

Cost and profitability analysis of forage crops: a case study of Burdur Province, Turkey

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Abstract

In the study, it is aimed to examine the changes in the costs and profitability of some important forage crops in Burdur province, Turkey. The main material of the study occurs from the data obtained from Burdur Directorate of Provincial Agriculture and Forestry. According to the research results, it was determined that silage corn was the forage crop with the highest production cost per decare and its production cost per decare was 994.06 TL. It was found that the highest increase was in the vetch grown in irrigated conditions and the lowest one was in alfalfa while there was an increase in the production costs of all products in the period of 2013-2019. Increases in the production cost of vetch and alfalfa were 133.02% and 35.31%, respectively. In the period 2013-2019, it was determined that the increase in the sales prices of all forage crops except sainfoin was higher than the costs when the cost per kg was compared to the sales prices per kg. When a comparison was made in terms of profitability indicators, it was seen that alfalfa was more advantageous than other forage crops. It was determined that the gross, net and relative profit figures calculated for alfalfa were higher than the other forage crops. In the 2013-2019 period, the highest increase was in the alfalfa although there was an increase in the net profits of all products. The increase in net profit of alfalfa was found as 514.45%. The alfalfa had the highest ratio of profit margin to the sales price. It was found that the ratio of profit margin to sales price for alfalfa was 43.03%. Accordingly, it can be said that 43.03% of every one kg of alfalfa sold was profit.

Keywords: Forage crop, Cost analysis, Profitability analysis, Turkey

1. Introduction

There are many difficulties in calculating production costs in agricultural enterprises. It is known that product costs vary significantly by regions and agricultural businesses. Since there is not only one cost price in agriculture, each enterprise has its cost price. On the other hand, some evaluations should be made in calculating the actual cost of a product due to common expenses in various production activities in a business. The composition of the various expenses incurred in the production of a product or service and the variation of the expenses during the production period differ greatly. It is important to make cost calculations to economically evaluate the operating results of businesses. The rational and efficient work by the businesses' conditions is directly related to these economic consequences (Gunes et al., 1990).

The purpose of determining the cost and usage levels of physical production inputs in agriculture is to make income and cost analysis of production activities in businesses. In these analyses, comparisons of production activities can be made among themselves, as well as information about the development of the same activity over time and the efficiency of production activities can be obtained. On the other hand, there is a need to continuously investigate agricultural product costs for purposes such as evaluating the results of agricultural policies, monitoring resource use activities in businesses and the developments in agricultural techniques (Anonymous, 2001).

Forage crops agriculture, which has a very important place in agricultural activities, is the insurance of plant and animal production. Forage crops produced in agricultural land are consumed by animals and transformed into products such as meat, milk, cheese, yoghurt, etc., and thus people benefit from these products (Soya et al., 2004).

By increasing the quality roughage production which is necessary for livestock in Turkey, the use of nutrient-poor forage such as stalk, straw and husk in animal husbandry will decrease, and rises will be observed on meat and milk yield obtained from per unit animal. The quality roughages in animal feeding are important for some reasons, as well as being a cheap source. These reasons are to contain protein, fat and cellulose necessary for the development of ruminant animals; to be rich in minerals and vitamins; to improve the performance of animals; to prevent many diseases related to feeding (Alcicek and Karaayvaz, 2003).

Burdur is one of the important provinces with high animal husbandry potential in Turkey. In Burdur province, significant developments have occurred in the existence of bovine and ovine, and the production of forage crops. Cattle stock, which was 105 716 in 2004, increased 2.17 times and reached 217 144 heads in 2019. Regarding the ovine stock, it increased by 73.99% and attained 410 055 heads in 2019 while it was 235 683 heads in 2004. Accordingly, there have recently been important improvements in roughage farming used in animal nutrition. In Burdur province, total forage crop production increased to 906 279 tonnes in 2019 from 239 966 tonnes in 2004 by 3.78 times (TUIK, 2020). This study aims to examine the developments in the cost and profitability of some significant forage crops in Burdur province, which has a high animal husbandry potential. For this purpose, barley, vetch, maize for silage, alfalfa and sainfoin crops grown under dry and irrigated conditions were discussed, and the developments in their costs and profitability in recent years were analysed in the study. It is expected that the results obtained from the study will provide useful information to policymakers, forage crop producers, animal breeders, and other relevant institutions and organizations.

2. Literature Review

There are many scientific papers examining the costs and/or profitability of a single forage crop. However, as far as is known, there are very few studies determining the changes in costs and/or profitability for more than one forage crop comparatively. The study of Vadas et al. (2008) estimated the annual farm-scale production costs, profits and energy budgets for alfalfa, maize and switchgrass in the Upper Midwest, USA. They revealed that the maize had the greatest production cost. However, its profit was the highest. Furthermore, when they compared the products in terms of the cost elements, alfalfa had the highest labour cost.

Mobtaker et al. (2010) aimed to explicate the costs of inputs used in alfalfa production in Hamedan, Iran with the help of an economic model. In the research, the analysis was performed by considering various cost elements comprising production costs and the total production value for alfalfa which has 7-year production life. According to the results, the total production cost is about 14 174 \$/ha while the gross production value is 17 936 \$/ha. Also, the highest cost element is the water cost which is followed by machinery and labour costs.

Polat et al. (2013) determined the production costs of some field crops in Eskişehir province in their studies. They presented the barley yield in dry conditions as 225 (kg/da) and

irrigated conditions as 450 (kg/da). They also reported that the lowest production cost in total production cost was for barley, poppy, wheat and safflower in dry conditions, while the highest cost was for tomato, onion and sugar beet products.

Uzundumlu and Sezgin (2017) calculated the production costs of barley in irrigated conditions in Erzurum province, Turkey. They stated that the variable cost of the businesses was 158.99 TL while the total production cost was 223.74 TL. The gross profit was 42.67 TL, and the net profit was -22.28 TL. They also reported the cost of 1 kg of barley as 0.72 TL.

Baran (2017) evaluated the energy and economic analysis of vetch production in the Thrace region, Turkey. In the study, for the year 2013, the total cost of vetch production was found as 1664.49 TL/ha. The variable cost was 1025.64 TL/ha while the gross value of production was 3811.50 TL/ha. Also, the profit margin per kg computed as 0.35 TL/kg for the region investigated.

3. Materials and Methods

The main material of the study was the data acquired from the Burdur Directorate of Provincial Agriculture and Forestry on the cost of forage crops (Anonymous, 2020). In the study, it was analysed that the changes in cost, sales price and profitability indicators per decare and kg in some important forage crops in the 2013-2019 period in Burdur province. Also, it was benefited from similar studies and statistics conducted by various persons and organizations related to the subject. In this sense, the study contains explanatory information in terms of forage crop production cost, income and profitability. Barley (grain), vetch, maize for silage, alfalfa and sainfoin were considered as forage crops.

The partial budget analysis method was used to determine production costs. Accordingly, the income-expense situation was calculated not for all products grown in an agricultural business, but only for the product subject to research. The daily wages given to male and female workers in the research area were taken as a basis in the calculation of wage provision for family labour. Since the partial budget analysis was grounded in the research, the unit machine rent was based on if the producers used their machines. Precisely 3% of the total variable costs are considered as general administrative expenses. The revolving fund interest is a variable cost and reflects the opportunity cost of the capital invested in the production activity. The revolving fund interest was calculated by applying half of the interest rate (7%) employed by the Republic of Turkey Ziraat Bank for plant production loans to the variable costs. Since alfalfa and sainfoin are perennial plants, their economic life was

considered as four years. The investment costs during the facility period were divided into four and added to the production period costs.

Profitability indicators were calculated to reveal the success levels of forage crops production activities. The gross production value was calculated by multiplying the amounts of main products and by-products obtained as a result of agricultural activity in the forage crops production branches with the sales prices. The gross profit was calculated by subtracting the variable costs from the gross production value, and net profit by subtracting the production costs from the gross production value (Rehber and Tipi, 2016). The relative profit was also computed with the ratio of gross production value to production costs (Erkuş et al. 1995).

4. Results and Discussions

The factors and shares of the production cost of forage crops for 2019 are given in Tables 1 and 2. It was determined that the silage maize had the highest production cost per decare among the examined forage crops.

Table 1: Forage crops production costs in 2019 (TL/da)

Cost Elements (TL/da)	Barley (dry)	Barley (irrigated)	Vetch (dry)	Vetch (irrigated)	Maize (silage)	Alfalfa (irrigated)	Sainfoin (dry)
Material Costs	78.85	192.90	76.95	214.35	471.40	266.00	117.76
Seed	17.00	32.00	50.40	50.40	75.00	7.50	20.56
Chemical fertilizer	47.85	43.90	26.55	31.95	160.00	37.50	37.20
Farm manure	-	75.00	-	100.00	100.00	80.00	60.00
Water	-	28.00	-	32.00	96.00	128.00	-
Agricultural pesticide	14.00	14.00	-	-	40.40	13.00	-
Labour and machinery expenses	157.5	176.27	117.10	162.71	317.15	489.05	160.18
Soil preparation and planting	56.00	43.56	57.10	64.69	68.00	21.51	21.00
Agricultural combat	10.00	7.00	-	-	20.00	10.00	-
Fertilisation	10.00	17.71	-	-	47.50	37.50	27.50
Hoeing, weeding	-	-	-	-	60.00	-	-
Irrigation	-	7.50	-	10.02	30.60	100.00	-
Harvesting and marketing	81.50	100.50	60.00	88.00	91.05	320.04	111.68
Revolving fund interest	16.54	25.84	13.58	26.39	55.20	52.85	19.46
Variable costs (A)	252.89	395.01	207.63	403.45	843.75	807.90	297.40
General administrative expenses	7.59	11.85	6.23	12.10	25.31	24.24	8.92
Land rent	35.00	65.00	50.00	100.00	125.00	125.00	50.00

Fixed costs (B)	42.59	76.85	56.23	112.10	150.31	149.24	58.92
Production costs (A+B)	295.48	471.86	263.86	515.56	994.06	957.14	356.32

Source: Anonymous, 2020.

The production cost of silage maize was calculated as 994.06 TL per decare. It was followed by alfalfa (957.14 TL/da) and vetch in irrigated conditions (515.56 TL/da). Moreover, it was ascertained that the forage crops with the lowest production costs were vetch in dry conditions and barley. Production costs of vetch in dry conditions and barley were found as 263.86 TL/da and 295.48 TL/da, respectively.

Table 2: Distribution of forage crops cost elements (TL/da) and shares (%)

Cost elements (TL/da)	Barley (dry)	Barley (irrigated)	Vetch (dry)	Vetch (irrigated)	Maize (silage)	Alfalfa (irrigated)	Sainfoin (dry)
Material Costs	78.85	192.90	76.95	214.35	471.40	266.00	117.76
Labour and machinery expenses	157.50	176.27	117.10	162.71	317.15	489.05	160.18
Revolving fund interest	16.54	25.84	13.58	26.39	55.20	52.85	19.46
Variable costs	252.89	395.01	207.63	403.45	843.75	807.90	297.40
General administrative expenses	7.59	11.85	6.23	12.10	25.31	24.24	8.92
Land rent	35.00	65.00	50.00	100	125.00	125.00	50.00
Fixed costs	42.59	76.85	56.23	112.10	150.31	149.24	58.92
Production costs	295.48	471.86	263.86	515.56	994.06	957.14	356.32
Cost elements (%)							
Material Costs	26.69	40.88	29.16	41.58	47.42	27.79	33.05
Labour and machinery expenses	53.30	37.36	44.38	31.56	31.91	51.10	44.95
Revolving fund interest	5.60	5.48	5.15	5.12	5.55	5.52	5.46
Variable costs	85.59	83.71	78.69	78.26	84.88	84.41	83.46
General administrative expenses	2.57	2.51	2.36	2.35	2.55	2.53	2.50
Land rent	11.85	13.78	18.95	19.40	12.57	13.06	14.03
Fixed costs	14.41	16.29	21.31	21.74	15.12	15.59	16.54
Production costs	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Anonymous, 2020.

It was observed that the production costs of forage crops grown in irrigated conditions were higher than in dry conditions due to higher material costs (seed, chemical fertilizer, farm manure, water and pesticide) and land rent. Production costs in forage crops were analysed as variable and fixed costs in two groups. Variable costs are the costs that increase or decrease depending on the production volume. These costs arise in production and vary depending on the amount of production. Regarding fixed costs, they do not change depending on the

production volume. In other words, they are the costs that occur whether production is made or not (Inan, 2016). In the study, the variable costs were composed of material costs, labour and machinery expenses, and revolving fund interest. The fixed costs consisted of administrative expenses and land rent.

It was detected that the variable costs per decare in the products examined were higher than fixed costs. Although the share of variable costs in total production costs varied according to the products, it was calculated that it varied between 78.26% and 85.59%. The shares of fixed costs were found to vary between 14.41% and 21.74% depending on the products. According to the products, the share of material costs in the variable costs differed between 26.69% and 47.42%. Also, the share of labour and machinery expenses varied between 31.56% and 53.30%. Land rent took the biggest share in fixed costs. It was computed that the share of the land rent in production costs varied between 11.85% and 19.40% for the analysed products.

In a study conducted by Uzundumlu and Sezgin (2017), the production cost of barley in irrigated conditions was found 223.74 TL per decare. In the study, the share of variable costs and fixed costs in total production costs were determined as 71.06% and 28.94%, respectively. In the study of Tasci (2018), the share of variable costs and fixed costs in the total production costs for barley grown in dry conditions was calculated as 82.46% and 17.54%, respectively. The share of variable costs for barley in irrigated conditions was 84.52% and the share of fixed costs was 15.48%. In the study, it was revealed that material costs constituted a significant part of the variable costs. The share of material costs in variable costs was calculated as 50.34% for barley in dry conditions and 55.68% for barley in irrigated conditions. Paksoy and Ortasoz (2018) measured the production cost of silage maize as 570.89 TL per decare. It was found that 83.44% and 16.56% of the total production cost consisted of variable and fixed costs, respectively. In another study demonstrated by Savasan (2007), it was determined that 74.56% of the total production cost of vetch per decare was composed of variable costs and 25.41% of it was fixed costs.

The change in production costs according to products between the year 2013-2019 is given in Table 3. While there was an increase in all production costs in the examined period, it was determined that the highest increase was in vetch in irrigated conditions and the lowest one was in alfalfa.

The increase in the production cost of the vetch was found at 133.02%. It was shown that the vetch was followed by sainfoin (113.46%), silage maize (73.70%), vetch in dry

conditions (72.81%), barley in dry conditions (59.10%) and irrigated conditions (45.56%), and alfalfa (35.31%).

Table 3: Changes in forage crops production costs (TL/da)

Years	Barley (dry)	Barley (irrigated)	Vetch (dry)	Vetch (irrigated)	Maize (silage)	Alfalfa (irrigated)	Sainfoin (dry)
2013	185.72	324.18	152.69	221.25	572.27	707.36	166.93
2014	201.70	383.55	173.57	269.70	745.13	948.36	251.31
2015	227.79	375.73	162.49	246.73	703.84	865.14	263.18
2016	179.41	308.84	190.03	280.48	798.51	750.87	229.70
2017	205.03	355.69	163.36	321.51	894.31	789.30	240.31
2018	228.31	476.03	175.43	371.22	795.25	850.52	268.13
2019	295.48	471.86	263.86	515.56	994.06	957.14	356.32
Change (%)	59.10	45.56	72.81	133.02	73.70	35.31	113.46

Source: Anonymous, 2020.

The change in costs and sales prices per kg in forage crops from 2013 to 2019 is given in Table 4. The cost of one kg of barley (grain) was calculated by dividing the difference between the production cost per decare and the by-product (straw) income by the yield per decare.

Table 4: Changes in the cost and sales price of forage crops per kg (TL/kg)

	Barley (dry)	Barley (irrigated)	Vetch (dry)	Vetch (irrigated)	Maize (silage)	Alfalfa (irrigated)	Sainfoin (dry)
Cost (TL/kg)							
Years							
2013	0.45	0.41	0.44	0.40	0.11	0.47	0.28
2014	0.43	0.44	0.50	0.49	0.15	0.54	0.42
2015	0.49	0.48	0.46	0.45	0.12	0.43	0.44
2016	0.49	0.45	0.45	0.47	0.13	0.38	0.46
2017	0.44	0.44	0.47	0.48	0.15	0.39	0.48
2018	0.52	0.66	0.50	0.55	0.16	0.43	0.54
2019	0.66	0.66	0.53	0.61	0.17	0.46	0.59
Change (%)	47.46	61.97	20.96	50.78	49.74	-3.35	113.46
Sales Price (TL/kg)							
Years							
2013	0.55	0.55	0.50	0.50	0.13	0.55	0.45
2014	0.70	0.70	0.60	0.60	0.18	0.65	0.60
2015	0.65	0.65	0.50	0.50	0.18	0.55	0.55
2016	0.68	0.68	0.55	0.55	0.19	0.55	0.55
2017	0.74	0.74	0.63	0.63	0.21	0.65	0.65
2018	0.95	1.10	0.75	0.75	0.23	0.75	0.75
2019	1.10	1.10	0.80	0.80	0.24	0.80	0.80
Change (%)	100.00	100.00	60.00	60.00	84.62	45.45	77.78

Source: Anonymous, 2020.

As of 2019, the highest cost per kg was in barley grown in dry and irrigated conditions, and it was computed as 0.66 TL. It was determined that barley was followed by vetch in irrigated conditions (0.61 TL), sainfoin (0.59 TL), vetch in dry conditions (0.53 TL), alfalfa (0.46 TL), and silage maize (0.17 TL), respectively. When the change in cost per kg between the years 2013-2019 was analysed, it was observed that the highest increase was in sainfoin. While the cost of sainfoin per kg was 0.28 TL in 2013, it increased by 113.46% and reached 0.59 TL in 2019. It can be said that the reason behind the high rise stems from the lower production cost of sainfoin per kg in 2013 compared to the other years. The sainfoin was followed by barley in irrigated conditions (61.97%), vetch in irrigated conditions (50.78%), silage maize (49.74%), barley in dry conditions (47.46%) and vetch in dry conditions (20.96%). While the cost of alfalfa per kg was 0.47 TL in 2013, it decreased by 3.35% to 0.46 TL in 2019. It was seen that the price of barley per kg was higher when the sales prices of forage crops in 2019 were examined. In the same year, the price of barley was 1.10 TL/kg and of vetch, alfalfa and sainfoin was 0.80 TL/kg. Regarding the price of silage maize was 0.24 TL/kg. Although it was observed that the sales price of all products increased in the 2013-2019 period, the highest increase was detected in barley (100%) in dry and irrigated conditions. Barley was followed by silage maize (84.62%), sainfoin (77.78%), vetch (60%) and alfalfa in dry and wet conditions (45.45%). According to the results, the increase in the sales prices of all other forage crops except sainfoin was higher than the costs between 2013 and 2019. Regarding sainfoin, it was determined that the cost per kg increased more than the sales price. Paksoy and Ortasoz (2018) calculated that the cost of silage maize per kg is 0.11 TL for 2014 in the study conducted in Kahramanmaras, Turkey.

Profitability indicators of forage crops in 2019 are given in Table 5. The gross production value of production activity is equal to the sum of the value of products at market prices obtained as a result of agricultural activities in this production branch and the annual productive inventory increases (Rehber and Tipi, 2016). In the calculation of the gross production values, the sales prices of the main and by-products received by the producer were taken into account. It was determined that alfalfa had the highest gross production value with 1680 TL per decare. It was followed by silage maize (1392 TL) and vetch in irrigated conditions (680 TL).

Gross profit is a significant measure of success in determining the competitiveness of production activities in terms of the use of scarce production factors in the business. In other words, it is an important criterion that shows the success of the business organization (Erkus et al., 1995). It was determined that the forage crop with the highest gross profit was alfalfa,

and it was calculated as 872.10 TL. Alfalfa was followed by silage maize (548.75 TL), barley (308.89 TL) and vetch (276.55 TL) in irrigated conditions, and vetch (192.37 TL), sainfoin (182.60 TL) and barley (174.01 TL) in dry conditions. When the net profits of forage crops per decare were analysed, it was seen that alfalfa ranked first with 722.86 TL/da.

Table 5: Forage crops profitability indicators in 2019

	Barley (dry)	Barley (irrigated)	Vetch (dry)	Vetch (irrigated)	Maize (silage)	Alfalfa (irrigated)	Sainfoin (dry)
Main product yield (kg/da)	300	500	500	850	5800	2100.00	600.00
Main product sales price (TL/kg)	1.10	1.10	0.80	0.80	0.24	0.80	0.80
By-product yield (kg/da)	170	270	-	-	-	-	-
By-product sales price (kg/da)	0.57	0.57	-	-	-	-	-
Gross production value (TL/da)	426.90	703.90	400.00	680.00	1392.00	1680.00	480.00
Variable costs (TL/da)	252.89	395.01	207.63	403.45	843.75	807.90	297.40
Production costs (TL/da)	295.48	471.86	263.86	515.56	994.06	957.14	356.32
Gross profit (TL/da)	174.01	308.89	192.37	276.55	548.25	872.10	182.60
Net profit (TL/da)	131.42	232.04	136.14	164.44	397.94	722.86	123.68
Relative profit	1.44	1.49	1.52	1.32	1.40	1.76	1.35

Source: Anonymous, 2020.

It was followed by silage maize (397.94 TL/da), and barley (232.04 TL/da) in irrigated conditions. It was determined that sainfoin had the lowest net profit among the forage crops (123.68 TL/da). Relative profit is another criterion measuring the success of production activities. It shows the income obtained for one TL of expenses. For the business to be deemed profitable, the relative profit must be higher than one. It was determined that alfalfa was the forage crop with the highest relative profit and it was calculated as 1.76. It was followed by vetch (1.52) in dry conditions, barley (1.49) in irrigated conditions, barley (1.44) in dry conditions, silage maize (1.40), sainfoin (1.35) and vetch in irrigated conditions (1.32) (see Table 5). In the study of Pishgar-Komleh et al. (2011), they calculated the relative profit of silage maize as 1.57 in Tehran, Iran. Also, Yousefi and Mohammadi (2011) found the relative profit of alfalfa as 2.41 in Kermanshah, Iran, in 2010.

The change in net profits per decare based on products between 2013 and 2019 is given in Table 6. Although there was a rise in the net profits of all products in this period, it was determined that alfalfa has the highest increase. The increase in net profit of alfalfa was

514.45%. It was followed by silage maize (411.97%), vetch (510.28%) and barley in dry conditions (419.90%), vetch (205.94%) and barley (176.43%) in irrigated conditions, and sainfoin (20%).

Table 6: Changes in forage crops net profits (TL/da)

Years	Barley (dry)	Barley (irrigated)	Vetch (dry)	Vetch (irrigated)	Maize (silage)	Alfalfa (irrigated)	Sainfoin (dry)
2013	25.28	63.32	22.31	53.75	77.73	117.64	103.07
2014	67.80	140.95	36.43	60.30	154.87	189.14	108.69
2015	47.21	93.77	12.51	28.27	376.16	234.86	66.82
2016	46.59	106.76	30.07	49.52	341.49	349.13	45.30
2017	79.77	149.31	57.14	103.74	365.69	510.70	84.69
2018	116.59	216.87	87.07	135.03	418.66	649.48	106.87
2019	131.42	175.04	136.14	164.44	397.94	722.86	123.68
Change (%)	419.90	176.43	510.28	205.94	411.97	514.45	20.00

Source: Anonymous, 2020.

The ratio of profit margin to sales price (%) and profit margin by products between 2013 and 2019 are given in Table 7.

Table 7: Changes in the profit margin and the ratio of profit margin to the sales price for forage crops

Years	Barley (dry)	Barley (irrigated)	Vetch (dry)	Vetch (irrigated)	Maize (silage)	Alfalfa (irrigated)	Sainfoin (dry)
Profit margin (TL/kg)							
2013	0.10	0.14	0.06	0.10	0.02	0.08	0.17
2014	0.27	0.26	0.10	0.11	0.03	0.11	0.18
2015	0.16	0.17	0.04	0.05	0.06	0.12	0.11
2016	0.19	0.23	0.10	0.08	0.06	0.17	0.09
2017	0.30	0.30	0.16	0.15	0.06	0.26	0.17
2018	0.43	0.44	0.25	0.20	0.07	0.32	0.21
2019	0.44	0.44	0.27	0.19	0.07	0.34	0.21
The ratio of profit margin to the sales price (%)							
2013	18.38	25.58	12.75	19.55	11.96	14.26	38.17
2014	38.74	36.61	17.35	18.27	17.21	16.63	30.19
2015	24.21	26.23	7.15	10.28	34.83	21.35	20.25
2016	27.40	33.40	18.23	15.01	29.96	31.74	16.47
2017	39.92	40.35	25.91	24.39	29.02	39.28	26.06
2018	45.45	40.24	33.17	26.67	30.34	43.30	28.50
2019	39.82	39.73	34.03	24.18	28.59	43.03	25.77

Source: Anonymous, 2020.

It was determined that the products with the highest profit margin were barley grown in dry and irrigated conditions (0.44 TL/kg) in 2019. It was followed by alfalfa (0.34 TL/kg), and vetch in dry conditions (0.27 TL/kg). The ratio of profit margin to sales price (profit

margin/sales price*100) criterion was calculated to determine how much of the sales price of forage crops was cost and profit. According to 2019 data, it was found that alfalfa was the product with the highest ratio of profit margin to the sales price (43.03%). Accordingly, it can be said that 43.03% of each one kg of alfalfa sold was profit. It was revealed that alfalfa was followed by barley (39.82%) in dry conditions, barley (39.73%) in irrigated conditions, vetch (34.03%) in dry conditions, silage maize (28.59%), sainfoin (25.77%) and vetch in irrigated conditions (24.18%). When an analysis was made of the change in the ratio of profit margin to sales price calculated for forage crops between 2013-2019, it can be said that there is a fluctuation in general, but an increasing trend.

5. Conclusions

As a result, according to different forage crops, it was seen that the share of variable costs within the total production cost differed from 78.26% to 85.59%, and the share of fixed costs differed from 14.41% to 21.74%. When a comparison was made among the forage crops, the production cost of silage maize per decare was higher than other forage crops. As the change between 2013 and 2019 was examined, it was determined that there was an increase in the production costs of all forage crops and the increase varied from 35.31% to 133.02% according to diverse forage crops. The highest increase in production costs was in vetch in irrigated conditions. Also, when a comparison was made in terms of profitability indicators, it was found that the net profit of alfalfa was higher. There was an increase in the net profits of all products between the years 2013-2019, and this increase changed from 20% to 514.45% for different forage crops. In net profit, the highest increase was in alfalfa, and the lowest one was in sainfoin among the forage crops. The criterion for the ratio of profit margin to sales price was calculated to establish how much of the sales price of forage crops was cost and how much of it was profit. According to 2019 data, it was determined that the product with the highest ratio of profit margin to sales price was alfalfa. This ratio for alfalfa was found as 43.03%. Therefore, we can say that 43.03% of every one kg of alfalfa sold was profit.

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