.238
Number of individuals working in agriculture	0.862	1.160
Irrigated land size	0.784	1.276
Non-agricultural income	0.773	1.294
Type of activity	0.856	1.168
Having agricultural insurance	0.798	1.254

The estimation results of the logistic regression model are given in Table 6. In the model, the chi-square value was determined as 40,337 and the significance level of this value was determined as 0.000. Since the significance level was $P<0.05$, the coefficients of the determined model were found to be significant. As a result of the Hosmer and Lemeshow test, the chi-square value was 4.108. It was found that $P=0.847>0.05$, and it was concluded that the model was suitable. The Nagelkerke R^2 statistic was found as 72%, and it showed a 72% relationship between the dependent variable, and the independent variables, and the independent variables explained 72% in the model. The classification ratio of the dependent variable was found as 84.60%, and it was determined that the logistic regression model had a good prediction ratio.

Among the variables included in the model, it was determined that the agricultural experience of the producers and the status of having agricultural insurance were statistically insignificant ($p>0.10$).

According to the results, the producers' age negatively affected the benefit drip irrigation subsidies at the 10% significance level. It was concluded that if the age of a producer who did not utilize drip irrigation subsidies in the region increased by one year, utilizing drip irrigation subsidies would decrease by 1.179 (1/0.848) times. In this context, it can be revealed that the tendency of young producers to benefit from drip irrigation subsidies is higher. In the study conducted by Topçu (2008), it was determined that the producers' age negatively affected the producers' tendency to agricultural supporting policies while it was determined that it had a positive effect in the study conducted by Abay et al. (2017). The result of the study differed with the research result of Abay et al. (2017) while Topçu (2008) showed similarity with the research result.

It was determined that the education period of the producers had a positive effect on the status of utilizing drip irrigation subsidies at the 10% significance level. A one-unit increase in the education period increases the probability of utilizing drip irrigation subsidies 1.429 times. In the study conducted by Abay et al. (2017), it was concluded that the education period of the producers positively affected the level of benefits of agricultural supports. In the study conducted by Tan et al. (2017), it was determined that there was a positive effect on the benefit of organic farming support, while it had a positive effect on the benefit of beef cattle support in the study conducted by Ağır and Akbay (2018). While it was determined that the number of family members negatively affected the benefit of drip irrigation subsidies, the number of people working in agriculture positively affected the status of utilizing drip irrigation subsidies. The fact that the number of individuals working in agriculture was high can be interpreted as that the producers generally earned their living from agricultural activities and therefore, they had a more positive attitude towards agricultural innovations and developments.

It was determined that the size of irrigated land positively affected the drip irrigation subsidies at the 5% significance level. As the size of the

irrigated land increases, the tendency of the producers to utilize drip irrigation subsidies increase. In the study carried out by Abay et al. (2017), it was determined that the size of the land cultivated by the producers positively affected the level of benefits from agricultural supports, similar to the research result.

The non-agricultural income of the producers affected the utilization from drip irrigation subsidies at the 5% level of importance and negatively. Since there are some procedures such as having projects prepared and analysis in drip irrigation subsidy applications, this situation can be interpreted as the fact that the producers engaged in non-agricultural activities cannot have the necessary attention and time.

The types of activities of the producers affected the utilization from drip irrigation subsidies at 10% significance level and negatively. It was seen that the tendency of the producers dealing with only plant production to receive drip irrigation subsidies increased. This situation can be interpreted as the fact that the producers dealing with plant and animal production cannot spare time for innovations related to plant production because they spend most of their time with livestock activities.

Table 6. Estimation results of the logistic regression model

Variables	Coefficient	Standard Error	Wald Statistic	df	P Value	Odds Ratio
Constant	1.721	3.714	0.215	1	0.643	5.591
Age	-0.164	0.089	3.409	1	0.065*	0.848
Education period	0.357	0.195	3.354	1	0.067*	1,429
Agricultural experience	0.071	0.075	0.898	1	0.343	1.074
Number of family members	-0.844	0.489	2,980	1	0.084*	0.430
Number of individuals working in agriculture	1.996	0.952	4.402	1	0.036**	7.362
Irrigated land size	0.011	0.005	4.045	1	0.044**	1.011
non-agricultural income	-2.982	1.445	4.258	1	0.039**	0.051
Type of activity	-3.094	1,749	3.129	1	0.077*	0.045
Having agricultural insurance	1.244	1.012	1.512	1	0.219	3.469
Cox&Snell R^2 = 0.540 Nagelkerke R^2 = 0.720						
-2 Log likelihood = 31.750a						
Chi square = 4.108 p = 0.847 (Hosmer Lemeshow test)						
Chi square = 40.337 p = 0.000 (Omnibus test)						
Classification ratio = 84.60%						

* Significant at 10% significance level, ** Significant at 5% significance level, *** Significant at 1% significance level

Conclusion

This study analyzed the factors affecting the benefit of drip irrigation subsidies. It was determined that the number of family members working in agriculture, the size of the irrigated land and the education period increased the probability of benefiting from the subsidies positively. These findings revealed that producers with higher education levels benefited more from drip irrigation subsidies. As the conscious level of the producers increased, the possibility of being aware of and benefiting from various supports also increased. In addition, it is possible to say that the number of family members working in agriculture was higher in the producer group benefiting the subsidies, and that drip irrigation subsidies had a positive effect on labor productivity. The income-enhancing effect of the irrigation systems used in the training and extension studies to be carried out to disseminating the use of drip irrigation systems should also be highlighted.

The number of family members negatively affected the probability of benefiting the subsidies. Young individuals tend to different interests instead of being interested in agricultural activities. It is thought to be beneficial to determine the policies that will encourage the young population to agricultural activities.

It was also concluded that the total size of the land cultivated by the producers who utilized drip irrigation subsidies was higher than the producers who did not.. It was observed that large enterprises and large land owners benefited more from the subsidies. Informing the producers about the subsidy application and benefiting from the subsidies of small enterprises will positively affect their decision on the support application.

Considering that the purpose of drip irrigation subsidies is to provide more effective use of limited water, increase productivity, to reduce labor and production costs, and increase the prevalence of drip irrigation systems, it is possible

to say that drip irrigation subsidy is applied in accordance with its purpose.

Drip irrigation subsidy is accepted by the farmers as a support tool with high satisfaction and desired to continue. It was observed that the conscious level of the producers about such irrigation systems, which was important in terms of limited water resources, was quite high. Although drip irrigation subsidies do not effect production, it is possible to say that it plays an active role in changing irrigation methods and tending to more effective irrigation methods.

Acknowledgement: This study was prepared by using the data obtained from the project titled "Impact Analysis of Drip Irrigation Subsidies in Adana and Niğde Provinces" carried out with the support of TAGEM.

Conflict of Interests: The authors declare that they do not have any conflict of interest.

Researchers' Contribution Rate Statement Summary: The authors declare that they have contributed equally to the manuscript.

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