How to cite: Cevher, C., B. Altunkaynak, Y. Ataseven, Ö. Köksal, Z. Bayramoğlu & G. G. Yavuz, 2022. Investigation of agricultural supports on forage crop production: a perspective of the effects of supports on the basis of regions. Ege Univ. Ziraat Fak. Derg., 59 (1):1-15, https://doi.org/10.20289/zfdergi.898219

Research Article
(Araştırma Makalesi)

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Keywords: Agricultural supports, forage crop production, regression analysis, Turkey

Anahtar sözcükler: Regresyon analizi, tarımsal destekler, Turkey, yem bitkisi üretimi

Ege Üniv. Ziraat Fak. Derg., 2022, 59 (1):1-15
https://doi.org/10.20289/zfdergi.898219

Investigation of agricultural supports on forage crop production: a perspective of the effects of supports on the basis of regions

Yem bitkileri üretimine yönelik tarımsal desteklerin araştırılması: Desteklerin bölgeler temelinde etkilerine bir bakış

Received (Alınış): **16.03.2021** **Accepted** (Kabul Tarihi): **17.06.2021**

ABSTRACT

Objective: Although the farmers producing forage crops have been supported since 2000, the targeted level of forage crop production has not been reached. Hence a study was conducted and the objective of this t was to determine the factors affecting the increase in forage crop production at the regional level.

Material and Methods: The Central Anatolia and Eastern Anatolia Regions, where forage crop production is common in Turkey, were selected. Data were collected through face-to-face interviews with randomly selected 980 forage crop producers. Linear regression analysis was used to analyze the data.

Results: It has been determined that the most important variables affecting the increase in forage crop production in both regions are the presence of land and the number of animals. An increase of 1 hectare in the irrigated land led to an increase in the production of 2.77 hectares of vetch crop *(Vicia sativa* L.) in the Central Anatolia Region. In the Eastern Anatolia Region, it was determined that this situation caused an increase in the production of 4.69 hectares of alfalfa crops *(Medicago sativa* L.). After the subsidies, the forage crop production of the non-animal farmers was approximately 2.14 times higher than the livestock farmers.

Conclusion: Giving forage crops supports considering the crops production pattern and geographical conditions of the regions will contribute more to the increase in forage crops production.

ÖZ

Amaç: 2000 yılından itibaren yem bitkisi üreten çiftçilerin desteklenmesine rağmen, yem bitkisi üretimi hedeflenen seviye ulaşılamamıştır. Bu çalışmada, bölgeler düzeyinde yem bitkisi üretim artışına etki eden faktörlerin belirlenmesi amaçlanmıştır.

Materyal ve Yöntem: Türkiye'de yem bitkisi üretiminin yaygın olarak yapıldığı Orta Anadolu ve Doğu Anadolu Bölgesi seçilmiştir. Rastgele seçilen 980 yem bitkisi üreticisiyle yüz yüze görüşülerek anket yoluyla veriler toplanmıştır. Verileri analiz etmek için doğrusal regresyon analizi kullanılmıştır.

Araştırma Bulguları: Her iki bölgede de yem bitkisi üretim artışına etki eden en önemli değişkenlerin arazi varlığı ve hayvan sayısı olduğu saptanmıştır. Sulu arazideki 1 hektarlık artış, İç Anadolu Bölgesi'nde 2,77 hektar fiğ bitkisi (*Vicia sativa* L.) üretiminde artışa neden olmuştur. Doğu Anadolu Bölgesi'nde ise bu durumun 4,69 hektar yonca bitkisinin (*Medicago sativa* L.) üretim artışına neden olduğu saptanmıştır. Desteklerden sonra, hayvancılık yapmayan çiftçilerin hayvancılık yapanlara kıyasla yem bitkisi üretimi yaklaşık olarak 2,14 kat daha fazla olmuştur.

Sonuç: Yem bitkisi desteklerinin bölgelerin bitkisel üretim deseni ve coğrafik şartları dikkate alınarak verilmesi, yem bitkisi üretim artışına daha fazla katkı sağlayacaktır.

INTRODUCTION

Livestock, especially cattle and sheep, is an important component of farming systems in every region of Turkey. In Turkey, the existing natural resources and the existence of suitable ecological conditions are suitable for cattle and sheep breeding and are also an integral part of mixed farming systems. Livestock in Turkey is significant in that it consists of a sector, which employs a high added value and low cost. Yılmaz and Koknaroglu (2007) stated in their study that the competitive power is less compared to the European Union livestock breeding due to the high production costs in the livestock sector in Turkey and the large number of small-scale enterprises.

The total assets of animals in Turkey was reported to be about 66.4 million cattle and sheep (Turkstat, 2019). There has been an increase in the presence of cattle and sheep in recent years compared to the previous years. Forage crop production increased by 13.65% in 2019 compared to 2002. Despite this increase, forage crop production is not at a level to meet the needs of animals (Ozkan, 2020). Therefore, forage crop production in Turkey is not in quantity to meet the needs feed the existing sheep and cattle (Agırbas et al., 2017; Topcu and Ozkan, 2017; Acer et al., 2020; Ozkan, 2020). However, Turkey has a great potential for feed production, and it is necessary to take active and more specific policy measures to mobilize this potential (Yılmaz & Mac, 2013). Cattle and sheep stock breeding is carried out intensively in both regions of the study area. According to the existing animal stock, the production of roughage crops is insufficient in both regions as in the whole of Turkey (Ozkan, 2020). In these regions where the study was conducted, there are many differences in terms of the cultivation area, animal breeds, socio-economic status and farm infrastructure of the livestock farmers. Due to these differences, it is inevitable that farmers will have differences in their production decision-making processes (Avazov, 2013; Onojah et al., 2013; Sami et al., 2014; Teklay & Teklay 2015; Balabanli et al., 2016; Lehtonen & Niemi, 2018).

It has been stated by various researchers that regional differences should be taken into account in order for agricultural support policies to achieve their goals effectively (Demir & Yavuz, 2010; Bernues et al., 2011; Galko &Jayet, 2011). Regional data on this issue provide important data for the development of strategies for sustainable milk production and decision-makers (Agostinho et al., 2019). For this reason, other variables that may affect the forage production should be determined apart from the subsidies given. Changes can be made in the agricultural support system by determining the effects of socio-economic variables on forage production (Cevher & Altunkaynak, 2020). These changes have an effect on decreasing production costs and increasing producer income. However, increasing the amount of animal production positively contributes to the national economy and the development of animal husbandry (Gupta et al., 2014).

The most important way to reduce input costs in livestock is to produce high quality roughage on the farm (Reheul et al., 2017). Swathy and Thomas (2020) stated that more training and extension studies should be done in order to increase the forage crop production. Reddy (2016) reported that the integrated agriculture system (animal and crop production) increases the profitability of the enterprise and intensifies the land use. In another study, they revealed that with the development of animal husbandry, there is a need for an increase in forage crop production, so it is necessary to consider forage crop production and animal husbandry together (Bai et al., 2018).

To increase the production of forage crops in Turkey, support policies are carried out for a long time. However, despite these supports, forage production did not reach the desired levels (Aksu & Dellal, 2015; Balabanli et al., 2016; Agirbas et al., 2017; Altındeger & Hekimoglu, 2017; Topcu & Ozkan, 2017; Aydogdu et al., 2020; Yılmaz et al., 2020). For this reason, apart from the supports given, other variables that may affect the forage production should be determined. Another important point in this regard is sustainability. Sustainable policies for the improvement of livestock production in Turkey are required. In this context,

sustainable agriculture policies need to be put forward and analyzed (Dogan & Altuntas, 2017; Topcu & Ozkan, 2017; Boyacı, 2020).

Stanek et al. (2018) determined that there are differences between the number of animals and the forage crop cultivation area at the level of regions. Stanek et al. (2018) reported that the relationship between fodder crop production and the number of animals at the regional level is important. The geographical conditions and economic development level of each region should be taken into account and specific support items should be provided at the regional level (Bhat & Bansil, 1999; Yılmaz et al., 2020; Erdal et al., 2021). It has been reported that, in addition to the ecological conditions of the regions, the animal species that are breeded should also be taken into account when planning production in forage crop cultivation (Benni & Finger, 2013; Bartzas & Komnitsas, 2020; Ozturk, 2020).

As understood from the literature, there are very important relationships between animal husbandry and forage crop breeding.

In this context, the main purposes of this study was; i) The effect of forage crop supports on forage crop production increase, ii) The hypothesis of which variables will have a greater effect on the increase of forage crop supports at the regional level has been tested. By testing these hypotheses, it is aimed to improve livestock activities and increase forage crops production. By demonstrating the importance and effect of these targets, it will be possible to shed light on the policies developed regarding agricultural supports.

MATERIAL and METHODS

Key characteristics of the study area

Forage crop production is achieved at a rate of 35% in the Eastern Anatolia Region (EAR) and 15% in the Central Anatolia Region (CAR) in Turkey. Therefore, these two regions were chosen as study areas.

Characteristics of the CAR; in the Central Anatolia Region, there is a suitable size of land for both forage crop and livestock production. There is a potential to increase the number of animals and forage crop cultivation area in order to make cattle and sheep breeding profitable. Forage crop production required for cattle and sheep breeding is not sufficient in this region. Climate characteristics; The CAR region is a bit hot in the summer and cold in the winter. Natural vegetation is dominated by steppe crops (herbaceous crops and shrubs) due to the summer drought. The average temperature of January, which is the cold month, is-0.7 °C, the warm month of July is 22 °C, and the annual average temperature is 10.8 °C. Average annual rains is 413.8 mm and most of the precipitation is in winter and spring. Annual average relative humidity is 63.7%.

Characteristics of the EAR; the economy of the Eastern Anatolia region is largely provided by sheep and cattle breeding. In this regard, the production of forage crops is very important for sheep and cattle breeding. Eastern Anatolia Region, Turkey provides 30% of the assets of sheep and cattle. It also provides 44.5% of alfalfa and sainfoin as cultivated area. Climate characteristics; the winter season is quite cold and long, and the summers are cool. During the cold period, this region is under snow and frost is common. Natural vegetation is dominated by meadows at high altitudes and steppe vegetation (herbaceous crops and shrubs) in low altitudes. The annual average temperature is 10.2 °C. Average annual rains is 579.4 mm and most of the precipitation is in winter and spring. Annual average relative humidity is 60.2%.

Forage crop support amount: The amount of support given to forage crop producers between the years 2000-2020 (BUGEM, 2021) is given in Table 1. Forage crop supports are given annually.

Table 1. Forage crop support amount (TL/ha/) (2000-2021)

Çizelge 1. *Yem bitkisi destek miktarı (TL/ha) (2000-2021)*

Forage crops	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Alfalfa (Irrigated Land)	170	230	340	560	680	950	1300	1300	1150	1150	1250	1300	1300	500	500	500	600	600	900	900	900
Alfalfa (Dry Land)	-	-	-	-	-	-	-	800	700	700	700	700	700	300	300	300		400		400	400
Sativa	140	180	270	300	380	550	800	800	750	750	800	900	900	400	400	400	450	600	900	900	900
Annual Forage Crops	70	90	140	180	230	370	500	500	300	300	300	300	300	350	350	350	400	400	600	600	600
Single Annual Silage	-	-	-	-	-	-	-	550	450	450	450	450	450	450	500						
Silage Corn (Irrigated Land)	100	140	210	300	350	600	600	600	450	450	500	550	550	550	750	750	900	900	1000	1000	1000
Silage Corn (Dry Land)	-	-	-	-	-	-	-	-	300	300	300	300	300	300	350	350		400		400	400
Artificial Meadow Pasture	-	-	-	-	-	-	1000	1000	750	750	750	750	750	750	1000		1500	600		1500	1500

Source: BUGEM.Crop production support unit prices

Data and variable selection

The data obtained through face-to-face surveys with the farmers in Central Anatolia Region and East Anatolia Region constitute the main material of the study. The data were collected in 2014 through a questionnaire organized in accordance with the purpose of the research. Survey data were obtained from farmers who have been producing forage crops continuously and intermittently since 2000. Two main materials were used in this study. The first material of this study was composed of the data obtained from secondary sources obtained from the studies performed nationally and internationally on the topic. Besides; published theses, articles and various publications were utilised. The second material of this study were data that were obtained from livestock farmers through questionnaire.

Livestock breeding costs are high in both regions. Therefore, there is a need to increase forage production. The regions in the study area have differences in terms of climate, soil characteristics, farmer behaviors and socio-economic characteristics (Cevher & Altunkaynak, 2020). Within the scope of this study, 9 provinces, 103 districts and 605 villages were considered,. The surveyed provinces (Green and blue) in the study area are depicted in Figure 1.

Figure 1. Areas of study.

Şekil 1. *Çalışma alanı.*

Central Anatolia Region *(CAR)* is formed in the provinces of Ankara, Konya, Yozgat and Aksaray. Although Afyonkarahisar is in the Aegean Region, it is included in this region because it is similar to the Central Anatolia Region in terms of forage crop and livestock production.

The Eastern Anatolia Region *(EAR)* is formed in the provinces of this region, Ağrı, Erzurum, Kars and Ardahan.

Number of Animals (Animal Unit): A culture breed dairy cow is Animal Unit. Culture, cultural crossbreed and indigenous breeds have been transformed into the cattle unit norm (TOB, Turkish Pasture Regulation, 2020).

Variable defination

The explanations of the independent variables in the study are given in the Table 2.

Table 2. The explanations of the variables

Çizelge 2. *Değişkenlerin açıklamaları*

Variable	Definition
Farmer characteristic	
Age	Age of the farmer
Education	1=Literate; 2=Primary School; 3=Middle school; 4=High school; 5=University
Place of residence	Dummy variable; 1=Rural; 0=City
Off-farm income	Dummy variable; 1=Yes; 0=No
Farm infrastructure	
Livestock/non-livestock	Dummy variable; 1=Yes; 0=No
Land size	1=[0, 100]; 2=[101, 500]; 3=[501-1000]
Using certified seeds	Dummy variable; 1=Yes; 0=No
Forage production is important for	
Feeding the livestock	Dummy variable; 1=Yes; 0=No
Stopping soil erosion	Dummy variable; 1=Yes; 0=No
Improving the soil structure	Dummy variable; 1=Yes; 0=No
Increasing the labor force	Dummy variable; 1=Yes; 0=No

Forage crops supports: Fodder crop producers are supported in order to increase forage crop production, increase yield and quality, contribute to meet production costs and ensure sustainability in animal husbandry. The amount of forage supports varies according to the amount of cultivated area each year. The registered farmers in the farmer registration system during the production year and want to benefit from the supports apply to the provincial / district agriculture directorates in accordance with the published feed crop communiqué. In order to benefit from the subsidies, farmers must have at least one hectare of forage crop production land. The number of supports varies according to the type of forage crop. The amount of support per hectare for 2020; 0.81 USD for annual forage crops (vetch), 1.21 USD for perennial forage crops (alfalfa), 1.34 USD for silage maize and 2.02 USD for artificial meadow pastures. These monetary values vary every year.

Sampling

For the sampling process, the size of the land which the producers had for the forage crop production was taken into consideration as the selection criterion. The size of the lands was retrieved from the Farmer Registration System to form a framework. As the land masses are not homogeneous in different provinces, and as all of the provinces have to be presented in the study, Stratified Random Sampling method was adopted for analysis. The sample size was calculated with the formula given below:

$$n = \frac{\left(\sum N_h S_h\right)^2}{N^2 D^2 + \sum N_h S_h^2} \quad (1)$$

n: The number of producers interviewed
N: Total number of producers
D^2: Desired variance on stratified random sampling $D^2 = \left(d/t\right)^2$
N_h: *h*. the total number of producers in the layer
S_h^2 : *h*. layer variance

The number of producers with whom the interviews were to be done was set to be 980 as a result of the calculation that was made. The distribution of the sample size into layers was done with Neyman's distribution method. In this regard, the size of the sample (n_h) from each province was determined by the formula given below:

$$n_h = \frac{N_h S_h}{\sum N_h S_h} n \quad (2)$$

According to this formula, 980 surveys, given to the producers in two regions, consisted of the provinces in CAR region; 136 from Afyonkarahisar, 48 from Ankara, 299 from Konya, 33 from Yozgat, and 94 from Aksaray; and the provinces in the EAR region; 82 from Ağrı, 130 from Erzurum, 93 from Kars, and 65 from Ardahan.

Empirical analysis

In the study, linear regression analysis was used to reveal the factors affecting the production of forage crops. The model structures in the form of linear, logarithmic, quadratic, exponential etc was testedto decide the model structure. It was determined that the linear model was the most suitable model form in this study. The Regression model was created separately for each forage crop variety. In these models, increasing the amount of forage crop production is considered as dependent variables, land quantity (dry, irrigated) and number of animals as independent variables. In cases where the dependent variable has only two values such as 0 and 1 or yes and no two values, the relationships were examined by binary logistic regression analysis. Binary logistic regression analysis was used to examine the socio-economic factors affecting this variable, since the status of whether there is an increase in production is considered as the dependent variable. The logistic regression model with "k" number of independent variables is defined as follows.

$$P(y) = \frac{e^{\beta_0 + \beta_1 X_1 + ... + \beta_k X_k}}{1 + e^{\beta_0 + \beta_1 X_1 + ... + \beta_k X_k}} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + ... + \beta_k X_k)}} \quad (3)$$

While $\beta_0, \beta_1, ..., \beta_k$ above shows model parameters, given the values of independent variables, *P(y)* indicates the probability of the dependent variable's positioning in either one of the values (0 or 1). This model can be constructed as follows:

$$\ln\left(\frac{P(y)}{1 - P(y)}\right) = \beta_0 + \beta_1 X_1 + ... + \beta_k X_k \quad (4)$$

As seen above, the part given as $P(y)/(1-P(y))$ is known as *odds*. The term *Odds* is used for the result that is found when the probability of the presence of a property is divided by the probability of the absence of the property. The ratio of two values to each other is known as the Odds Ratio (OR).

RESULTS

In this section, some basic socio-economic characteristics of farmers, farm structure and the effects of these characteristics on forage crops production are examined.

Examination of variables affecting after supports feed crop production

In this section, where the characteristics of the producers benefiting from forage crop supports are determined, the results obtained are tabulated in Table 3. The chart was examined and according to the results of the logistic regression analysis, it was found that the age of the farmer had a significant effect on the increase in forage crop production after support ($p < 0.05$). It has been determined that per year hectare in the age of the farmer creates an increase of about 20% after supports forage production. According to this result, it was concluded that elderly farmers should be trained more on forage crop production.

It has been determined that the use of certified seeds by farmers has a significant effect on the growth of forage crop production. After the supports, it was determined that the contribution of the farmers using certified feed crop seeds to production was 1.84 times higher than those who did not use certified feed crop seeds. This result is due to the fact that the farmers using certified seeds obtained higher yield per unit area as a result of using quality seeds. After the supports, it was determined that the amount of forage crop increase of the farmers who do not engage in livestock was approximately 2.14 (1/0.468) times more than the farmers engaged in livestock. It can be said that the income earned by the farmers who do not engage in sheep and cattle breeding is higher than the income obtained from other crops. After the supports, it was determined that there was no statistically significant relationship between the farmers who increased their production and their education level ($p > 0.05$). In studies conducted by various researchers, it has been determined that the farmer's education level is related to access to information, positive environmental attitudes, environmental awareness and the use of social networks and adoption rates (Vanslembrouck et al., 2002; Asfaw & Admassie, 2004; Alene & Manyong, 2007; Prokopy et al., 2008; Abah & Betja 2015; Mittal & Mehar, 2016; Nakano et al., 2018). After the supports, it was concluded that place of residence and off-farm income, which is one of the other socio-economic variables, does not have a significant effect on forage crop cultivation.

Table 3. Logistic regression estimates of variables

Çizelge 3. *Değişkenlerin lojistik regresyon tahminleri*

Variable	B	SE	Wald	df	P	Exp(B)
Constant	2.292	0.992	5.341	1	0.021	9.898
Farmer characteristic						
Age	-0.021	0.008	6.543	1	**0.011***	0.979
Education	-0.108	0.088	1.506	1	0.220	0.898
Place of residence	0.075	0.228	0.107	1	0.744	1.077
Off-farm income	-0.260	0.182	2.042	1	0.153	0.771
Farm infrastructure						
Livestock/non-livestock	-0.760	0.299	6.439	1	**0.011***	0.468
Land size	0.139	0.145	0.927	1	0.336	1.150
Using certified seeds	0.608	0.166	13.379	1	**0.000***	1.837
Forage production is important for						
Feeding the livestock	0.124	0.587	0.045	1	0.833	1.132
Stopping soil erosion	-0.323	0.191	2.865	1	0.091	0.724
Improving the soil structure	0.411	0.195	4.455	1	**0.035***	1.509
Increasing the labor force	-0.257	0.187	1.886	1	0.170	0.773
LR $Chi^2(11)$	39.773	-	-	-	-	-
Prob>Chi^2	0.000	-	-	-	-	-
Log-likelihood	957.423					

Significance level: * p-value < 0.05

Investigation of factors affecting alfalfa production in CAR and EAR regions (Irrigated Land)

After the supports, in order to compare the regions, the size of the land (irrigated and dry) and the number of cattle and sheep animals that have the greatest impact on forage crop production were tested by Regression Analysis. Regression analysis could not be performed for the farmers producing alfalfa and corn for silage corn in both regions since the number of farmers was insufficient. All regression analysis results are shown below in tables 4 thru 7.

The analysis results for alfalfa (irrigated land) in the CAR region are shown in Table 4. When the chart results are examined, it is seen that the model is significant ($p < 0.01$). As seen from the significance tests of the regression coefficients, it can be said that the presence of irrigated land in the CAR region and the Animal Unit have an effect on the alfalfa (irrigated) production. In the study conducted by Cevher and Altunkaynak (2020) it was determined that one of the most important variables affecting the production of forage crops is the existing land size of the farmer. One of the variables that increase the production of roughage at most is irrigated land size. In this context, the effect of the increase in irrigated land on the production of forage crops was tried to be determined. In the CAR region, there was an average increase of 3.22 hectares in alfalfa production, with per hectare increase in irrigated land. In terms of the number of animals, per unit of increase in the Animal Unit caused an average decrease of 2.12 hectares in alfalfa production in the total irrigated land. In a similar study conducted by Stenak et al. (2018) on the basis of Southern Poland and Western Carpathians regions, their findings were similar to ours.

It has been determined that the increase in irrigated land in the CAR region increased the production of alfalfa the most. On the other hand, It can be said that the increase in the number of animals decreases the alfalfa production within the total land width. In the CAR region, greater support for alfalfa production in irrigated land than in dry land will result in a notable increase in roughage production. In addition, it was determined that as the width of the land in the enterprise increased, the forage cultivation area increased. In similar studies, it has been reported that as the total land width increases, the forage cultivation land increase (Stanek et al., 2018). They stated that new support policies in terms of sustainable and economic animal husbandry should be established and revealed with the research results (Chang, 2018; Torgut et al., 2019). Considering the geographical conditions of the regions and the level of economic development, it was reported that different subsidies should be recommended at the regional level (Bhat & Bansil, 1999; Erdal et al., 2021). D'Amico et al. (2013) put forward the necessity of establishing agricultural and regional systems, defining regional development programs and designing them.

The results of the analysis for the irrigated alfalfa land in the EAR region are given in Table 5. It can be said that the presence of irrigated land in the EAR Region is more effective on alfalfa production in dry land. An increase in irrigated land in this region causes an average of 4.69 hectares of increase in alfalfa production in irrigated land. In similar studies, it has been reported that as the total land width increases, forage crop cultivation land increase. Considering the geographical conditions of the regions and the level of economic development, the necessity of different supports at the regional level were reported by various researchers (Bhat & Bansil, 1999; Stanek et al., 2018; Chang, 2018; Torgut et al., 2019; Erdal et al., 2021).

It has been determined that the increase in the amount of land in irrigated land after the supports has a positive effect on alfalfa production in both regions. However, it is seen that the increase in alfalfa production in EAR is higher than the one in CAR. Therefore, the higher the amount of supports to be given to irrigated land in the EAR region compared to the CAR region will result in a further increase in alfalfa production. In the CAR region, there will be more monetary support for alfalfa production in drylands than in the EAR region. However, the effect of this variable on the increase in alfalfa production will be limited since alfalfa production is very low in dry land.

Table 4. Alfalfa production regression analysis results in CAR region (irrigated land)

Çizelge 4*. CAR bölgesinde yonca üretim regresyon analiz sonuçları (sulanan arazi)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	10,722	3.994	2.684	0.008		
Dry land	0.660	0.167	0.396	0.693	0.992	1.008
Irrigated land	3.220	0.018	17.674	0.000	0.627	1.594
Animal Unit	-2.120	0.063	-3.387	0.001	0.631	1.585

$F_{3,273}$=133.20; p=0.000; R^2=0.59

Table 5. Alfalfa production regression analysis results in EAR region (ırrigated land)

Çizelge 5. *EAR bölgesinde yonca üretim regresyon analiz sonuçları (sulanan arazi)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	2.724	11.648	0.234	0.816		
Dry land	0.310	0.113	0.273	0.785	0.838	1.194
Irrigated land	4.690	0.081	5.799	0.000	0.974	1.026
Animal Unit	-0.290	0.361	-0.079	0.937	0.858	1.165

$F_{3,96}$=11.36; p=0.000; R^2=0.26

Investigation of factors affecting silage corn production in CAR and EAR regions (Irrigated Land)

The results of the analysis of silage corn (irrigated land) in CAR and EAR regions are given in tables 6 and 7. It appears that the presence of irrigated land in the CAR region has more impact on maize production for silage, while this effect is less in dry land. The per hectares increase in irrigated land resulted in an average of 4.52 hectare increase in silage corn production after subsidies**.** Yılmaz et al. (2020) stated that the possibilities of silage forage crops should be investigated according to the regions and their use should be encouraged. Table 6 shows that the presence of irrigated land in the EAR region has an impact on silage corn production under irrigated conditions. It is seen that per hectare increase in irrigable land in this region results in an average of 2.12 hectare increase in silage corn production in irrigated conditions. According to the increase in the number of animals, the decrease in silage corn land remained lower than the decrease in alfalfa land. It can be said that this is due to the fact that the alfalfa crop is perennial and the silage corn is an annual crops. Farmers stated that silage corn supports are more advantageous than alfalfa supports in terms of production pattern in the enterprise.

Table 6. Silage corn production regression analysis results in CAR region (irrigated land)

Çizelge 6. *CAR bölgesinde silaj mısır üretimi regresyon analiz sonuçları (sulanan alan)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	11.930	6.348	1.879	0.061		
Dry land	0.380	0.379	0.099	0.921	0.984	1.016
Irrigated land	4.520	0.029	15.458	0.000	0.554	1.804
Animal Unit	-1.350	0.121	-1.115	0.266	0.558	1.793

$F_{5,604}$=130.63; p=0.000; R^2=0.60

Table 7. Silage corn production regression analysis results in EAR region (irrigated land)

Çizelge 7. *EAR bölgesinde silaj mısır üretimi regresyon analiz sonuçları (sulanan alan)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	10.063	5.737	1.754	0.089		
Dry land	-2.100	0.166	-1.267	0.214	0.989	1.011
Irrigated land	2.120	0.032	6.735	0.000	1.000	1.000
Animal Unit	-0.480	0.165	-0.291	0.773	0.989	1.011

$F_{3,32}$=15.63; p=.000; R^2=0.59

Investigation of factors affecting vetch production in CAR and EAR regions (Irrigated Land)

In the CAR Region, the presence of dry and irrigated land is effective on vetch production. An increase of per hectare in irrigated land results in an average increase of 2.77 hectares in vetch production, while a per hectare increase in dry land value brings an average increase of 6.52 hectares in vetch production. Regression Analysis results for vetch (irrigated land) production in the EAR and CAR regions are given in tables 8 and 9. It can be said that the width of the land and the number of animals are not important for vetch production in irrigated conditions in this region.

Table 8. Vetch production regression analysis results in CAR region (irrigated land)

Çizelge 8. *CAR bölgesi fiğ üretimi regresyon analiz sonuçları (sulanan arazi)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	5.283	3.644	1.450	0.149		
Dry land	6.520	0.115	5.659	0.000	0.919	1.088
Irrigated land	2.770	0.016	17.181	0.000	0.547	1.827
Animal Unit	0.460	0.067	0.692	0.490	0.535	1.870

$F_{5,604}$=195.57; p=0.000; R2=0.74

Table 9. Vetch production regression analysis results in EAR region (irrigated land)

Çizelge 9. *EAR bölgesi fiğ üretimi regresyon analiz sonuçları (sulanan arazi)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	3.264	21.216	0.154	0.879		
Dry land	-3.620	0.248	-1.458	0.154	0.890	1.124
Irrigated land	0.990	0.171	0.579	0.567	0.917	1.091
Animal Unit	1.340	0.781	0.171	0.865	0.969	1.032

$F_{3,34}$=1.07; p=0.231; R^2=0.09

Investigation of factors affecting vetch production in CAR and EAR regions (Dry Land)

The presence of dry land, irrigated land and Animal Unit in the CAR Region are effective on vetch production (Table 10). Per hectare increase in irrigable land resulted in an average decrease of 3.31 hectare in dry field vetch production, while per hectare increase in dry land resulted in an average increase of 5.09 hectares in dry land. On the other hand, per unit increase in the assets of Animal Unit showed an average increase of 3.11 hectare in vetch production in the dry field. When the results in Table 10 are examined, it is seen that the model is significant ($p < 0.05$). The presence of dry land in the EAR region is effective on vetch production in dry land. Per hectare increase in dry land resulted in an average of 1.18 hectares of increase in vetch production in dry land. Regression Analysis results for vetch (dry land) production in the EAR region are given in table 11.

Table 10. Vetch production regression analysis results in CAR region (dry land)

Çizelge 10. *CAR bölgesi fiğ üretimi regresyon analiz sonuçları (kuru arazi)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	0.708	5.289	0.134	0.894		
Dry land	5.090	0.094	5.416	0.000	0.757	1.321
Irrigated land	-3.310	0.158	-2.097	0.038	0.949	1.053
Animal Unit	3.110	0.135	2.300	0.023	0.773	1.294

$F_{3,102}$=22.84; p=0.000; R^2=0.40

Table 11. Vetch production regression analysis results in EAR region (dry land)

Çizelge 11. *EAR bölgesi fiğ üretimi regresyon analiz sonuçları (kuru arazi)*

Model	B	Std. Error	t	p	Tolerance	VIF
(Constant)	12.345	4.631	2.666	0.008		
Dry land	1.180	0.025	4.661	0.000	0.877	1.140
Irrigated land	-1.750	0.197	-0.888	0.375	0.945	1.058
Animal Unit	2.560	0.176	1.459	0.146	0.858	1.165

$F_{3,206}$=11.13; p=0.000; R^2=0.14

DISCUSSION

In this study, some basic socio-economic characteristics of farmers, farm structures and the effects of these characteristics on forage crops production were examined. It was found that elderly farmers should be trained more on forage crop production in CAR and EAR. Similar results have been obtained from previous studies on this subject. In the field researches, it was found that individuals with behavioral changes are younger and young people are more willing to benefit from supports (Storstad, 2003; Topcu, 2008; Demir & Yavuz, 2010; Mittal & Mehar, 2016). However, it has been determined by different researchers that the age factor has no significant effect on the sustainability of forage crop production and behavior change (Aslan & Boz, 2005; Saygi & Alarslan 2012; Cevher & Altunkaynak, 2020).

In this study, it was determined that forage crop supports had a positive effect on the increase in alfalfa, maize and vetch production in both dry and irrigated land. The effect of forage crop supports on the increase in forage crop production have been revealed by various researchers. These mentioned studies are in parallel with this study results (Sayar *at al*., 2010; Ata & Yılmaz, 2015; Ahn & Han, 2016; Aksu & Dellal, 2016; Mac & Yılmaz, 2016; Cevher, 2019; Todorovic et al., 2020; Yavuz et al., 2020). On the contrary, in a study in which the positive effect of agricultural supports was not observed, researchers attributed this to the fact that farmers were not aware of the need for roughage for animal production (Mut et al., 2017). Not only the support given to the increase in the production of forage crops, but also the increase in the number of animals, the understanding of the importance of the fodder crops in the livestock and production pattern, the development of intensive livestock and the profitability of other products in the production pattern have also been effective. Therefore, in order to sustain the increase in forage crop production, the first requirement will be to ensure the continuity of forage crop supports. In their study, Mac and Yılmaz (2016) emphasized that increasing the production of forage crops in Turkey is an important goal for the development of the sustainable livestock sector. Therefore, it was stated that the current incentive support for forage crop cultivation should be maintained and increased. They also stated that, in addition to the problems and demands of farmers, policy implementations for forage crop production should be prioritized.

The proportion of farmers who stated that forage crop production would be sustainable under current conditions was higher in the CAR region. According to this result, it is seen that if the subsidies remain at the same level or are decreased, the decrease in the amount of forage production will be more in the EAR region. Farmers in the EAR region increased their production increase depending on the supports. However, farmers in the CAR region have realized that forage production is an important factor in reducing animal production costs and profitability. The fact that forage crop production has a positive effect in reducing the costs of livestock is similar to the findings of this study presented and other researchers' findings on this subject. Adam et al. (2012) reported that forage crop supports increased household income.

Considering the width of the land and the number of animals, it has been determined that the increase and decrease of the forage crop cultivation area varies according to the regions. It can be said that these differences are due to the different climatic characteristics and animal races. It is known that intensive livestock breeding is dominant in the CAR region, and domestic and hybrid animal breeds are

dominant in the EAR region. The climatic conditions in EAR are harder and longer than the climatic conditions in the CAR region. Different climatic conditions affect the forage cultivation area and the condition of the forage crop species (Topcu & Ozkan, 2017). As the number of livestock increased in the EAR region, the forage cultivation area in the total land decreased. This indicates that the forage cultivation land in the region are of limited size and cannot be increased in a short time. This shows that as the number of animals increases, the roughage deficit in the region will be greater. Supports made in the EAR Region should be continued by increasing and diversifying in the field of forage crops (Bıcakci & Acıkbas, 2018). Bhat and Bansil (1999) emphasized that the need for forage crops is necessary at the regional level and the importance of testing them separately. In another study, it was stated that the conditions of each region are different, so support policies should be planned accordingly (Erdal et al., 2021). Yilmaz et al. (2020) stated that incentive plans based on regional production and product quality should be made. The main goal of national and regional agricultural policies is to ensure and implement the principle of "self-sufficiency" (Topcu & Ozkan, 2017). Bontkes and Keulen (2003) argued that in order to increase sustainable agricultural development, it is necessary to formulate policies and determine the complex dynamics of agricultural systems at the farm and regional level.

In the CAR region, there are conditions for increasing the forage cultivation area in parallel with the increase in the number of animals. This is possible by transforming livestock farming into a profitable activity in the CAR region and ensuring that forage crop production generates more income than other crops. The authorities in support policies need to increase the amount of supports in parallel with the increase in the number of animals.

In the decision of farmers to increase the production of forage crops, vetch production comes before alfalfa and silage corn. This finding has been revealed by both the analysis result and the observations of the researchers in the field of study. The adaptation of the vetch crops to alfalfa and silage corn is quite wide. Alfalfa crops follows the vetch crops in terms of adaptation. This situation should be taken into account when determining the support policies. Taking this into account, it was reported that forage crop production will be higher at the regional level (Sayar at al., 2010). Farmers adopt vetch production earlier due to the low cost of production and easy cultivation technique. However, it should not be ignored that wheat and barley cultivation land will decrease with the increase in vetch production land (Cevher, 2019). It has been determined that the increase in forage crops of the producers who do not make livestock after the supports is approximately two times more than the producers who do animal husbandry. It can be said that this situation is caused by the higher income obtained from other crops products by farmers who do not engage in livestock breeding. Farmers who do not make livestock but produce forage crops have contributed to the formation of the roughage exchange. Therefore, when determining support policies, no distinction should be made between these two groups. This will have a positive effect on forage production.

If the current support policies continue in the same way, it does not seem possible to increase the sustainability in forage production and the forage cultivation area in the total area to 25-30%. In this context, it has been concluded that more studies are needed to formulate new support policies.

CONCLUSION

Before the supports, the forage crop planting area was 2-3%, this ratio increased to 13-15% after the supports in Turkey. Despite this increase, the amount of forage crops production is not enough to meet the feed needs of the animals. The increase in the number of medium and large-scale livestock farms in recent years has also been effective in the formation of roughage deficit. Therefore, studies examining the effectiveness of forage crop supplements and their relationship with animal husbandry activities are needed. This study was carried out in CAR and EAR regions, which have an important place in livestock and forage production. It was aimed to determine the variables affecting livestock and forage production in these regions. The results of the research are expected to contribute to the development of

forage crop support policies. It is possible to increase forage crop production in both regions by increasing the monetary supports and developing support policies. It was concluded that the increase in vetch crops production could occur faster in both regions. As a result, it has been concluded that by applying the results of the research at the regional level, sustainability in animal and forage crop production will be achieved more.

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