A study on the determining silage corn production cost: the case of Van Province, Turkey

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Hediye Kumbasaroğlu
Assist. Prof. in Agricultural Economics
Erzincan Binali Yıldırım University
Erzincan Binali Yıldırım University, Vocational School, Department of Marketing and External Commerce, Marketing Program
Yalnızbağ Campus, 24002 Erzincan / TÜRKİYE
E-mail: hediye.kumbasaroglu@erzincan.edu.tr

Emine Aşkan
Assist. Prof. in Agricultural Economics
Iğdır University
Iğdır University, Faculty of Agriculture, Department of Agricultural Economics
Karaağaç Campus, 76000 Iğdır / TÜRKİYE
E-mail: emine.askan@igdir.edu.tr

Abstract

High productivity in livestock enterprises requires the farm animals to be fed well throughout the year. Moreover, it has been known that it is not possible to meet the need for roughage as fresh throughout the year in animal husbandry and various methods have been preferred to meet this need. For that reason, corn, cereals, assorted millet and sudangrass, alfalfa and sainfoin, sugar beet leaves, sunflower, tree branches and leaves, industrial waste pulp have commonly been ensiled for the feeding of farm animals. Among these, corn is the most easily ensiled forage crop containing high level of carbohydrate. Furthermore, corn has dependently been an indispensable source of roughage because it has been consumed fondly by farm animals, rich in energy, green in winter, juicy and economical, and the best and cheapest nutrition source for the livestock. Therefore, corn is the leading crop for silage. Corn also provides the advantage of eliminating the problem of weed storage and reducing the costs of storage for enterprises. Due to these specified characteristics of corn, it has been understood that the importance of silage corn production has started to increase in recent years and the researches carried out on the cost of silage corn have gained importance. The need for studies at local level has also increased. In this study, it was aimed to calculate the cost of silage corn production in the province of Van where animal production was administered intensely. Within the scope of the research, face-to-face questionnaires were performed with 46 enterprises corresponding to 40% of 116 enterprises producing silage corn in Van Province in 2020. As result of the research, forward-looking explanatory information was presented in terms of production cost, gross production value, variable costs and calculation of gross margin of silage corn spreading to be produced increasingly widespread throughout Turkey and developing corn production planning carried out by local farmers.

Keywords: Silage corn. Production cost. Gross margin. Van.

1. Introduction

Corn is an important plant used mostly as animal feed and slightly as industrial raw material in developed countries, and as human and animal nutrition in developing countries. No matter how good the genetic capacities and environmental conditions of the animals are, it is difficult to get high productivity unless the care and feeding are good. Silage is the only green, juicy and economical roughage possible to be given to animals during the winter months when there is no green grass. Corn is the most suitable silage plant, and silage corn is a forage that is fondly consumed by animals and rich in energy.

Among the forage crops, silage corn with high variety of type is remarkable in livestock production. Silage corn is widely used for feeding cattle and sheep because it is easier to digest rather than various forages. However, high cost of inputs in animal production has been encountered as a vital problem (Akdemir et al., 1997).

Corn is possible to be grown in places up to 4.000 m above sea level. The temperature of 20-21℃ is sufficient for the corn to reach maximum productivity especially in June, July and August. The minimum temperature requirement for the germination and growth of corn is 10℃. The altitude of Van province is 1.725 m, and the annual average temperature value is 21-22℃ in June, July and August. The sufficient vegetation period of 90-140 days for the cultivation of early and late corn varieties is available in Van (Yılmaz, 1999).

Whereas 6,200,000 tons of silage corn was produced in Turkey in 2004, this figure increased up to 27,186,949 tons in 2020. Whereas the silage corn production in Van was 2.063 tons in 2004, it reached up to 27.280 tons in 2020. 2.73% of Turkey's production amount in terms of silage corn production was in Van province in 2020 (TUIK, 2021).

Van province is one of the regions where animal husbandry is important. However, it has been known that the roughage obtained from meadow, pasture and forage plants in the region is not sufficient for livestock, and vegetable residues have extensively been used for the nutrition of animals (Serin and Tan, 1998). On the other hand, the misuse of meadows and pastures in the region out of purposes has caused these areas to become unproductive and lose their meadow-pasture character. Therefore, farmers have tried to supply needed animal feed from other sources. Silage corn is one of the most preferred alternative forage sources of farmers because green fodder can be stored without spoiling due to the silage process, green fodder has less loss of nutritional value rather than dry grass and provides easier and cheaper production cost (Basmacıoğlu and Ergül, 2002).

In this study, the cost of silage corn production predicted to be an alternative production by the farmers in the province of Van where animal production was administered intensely was calculated. Within the scope of the research, in addition, the gross production value, variable costs and gross margin of silage corn were calculated, and prospective explanatory information in terms of improving the corn production planning carried out by local farmers was presented.

2. Literature Review

In their study upon the economic analysis of corn production activity in Pazarcık district of Kahramanmaraş Province, Paksoy and Ortasöz (2018) performed the economic analysis of the silage and sweet corn production. They compared sweet and silage corn production costs and product sales prices and revealed that farmers had difficulty in meeting their input costs without agricultural support.

Doğan and Külekçi (2020) determined the general technique, pure technique and scale efficiency of the silage corn producing enterprises upon determining the efficiency and the factors affecting the efficiency in silage corn production in Iğdır Province as 0.42, 0.94 and 0.44, respectively. They reported that the production value of efficient enterprises was 62.22% higher than the inefficient ones. They stated that it was necessary to organize farmer training programs upon agricultural techniques, the efficient use of inputs as the leading, and to ensure the participation of young farmers in these programs in order to increase efficiency in enterprises producing silage corn.

In their study carried out on the effect of soil cultivation upon energy use efficiency in silage corn production in the Middle Black Sea transition climate zone, Altuntas et al. (2018) determined that the highest share in total input energies in silage corn production was chemical fertilizer energy followed by fuel and seed energy.

In their study on determining the cost of silage corn production in Pasinler District of Erzurum, Tuvanç and Dağdemir (2009) calculated the production cost of 1 kg silage corn before and after receiving government support, and they determined the cost of 1 kg silage corn to be 0.066 TL before and 0.051 TL after government support.

In their research on determining the production inputs and costs of the corn plant grown in the Konya region, Çarkacı et al. (2016) calculated the production costs of sweet and silage corn. As result, the production cost of 1 kg sweet corn was determined to be 0.43 TL and the cost of silage corn was 0.06 TL.

In terms of the revealing the factors that affected enterprises' receiving support for producing silage corn in the central district of Tokat Province, Kızıloğlu and Kızılaslan (2016) determined the production cost of 1 kg silage corn to be 0.14 TL and gross production value to be 2.137.53 TL.

In their study on energy use and economic analysis of corn silage production under three cultivated area levels in Tehran province of Iran, Komleh et al. (2011) stated that the energy inputs of seeds and chemical fertilizers had a high effect upon the yield of silage corn. They found the production cost per hectare to be $1,973.

3. Material and Method

3.1. Material

The main material of this study was the primary data collected through face-to-face questionnaires with farmers in Bahçesaray, Edremit, Erciş, Gevaş, Muradiye, Tusba, Özalp and İpekyolu districts of Van province in the production period of 2020. The secondary data of the study included Van Provincial Directorate of Agriculture and Forestry records, the statistical data obtained from the Turkish Statistical Institute (TUIK, 2021) and reviewed literature studies.

3.2. Method

3.2.1. Selecting the entities creating the sample

Within the scope of the research, face-to-face questionnaires were performed with 46 enterprises corresponding to 40% of totally 116 enterprises producing silage corn in Van Province for 2020.

3.2.2. Data analysis method

The unit product cost of silage corn produced in Van was calculated in the study. Employment utilization status, gross production value, gross margin and net income were calculated for analyzed enterprises. It has been known that the population of workable age, in general, in agricultural enterprises refers to 7 years old and above (Kumbasaroğlu and Dağdemir, 2010). Within the scope of the study, the number of individuals who could not work due to various reasons such as education, permanent illness and military service was

regarded for calculating the amount of workable population in agricultural enterprises. Moreover, the workforce was determined in terms of the unit of Male Work Day (MWD) calculations considering the number of workable days in the region. Thus, the existing workforce in agricultural enterprises was included in the calculations converting into Male Wok Unit (MWU). The conversion coefficients to MWU were used as 0.50 for males and 0.50 for females between the ages of 07-14, 1.00 for males between the ages of 15-49 and 0.75 for females between the ages of 15-49, 0.75 for males and 0.50 for females aged 50 and above (Kumbasaroğlu and Dağdemir, 2010).

The coefficients used in the research were used as 1.00, 0.50, 0.70, 0.70, 0.10 for cow, calf, heifer, bullock and sheep, respectively, in order to discuss the animal existence as a single unit for the Bovine Animal Unit (BAU) (Kızıloğlu, 1997). In studied area, the average rental prices valid for silage corn production were included in the calculations in terms of field rent (Özkan and Kuzgun, 1997). Field rent was considered as a fixed cost in cost calculations (Dağdemir and Özçelebi, 1995; Frate et al., 2008). The circulating capital interest rate which could not be ignored in the cost calculations was regarded as the loan interest rate determined for plant production. The loan interest rate applied by TR Ziraat Bank for 2020 was 10.002%, and half of this rate (5.001%) was used in the cost calculations within the scope of the research due to remaining on the safe side.

The reason for adopting this method was possible to be explained with the production costs spreading over the production period (Gündoğmuş, 1998). General administrative expenses included the expenditures incurred for common services. These costs concerned the administration of the enterprise and social services and all production activities of the enterprise. Within the scope of the study, general administrative expenses were regarded to be 3% of the variable costs as frequently accepted in the literature for the cost calculations of silage corn production (Özkan and Kuzgun, 1997). In addition to these expenses, the material expenses such as seeds and fertilizers used for production and other expenses to be incurred affecting the production cost calculations of silage corn were included in the calculations by multiplying the amount used in production within the scope of the research and the cost of goods.

In this study, the questionnaire data was organized indicating the production inputs for the area per decare. The production costs were calculated in two stages as variable costs and fixed costs. Gross production value was included in the calculations multiplying the sales price of the product with the production amount. Whereas the gross margin value was

calculated subtracting the variable costs from the gross production value, the net income value was obtained subtracting the production costs from the gross production value.

4. Results and Discussion

4.1. Population and workforce of entities

The average population per enterprise was determined to be 6.56 people in the enterprises analyzed within the scope of the study. The female population created 42.53% of the total population (Table 1). The average number of population per enterprise was obtained in the studies carried out by other researchers for the province of Van and/or its districts. Accordingly, the average family size was reported to be 11.8 in the study carried out by Yıldırım (1993). This rate was reported to be 5.8 in the study carried out by Acar (2001). This rate was reported to be 10.02 in the study by Şahin and Yılmaz (2008b). Whereas the average family size was reported to be 7.29 in the study carried out by Şahin (2007) in Gürpınar district of Van province, the rate was similarly found to be 6.74 in the study by Şahin and Yılmaz (2008b) in Gürpınar district and its villages. In this study, the average population per enterprise was obtained at a value close to the averages of previous studies carried out in Van region.

Table 1: Distribution of Population According to Age and Gender in Entities (Person)

Age Groups	Entity Average
0-6	**0.35**
- Male	0.31
- Female	0.04
%	**5.34**
7-14	**0.61**
- Male	0.35
- Female	0.26
%	**9.30**
15-49	**4.57**
- Male	2.50
- Female	2.07
%	**69.66**
50-65	**1.03**
- Male	0.61
- Female	0.42
%	**15.70**

Total	**6.56**
- Male	3.77
- Female	2.79
%	**100.00**

4.2. Workforce

Workforce is the most important factor required for production. The entities that have other production factors need workforce in order to carry out production activities and use production factors efficiently. As explained in previous paragraphs, the population at workable age in agricultural enterprises was calculated converting to Male Work Unit (EIB). In Table 2, the female and male workforce participating into agricultural activities in analyzed enterprises was determined to be 5.02 in total in terms of MWU. Among these, 3.13 MWU were male and 1.89 MWU were female (Table 2). In a similar study carried out by Şahin and Yılmaz (2008b) in the province of Van, the male and female workforce used in agricultural activities was determined to be 3.87 MWU. According to this study, 1.03 of the total MWU was reported as female and 2.84 as male.

Table 2: Family Workforce (MWU) in Entities According to Age Groups

Age Groups	Entity Average
7-14	**0.30**
Male	0.17
Female	0.13
%	**5.98**
15-49	**4.05**
Male	2.50
Female	1.55
%	**80.68**
50-65	**0.67**
Male	0.46
Female	0.21
%	**13.34**
Total	**5.02**
Male	3.13
Female	1.89
Total (%)	**100.00**

The idle workforce rate in analyzed enterprises was 20.86% (Table 3). Although the idle workforce rate was high in Table 3, the share of the alien workforce in total workforce was calculated to be 3.08%. This was explained through not much using the alien workforce in enterprises and using alien workforce intensively only during the harvest period when the work was intense.

Table 3: Current, Used and Idle Workforce in Terms of MWD in Entities

	Entity Average
Current workforce (MWD)	1.554
%	100.00
Family workforce (MWD)	1.506
%	96.92
Alien workforce (MWD)	48
%	3.08
Assessed Workforce	
- In Entity (MWD)	1.083
- Out of Entity (MWD)	150
Total (MWD)	**1.233**
Idle Workforce (MWD)	**321**
%	**20.86**

It has been known that there is a very close relationship between the level of education and the productivity obtained in enterprises, and the education rate is generally high in regions where agricultural production is administered consciously. Therefore, the educational status of the entity owners has not been ignored in questionnaires performed for this purpose. The educational level of entity owners is an efficient factor especially for adopting the innovations. When the education level of the population aged seven and above has been analyzed in the questionnaire studies, it has been possible to notice that the rate of having a diploma is 71.88%, according to the average of the enterprises. It was understood in Table 4 that 28.95% of this rate was primary school graduates, whereas vocational school graduates were at a lower rate with 2.83%.

Table 4: Educational Status of Population Aged Seven and Above (Person)

	Entity Average
Illiterate	**0.43**
M	0.13
F	0.30
Literate	**1.15**
M	0.76
F	0.39
Primary Graduate	**1.74**
M	0.98
F	0.76
Secondary Graduate	**1.54**
M	0.80
F	0.74
High School Graduate	**0.87**
M	0.70
F	0.17
Vocational School Graduate	**0.17**
M	0.13
F	0.04
Studying Primary Education	**0.11**
M	0.09
F	0.02
Total	**6.01**

4.3. Field

Land is the main element of agricultural production. Therefore, the enterprise organization is determined by the use of the land. According to the questionnaire studies performed in the present study, whereas 61.78% of the total land in the enterprises was property land, 38.22% was rented and shared lands (Table 5). These rates indicated that property management was more common in the studied area.

Table 5: Distribution of enterprises according to land ownership status

Current Land	Average (da)	%
Property Land	136.89	74.48
Rented and Shared Land	46.91	25.52

Total	**183.80**	**100.00**

The land assets and qualities of the land in the enterprises were presented in Table 6. Accordingly, the average size of the enterprise lands corresponded to 183.80 decares. It was understood in Table 6 that 97.24% of this available land was for field and 2.76% was meadow land. On the other hand, it was determined that there was no fallow area was in the enterprises analyzed in the current study. It was estimated that consolidation was the reason for average entity land to be high.

Table 6: Use of land assets in enterprises

Types of Land	Average (da)	%
Land for Field	178.73	97.24
• Irrigated Land	149.34	81.25
• Barren Land	29.39	15.99
• Fallow Land	-	-
• Meadow Land	5.07	2.76
Total	183.80	100.00

It was noticed when the amount of field land allocated to various products by the enterprises within the scope of the study was analyzed that the grain production had a large portion (Table 7). It was understood from Table 7 that the ratio of field land allocated to silage corn production to average entity land was 45.68%, and the ratio of field land allocated to grain production was 32.76% on average. The product group allocated to field land the most subsequent to grains was forage crops. The rate of field land allocated to forage crop production was 17.66%. The rate of meadow land was 2.76% and the rate of vegetable land was 1.14% (Table 7).

Table 7: Average land and silage corn availability in entities

Current Land	Average (da)
Average Entity Land	183.80
Average Silage Corn Production Land	83.96
Grain production Land	60.22
Forage Crop production Land	32.46
Meadow Land	5.07
Vegetable Production Land	2.09

4.4. Animal presence

In the enterprises analyzed within the scope of the study, cows, calves, bullocks and heifers were raised as bovine, and sheep, goats and lambs were raised as ovine. The number of bovines in analyzed enterprises was calculated to be 11.77 in terms of bovine animal unit (BAU). The number of ovine animals was determined to be 12.78 BAU with a similar approach. Accordingly, the average animal existence was determined to be 24.55 BAU. 52.96% of this unit included ovine and 47.94% bovine animals (Table 8). It was reported in a study carried out by Şahin and Yılmaz (2008b) within Van province that the number of bovine animals was 4.61 BAU and the number of ovine animals was 36.08 BAU. In another study carried out by Şahin and Yılmaz (2008a) in Van province, the number of bovine and ovine animals per farm was determined to be 5.08 and 46.82 BAU, respectively. Revealing the number of bovine animals in the current study to be higher than in the studies mentioned above was interpreted as a general increase in bovine breeding in the region over the years

Table 8: Average Animal Presence in Entities

Types of Animals	Number	BAU	%
Cow	8.54	8.54	
Heifer	1.17	0.82	
Bullock	1.00	0.70	
Calf	3.43	1.72	
Bovine Total	**14.14**	**11.77**	**47.94**
Sheep	90.05	9.01	
Lamb	45.50	2.28	
Goat	15.00	1.50	
Ovine Total	**150.55**	**12.78**	**52.96**
Poultry	25.58	-	
Total		**24.55**	

In the study, the duration for entities to engage with silage corn was determined to be 3.5 years. 50.00% of the producers used pesticides. The producers obtained the pesticides used from various institutions and/or entities. When these institutions/entities were considered on the basis of producers, it was understood that 78.26% of the producers supplied pesticides from dealers, 13.04% from district directorates and 8.70% from cooperatives. It was also determined that the enterprises obtained 54.35% of the fertilizers they used from dealers, 45.65% from cooperatives, 52.17% of the seeds from dealers, 21.74% from cooperatives, and 26.09% from the District Directorates of Agriculture.

The production requirements of silage corn were also interpreted within the scope of the study. The reason for silage corn production of the enterprises was summarized in Table 9. According to this, it was understood that 41.30% of the producers grew corn for pet farming, 28.26% for dairy farming, 23.92% for marketing and 6.52% for livestock farming.

Table 9: The Reason for Enterprises to Produce Silage Corn

Reason for Production	Number	%
Pet farming	19	41.30
Livestock Farming	3	6.52
Dairy Farming	13	28.26
Marketing	11	23.92
Total	46	100.00

In this study, the crop rotation products in the land in local region were investigated. In Table 10, the products that producers cropped in enterprises were summarized. It was understood from Table 10 that the producers administered alfalfa-wheat-corn crop rotation at the rate of 30.43%. This was followed by wheat-wheat-corn crop rotation with 26.09%, barley-alfalfa-corn with 21.74% and wheat-barley-corn with 6.52%, respectively (Table 10). In fact, it was known that the most suitable form for crop rotation in the region was hoe crop-cereal-legume. However, it was determined in the current study that the enterprises mostly preferred the forage plant-cereal-corn order (Table 10).

Table 10: Products that Enterprises Administered Crop Rotation

Products	Number of Enterprises	%
Alfalfa-Wheat-Silage Corn	14	30.43
Wheat-Wheat-Silage Corn	12	26.09
Barley-Alfalfa-Silage Corn	10	21.74
Wheat-Barley-Silage Corn	7	15.22
Other	3	6.52
Total	**46**	**100.00**

In this study, the amount of fertilizers used in the enterprises was also evaluated. In Table 11, the types and amounts of fertilizers used in the enterprises were summarized. It was determined that the analyzed enterprises used chemical fertilizers as well as farm manure (Table 11).

Table 11: The Amount of Fertilizers Used in Enterprises

Used Fertilizers	Amount of Fertilizer (kg da^{-1})
Chemical Fertilizer	12.98
Farm Manure	837.00

Within the scope of the study, cost silage corn was calculated according to the cost groups of production expenses. The distribution of silage corn production expenses according to cost groups was summarized in Table 12. It was understood from Table 12 that the cost of soil preparation was 70.50₺, caring cost was 91.83₺, harvest, transportation and silage making costs were 142.93₺, material cost was 234.21₺, and average silage corn yield was 4.304 kg/da^{-1} in analyzed enterprises, and the production cost per crop was calculated to be 0.15₺.kg^{-1}.

Table 12: Distribution of Production Expenses According to Cost Groups

Cost Items	Workforce Use (sa da^{-1})		Cost	
	Person	Machine	(₺ da^{-1})	Oran (%)
1. Soil Preparation Costs			**70,50**	**10,85**
* Plow Cost		0.54	25.00	3.84
* Disc Harrow, Rake Cost		0.21	22.00	3.39
* Cropping Cost	0.50	0.50	23.50	3.62
2. Caring Cost			**91.83**	**14.13**
* Fertilizing Cost	0.31	0.36	12.26	1.89
* Weeding Cost	13.50	1,02	44.67	6.87
* Pesticide Cost		0,20	7.40	1.14
* Irrigation Cost	0.50		27.50	4.23
3. Harvest, Transportation and Silage Making Cost			**142.93**	**22.00**
* Harvest Cost		1,04	88.12	13.56
* Silage Transportation and Silage Making Cost		1,02	28.31	4.36
* Salt and Nylon Cost	1.09		26.50	4.08
4. Material Cost			**237.21**	**36.51**
* Seed Cost			121.5	18.70
* Fertilizer Cost			37	5.70
* Water Cost			32.50	5.00
* Nylon and Salt Cost			8.71	1.34
* Herbicide Cost			37.50	5.77
*** Total**			**542.47**	83.49
5. Circulating Capital Interest (5.001%)			27.13	4.18

A. Variable Costs Total 1+2+3+4+5			**569.60**	**87.67**
6. General Administrative Costs (3%)			17.09	2.63
7. Field Rent			63	9.70
B. Fixed Costs Total (6+7)			**80.09**	**12.33**
8. Production Cost (A+B)			**649.69**	100.00
9. Silage Corn Yield (kg da^{-1})			**4.304**	
Cost of 1 kg Silage Corn (₺) (8/9)			**0.15**	

In this study, the gross margin and net income levels for silage corn production of the enterprises were regarded due to directly affecting the cost calculations. The gross margin levels and net income levels of the mentioned enterprises in silage corn production were summarized in Table 13. According to Table 13, the average product sales price per kilogram in enterprises was noticed to be 0.45₺.kg^{-1}, the gross production value per decare was 1936.80 ₺.da^{-1}, variable cost was 649.69 ₺.da^{-1}, fixed cost was 80.09 ₺.da^{-1}, and the gross margin per decare was calculated to be 1367.20 ₺.da^{-1}. It was also noticed from Table 13 that the net income of the analyzed enterprises was 1287.33 ₺.da^{-1}.

It was reported in the study carried out by Tuvanç and Dağdemir (2009) in Erzurum province that the production cost of 1 kg silage corn was 0.066₺, gross margin was 52.32 ₺.da^{-1} and net income was -20.72 ₺.da^{-1}. In their study in Konya region, Carkaci et al. (2016) calculated the cost of 1 kg silage corn as 0.06₺ and gross production value as 480.90 ₺.da^{-1}. In this study, the increasing local increasing variation of corn production cost and gross margin was explained as the increase in input costs. The positive increase in net income and gross production value indicated importance given to silage corn production and utilization in recent years.

Table 13: Gross Margin and Net Income Levels of Enterprises in Silage Corn Production

Types of Cost	Amount
1. Fixed Costs (₺ da^{-1})	80.09
2. Variable Costs (₺ da^{-1})	569.60
3. Production Costs (₺ da^{-1})	649.69
Gross Production Value (₺ da^{-1}) (4)	1936.80
- *Silage Corn Income (₺ da^{-1})*	*1936.80*
Sales Price (₺ kg^{-1})	0.45
Production Cost (₺ kg^{-1})	0.15
Gross Margin (₺ da^{-1}) (4-2)	1367.20
Net Income (₺ da^{-1}) (4-3)	1287.33
Yield (kg da^{-1})	4.304

According to 2020 support program of the TR Ministry of Agriculture and Forestry, Van Provincial Directorate of Agriculture and Forestry, the budget allocated per acre for silage corn was 100₺. In the cost calculation made considering the government support, the cost of silage corn per kilogram was calculated to be 0.13 ₺.kg^{-1} (Table 14). Within the scope of the study, the gross margin and net income levels of the silage corn production for the enterprises were also calculated considering the government support and summarized in Table 15. It was understood from Table 15 that the gross production value per decare and the gross margin per unit area in the aforementioned enterprises producing silage corn after receiving government support were 2036.80 ₺.da^{-1} and 1467.20 ₺.da^{-1}, respectively. Moreover, the net income considered as a criterion of achievement was 1387.11 ₺ da^{-1}. Accordingly, it was understood that the producers gained more profit in cost calculations made considering the government support as by-product income.

Table 14: Distribution of Production Expenses According to Cost Groups After the Government Support (2020)

Cost Items	Workforce Use (sa/da)		Cost	
	Person	Machine	(₺ da^{-1})	Oran (%)
1. Soil Preparation Costs			**70.50**	**10.85**
* Plow Cost		0.54	25.00	3.84
* Disc Harrow, Rake Cost		0.21	22.00	3.39
* Cropping Cost	0.50	0.50	23.50	3.62
2. Caring Cost			**91.83**	**14.13**
* Fertilizing Cost	0.31	0.36	12.26	1.89
* Weeding Cost	13.50	1.02	44.67	6.87
* Pesticide Cost		0.20	7.40	1.14
* Irrigation Cost	0.50		27.50	4.23
3. Harvest, Transportation and Silage Making Cost			**142.93**	**22.00**
* Harvest Cost		1.04	88.12	13.56
* Silage Transportation and Silage Making Cost		1.02	28.31	4.36
* Salt and Nylon Cost	1.09		26.50	4.08
4. Material Cost			**237.21**	**36.51**
* Seed Cost			121.5	18.70
* Fertilizer Cost			37	5.70
* Water Cost			32.50	5.00
* Nylon and Salt Cost			8.71	1.34
* Herbicide Cost			37.50	5.77

*** Total**			**542.47**	83.49
5. Circulating Capital Interest (5.001%)			27.13	4.18
A. Variable Costs Total 1+2+3+4+5			**569.60**	**87.67**
6. General Administrative Costs (3%)			17.09	2.63
7. Field Rent			63	9.70
B. Fixed Costs Total (6+7)			**80,09**	**12.33**
8. Production Cost (A+B)			**649.69**	100.00
9. Government support per decare*			**100,00**	
10. Production cost after deduction of seeds and government support per decare (8-9)			**549.69**	
11. Silage Corn Yield (kg da^{-1})			**4.304**	
Cost of 1 kg of silage corn after support (₺) (10/11)			**0.13**	

In the study carried out by Kızıloğlu and Kızılaslan (2016) in the province of Tokat, the production cost of 1 kg silage corn was calculated to be 0.14₺, the gross production value was 2.137.53 ₺.da^{-1}, the gross margin was 1 711.09 ₺.da^{-1} and the net profit was 1.617.89 ₺.da^{-1}. In another study carried out by Tuvanç and Dağdemir (2009) in Erzurum province, the cost of 1 kg silage corn was calculated to be 0.051₺, gross margin was 62.88 ₺.da^{-1} and net income was 75.05 ₺.da^{-1} after receiving government support. In the study carried out by Paksoy and Ortasöz (2018) in Kahramanmaraş, the cost of 1 kg silage corn was reported to be 0.11 ₺.kg^{-1}, sales price was 0.122 ₺.kg^{-1}, government support was 0.014 ₺.kg^{-1} and net profit was 0.0136 ₺.kg^{-1}. When discussed in terms of gross profit within the scope of cost calculations, in the studies carried out by Doğan and Külekçi (2020) and Bayramoğlu and Açan (2016) in the province of Iğdır and Konya, the gross profit per unit area was determined to be 1 181.75 ₺.da^{-1} and 597.88 ₺.da^{-1}, respectively. When the cost calculations of other researchers in the literature were compared with the current study, it was understood that the research findings obtained were quite reasonable in terms of the studied region.

Table 15: Gross Margin and Net Income Levels in Silage Corn Production of Enterprises Considering Government Support

Types of Costs	Amount
1. Fixed Costs (₺ da^{-1})	80.09
2. Variable Costs (₺ da^{-1})	569.60
3. Production Costs (₺ da^{-1})	649.69
Gross Production Value (₺ da^{-1}) (4)	2036.80
- *Silage Corn Income (₺ da^{-1})*	*1936.80*
- Sales Price (₺ kg^{-1})	*100.00*
Production Cost (₺ kg^{-1})	0.45

Gross Margin (₺ da^{-1}) (4-2)	0.13
Net Income (₺ da^{-1}) (4-3)	1467.20
Yield (kg da^{-1})	1387.11
Fixed Costs (₺ da^{-1})	4.304

In the questionnaire studies related to the study area, 95.65% of the producers reported input prices to be high in silage corn production. Furthermore, 34.78% of them expressed to have high wages for workers, 32.61% had insufficient technical knowledge, 30.43% had marketing problems, 26.09% had low working capital, 21.74% had shortage of skilled workers, 19.56% could not get enough information and assistance from agricultural establishments, 13.04% of had insufficient irrigation water and 13.04% could not control pests. The problems faced by producers for the production and marketing of silage corn was summarized in Table 16. Since the problems encountered were general in Turkey, the solution was discussed to be met for the long term.

Table 16: Problems Faced by Producers for Silage Corn Production and Marketing

Problems of Producers	Number	%
High Input Prices	44	95.65
High Worker Wages	16	34.78
Insufficient Technical Knowledge	15	32.61
Marketing Problem	14	30.43
Low Working Capital	12	26.09
Shortage of Skilled Workers	10	21.74
Relationships with Agricultural Establishments	9	19.56
Insufficient Irrigation Water	6	13.04
Not Controlling Pests	6	13.04

5. Conclusion

In this study, the cost of silage corn production in Van province before and after government support was calculated with 2020 prices. The questionnaire data in the study area, the data from the Ministry of Agriculture and Forestry, Van Provincial Directorate of Agriculture and Forestry and the data from the Turkish Statistical Institute were included in the calculations. The following results were obtained from the study.

- It was determined that the production cost slightly decreased when government support was received, whereas gross production value, gross margin and net income

increased slightly. It was discussed that state support should be increasingly maintained in order to encourage silage corn production.

- When the producers were considered in terms of various problems experienced in silage corn production and marketing, it was discussed that the problems encountered were general in Turkey and these problems should be overcome even in the long term.
- As in every field, agricultural extension studies were recommended to be carried out in order to increase especially the quality in silage corn production.

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