



A Review of the Current Status of Forage Crops Cultivation and Evaluation in Türkiye

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ABSTRACT

With the changing market conditions in Türkiye, the shortage of quality roughage causes an increase in input costs. In the livestock sector, feeding and maintenance expenses are forcing the enterprises. Compared to the previous year, in 2022, there is a 5,6% decrease in total cattle presence and a 2,2% decrease in small ruminants.

Parallel to the increase in population, the importance of continuous and effective farming of forage crops and animal husbandry has emerged. The cultivation areas of forage crops have increased significantly since the 2000s, thanks to government subsidies. However, the current situation is not sufficient for feeding the livestock. In this article, the existence of bovine and small livestock is studied, and detailed current data on the roughage resources, cultivation areas and production amounts of Türkiye are presented. The availability of roughage resources to meet the needs of animal presence has been revealed. In addition, evaluations on what can be done to improve the production of quality roughage are presented. The future of the livestock sector depends on the government's encouragement of the producer to sustainable and effective forage crop farming.

1. Introduction

In terms of economic sustainability, animal production and agriculture sector should be well planned for adequate nutrition of people in every country. The most important roughage sources in the livestock sector are meadows and pastures. There is 14,6 million hectares (ha) of meadow-pasture area in Türkiye (TUIK, 2023a).

Meadows and pastures lose their productivity and cannot be used effectively due to many reasons such as Türkiye's arid climate, irregularities in the precipitation regime of the regions, and excessive and unconscious grazing that has been going on

since the past (Kuşvuran et al., 2011). The inability to obtain the required yield for animal production from meadows and pastures leads to agriculture and production for forage crops. Forage crops agriculture, which is the most important way to reach consistent and safe high-quality roughage is the guarantee of livestock production (Akman et al., 2007).

In addition to its use in animal feeding, forage crops are also very valuable for the agro-ecosystem. For example, some forage crops such as alfalfa, vetch fix and clover keep nitrogen in the soil and enable the plants to grow in the following process to be more productive. Forage crops are harvested earlier than other product groups and are

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planted more frequently per unit area. It also plays a role in enriching the structure of the soil and preventing disasters such as soil and water erosion by reducing fallow areas (Sürmen and Kara, 2017).

Forage crops (Lucerne, sainfoin, common vetch etc.) have been cultivated in Anatolia since the Hittites. Since animal husbandry is an important source of livelihood for Türkiye from past to present, the cultivation of forage crops in Türkiye dates back to ancient times. Today, forage crops cultivation areas are increasing rapidly and new types are being added. Some new species such as Italian grass, fodder turnip, ryegrass are spreading throughout the country (Tan and Yolcu, 2021). On the other hand, although the states subsidizes the agriculture of forage crops for livestock production, Türkiye's forage crops production is not sufficient to meet the quality roughage needs of the country's livestock. Not enough roughage production is the most important problems of animal husbandry in Türkiye.

In summary, water resources are gradually decreasing and the effects of global warming and the damage to air and soil are increasingly felt. For this reason, it is of great importance for the livestock sector in Türkiye to determine the current situation of forage cultivation areas and to observe the change in cultivation areas in recent years. The paper, in the light of current data, the existing situation of forage crops, the situation of meeting the feeding of animal existence in Türkiye is revealed. An evaluation of increasing the agriculture of forage crops and indirectly contributing to the future of animal husbandry is presented.

2. Agricultural areas and distribution in Türkiye

Agricultural areas in Türkiye are 38.462 (1000 ha) in 2022. Meadow- pasture areas are 14.617 (1000 ha), Cereals and other crops products cultivation areas are 19.447 (1000 ha) and 2.960 (1000 ha) of these areas are fallow. Forage crops cultivation field is 2.757 (1000 ha). The share of this area in the Türkiye's total agricultural areas and the share of Cereals and other crops products area is 7,17% and 14,18%, respectively (Table 1). The share of forage crops in total agricultural area was 5% for the year 2007 (Yolcu and Tan, 2008) and 6,1% in 2020. Forage crops cultivation areas in Türkiye have increased gradually over the last two decades. It is thought that government subsidies contributed to this situation (Tan and Yolcu, 2021). However, the need for quality roughage for animal husbandry in Türkiye is always an ongoing problem and forage crops cultivation needs to be improved (Koç et al., 2012; Acar et al., 2020).

3. Forage Crops Cultivation in Türkiye

The cultivation areas where forage crops are cultivated, the production amounts of forage crops and green forage yield in Türkiye are seen in Table 2.

As of 2022, fodder crops are cultivated on an area of 2.757.082 ha in Türkiye and the amount of green forage production is 67.038.886 tons. Because of its high vitamin and nutritional value, good adaptation to the environment and longevity, lucerne is preferred for animal grazing and is a highly preferred forage crops in plant production (Okçu, 2020).

Table 1. Agricultural areas of Türkiye according to the statistical data of the year 2022*

Agricultural Areas	Area (1,000 ha)	Ratio (%) ^a
Cereals and other crop products (sown area)	16.487	42,9
Cereals and other crop products (fallow land)	2.960	7,7
Fruits, beverage, spice herbs	3.675	9,6
Vegetable gardens	718	1,9
Ornamental plant	6	0,02
Meadow and rangeland	14.617	38,0
Total	38.462	100
Forage Crops	2,757^b	7,17

*(TUIK, 2023a).

^a Statistics of the data obtained from the TUIK database have been calculated by the author.

^b Forage crop area of Türkiye is 2.757.082 ha in 2022. The share of this area within the Agriculture areas has been calculated as 7,17%.

In terms of the size of the cultivation areas for the forage crops grown in Türkiye for 2022, lucerne comes first with 6,4 million decares (da). Maize, which is easy to ensilage and has a high digestibility for animals, ranks second as silage with approximately 5,3 million da. In short, both lucerne and maize silage outweigh the forage crops cultivation with 42,6% of all forage crops (Table 2).

Lucerne (19,1 million tons) and corn silage (28,6 million tons) showed themselves as the two most important crops that account for approximately 72% of forage crops agriculture in Türkiye. Oat with 3,6 million da and vetch on 3,4 million da were listed as other widely grown forage crops in Türkiye. When the production amounts are taken into consideration, oat (green grass), which increased the production from 3,8 million tons in 2021 to 4,6 million tons in 2022, took the third place. Vetch species (common vetch, hungarian vetch and other vetches) with a total production of approximately 4,1 million tons and sainfoin 1,8 million tons were the plants that support forage crops production (Table 2).

It is seen that among the forage crops cultivated in Türkiye, silage corn, forage turnip, forage beet and sorghum are the highest yielding forage crops,

respectively. Sorghum is followed by Italian grass and sudan grass. The roughage source with the lowest yield is forage crops, meadow grass and wild vetch (Table 2). The use of the wild vetch plant as a forage crop is low. While the cultivation area was 25.613 da in 2019, it decreased to 20.432 da in 2022 (TUIK, 2023a).

The most widely cultivated forage plant species in Türkiye for many years are sainfoin, common vetch, lucerne and silage corn. In addition to these, farming fodder beet and forage peas have begun to be planned since the early 2000s. In the last years, new types of forage crops such as meadow grass, Italian grass, sorghum have started to be cultivated as an alternative to widely produced forage crops in Türkiye (Tan and Yolcu, 2021).

The cultivation areas and production amounts of new types of forage crops are gradually increasing. Italian grass production amount is 2,1 million tons (Table 2). The increase in production of these new species may have an impact on closing the livestock roughage deficit. The initiation of the production of alternative forage crops has not significantly affected the cultivation area of forage crops, which is a widely produced roughage source, but has greatly increased the area where forage crops are produced.

Table 2. Green productions, yields and cultivation areas of forage crops in Türkiye (2022)*

Forage Crops	Cultivation Area (da)	Green Production (ton)	Ratio of cultivation area (%) ^a	Green Yield (t da ⁻¹) ^b
Sainfoin	1.618.249	1.786.207	5,87	1.104
Wild vetches	20.432	12.417	0,07	0.608
Corn (Silage)	5. 298. 522	28.558.983	19,22	5.390
Forage Beet	11.491	56.360	0,04	4.905
Forage Turnip	49.459	268.890	0,18	5.437
Wheat (Green)	168.327	310.966	0,61	1.847
Barley (Green)	292.728	482.665	1,06	1.649
Rye (Green)	106.546	150.885	0,39	1.416
Forage Pea (Green)	258867	475.005	0,94	1.835
Sudan grass	2.424	9.169	0,01	3.783
Vetch– (Common, hungarian and other vetches)	3.421.760	4.020.433	12,41	1.175
Clover	72	117	0,00	1.625
Lucerne	6.435.927	19.064.213	23,34	2.962
Meadow grass	4.955.951	3.683.405	17,98	0.743
Oats (Green)	3.607.194	4.649.051	13,08	1,289
Sorghum (Green)	29.205	117.076	0,11	4.009
Triticale (Green)	619.185	1.072.635	2,25	1.732
Grass pea (Green)	66.994	55.208	0,24	0.824
Italian ryegrass	539.944	2.122.105	1,96	3.930
Other forage crops ⁽⁹⁾	16.932	28.424	0,06	1.679
Corn (for hay)	50.607	114.672	0,18	2.266
Total	27.570.816	67.038.886	100,00	--

*(TUIK, 2023a)

^{a,b} Statistics of the data obtained from the TUIK database have been calculated by the author.

Lucerne, oat (green), common vetch, sainfoin, silage maize are the plants most grown in forage crops and evaluated as dry grass and green grass in Türkiye. When we examine the information on the regional distribution of the cultivation areas of these basic forage crops, it can be seen from the data on the cultivation areas to which region/regions each plant is more suitable (Table 3).

Lucerne (1.933.281 da) is the most cultivated in the Middle East Anatolia Region. Northeast Anatolian Region comes second with 1.212.882 da. Sainfoin is most cultivated in Northeast Anatolia (716.644 da) and Middle East Anatolia (420.553 da) regions. Since lucerne and sainfoin are forage crops that can withstand long and harsh winter conditions, the growing areas are high in the eastern regions. Oats are mostly cultivated in the Northeast Anatolia Region with 1.220.210 da (Table 3).

The largest cultivation area of silage corn is the Aegean Region with 1.470.186 da. The Aegean Region is followed by West Marmara, West Blacksea, West Anatolia and Mediterranean

regions, respectively. Common vetch is grown more in Aegean Region (783.462 da) and Western Blacksea Region (583.889 da) (Table 3). Information on the change of cultivation areas of some forage crops by years is presented in Table 4.

Forage crops agriculture in Türkiye has been supported by the Decision of the Ministry of Agriculture and Rural Affairs numbered 2000/467 since 2000. The forage cultivation areas in Türkiye, which was 754.177 ha in the same year, expanded to 2.757.082 ha in 2022 with a substantial increase of 265,6% (TUIK, 2023a). The support program is seen as an important contribution to improving forage crops production (Tan and Yolcu 2021).

Lucerne, silage corn, common vetch, sainfoin, oat (green) are the plants most grown in forage crops and considered as hay production and green material. Since 2010, there has been an increase of more than 100% in cultivation areas in silage maize. This situation is a result of the state subsidies implemented since the 2000s. It shows that farmers are also not indifferent to government incentives and silage corn agriculture is adopted (Acar et al., 2020).

Table 3. Regional distribution of some forage crops cultivation areas in Türkiye (2022)*

Statistical Regions	Forage Crops Area (da)				
	Lucerne	Corn (Silage)	Oat (Green)	Vetches	Sainfoin
Mediterranean	210.473	464.034	128.201	287.283	39.754
West Anatolia	515.522	526.295	22.263	365.048	29.533
West Blacksea	412.436	544.956	523.895	583.889	88.704
West Marmara	184.237	720.935	567.541	115.587	2659
East Blacksea	94.705	16.345	33.647	33.185	46.491
East Marmara	342.750	585.204	346.793	146.658	12.784
Aegean	576.608	1.470.186	500.489	783.462	34.058
Southeastern Anatolia	106.247	284.210	--	154.182	10.940
Northeast Anatolia	1.212.882	136.692	1.220.210	527.113	716.644
Middle Anatolia	843.636	396.435	223.573	274.310	215.824
Middle East Anatolia	1.933.281	90.584	11.235	148.163	420.553
Istanbul	3.150	12.039	29.347	2880	305
Total	6.435.927	5.247.915	3.607.194	3.421.760	1.618.249

*(TUIK,2023a).

Table 4. Changes of forage crops cultivation areas in Türkiye between 2005-2022*

Forage Crop/Area (da)	Years					
	2005	2010	2015	2020	2021	2022
Lucerne	.750.000	5.688.107	6.620.459	6.628.887	6.730.474	6.435.927
Corn (Silage)	1.800.000	2.844.728	4.105.412	5.205.892	5.248.424	5.247.915
Oat (Green)-	--	825 512*	825.890	3.240.182	3.740.583	3.607.194
Vetch (all)	2 500 000	4 288 400	4 365 182	3 759 436	3 652 849	3 421 760
Sainfoin	1.100.000	1.570.810	1.914.036	1.744.949	1.814.737	1.618.249

*(TUIK, 2023a).

*Oat data has been started to be compiled since 2012. The data of 2012 was taken as the closest year.

Lucerne cultivation areas, which were 3.750.000 da in 2005, reached 5.688.107 da in 2015. Lucerne cultivation areas increased by 51,7% from 2005 to 2015. There was no significant increase in cultivation areas after 2015. Likewise, there was no significant increase in sainfoin and vetch cultivation areas (Table 4).

Oat cultivation area has increased considerably over time. While it had a cultivation area of 825.890 da in 2015, it expanded to 3.607.194 da in 2022 with a substantial increase of 336,8%. Although there was a small decrease in 2022, it is thought that the areas where oat production is carried out in general will increase. The reason for this increase is considered to be the factors such as government incentives, widespread oat production among farmers, as well as ecological factors such as soil and climate (KUDAKA, 2022).

4. Animal Husbandry and Forage Crops in Türkiye

Türkiye's cattle stock was 18.157.971 in 2020 and decreased to 17.023.791 in 2022. In 2022, there was a decrease of 5,6% compared to the previous year. In the presence of small cattle, while the data for the year 2021 was 57.519.204, it decreased to 56.265.750 in 2022. In 2022, there was a decrease of 2,2% in the previous year (TUIK, 2023b). In order to find the annual life share and roughage requirement of Türkiye's livestock, the conversion process to cattle unit (CU) was applied (Table 5).

According to the Pasture Law dating 31/07/1998 and numbered 4342, using the cattle unit conversion coefficients, a detailed conversion process was applied according to all different ages and breeds under the category. While this process is being applied, separate coefficients are determined for each of the cow-heifer categories

under the Cultural breed cattle breed, male and female under the buffalo breed, bull, ox and bull and lamb-goat category under the sheep and goat breed. A CU value close to the correct number cannot be found without a detailed calculation over the coefficients.

A cattle with a live weight of 500 kg (1 CU) should consume 4 kg/day of quality hay and 10 kg/day of quality green grass or silage corn to meet the nutrient requirement for survival (Alçiçek et al., 2010). The green grass or silage requirement of the livestock for the year 2022 was calculated as $17.499.827 \times 10 \times 365 = 63,9$ million tons with the formula = CU x 10 kg/day x 365 days. Dry grass need was calculated as $17.499.827 \times 4 \times 365 = 25,6$ million tons and the total annual roughage requirement was 89,5 million tons. The values found with the same formula for other years are also shown in Table 5.

On the other hand, Türkiye's roughage production from meadow, pasture (14,6 million tons) and forage crops (67,0 million tons) in 2022 was determined as 81,6 million tons in total. In this case, it has been observed that there is a deficit of 7,9 million tons of roughage for 2022 (Table 5). Based on these data, it is understood that the rate of meeting the need for quality roughage in the current production in 2022 is 91.2% compared to meadow, pasture and forage crops.

The reason for this high rate is due to the decrease in the number of animals in 2022. In 2022, there is a 4,3% decrease in the number of CU compared to the previous year. In parallel, there has been a decrease in the annual need for quality roughage. Annual total forage production has increased by approximately 8,4% from 2020 (75,3) to 2022 (81,6). When we look at the roughage deficit data of the last 5 years, an optimistic picture is not seen until 2022.

Table 5. Bovine and small livestock presence and roughage deficit in Türkiye 2018-2022 period

Years	Cattle Unit (CU)			Annual roughage requirement (million ton)			Annual roughage production (million ton)			Quality roughage deficit (million ton)
	Cattle*	Small Ruminant	Total	Green +Slage	Hay	Total	Meadow-rangeland	Forage Crops	Total	
2018	12.307.093	4.259.462	16.566.555	60,5	24,2	84,7	14,6	52,3	66,9	17,8
2019	12.746.515	4.487.547	17.234.062	62,9	25,2	88,1	14,6	55,5	70,1	18,0
2020	13.045.632	4.959.817	18.005.449	65,7	26,3	92,0	14,6	60,7	75,3	16,7
2021	13.004.988	5.282.111	18.287.100	66,8	26,7	93,5	14,6	60,3	74,9	18,6
2022	12.305.035	5.194.792	17.499.827	63,9	25,6	89,5	14,6	67,0	81,6	7,9

* Equids (horse, donkey etc.) and camel are not included in the cattle presence.

For the year 2021, 18,6 million tons, for 2020 16,7 million tons of roughage deficit has occurred. The roughage meeting the need ratio for 2021 and 2020 are approximately 80%. The fact that the roughage deficit has decreased for 2022 should not be perceived as a positive situation. This situation, which occurs due to animal declines, is temporary and the result of many factors. For decades, it does not change the situation that forage crops production is not sufficient to feed livestock.

5. Conclusion

As in the whole world, the cheapest and most easily utilized roughage source in Türkiye is meadows and pastures. The meadow and pasture areas of Türkiye in 2022 are 14.617.000 ha. The ratio of meadow and pasture areas to land areas has remained constant for many years with 18,7%. This rate is far behind many European countries. In addition, due to changes in climatic conditions and unconscious grazing, it is not possible to obtain sufficient roughage yield from meadows and pastures.

Most of the roughage needed by the animals is obtained from meadows and pastures, whose quality roughage production potential is greatly reduced, and from grain straw and hay with very low nutritional value. This situation causes low yield in animal products. Forage crops, another source of quality roughage, are the insurance of both plant and animal production and are important for sustainable agriculture and high-quality roughage production.

Türkiye's forage crops cultivation areas have shown a great increase in the last 20 years. Forage crops cultivation area in 2022 is 2.757 (1000ha). The share of this area in the agriculture land is only 7,17% and its share in the land area is 14,18%. Although the cultivation area increases from year by year, the rate of increase is very low and cannot meet the needs of the livestock.

Türkiye's roughage production from meadow, pasture (14,6 million tons) and forage crops (60,3 million tons) in 2021 has been determined as 74,9 million tons. It has been observed that there is a deficit of 18,6 million tons of roughage for 2021 (Table 5). In this case, the ratio of quality roughage produced for the year 2021 to meet the animal presence is approximately 80%, for the year 2022 this ratio is 91,2%. The reason for the high rate of 2022 is entirely due to the decrease in the number of animals. Compared to the previous year, in 2022,

the number of cattle decreased by 5,6% and the number of small ruminants by 2,2%.

Due to the shortage of quality roughage, in order to fill this forage deficit, it should be prevented that animals are fed with products that are not suitable for their physiology. On the other hand, small producers with 10-20 animals had to withdraw from the sector due to the increasing costs in the livestock sector, while large enterprises reduced the number of animals. Increases in forage crops production will also increase animal production. Forage crops agriculture is effective in solving pest and weed problems and will indirectly reduce diseases and increase plant and animal productivity.

In addition, the cultivation of forage crops will reduce the pressure on the pastures, on the other hand, will help protect natural resources and prevent water and soil erosion.

Special incentive policies should be implemented by the state to encourage forage crop cultivation. Instead of giving fixed supports, the support system should be renewed by making regional-oriented plans. Every local farmer should be taught the cultivation of forage crops suitable for ecological conditions, the cultivation areas of forage crops specific to the region should be expanded, and seed production should be increased. The importance of quality as well as yield for quality roughage should be explained to the farmers. Maintaining the quality of forage crops at a certain level by making better quality agriculture will also have a positive effect on animal production. In the triangle of environment, animals and farmers, it should be taken into account that sustainable agriculture can be realized with a business model that can positively affect the welfare of all.

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