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Koc A., Tan M., Erkovan H.I.

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An overview of fodder resources and animal production in Turkey

A. Koc*, M. Tan and H.I. Erkovan

Department of Field Crops, Faculty of Agriculture, Ataturk University, Erzurum (Turkey)
*E-mail: akoc@atauni.edu.tr

Abstract. In this paper, roughage resources of Turkey were reviewed. Problems and recommendations were discussed for sustainable animal production in the country. Hay production and forage crops acreage have increased significantly last two decades owing to governmental incentives but there is still gap in sufficient quality forage in the country. The forage gap is mainly compensated with cereal straw which is too far to meet animal maintenance need. Some serious measurements such as regulation of grazing season, grazing capacity and selection of proper animal species for rangelands are needed. With respect to forage crops production, solving seed problems and marketing, and determining roughage prices considering feed quality are especially important challenges. Finally producers have to be trained on animal feeding and raising and rangelands management.

Keywords. Turkey – Animal raising – Rangeland – Forage production.

Une vue d'ensemble des ressources fourragères et de la production animale Turquie

Résumé. *Dans cet article, les ressources en fourrage de la Turquie ont été examinés. Les problèmes et les recommandations ont été examinées pour la production animale durable dans le pays. Les surfaces de foin et de cultures fourragères ont augmenté de manière significative ces deux dernières décennies en raison de mesures gouvernementales, mais il existe est encore une besoin de fourrage de qualité dans le pays qui n'est pas couverte. Cet écart et principalement compensée par la paille de céréales, mais ceci est trop pauvre pour répondre aux besoins d'entretien des animaux. Certaines mesures sérieuses telles que la réglementation de la saison de pâturage, la capacité de pâturage et la sélection des espèces animales appropriées pour les parcours sont nécessaires. En ce qui concerne la production des cultures fourragères, la résolution des problèmes liés aux semences et à son commercialisation, et la détermination des prix du fourrage considérant son qualité nutritive sont des défis particulièrement importants. Enfin les producteurs doivent être formés sur l'alimentation animale et élevage et sur la gestion des pâturages.*

Mots-clés. *Turquie – Élevage – Parcours – Production de fourrage.*

I – Introduction

Turkey is a country located between Europe and Asia from 26° to 45° E and from 36° to 42° N with total area is 78.35 million ha of which 76.96 million ha is land area. The distribution of land use can be summarized as follows: field crop areas are 21.4 million ha (of which forage crops reach 1.46 million ha), horticultural areas (vegetables, vine, fruit, olive, hazelnut and the other agricultural tree) are 3.0 million ha, rangelands are 13.2 million ha, meadows are 1.4 million ha, forests are 15.1 million ha, shrublands 8.3 million ha and 15.4 million ha the other areas which are mainly water surface, settlement, barren areas, and etc. (ps: some low productive areas are officially defined in this class, most of them over degraded rangelands) (TUIK, 2010).

Turkey has 750 billion dollar national gross income and 70 billion of which obtain from agriculture. The share of animal husbandry in agriculture is about 30 percent (TUIK, 2010). All small livestock and vast majority of large livestock depend on rangelands and harvest residues in agricultural areas for feeding during the grazing season (Altin *et al.*, 2011). Therefore, rangelands have crucial importance for animal husbandry, especially during crop growing

season because there are no artificial pastures or feed resources for extensive animal husbandry during this period. On the other hand, intensive animal farms, which do not depend on natural pasture, especially dairy, are quite few and they are located around crowded cities in the western and central parts of the country.

The average elevation is 1100 m and annual total precipitation is 643 mm. Both the amount and distribution patterns of precipitation show great variation depending on geomorphological features. Therefore, eleven agro-ecological regions occur in the country (Fig. 1). Agricultural practices show great variation among the regions, depending on difference of topographical conditions and precipitation patterns. While plant production is the main occupation in the western part of the country, the animal husbandry is the major occupation in both East and Central Regions. This variation affects also animal type and raising system.

Fig. 1. Agro-ecological regions of Turkey.

II – Presence of animal resources

Turkey's domestic ruminant population consists of 11,555,800 cattle and 25,769,900 sheep and goats (TUIK, 2010), which are equal to 10.14 million Animal Units (AU). While cattle number has not changed significantly in the last years, small ruminant number decreased seriously, especially Angora goat, in last decades. For example, the decreases in small ruminant number from 1980 to 2010 were as follows: sheep from 48.63 to 20.88 million, ordinary goat from 15.38 to 5.53 million, Angora goat from 3.66 to 0.15 million (TUIK, 2010). During this period, the amount of cattle products increased despite the decline in the number of cattle because of replacement of local breed animals with cross-breed and pure races. The distribution of animals among agro-ecological regions is summarized in Table 1.

Due to increasing mechanization in agriculture last decades, equids number decreased seriously in the country. Nowadays, the country has 416,500 equids and its number changes from 8800 to 68,000 among agro-ecological zones. Horse power use is common to carry hay from meadows and fields in North-Eastern Anatolia agro-ecological region, while asses and mules are used to carry goods and for transportation in West Marmara and South-Eastern Anatolia regions.

Buffalo number decreased seriously in past decades because of low production capacity and decreasing demand for its power. But buffalo milk product, especially skimming and yoghurt, attain special demand with high price in Aegean and West Black Sea regions, hence, some farmers in these regions raise buffalo to meet this demand.

Table 1. The distribution of animal presence among agro-ecological regions (x 1000) (TUIK, 2010)

Agro-ecological regions[†]	Equids	Buffalo	Cattle			Sheep	Goat	Total (AU)[††]
			Pure	Hybrid	Local			
NE Anatolia	57.7	3.9	135.3	874.8	641.4	2323.1	194.8	1219.1
ME Anatolia	40.8	10.1	153.8	337.4	282.0	4471.2	747.0	1020.1
SE Anatolia	53.2	6.8	154.0	248.4	338.0	3586.3	1224.8	950.8
West Marmara	20.1	4.4	844.6	190.8	36.5	1349.4	451.4	960.4
East Marmara	68.0	6.3	1085.0	499.1	155.0	2275.8	764.0	1553.5
Aegean	21.5	16.0	306.4	349.4	88.2	890.3	207.0	626.1
Western Anatolia	19.6	0.7	350.2	265.2	107.2	2121.1	240.6	708.4
Mediterranean	47.8	1.3	368.7	488.2	87.1	1284.4	1476.9	926.7
Central Anatolia	23.4	6.4	372.0	537.3	226.2	1562.7	211.1	913.1
West Black Sea	55.6	27.3	345.5	671.3	390.7	691.8	134.1	961.5
East Black Sea	8.8	2.8	68.3	245.4	112.4	326.1	29.1	298.1
Total	416.5	86.0	4183.8	4707.3	2464.7	20882.2	5680.8	10138.0

[†]NE: North-Eastern, ME: Middle-Eastern, SE: South-Eastern.
[††]AU (Animal Unit): Equal to 500 kg live weight.

Cattle production is a main resource of meat and milk demand of the country. The majority of cattle is pure or cross breed but breeds distribution shows a great variation among regions. West and East Marmara region is about to have half of the pure cattle breed population of the country, since these regions are the most crowded part of the country, and the demand for milk product is very high. Local and cross breeds cattle populations are common in North-Eastern Anatolia and West Black Sea regions, regions that have hill topographical rangelands. Local breeds and their crosses are common in these regions since they perfectly match for hilly topography.

Sheep industry for milk, meat and wool is common in Middle-Eastern Anatolia and South-Eastern Anatolia regions because the rangelands in these regions have sparse and short plant cover, hence they are not suitable for cattle grazing. Stubble and fallow areas are significant feed resources for rangeland depended animal husbandry. Moreover, the vast majority of sheep flocks, especially from South-Eastern Anatolia, move to North-Eastern Anatolian highlands during hot summer period to overcome the hot weather stress and feed shortage. In addition to these regions, Central Anatolia and East and West Marmara regions are significant sheep production areas in the country; because rangeland areas are extremely restricted in Marmara and quite poor in Central Anatolia, hence, stubble grazing is the main feed resource for sheep industry in these regions. The lowest presence of sheep and goat is found in East Black Sea region because in addition of a limited rangeland area, moistly climate is not suitable small ruminant raising (Holechek *et al*., 2004).

Goat milk product and meat have special interest in Mediterranean region. On the other hand, maquis are the most common feed resource for grazers, hence, ordinary goat (not Angora) breeding is the most common in the region. In addition to Mediterranean region, the second most important region for ordinary goat production is South-Eastern Anatolia because the northern part of the region is characterized by a sharp topography and sparse oak vegetation. Angora goat production was common in the Central Anatolia region but it is near to extinction nowadays, due to the sharp decrease of mohair demand in both national and international markets in the last decades.

III – Rangeland resource of Turkey

Although Turkey's rangelands lost true climax vegetation because they have been faced to intensive grazing since ancient civilization and plant communities show great variation among

regions (Firincioglu *et al*., 2008), the rangelands are the most important feed resource for animal husbandry in the country. Turkey has 13.17 million ha rangelands area but its distribution show great differences among the regions (Table 2). While rangelands cover large areas in the North-East Anatolia region, the West Marmara has the least rangeland area. Hence, the contribution of rangelands to animal husbandry show great variation among the regions.

The North-East and the Black Sea regions rangelands primarily are grazed with cattle herds because rangeland vegetation are consisted of better quality in these regions. Black Sea regions rangelands are characterized by forest gaps and alpine rangelands types with sharp topography, while North-East Anatolia rangelands are characterized by open vegetation with uneven topography. The rangelands in southern and central parts of the county are primarily grazed with sheep flocks and plant communities are characterized by dry steppe vegetation (sparse canopy cover and short plants) with harsh topography because all flat areas were converted to cropland during fifties. The poorest rangelands are located in South-East Anatolia region. The Mediterranean rangelands are located in forest gaps and in alpine zones with harsh topography.

In addition to true rangelands, maquis (officially registered in the forest inventory of the country) provide significant feed amounts to goat flocks in the region. Traditional goat transhumant grazing systems is generally characteristic of the region. Transhumance routes lies from coastal areas of Mediterranean Sea to inside of Central Anatolia Region.

The rangelands are insufficient to meet animal needs during the grazing season on countrywide, especially in Central Anatolia, Middle-Eastern Anatolia, South-Eastern Anatolia and West Marmara regions, thus stubble grazing after cereal harvest play a significant role in the range depending animal husbandry.

IV – Hay production in Turkey

Turkey has 1.45 million ha natural hay meadows and their production is about 5.81 million tones. More than half of the natural meadow areas are located in the North-Eastern and Middle-Eastern Anatolia regions. West Marmara region has the least natural hay meadow areas in the country. The production from natural hay meadows is not enough to meet feedlot period roughage needs in any region of the country.

In the country, total forge crop sowing areas is 1.46 million ha, which is equal to 8.6% of country croplands, and the total production is 7.48 million tones forage (Table 2). Forage crop acreage is higher in North-Eastern Anatolia, Middle-Eastern Anatolia and East Marmara regions, while it is lowest in East Black Sea region. While North-Eastern Anatolian farmers allocate about a quarter of their field areas for forage crop production, South-Eastern Anatolian farmers allocate only 1.4% of total field for forage production.

Forage crop cultivation pattern shows significantly differences among regions (Table 3). While alfalfa and sainfoin cultivation are common in North-Eastern and Middle-Eastern Anatolia regions, silage maize cultivation is important in the Marmara and Aegean regions, where milk production of the country is concentrated. Annual forage crops cultivation is generally more importante in the Mediterranean and the Aegean regions. These regions have the best climatic condition for plant growth, hence, crop diversity is very high.

Although government gives significant financial support for forage crop cultivation countrywide, forage crops are still not economically competitive with cash crops. Hence, perennial forage crops and annuals do not cover large areas during cash crop growing season, but annual legumes, primarily vetch, cover large areas during the winter season in the regions. Annual forage crops cultivation is common under dry farming conditions in the North-Eastern Anatolia and upward part of the West Black Sea regions because natural hay meadows and perennial forage crops do not meet roughage gap during the long feedlot period.

Table 2. Meadow, rangeland and forage crops covered areas and total production by agro-ecological regions. TUIK (2010) values

Regions†	Area (ha)				Production (ton)				Demands
	Meadows	Rangelands	Forage crops		Meadows	Rangelands	Forage crops	Total production	
			Area	Ratio††					
NE Anatolia	484,071	2,748,321	306,294	24.2	1,936,285	1,648,993	1,046,245	4,631,523	4,449,774
ME Anatolia	343,695	2,020,073	239,342	18.6	1,202,932	1,212,044	862,701	3,277,677	3,723,507
SE Anatolia	47,944	964,632	44,237	1.4	191,776	482,316	181,142	855,234	3,470,580
West Marmara	26,257	389,478	87,317	5.3	105,026	272,635	715,827	1,093,488	3,505,686
East Marmara	52,827	750,055	204,133	7.1	237,719	450,033	1,582,995	2,270,747	5,670,378
Aegean	51,383	544,483	98,848	7.1	231,224	353,914	654,706	1,239,844	2,285,253
Western Anatolia	75,984	1,339,556	62,679	1.8	227,952	535,822	463,170	1,326,944	2,585,740
Mediterranean	44,888	614,446	83,728	3.4	224,438	399,390	422,188	1,046,016	3,382,500
Central Anatolia	78,064	2,500,009	168,350	4.2	234,192	1,125,004	793,533	2,152,729	3,332,698
West Black Sea	42,232	740,024	146,933	6.9	211,158	592,019	701,806	1,504,983	3,509,494
East Black Sea	201,969	556,297	19,593	3.0	1,009,847	556,298	60,673	1,626,818	1,087,864
Total	1,449,313	13,167,375	1,461,454	8.6	5,812,549	7,628,467	7,483,986	20,925,002	37,003,475

†NE: North-Eastern, ME: Middle-Eastern, SE: South-Eastern.
††Share in the total sowing area.

Table 3. Forage crops sowing area (ha) and production (kg) in Turkey. TUIK (2010) values

Regions†	Alfalfa		Sainfoin		Annuals		Maize		Total	
	Sown	Product.	Sown	Product.	Sown	Product.	Sown	Product.	Sown	Product.
NE Anatolia	153,190	712,987	67,817	151,163	81,506	137,122	3,781	44,973	306,294	1,046,245
ME Anatolia	193,658	727,320	20,346	45,099	22,528	64,973	2,504	25,308	239,036	862,700
SE Anatolia	6,827	28,554	1,766	2,033	25,930	49,866	9,714	100,940	44,237	181,393
West Marmara	9,711	81,506	449	1,540	25,890	70,134	50,630	562,647	86,680	715,827
East Marmara	22,828	103,766	1,918	4,747	28,849	62,272	45,069	483,447	98,664	654,232
Aegean	40,510	323,061	3,322	9,044	67,316	199,037	91,677	1,051,853	202,825	1,582,995
Western Anatolia	24,013	251,278	3,212	9,669	21,115	42,845	14,282	159,379	62,622	463,171
Mediterranean	11,531	74,840	2,729	6,060	45,632	95,820	23,436	245,468	83,328	422,188
Central Anatolia	76,501	442,436	45,255	119,583	32,250	64,742	14,293	166,772	168,299	793,533
West Black Sea	20,780	145,825	7,880	22,360	82,755	227,717	35,399	305,905	146,814	701,807
East Black Sea	93,200	27,620	2,387	5,936	5,020	10,221	2,557	15,041	103,164	58,818
Total	568,849	2,919,193	157,081	377,234	438,791	1,024,749	293,341	3,161,733	1,458,062	7,482,909

†NE: North-Eastern, ME: Middle-Eastern, SE: South-Eastern.

V – Roughage supply and demand in Turkey

Turkey has 10.14 million AU livestock and year-round roughage demandt is about 37.0 million tones. The average altitude is about 1000 m in the country and grazing season is roughly 180 days (Altin *et al*., 2011). About 7.5 million AU obtain their feed from rangeland and roughly their demand is 13.5 million tones roughage whereas the rangelands supply about 7.6 million tones roughage. Thus, there is a big roughage gap during the grazing season in the country as a whole. This gap is compensated with poor quality feed grazed stubble, fallow or abandoned fields and understory vegetation (orchards and forests).

Approximately, 2.64 million AU cattle are risen in intensive system or barn during the year-round in the country and their roughage needs during summer season reaches 4.75 million tones. These demand is met from forage crop production in the cropping system. In addition to summer demand, there is a 18.75 million tones roughage demand during the winter period and the total roughage needs for barn feeding is about to 25.5 million tones. The total production from hay lands (meadow plus forage crop cultivation) is about 13.3 million tons in the country. In this case, there is a 12.2 million tones roughage gap in the country. There are some alternative roughage sources, such as vegetable residues, sugar beet leaf and pulp and fruit garden understory, which account for an amount of about 5.0 million tones. Finally, 7.2 tons of roughage gap are compensated by cereal straw.

VI – The problems with animal husbandry

The problems can be summarized under three categories:

(i) Rangelands. Since the establishing of Republic of Turkey, it have been occurred a significant shrinkage of the rangelands area (from 44.50 to 13.17 million ha). As a result of this shrinkage, grazing pressure gradually increased on the rangelands because forage crops acreage has not increased in this period. Hence, overgrazing, which has been continuous for at least 5 or 6 decades (Koc *et al*., 2000) is the main problem of the rangelands. As a result of continued overgrazing for decades, the vast majority of the rangelands in the country is poor or fair range condition class. This is not a personal or general presumption, this fact has also been estimated by a research conducted on countrywide using satellite imaginary (Avag *et al*., 2012).

In addition to overgrazing, early and late season grazing is another problem with the rangelands. Traditionally, animal raisers tend to graze rangelands as long as climatic conditions are favorable for grazing on the rangelands and grazing season is lasted least two months. This is extremely harmful because range plants are under grazing pressure during both spring and autumn critical periods (Koc and Gokkus, 1997).

The grazing systems applied are not considering plant growth dynamics. Traditionally, herder grazing system is used in all rangelands in the country. Herder profession is generally done by uneducated and poor peoples. If herders were trained about animal feeding, and range and herd management they could take some measurements with respect to prevent overgrazing, early grazing and could practice a more skilful grazing, planning intensity and other factors.

There are 15.4 million ha areas officially classified as undefined areas. The vast majority of these areas is comprised of denuded rangeland areas due to overgrazing. These areas might be reclaimed using herbaceous plants or shrubs establishment. But there is not scientific information about this topic in the country and also seed and seedling material is lacking.

(ii) Forage crops. Forage crop sowing areas have been increased about four fold (from 2.0% to 8.6%) for last two decades due to governmental incentives. But there is still a serious forage gap in the country. In general, the farmers who are primarily interested in animal raising have not enough cultivation area and large land owners are generally not interested in animal raising and they are not willing to cultivate forage crops because they do not find a reliable market. On the other hand, plant residuals, especially cereal straws, have a good market value in the country.

Late cutting and spring grazing is the main problem with natural hay meadows. The grazing at the beginning of the growth period cause at least a decreasing of 30% of hay production in natural meadows (Gokkus, 1989). Farmers delay hay harvest date up to plant color turn from green to yellow, thus, digestibility of harvested hay decreased at least 50% (Akyildiz, 1957).

Turkey has different agro-ecological regions but there is not enough high yielding forage crop cultivars for every region because plant improvement studies are quite limited and it has been concentrated on a few plants such as alfalfa, vetch and pea.

There is not enough forage seed production in the country. Hence, forage seed demand is provided from international markets but there is not enough control. Hence, unstandard seeds are sold by seed markets, and especially, cultivar adaptation test have not done.

(iii) Animal raising. There is not domestic large ruminant breed race in the country. High yielding cattle breeds requested by the producers are provided by international markets. For example a quite big number Angus breed were introduced and distributed to farmers without performing any adaptation test during last two years.

The vast majority of our animal productions is provided by traditional animal raising enterprises. They do not aware of maintenance nutrition needs and welfare of animals. They keep their animals in unhealthy (unventilated, unlighted) barns during the long feedlot period and they use mainly straw in animal rations, which is too far to meet maintenance demand of animals, during the long feedlod period. Hence, range depending herds reach the spring under metabolically ruined conditions and the animals try to repair their metabolism in the beginning of the grazing season. As a result of this mistake, the high quality spring forage is not turned to animal product.

VII – Recommendations related to range, forage and animal production in Turkey

It is essential to determine the grazing season, the carrying capacity and suitable grazing systems to sustainably use the natural rangelands. Grazing season and carrying capacity can be determined for every rangeland sites using vegetation index values and range condition scores estimated by the National Range Management Project using satellite imaginary which are available at Ministry of Food, Agriculture and Animal Husbandry data base. The determination of suitable grazing systems and animal types for each rangeland types is a seriously necessity for Turkish rangelands.

Degraded rangelands and officially undefined areas cover a large area, hence, erosion is a serious problem in the country. Reclamation and rehabilitation of these areas are urgent and necessary to alleviate the erosion problem and overgrazing on the rangelands. For this purpose, to determine suitable rehabilitation techniques and to develop suitable plant material are priorities.

Although forage crops sowing areas increased seriously in last decades owing to governmental incentives in forage crop production, there are still serious roughage gap in some agro-ecological regions (SE Anatolia, Marmara, Mediterranean, Aegean and West Black Sea) because forage crops cannot compete economically with cash crops under current incentives in these regions. Therefore, establishing a hay stock market, which covers all around the country in trading, is crucially important for sustainable animal production. By this way, large land owners, who are not interested in animal production, can contribute to forage crop production as they can allocate large areas for forage crops in rotation systems if they find a reliable and profitable market. It is essential to determine roughage prices considering feed quality in this organization.

Seed production and seed trade problems with forage crops are to be urgently solved. Especially, it is important to be given priority to develop new cultivars for each agro-ecological region.

In natural hay meadows, spring grazing has to be stopped and the cutting stage has to be arranged considering hay quality.

In rangeland depending animal husbandry, animal producers should be trained on animal feeding, race selection and barn comfort. At least, animal producer should be aware of maintenance needs of animals and optimal barn climatic conditions. At a national scale, to develop suitable animal races, which efficiently transform rangeland resources, should be a main policy and new races should never be imported without doing adaptation tests.

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