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Abstract. A great portion of the grassland in Antalya is in poor condition due to long dry period in summer season and improper range management practices. In this work three highland pastures, 3800 ha in total, and three coastal pastures 175 ha in total were studied, and hay yield improvement was aimed. At the beginning all coastal pastures and highland ranges were covered with fences, to control grazing periods. All pastures were fertilized in different seasons during program. In some parts of controlled pastures, seed mixtures were sown. The first year of the study all pastures were closed for grazing animals. The following years animals were grazed from May-October. Bushes and unflavoured plants were cut to give a better growing chance to favour grasses. Loop and 1 m. frame methods were used to obtain, hay yields, average plant covered areas %, and botanical composition in all coastal pastures and highland ranges. As a result, all data were shown improvement of all pastures were satisfactory, but coastal pastures observed better behaviour than highland ranges in all determined characteristics.

Keywords. Coastal pastures – Highland ranges – Hay yield - Botanical composition – Plant-covered area.

Programmes d'amélioration des pâturages menés sur des prairies côtières et des parcours montagneux d'Antalya

Résumé. *Une grande partie des pâturages d'Antalya sont en mauvais état dû à une longue période de sécheresse en été et à des pratiques peu appropriées de gestion des parcours. Dans ce travail, trois pâturages de montagne d'une surface totale de 3800 ha, et trois pâturages côtiers d'une surface totale de 175 ha, ont été étudiés en vue d'améliorer le rendement en foin. On a commencé par poser des clôtures dans tous les pâturages côtiers et parcours de montagne afin de contrôler les périodes de pâturage. Tous les pâturages ont été fertilisés à différentes saisons au cours du programme. Un mélange de semences a été semé dans certaines parties des pâturages contrôlés. Pendant la première année de l'étude, tous les pâturages étaient interdits aux animaux brouteurs. Lors des années suivantes on faisait paître les animaux de mai à octobre. Les buissons et les plantes non appétentes étaient coupés afin de favoriser la croissance des graminées. Les méthodes de la boucle et du cadre de 1 m étaient utilisées pour étudier les rendements en foin, le pourcentage moyen de couverture végétale des zones, et la composition botanique sur tous les pâturages côtiers et les parcours de montagne. Comme résultat, toutes les données ont montré une amélioration satisfaisante pour tous les pâturages, mais on a observé pour les pâturages côtiers un meilleur comportement que pour les pâturages de montagne pour toutes les caractéristiques déterminées.*

Mots-clés. *Pâturages côtiers – Parcours de montagne – Rendement en foin – Composition botanique – Zone couverte de végétation.*

I – Introduction

For the animal production, livestock enterprises basically are in need of quality roughage, which is the cheapest source of animal feed. Moreover, keeping pastures and meadows in good condition prevent water and wind erosion of soil.

Lacking of an independent pasture law, pastures areas could not be well controlled and most of pastures and meadows were sown for producing cereals during the last decades. Finally 44 million hectares of pasture land has dropped dramatically to 12.3 million hectares in Turkey.

In addition, early and excessive grazing practices for many years have impoverished pastures. So as a result of this practices hay yields of meadows and pastures were decreased.

At the year of 1998 a detailed pasture law was accepted at Turkish National Assembly. Firstly, the process of characterization and determination of pastures is important for keeping them safe and implement some necessary processes for increasing their production. Protecting pastures can help decreasing effects of global warming (Anonymous, 2010).

Pasture improvement and management activities in Antalya (5 in 2004, 1 in 2006, 1 in 2007 and 2 in 2009), continues with a total of 9 projects. This projects are implemented on the pastures of the villages of Yenidumanlar, Yurtpınar, Aşağıoba, Yağca, Kovanlık, Imırcık, Eymir, Eynif and Küçükköy.

The better parts of pastures were planted mixture of legumes and grasses. Suitable and grazing resistant, productive legumes and grasses were chosen for grazing of cattle and sheep. Fertilizers were used, and grazing period were limited.

In this study pastures conditions were determined at three coastal pastures and tree highland pastures of Antalya.

II – Materials and methods

Rangelands and pastures located in Antalya Province were surveyed for vegetation cover, botanical composition and forage yield. Six rangelands (three rangelands to represent coastal zone and three rangelands to represent highland zone) were chosen for the improvement program.

Rangelands chosen to represent coastal zone are Yenidumanlar, Aşağıoba and Yağca rangelands. Eymir, Eynif and Küçükköy rangelands were selected to represent highland zone. Yenidumanlar is located in Aksu district approximately 25 km east of Antalya. Aşağıoba and Yağca rangelands are located in Döşemealtı district approximately 20 km north of Antalya. Eymir is located in Elmalı district, 120 km west of Antalya and at a location of 1000 m above sea level. Eynif is located in İbradı district 180 km North-east of Antalya and 1050 m above sea level. Küçükköy is located in Korkuteli district, 85 km west of Antalya and at 1400-1500 m above sea level. Antalya has a Mediterranean climate, with mild, rainy winters and hot, dry summers. According to climate data, coastal zone has typical Mediterranean climate but highland zone has typical continental climate. Main winds flow from south and north directions. Wind speed is the highest in winter. Average temperature is 18°C and average relative humidity is 60,6% in Antalya.

Rangeland improvement studies were conducted for four years (2004-2008). Treatments applied in rangelands are presented below for each rangeland, separately.

Yenidumanlar. Rangeland was fenced wit wire completely and grazing was stopped. Drainage system was cleaned and renewed. Bush and shrubs were removed in certain parts of meadow. These areas were tilled and prepared seedbed and seed were sown. Soil was cultivated with minimal tillage techniques in other part of rangelands. Sprinkler irrigation system was established on rangeland. A seed mix including smooth brome (*Bromus inermis* Leys), Kentucky bluegrass (*Poa pratensis*), Bermuda grass (*Cynodon dactylis*), alfalfa (*Medicago sativa* L.), bird's-foot trefoil (*Lotus corniculatus*) and red clover (*Trifolium pratense*) was sown in 2005 autumn. 170 kg/ha diammonium phosphate (DAP) was applied during the sowing. 100 kg/ha ammonium nitrate was applied in early spring (Gençkan 1985). Yenidumanlar rangeland was

not used in the first year of improvement study. The rangeland was opened to grazing in order to grazing plan and other management rules in the second year of improvement study.

Aşağıoba. Rangeland was fenced completely, an irrigation pond was made and sprinkler irrigation system was established on rangeland. Weeds were cleaned with hoe and seedbed prepared. Seed mix including smooth brome, Kentucky bluegrass, orchard grass (*Dactylis glomerata*), crested wheatgrass (*Agropyron cristatum*), sheep's fescue (*Festuca ovina*), çayır düğmesi (*Potaryum songisorba*), bird's-foot trefoil, red clover and crimson clover (*Trifolium incarnatum*) was sown. Seeding rate was 21.9 kg/ha (Bakır 1985). 170 kg/ha DAP was applied during the sowing, and 100 kg/ha ammonium nitrate was applied in early spring.

Yağca. Rangeland was fenced completely. Bushes were removed from a part of rangeland and over-seeded in that site. Soil was cultivated in a part of meadow, and a seed mix was sown in that site. The rest of the rangeland was left in natural state as a goat rangeland. Sprinkler irrigation system was established on rangeland. The seed mixture included red clover, bird's-foot trefoil, alfalfa, smooth brome, orchard grass and perennial ryegrass (*Lolium perenne*). Seeding rate was 22 kg/ha. 170 kg/ha DAP fertilizer was applied during the sowing and 100 kg/ha ammonium nitrate was applied in early spring.

Eymir. Rangeland was fenced completely and separated to three paddocks for rotational grazing. Weed control was done with chain and cutting. Soil was cultivated with minimal tillage techniques and a seed mixture (13,7 kg/ha) was sown in 2006. Seed mixture included red clover, bird's-foot trefoil, alfalfa, smooth brome, orchard grass and sheep's fescue. 220 kg/ha DAP fertilizer was applied during the sowing and 120 kg/ha ammonium nitrate was applied in early spring. Rangeland was not used in the first year of study and opened to grazing in order to grazing plan and other management rules in the second year.

Küçükköy. Broadcasting seeding was done on 750 ha existing vegetation in Küçükköy rangeland. The seed mixture included red clover, bird's-foot trefoil, sainfoin, smooth brome, crested wheatgrass and sheep's fescue. Seeding rate was 13.7 kg/ha. 120 kg/ha DAP fertilizer was applied during the sowing and 60 kg/ha ammonium nitrate was applied in early spring.

Eynif. A Grazing plan was prepared for rotational grazing and the rangeland was used in order to this plan.

All of the seed mixtures used in improvement studies were selected to suit for existing species on natural vegetation.

Vegetation cover percent, botanical composition and forage yield were determined for each rangeland in second year of rangelands improvement program.

Vegetation cover was recorded at five sites along three loops for each rangeland (Avcıoğlu, 1983). The identified species were classified according to their families: legumes, grasses and other plant species for botanical composition. Vegetation in a 1 x 1 m frame was clipped at 3 to 5 sites and weighed for forage yield determination. Forage samples were dried at 65ºC for 48 hours and were weighed for dry matter yield.

III – Results and discussion

Vegetation covered area, botanical composition and forage yield were recorded using loop method and 1 x 1 m frame method in order to determine effects of improvement practices and management on rangelands during the grazing season (Table 1).

According to results of improvement studies, vegetation covered area ranged from 77.4% to 95%. However, vegetation covered area ranges from 10% to 27% on not improved rangelands in Turkey (Bakır ve Açıkgöz, 1979). These results show that improved rangelands were better situation after improvement studies.

Forage yields were higher in coastal zone rangelands than in highland rangelands. The highest forage yield was obtained from Yağca (30,400 kg/ha) and the lowest forage yield was obtained from Eynif (8500 kg/ha). Tung *et al.* (1991) compared 5 different improvement methods in Doğanbey and the highest forage yield was obtained from Çıfıt Castle I (2720,7 kg/ha) and from Payamlı region (6645 kg/ha). Tetik *et al.* (2002) compared different rangeland improvement methods and the highest forage yield was 8741.9 kg/ha. These results agree with our result obtained from Eynif.

Table 1. Vegetation covered area, botanical composition, yield and quality traits of rangelands

Regions	Rangelands	VCA (%)	BC (%)	FY (kg/ha)	DMY (kg/ha)	Lgm/DMY (kg/ha)	Grs/DMY (kg/ha)	OPS/DMY (kg/ha)
Coastal Zone	Yenidumanlar	95.0	Lgm:13 Grs:39 OPS:48	18100	5340	580	2000	2760
	Aşağıoba	77.4	Lgm:19 Grs: 46 OPS:35	27670	9545	951	1852	6743
	Yağca	90.4	Lgm:51 Grs:16 OPS:33	30400	7803	3425	439	2802
Highland Zone	Eymir	79.4	Lgm:36 Grs: 34 OPS:30	14830	4399	1491	1496	1412
	Küçükköy	92.3	Lgm:13 Grs:59 OPS:28	21500	5122	849	2703	1570
	Eynif	79.4	Lgm:55 Grs:10 OPS:35	8500	1940	889	324	820

VC: Vegetation Covered Area; BC: Botanical Composition; FY: Forage Yield; DMY: Dry Matter Yield; Lgm: Legumes; Grs: Grasses; OPS: Other Plant Species.

Hay yields determined in our study were higher than average hay yields (300- 900 kg/ha) of Turkey rangelands (Bakır ve Açıkgöz, 1979). The highest hay yield was determined in Aşağıoba (9545 kg/ha) and lowest hay yield was obtained from Eynif (8500 kg/ha). Yılmaz *et al.* (1999); conducted a research to determine yields of a heavy grazing and a light grazing rangeland in Van. They obtained 1741.4 kg/ha hay from light grazing rangeland and 630.8 kg/ha hay from heavy grazing rangeland. Tükel *et al.* (1991); obtained 1096.1 kg/ha hay from protected rangeland from grazing and 534.6 kg/ha hay from grazing rangeland in early summer in Çukurova University Campus. Polat *et al.* (1996) conducted a rangeland improvement study and they determined hay yield of protected rangeland as 1531.7 kg/ha in Tektek Mountains in Şanlıurfa.

IV – Conclusions

The results of the study showed that breeding studies carried out on pastures of Antalya increased quality and yield. It is also important for the sustainability of the vegetation to take into account the natural vegetation available in the target pasture, when deciding the composition of seed mixtures in the over seeding system.

As a result, determination of the plant species in the target pasture and organizing breeding studies according to the natural vegetation should be used.

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