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Determination of the Main Socio-Economic Factors of the Sustainable Production of Forage Crops: Research of Kayseri Province

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ABSTRACT

Today, about 21% of the Turkey's population lives engage plant production and animal husbandry; the most crucial aspect of livestock breeding is producing forage crops. Since 2000, growers in Turkey have been subsidized and encouraged to increase both their production and quality of forage crops. However, despite all this support and assistance, desired production levels have not yet been achieved. Therefore, it is equally crucial analyze the effects of factors other than the subsidies provided on forage crops production. This study aims to determine the socio-economic factors that affect sustainable forage crops production. The study was carried out in the province of Kayseri, specifically in 11 villages where both plant production and animal husbandry systems are common. The subjects of the study were selected through the Random Sampling Method and data was collected by surveying 310 forage crops growers. To identify dependency relationships between qualitative variables used mainly based on a statistical chi-square statistic. According to the analysis results, 35.5% of growers found forage crops production sustainable, whereas 64.5% of them thought that it was unsustainable. When both socio-economic variables and the answers to survey questions were taken into account, variables such as grower's age, education level, income level, land for fodder crops, livestock count, recent increase in livestock count, subsidies, and the conditions under which sustainability may be maintained were found to be related to forage crops production sustainability.

Keywords: Sustainability; Forage crops; Subsidies; Kayseri-Turkey

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1. Introduction

Forage crops production is the backbone of livestock breeding. Forage crops both directly and indirectly improve the productivity of land use (Maç & Yilmaz 2016). The fact that forage plants are rich in minerals and vitamins makes them enhance livestock productivity and produce quality foods from animals (Peters et al 2001). However, the amount of coarse fodder produced in Turkey is far outstripped by the feed demands of the existing livestock population (Yolcu & Tan 2008; Temel & Şahin 2011). In Turkey, forage crops are grown in as much as 2.689,253 hectares. Specifically, forage crops that are grown most often in Turkey are corn (976.698 ha), clover (676.172 ha) and common vetch (669.432 ha). When cultivated lands (15.464 ha) and fallow lands (4.286 ha) are combined, the proportion of the forage crop lands is 13.6% (BUGEM 2017). The first reason for this is that the coarse fodder yield in meadows and rangelands is low. The second reason is that the

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forage crops production is insufficient (Kusvuran et al 2011). Ecologically, Turkey has the necessary resources to meet the coarse fodder demand and feed its livestock population.

Turkey has a great potential for forage production, but this potential can be accomplished with active and more specific policy measures (Yilmaz & Mac 2013). Therefore, there are plans to ameliorate Turkey's coarse fodder deficit. For this, efforts to improve meadows and rangelands have been intensified and forage crops growers are subsidized. Forage crop growers have been supported since 2000 to foster, promote, and keep track of livestock breeding in Turkey. One objective of the forage crops subsidy policies in place is sustainable forage crops production. It is well known that government-provided subsidies positively impact the amount of forage crops produced (Cevher et al 2012). However, the increase in the amount of production and productivity depend on both the subsidies and the forage crop growers' socio-economic features (Ward et al 2016). For instance, a study on developing livestock breeding found that socio-economic features such as breeders' age, education level, non-agricultural activities, and production objectives affect livestock breeding (Demir & Yavuz 2010). In another study (Karadavut et al 2011), proved that the growers' socio-economic features help their success in producing forage crops.

This study determines the socio-economic factors that affect growers' forage crops production and its sustainability. In addition, the socio-economic variables that impact the sustainability of forage crops production and the subsidies given by the government have been studied. It is crucial to determine these variables to reinforce the government support for producing forage crops.

2. Material and Methods

2.1. Data

This study's subjects are registered growers who grow forage crops in Kayseri province, of whom there are 1.600. A random sampling method is used to select subjects among them (Yamane 2001) Equation 1 is used to determine the sample size.

$$n = \frac{Npqz_{\alpha/2}^2}{Nd^2 + pqz_{\alpha/2}^2} \qquad \text{Equation 1} \qquad (1)$$

In this equation, n is the sampling size, p is the estimated percentage of the subjects saying that forage crops production is sustainable (0.5), q is the estimated percentage of subjects saying that forage crops production is unsustainable (0.5), N is the population size, d is the sampling error (0.05), α is the first type error level (0.05), and z is the standard normal distribution value (1.96). When all these values are placed into Equation 1, we have:

$$n = \frac{1600(0.5)(0.5)(1.96)^2}{1600(0.05)^2 + (0.5)(0.5)(1.96)^2} = 309.78 \qquad (2)$$

Based on this, the sample size should be at least 310 subjects. Accordingly, 310 registered growers were randomly selected for this study. In addition, 30 growers, roughly 10% of the sample size, were picked as substitute subjects, in case some primary ones chose not to answer the questionnaire or could not be reached. Thus, 310 growers were surveyed through face-to-face interviews.

2.2. Analysis

In this study, since the state of sustainability and socioeconomic variables are categorical, the relationship between variables was analyzed via chi-squared test. c was the number of columns and r was the number of rows; the expected frequencies for each cell in a $c \times r$ frequency table were calculated as follows:

$$E_{ij} = \frac{1}{n}\left(\sum_{k=1}^{r} O_{kj}\right)\left(\sum_{k=1}^{c} O_{ik}\right) \qquad \text{Equation 2} \qquad (3)$$

The test statistics showing the differences between the observed and expected frequencies are defined as follows:

$$\sum_{j=1}^{c}\sum_{i=1}^{r}\left(\frac{(O_{ij} - E_{ij})^2}{E_{ij}}\right) \qquad \text{Equation 3} \qquad (4)$$

While the variables were independent, this statistic had a chi-squared distribution with an approximate degree of freedom of (r - 1) (c - 1) (Ozkan et al 2016).

$$\sum_{j=1}^{c}\sum_{i=1}^{r}\frac{(O_{ij}-E_{ij})^2}{E_{ij}} \sim \chi^2_{(r-1)(c-1)} \qquad \text{Equation 4} \qquad (5)$$

The Cramer v correlation coefficient was calculated for the relationships that were found in the chi squared analysis.

$$v=\sqrt{\frac{\chi^2}{n\times\min\{(r-1),(c-1)\}}} \qquad \text{Equation 5} \qquad (6)$$

This coefficient has a value between [0.1] and as it approaches 1, the correlation between the variables increases. As a measure of association, making the proviso that this indicator should not be considered as absolute support to guarantee or not the association between variables; however, it serves to clarify the type and magnitude of a possible relationship between the variables of interest. Additionally, a correlation graph is provided to make it easier to compare correlation coefficients and the data based on the analysis are evaluated by the significance level of P<0.05.

In this study, the concept of sustainability in fodder crop production indicates whether the producer will continue to produce fodder crops when the supports (subsidizations) are removed.

3. Results and Discussion

3.1. The demographic features

The demographic features of subjects in this study are given in Table 1. Analyzing these features revealed that more than half of them were aged 46 or older. Another similar study found that the average age of the forage crop farmers was 46.2 years and they have an average education level of the farmers was nine years (Maç & Yilmaz 2016). The percentage of growers who were elementary school graduates was 67.4%, and 88.7% of growers live in rural areas. The percentage of growers who said that they had a low income was 10%, while 17.1% said that they had a high income. The sustainability rate was 35.5 (Figure 1).

Table 1- Growers' demographic features (n= 310)

Variables	*Value*	*f*	*%*
Age	≤ 30	30	9.7
	31-45	117	37.7
	≥ 46 +	163	52.6
Education	Primary school	209	67.4
	Middle school	44	14.2
	High school and higher	57	18.4
Living place	Rural	275	88.7
	Urban	35	11.3
Income level	Low	31	10.0
	Medium	226	72.9
	High	53	17.1

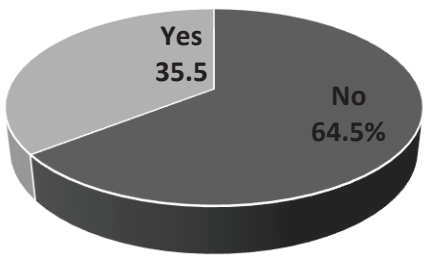

Figure 1- The distribution on the state of sustainability

3.2. The chi square analysis results

As shown in Table 2, the area in which growers reside and whether they had non-agricultural income had no significant effect on forage crop production sustainability (P>0.05). But, it is statistically significant for P<0.10. In addition, growers' age, education level, income level, whether they owned forage crop land, livestock count, whether they received subsidies, the conditions under which sustainability was ensured and the effects of subsidies on livestock count had a significant relationship with sustainability (P<0.05).

Although (Cevher & Tatlidil 2001; Çukur & Işın 2008) found no significant relationship between

Table 2- The Correlation of socio-economic variables with sustainability (n= 310)

Variables		*Sustainable*					χ^2	*P*
		No		*Yes*				
	Value	*f*	*%*	*f*	*%*	*Total*		
Age	≤ 30	13	43.3	17	56.7	30	10.47	0.005*
	31-45	86	73.5	31	26.5	117		
	≥ 46 +	101	62.0	62	38.0	163		
Education	Primary	128	61.2	81	38.8	209	8.58	0.014**
	Middle	37	84.1	7	15.9	44		
	High	35	61.4	22	38.6	57		
Living place	Rural	183	66.5	92	33.5	275	3.11	0.078***
	Urban	18	51.4	17	48.6	35		
Having off farm job	No	174	63.3	101	36.7	275	1.65	0.200
	Yes	26	74.3	9	25.7	35		
Income level	Low	27	87.1	4	12.9	31	30.64	0.000*
	Medium	156	69.0	70	31.0	226		
	High	18	34.0	35	66.0	53		
Fodder crops area	No	36	90.0	4	10.0	40	16.58	0.000*
	Yes	152	56.3	118	43.7	270		
Animal unit	1-15	121	93.1	9	6.9	130	101.41	0.000*
	16-30	68	56.2	53	43.8	121		
	31 or more	11	19.3	46	80.7	59		
Taking forage crop incentives	No	154	93.3	11	6.7	165	127.96	0.000*
	Yes	46	31.7	99	68.3	145		
Factors that ensure sustainability	Feed support	88	46.6	101	53.4	189	70.32	0.000*
	Animal prices	61	87.1	9	12.9	70		
	Number of animals	51	100.0	0	0.0	51		
The effect of incentives to increase animal numbers	No	200	79.7	51	20.3	251	132.49	0.000*
	Yes	0	0.0	59	100.0	59		

Significance level: 0.01*, 0.05**, 0.10***

sustainability and age, we found that the two were significantly related. The rate of growers, who were 30 years old or below and considered forage crops production sustainable was higher than that among growers in other age groups. Hence, sustainability is possible as it is easy to make young growers adopt innovations in agriculture. The percentage of growers whose education level was either primary or high and who considered forage crops production sustainable was greater than the percentage among middle school graduate growers. Several studies on Turkey's different crops found that education level and sustainability were related (Çukur & Işın 2008; Kılıç & Kıymaz 2014; Yildiz & Boyacı 2017), indicating that growers with a higher level of education had a high level of sustainability. This could stem from the increased awareness of sustainability associated with an increased level of education.

Regarding income, the higher the income level, the higher the rate of growers who consider forage crops production sustainable; 66% of growers who have a high income maintain that forage crops production is sustainable, whereas only 12.9% of those with a low income consider it sustainable. Similarly (Topcu 2008), found that as the level of income increased, the willingness to benefit from agricultural subsidies also increased. Using logistic

regression analysis (Kaya & Atsan 2013) concluded that there was a significant relationship between income and the adoption of agricultural innovations. Out of the growers who owned forage crop lands, 68.3% stated that forage crops production was sustainable while only 6.7% of growers without any lands were positive about the sustainability of forage crops production. In a study conducted (Kaya & Atsan 2013) concluded that there was a significant relationship between owning land area and subsidies. The subsidies for sustainable agriculture increased in proportion to land ownership.

In addition, the rate of sustainability visibly increased in accordance with the livestock count; 80.7% of growers who owned 31 or more livestock saw forage crops production as sustainable. This rate was only approximately 6.9% among growers with 1-15 livestock. In a study on this subject (Aksu & Dellal 2016) concluded that increasing the number of the livestock positively influenced sustainability.

Whereas 68.3% of the growers who benefit from subsidies for producing forage crops saw it as sustainable, the rate of those without any subsidies who consider it sustainable was only 6.7%. When the distribution between the suggestions for ensuring sustainability and sustainability itself were analyzed, the most valuable suggestion was to "increase the subsidies for forage crops"; 53.4% of the growers confirmed that forage crops production would be sustainable if subsidies increased. All growers who had increased their livestock count thanks to subsidies found forage crops production sustainable.

Figure 2 shows the Cramer *v* correlation coefficients between the significant variables and the state of sustainability; the thicker the line, the more significant the correlation. The increase in the livestock count was the most significant variable (*v*= 0.654), followed by the variable for whether the grower received any subsidies (*v*= 0.642). The third most significant variable that had an effect on sustainability was the livestock count (*v*= 0.574).

3.3. Discussion

To benefit from support for feed plants in the study area, manufacturers with sensible fields should be provided with convenience. Because 41% of the tapestries in the research area are sensible territories

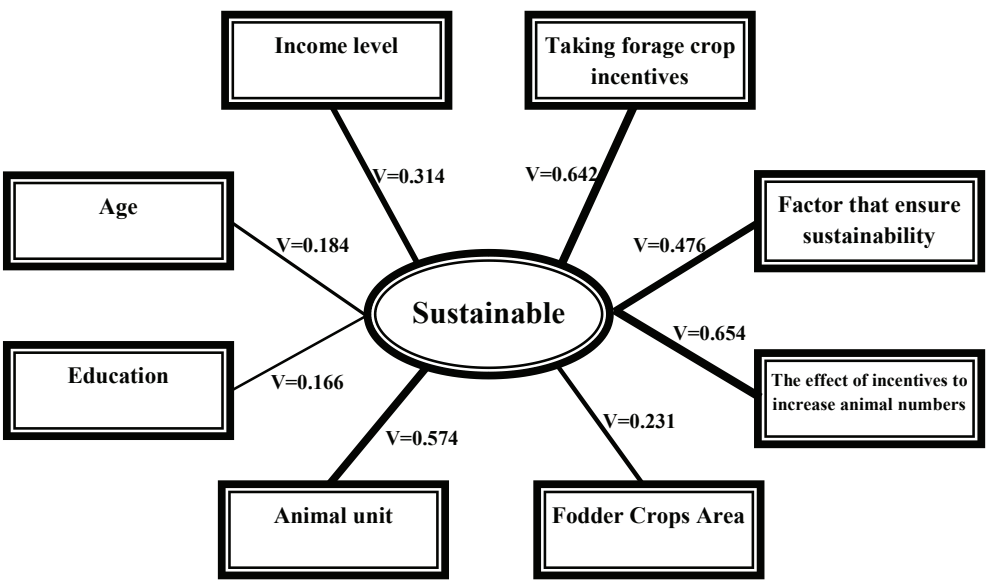

Figure 2- Correlation graph (the thicker the line is, the more significant the correlation is)

and producers can't benefit from the incentive. This is an obstacle to increased production. Manufacturers who have leased treasury and neighboring land have stated that they do not benefit from support. This is an obstacle to the increase in production of feed plants. If this situation is done in favor of the producer, it will contribute to the increase of production. In addition to support for increased production of feed crops, agricultural publication studies and increased need for coarse feeds have also been effective. In this context, emphasis on agricultural publishing studies will increase production. 50% of perennial feed plants should be given in breeding. This will lead to an increase in production. Feed plant supports have put production of feed plants in an advantageous position in production pattern (according to other products). This has contributed to the increase in production of feed plants. Maintaining this support will contribute to the production of feed plants, the improvement of soil structure and the increase in the profit of operation in operation.

4. Conclusions

This study reveals that forage crops production closely depends on growers' income level, whether they own forage crop lands, livestock count, whether they receive subsidies, the conditions under which sustainability is maintained, and the effects of subsidies on livestock count. In particular, livestock count significantly correlates with sustainability. This study indicates that the increase in livestock count due to subsidies given is the most important factor for ensuring sustainability. The rate of growers who have increased their livestock count thanks to subsidies is 19% (59 out of 310 growers). Moreover, all these growers find forage crops production sustainable. Thus, forage crops production subsidies are insufficient and should be increased. In addition, stockbreeding should be turned into a more lucrative line of business by stabilizing the prices of animal-based products in commodity markets, which would encourage increased livestock counts. It is necessary to boost breeders' purchasing power. Apart from enhancing the livestock, receiving subsidies is confirmed as directly impacting sustainability. One reason for this could be that forage crop lands and the amount of production soar after subsidies are reimbursed. Another reason could be that subsidies greatly encourage forage crops production compared to regular crop production. It is seen that growers' financial situations really matter with regard to sustainability. This paper found that the rate of sustainability among growers with a larger income was high, which was why extending additional subsidies and supplying equipment and labor support to the growers with low income in particular could play an important role in ensuring sustainability. Since whether a person owns forage crop lands affects the sustainable production of such crops, a hike in the amount of forage crops would mean a hike in the sustainability. When growers were interviewed on the conditions under which forage crops production could be sustainable, it was concluded that increasing subsidies and livestock prices would encourage sustainability. In addition, the following course of action should be taken to reinforce coarse fodder production in Turkey: it is particularly necessary to enhance the quality of fodder, add forage crops to growers' growing cycle, make use of publications on forage crops, and collaborate with universities. Promotion of young population through support (subsidizations) and training activities, the effectiveness of producer organizations to benefit from support (subsidizations) will contribute to sustainable forage production.

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