

Nutritive values of common plant species on natural grassland in Kızılırmak Delta

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Abstract: The aim of this study was to determine the monthly changes of nutritive values of plant species of natural grassland in Kızılırmak Delta listed under the Ramsar Convention which is natural habitat of Anatolian buffalos. Collected plant species from four different points were *Smilax excelsa* (*S.excelsa*), *Trifolium campestre* (*T.campestre*), *Tamus communis* (*T. communis*), *Salvia verbenaca* (*S.verbanaca*), *Plantago lanceolata* (*P.lanceolata*), *Agropyron repens* (*A.repens*), *Juncus acutus* (*J.acutus*) and *Carum carvi* (*C.carvi*). Nutritive values of monthly collected plant species were determined. The percentage of availability of *J.acutus* which is the most common wetland plant was higher (34.62%) than other plant species on natural grassland in Kızılırmak Delta. However, *P.lanceolata* was the highest as herb species (18.27%). There were no differences among mean values of ash, crude protein, acid detergent fibre, neutral detergent fibre and metabolizable energy of monthly collected plant species ($P>0.05$). Moreover, mean zinc, copper, iron, magnesium and calcium levels were not significantly different in monthly collected and combined plant species ($P>0.05$). Se levels were found significantly ($P<0.05$) and toxic. As a result, monthly nutrient supplies of plant species on

natural grassland have not been fluctuated from April to October. However, energy and protein supplementation and Se toxicity tests may be required for reaching potential productivity for Anatolian buffalo during grazing season on natural grassland of Kızılırmak Delta.

Keywords: Kızılırmak Delta, natural grassland, nutrients, plant species

Kızılırmak Deltası meralarında yetişen bazı bitki türlerinin besin madde değerleri

Öz: Bu çalışmada Türkiye’de bulunan bir doğal deltada hayvanların ekstansif olarak beslenmesinde kullanılan doğal bitki türlerinin besleyicilik değerlerinin yıl içindeki aylık değişiminin saptanması amaçlanmıştır. Delta içinde dört farklı noktadan toplanan bitkilerin *Smilax excelsa* (*S.excelsa*), *Trifolium campestre* (*T.campestre*), *Tamus communis* (*T. communis*), *Salvia verbenaca* (*S.verbanaca*), *Plantago lanceolata* (*P.lanceolata*), *Agropyron repens* (*A.repens*), *Juncus acutus* (*J.acutus*) ve *Carum carvi* (*C.carvi*) türlerine ait olduğu belirlenmiştir. *J.acutus* türünün deltadaki doğal merada en sık (%34.62) rastlanan sulak alan bitkisi olduğu ve toprak alanda ise *P.lanceolata*’nın en yüksek değerde (%18.27) olduğu görülmüştür.

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Aylık olarak toplanan bitkilerde ham kül, ham protein, asit deterjan fiber, nötral deterjan fiber ve metabolize olabilir enerji değerleri arasında istatistiksel farka rastlanmamıştır ($P>0.05$). Ortalama çinko, bakır, demir, magnezyum ve kalsiyum değerlerinde istatistiksel anlamda farklı olmadığı ($P>0.05$) Se değerinde ise anlamlı fark olduğu görülmüştür ($P<0.05$). Sonuç olarak ruminantların ekstansif olarak beslendiği Nisan-Ekim ayları arasında deltadaki yem olarak tüketilen bitki türlerinde Se hariç besin maddeleri değerliğinin önemli oranda değişmediği ($P>0.05$) saptanmıştır. Ancak özellikle Anadolu Mandalarının doğal beslenme alanı olan deltada enerji ve protein yönünden katkı yapılmasının ve Se toksisitesinin araştırılması gerektiği ve bu uygulamanın manda ve ürünlerinin üretiminin artırılmasını destekleyeceği kanısına varılmıştır.

Anahtar sözcükler: Besin maddeleri, bitki türleri, Kızılırmak Deltası, mera

Introduction

Conservation the biodiversity of natural grassland is essential for grazing animals to gain maximum benefit from plant species. Climate type and the amount of rainfall affect the types of plant species in a location. Generally, quality of plant species of grassland is depend on crude protein (CP), acid detergent fibre (ADF), neutral detergent fibre (NDF), ash, lignin, lipid, metabolizable energy (ME) and organic matter digestibility (OMD) (14).

Different protection statuses with various boards are identified to protect the wild life in Kızılırmak Delta where is located in the Central Black Sea Region of Turkey. Kızılırmak Delta was listed as Ramsar Site in 1998 under the Ramsar Convention. Anatolian water buffalo is essential for pasture vegetation,

lake sedimentation, and wetland ecosystem just like birds and fish. Water buffalo is one of the important components of Kızılırmak Delta due to rolling dispersion of many wetland plants recreating of the reed beds and providing protected areas for bird nests. Anatolian buffalo nutrition depends argely on natural grassland grazing in Kızılırmak Delta. Kızılırmak Delta has the biggest Anatolian buffalo population of Turkey with 4087 heads of animal (23).

Kızılırmak Delta has a salty water and soil and is a natural habitat for Anatolian buffalo production system from April to October when the buffalos are allowed to natural grassland. Even though natural grassland grazing in Kızılırmak Delta offers versatile advantages for supplying variable forage sources for buffalo nutrition, there is no published report available on nutritive values of plant species. Determination of the nutritional value of forages in pasture feeding is very essential for natural grassland feeding system. Thus, the aim of the study was to determine the monthly availability of plant species and their nutrient composition in natural grassland of Kızılırmak Delta from April to October.

Material and Methods

Sample collection and chemical analysis: Plant species *S.excelsa*, *T.campestre*, *T.communis*, *S.verbenaca*, *P.lanceolata*, *A.repens*, *J.acutus* and *C.carvi* were collected from Kızılırmak Delta, Samsun Province of Turkey between April and October in 2011.

Plant species were collected from three locations selected in Kızılırmak Delta. Each location has four points and every point has 4 m² space surrounded by wire mash. According to GPS (Global Positioning System) data, coordinates of the locations were 41°

38°51.7'N 36°04'43.3"E, 41°38'53.8"N 36°04'49.0"E, 41°37'34.5"N 36°06'36.1"E and 41°37'35.9"N 36°06'38.8"E. Nutrient compositions of plant samples were carried out in the laboratories of Ondokuz Mayıs University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases. Minerals; zinc (Zn), copper (Cu), iron (Fe), magnesium (Mg) and calcium (Ca) levels of plant samples were determined by atomic absorption spectrophotometer (Perkin Elmer Analyst 100) and selenium (Se) levels were determined by Graphite Furnace Atomic Absorption (GFAA) method in the laboratory of Samsun Veterinary Control Institute. Dry matter (DM), ash and crude protein (CP) contents of plant species were analyzed according to AOAC (1990) (24). Metabolizable energy (ME) values of plant samples were calculated by TSE (1991) (24).

Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were analyzed by using ANKOM A220 Fiber Analyzer according to Van Soest and Robertson (26) and Goering and Van Soest, (12) respectively.

Statistical analysis: Descriptive statistic analysis was used to calculate means and Standard Error (SEM) of nutrient values of groups. Differences between groups were compared by one-way analysis of variance (ANOVA) after testing the data in terms of homogeneity of variance and normal distribution to fit all the assumptions of ANOVA. Analysis and calculations were done using SAS 9.2 (2006) computer program (20).

Results

Monthly availability (%) and number (n) of plant species in natural grassland from April to October was shown in Table 1. Some of plant species were not available in several months in natural grassland. *S.excelsa*, *T.campestre*, *T.communis*, *S.verbenaca*, *P.lanceolata*, *A.repens*, *J.acutus* and *C. carvi* were common plant species in delta. The broad distribution and the percentage availability of natural grassland during grazing season from April to October in 2011 were following herb species; *J.acutus*, *P.lanceolata*, *S.excelsa* and *T.communis*. The percentage of availability of *J.acutus* which is the most common wetland plant was higher (34.62%) than other plant species. However, *P.lanceolata* was the highest as herb species (18.27%) among concerned pasture species.

Mean ash, CP, ADF and NDF (%) and ME (KJ/kg DM) values of each plant species collected from delta was shown in Table 2.

T. campestre was determined to have the highest CP value (20.96 %) and low ADF value (27.41%). The obtained data shows that this plant species is an important source for supplying CP to natural grassland in buffalo nutrition. *S. excelsa* was observed on natural grassland in delta during the 7 months from April to October with the share of 11.54%. Mean CP value of *S.excelsa* was 16.14%. *T. campestre* which was randomly observed in pasture and its energy value was 9.93MJ/kg DM.

Table 1: Monthly availability (%) and number (n) of plant species in natural grassland from April to October 2011**Tablo 1:** Nisan-Ekim 2011 tarihlerinde meradan alınan bitk türlerinin aylık miktarları (% ,n)

Plant	April	May	June	July	August	September	October	Total
<i>S. verbenaca</i>	0.96	0.96	0.96	NA	NA	NA	NA	2.88
<i>A. repens</i>	0.96	0.90	0.96	0.96	0.96	0.96	1.92	7.69
<i>J. acutus</i>	4.81	2.88	4.81	4.81	4.81	6.73	5.77	34.62
<i>C. carvi</i>	NA	NA	1.92	2.88	2.88	NA	NA	7.69
<i>S.excelsa</i>	2.88	3.85	1.92	0.96	0.96	0.96	NA	11.54
<i>T. communis</i>	1.92	1.92	0.96	0.96	0.96	1.92	1.92	10.58
<i>P. lanceolata</i>	1.92	2.88	1.92	2.88	1.92	2.88	3.85	18.27
<i>T. campestre</i>	0.96	0.96	0.96	0.96	0.96	0.96	0.96	6.73
Total								100
Number of plants species in natural grassland								
<i>S. verbenaca</i>	2	2	2	NA	NA	NA	NA	6
<i>A. repens</i>	2	2	2	2	2	2	4	16
<i>J. acutus</i>	10	6	10	10	10	14	12	72
<i>C. carvi</i>	NA	NA	4	6	6	NA	NA	16
<i>S.excelsa</i>	6	8	4	2	2	2	NA	24
<i>T. communis</i>	4	4	2	2	2	4	4	22
<i>P. lanceolata</i>	4	6	4	6	4	6	8	38
<i>T. campestre</i>	2	2	2	2	2	2	2	14
Total	30	30	26	30	28	30	30	208

NA: Not available

Table 2: Mean ash, CP, ADF and NDF (%) and ME (MJ/kg DM) values of each+ plant species collected from April to October 2011 in Kızılırmak Delta**Tablo 2:** Kızılırmak Deltasından Nisan-Ekim 2011 tarihleri arasında toplanan bitki türlerinin ortalama Ham Kül, Ham Protein, NDF (%) ve ME (MJ/kg KM) değerleri

Plant	n	Ash $\bar{X} \pm S_{\bar{x}}$	CP $\bar{X} \pm S_{\bar{x}}$	ADF $\bar{X} \pm S_{\bar{x}}$	NDF $\bar{X} \pm S_{\bar{x}}$	ME $\bar{X} \pm S_{\bar{x}}$
<i>S. verbenaca</i>	6	4.98 \pm 2.19	3.88 \pm 0.39	37.46 \pm 4.59	46.99 \pm 4.82	8.78 \pm 0.36
<i>A. repens</i>	16	9.95 \pm 0.52	10.29 \pm 1.10	29.55 \pm 0.49	58.87 \pm 1.83	10.09 \pm 0.90
<i>J. acutus</i>	72	4.43 \pm 0.09	4.85 \pm 0.59	48.81 \pm 0.54	74.83 \pm 1.26	6.89 \pm 0.81
<i>C. carvi</i>	16	5.72 \pm 1.84	4.68 \pm 1.50	28.00 \pm 3.91	45.28 \pm 4.82	10.19 \pm 0.45
<i>S.excelsa</i>	24	7.67 \pm 0.89	16.14 \pm 2.03	33.63 \pm 2.83	43.82 \pm 3.98	9.41 \pm 0.56
<i>T. communis</i>	22	11.36 \pm 0.70	13.98 \pm 0.91	31.43 \pm 0.85	37.10 \pm 0.44	9.78 \pm 0.03
<i>P. lanceolata</i>	38	16.49 \pm 0.50	13.72 \pm 0.55	32.43 \pm 1.45	33.93 \pm 1.47	9.61 \pm 0.89
<i>T. campestre</i>	14	16.25 \pm 0.99	20.96 \pm 0.79	27.41 \pm 1.10	36.90 \pm 0.79	9.93 \pm 0.47

DM: Dry Matter, CP:Crude Protein, ME: Metabolizable energy, ADF: Acid detergent fiber, NDF: Neutral detergent fiber

The determined mean ash, CP, ADF and NDF (%) and metabolizable energy (MJ/kg DM) values of monthly collected and combined plant species were not changed significantly ($P>0.05$) from April to October in 2011 (Table 3).

Mean ash content of each plant species collected and combined from Kızılırmak Delta between April and October ranged from 8.44 to 11.06% and mean CP content changed from 8.16 to 15.10% in the study (Table 3). There are no differences among monthly mean CP values of combined plant species. The highest

and the lowest values of CP were obtained in April and September, respectively.

In our study, mean ADF and NDF contents changed between April and October from 31.27 to 39.12% and from 37.96 to 58.34%, respectively (Table 3). Even though, there are no differences among monthly mean ADF and NDF values of combined plant species, the highest ADF (39.12%) was in September and NDF value (58.34%) was in October. Mean ME value between April and October ranged from 7.91 to 8.94 MJ/kg DM in the present study (Table 3).

Table 3: Mean ash, CP, ADF and NDF (%) and metabolizable energy (MJ/kg DM) values of monthly collected from April to October 2011 and combined plant species

Tablo 3: Nisan-Ekim 2011 tarihleri arasında toplanan ve karma yapılan bitki türlerinin ortalama Ham Kül, Ham Protein, NDF (%) ve ME (MJ/kg KM) değerlerinin aylara göre değişimi

Month	n	Ash $\bar{X}\pm S\bar{x}$	CP $\bar{X}\pm S\bar{x}$	ADF $\bar{X}\pm S\bar{x}$	NDF $\bar{X}\pm S\bar{x}$	ME $\bar{X}\pm S\bar{x}$
April	30	10.36 \pm 1.32	13.61 \pm 1.77	37.86 \pm 2.52	51.94 \pm 5.20	8.66 \pm 0.10
May	30	10.98 \pm 1.13	15.10 \pm 1.78	31.27 \pm 1.89	37.96 \pm 4.38	9.76 \pm 0.08
June	26	8.44 \pm 1.30	9.96 \pm 1.25	36.38 \pm 3.48	47.56 \pm 5.51	7.91 \pm 0.16
July	30	11.06 \pm 1.51	11.03 \pm 1.20	36.46 \pm 2.50	50.14 \pm 4.47	8.94 \pm 0.10
August	28	9.37 \pm 1.13	9.59 \pm 1.65	36.55 \pm 2.68	51.53 \pm 4.21	8.82 \pm 0.01
September	30	9.92 \pm 1.42	8.16 \pm 1.57	39.12 \pm 2.50	58.04 \pm 5.18	8.50 \pm 0.10
October	30	10.39 \pm 1.43	9.167 \pm 1.69	37.51 \pm 2.30	58.34 \pm 5.46	8.71 \pm 0.09
P		0.5860	0.3624	0.467	0.954	0.4608

DM: Dry Matter, CP: Crude Protein, ME: Metabolizable energy, ADF: Acid detergent fiber, NDF: Neutral detergent fiber

In the natural grassland; Zn, Cu, Se, Fe, Mg and Ca levels of monthly collected and combined plant species were not changed significantly ($P>0.05$) from April to October

in 2011 (Table 4). Mean Zn, Cu, Se, Fe, Mg and Ca contents were at the lowest level in June.

Table 4: Mean Zn, Cu, Se (ppm) and Fe, Mg and Ca (mg/g) levels of monthly collected and combined plant species**Tablo 4:** Aylık olarak toplanan ve karma yapılan bitkilerin ortalama Zn, Cu, Se (ppm) and Fe, Mg ve Ca (mg/g) değerleri

	n	Zn (ppm)	Cu(ppm)	Se (ppm)	Fe (mg/g)	Mg(mg/g)	Ca (mg/g)
		$\bar{X} \pm S\bar{x}$	$\bar{X} \pm S\bar{x}$	$\bar{X} \pm S\bar{x}$	$\bar{X} \pm S\bar{x}$	$\bar{X} \pm S\bar{x}$	$\bar{X} \pm S\bar{x}$
April	30	16.14 \pm 1.34	6.93 \pm 1.32	6.24 \pm 0.06a	0.66 \pm 0.22	1.35 \pm 0.08	6.67 \pm 1.30
May	30	20.23 \pm 3.06	7.30 \pm 0.90	6.41 \pm 0.26a	1.28 \pm 0.23	1.55 \pm 0.03	7.88 \pm 1.44
June	26	11.00 \pm 2.53	4.58 \pm 0.82	2.70 \pm 0.42b	0.42 \pm 0.11	1.27 \pm 0.11	6.73 \pm 1.61
July	30	13.90 \pm 2.57	4.16 \pm 0.85	7.89 \pm 0.45a	0.83 \pm 0.18	1.49 \pm 0.04	7.12 \pm 1.21
Agust	28	24.93 \pm 3.12	6.84 \pm 1.29	9.19 \pm 0.44a	0.80 \pm 0.23	1.46 \pm 0.05	6.97 \pm 1.69
September	30	18.28 \pm 3.24	5.35 \pm 1.03	7.02 \pm 27ab	0.63 \pm 0.17	1.55 \pm 0.02	8.06 \pm 2.04
October	30	22.73 \pm 2.21	7.86 \pm 1.47	9.15 \pm 0.49a	0.84 \pm 0.18	1.44 \pm 0.06	8.03 \pm 1.79
P		0.145	0.9203	0.004	0.157	0.53	0.91

Zinc: Zn, Copper: Cu, Selenium: Se, Iron: Fe, Magnesium: Mg and Calcium: Ca

Discussion and Conclusion

Meadows and pastures in natural grasslands meet major nutrient requirement of grazing ruminants. Grassland of Kızılırmak Delta supplies biological diversity of plant species.

Some of plant species were not available in several months in natural grassland (Table 1). *S.excelsa*, *T.campestre*, *T.communis*, *S.verbenaca*, *P.lanceolata*, *A.repens*, *J.acutus* and *C. carvi* are common plant species in Kızılırmak Delta. The broad distribution and the percentage availability of natural grassland during grazing season from April to October in 2011 were following herb species; *J.acutus*, *P.lanceolata*, *S.excelsa* and *T.communis*. The percentage of availability of *J.acutus* which is the most common wetland plant was higher (34.62%) than other plant species on natural grassland in Kızılırmak Delta. However, *P.lanceolata* was the highest as herb species (18.27%) among concerned pasture species.

P. lanceolata is rapid to establish, grows on a wide range of agricultural soils and is tolerant of drought and of many common diseases and pests (22). *J. acutus* is the most consumed plant by buffalos because of its higher availability round the year. More recently, nutritive values of *J. acutus* have been well estimated and proposed as an alternative roughage source for ruminant animals (9).

The obtained data shows that *T. campestre* is an important source for supplying CP to natural grassland in buffalo nutrition. Estimated CP value was 20.96% of *T. campestre* and it was higher than value (17.90%) determined by Ergun et al. (10). This plant which was randomly observed in pasture and its energy value was 9.93MJ/kg DM which was similar to reported value 10.18 MJ/kg DM (10). It was determined to have low ADF value (27.41%). Salinity in delta and uncontrolled grazing may affect the nutrient values of *T. campestre* on natural grassland of delta.

Nutrient values of *P. lanceolata* are similar with the results reported by Al Mamun et.al. (4). Moreover its antibiotic effect makes it possible to use as an alternative for growth-promoting factor (19). However, this plant species is not harvested because of its bad flavor, thus it remains a limiting factor for plant species.

Mean CP value of collected samples of *S.excelsa* was 16.14%, this value is higher than reported values 4.20% (21) and 7.20% (17). The differences between our findings and reported values may be originated from different environmental conditions and different sampling time during vegetation period.

The obtained nutrient levels of *A. repensis* are different from the levels published as CP 8.90%, 6.57 MJ/kg ME, 38.30% ADF, 69.50% NDF and 11.20% ash by Naser et al., (16).

In this study, mean ash and CP values of *T.communis* were 11.36 and 13.98% respectively. Martins et al.(15) reported that *T. Communis* contains 8.62% ash and 19.10% CP. *T. Communis* is known as a good source of carbohydrate (69.30 g/100 g), its contribution to *T.communis*' shoots are in general more fibrous than the others. Also it is considered a rich plant in antioxidant phenolic components (258- 759 mg GAE/g of extract), flavonoids and β -carotene among the convolvulaceae spp. With these features, Iberian Peninsula was enhanced with this plant species since it was considered as health promoting nutrient for grazing animals (15).

The estimated ash values are quite similar to reported values ranged between 7.48 and 13.12% in pasture samples collected during

three seasons (autumn, spring and summer) by Pullanagari et al. (18).

There are no differences significant ($P>0.05$) among monthly mean CP values of combined plant species. The highest and the lowest values of CP were obtained in April and September, respectively. The mean CP level of pasture was 21.40% and also it has been emphasized that in view of the large range in values within months (27). The seasonal differences in pasture CP content were also reported in a large range by Pullanagari et al. (18).

Although, ADF represents the amount of indigestible carbohydrate, NDF is a measure of the amount of structural carbohydrate in the plant species and includes hemicellulose, cellulose and lignin components. Even though, there are no differences among monthly mean ADF and NDF values of combined plant species, the highest ADF (39.12%) was in September and NDF value (58.34%) was in October. The mean ADF and NDF values were increased from August to October in combined plant species from different three sites. Hedtcke et al. (13) were also reported that ADF and NDF values increased from October to December in most species at each site.

Mean ME value between April and October in a harmony with study of Pullanagari et al. (18) were determined that the same value ranged between 8.47 and 12.92 MJ/kg DM in pasture samples collected during three seasons (autumn, spring and summer).

Mean Zn, Cu, Se, Fe, Mg and Ca contents were at the lowest level in June. Zn content was minimum in June (11.00 ppm) and was maximum in August (24.93 ppm) during 7

months grazing period. The desired range of zinc levels considered adequate in pasture and animal feeds is 30 to 50 ppm. *P. lanceolata* is a herb species with a broad distribution in grasslands throughout the temperate World and its leaf is highly palatable to grazing animals, providing a mineral- rich forage (22). Plant species investigated were similar to reported levels of Zn, Cu, and Fe by Garmo et. Al. (11) for plant species from mountain area of Central Southern Norway. Cu level was low however Zn and Fe levels were found to be adequate for ruminants.

In present study, the level of Se was determined over the recommended amount and as variable by monthly. The natural grassland in Kızılırmak Delta is a sandy area. Trace elements such as selenium in sandy coastal areas may be deficient (7). Adequate level of selenium in pasture is 0.10 ppm, however 5.00 ppm is likely to be toxic (1). The lowest level was in June (2.70 ppm) and the highest in August (9.19 ppm). This may be linked to variable salinity concentration and pH value of soil due to the water movements of Black Sea and Kızılırmak River.

The reference value for Mg is 1.20-2.00 mg/g (10) for pastures, levels determined in our study in all concerned months were in the limits of reference levels. In a study (3) performed on different pastures of Black Sea Region mean Mg levels were determined as 3,20 mg/g DM. The results obtained in the present study for Mg was supported by suggested values of Comakli et al. (6).

In present study, mean Ca levels were over reference (10) value (2.50 – 5.00 mg/g for pastures) for adequate level of Ca for all months. High level of Ca in plant samples may be attributed to being of rich soluble Ca deposits of Kızılırmak Basin (25). Ca concentrations of pasture are lowest in the

winter and spring and highest in the summer (8) but their findings were not in agreement with that of the present study.

In conclusion, monthly nutrient supplies of plant species on natural grassland have not been fluctuated from April to October. However, energy and protein supplementation may be required for reaching potential productivity for Anatolian buffalo during grazing season on natural grassland of Kızılırmak Delta.

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References

1. **Agrifert** (2014): *Animal health*. available at <http://www.agrifert.co.nz/content/12/18/> Accessed October 2014.
2. **Akgun A, Yazici F** (2012): *In Traditional buffalo yogurt*. Samsun Symposium. Vol III, P.255-262. Ceylan offset, Samsun, Turkey. (article in Turkish with an English abstract).
3. **Akyildiz R, Atay D, Erdem A** (1974): *Researches on macro and micro-elements of pasture and other forage crops grown in different conditions*. The scientific and Technological Research Council of Turkey TOAG-41, Ankara.
4. **Al Mamun M, Abe D, Kofujita H, Tamura Y, Sano H**. (2008): *Comparison of the bioactive components of the ecotypes and cultivars of plantain (*Plantago lanceolata* L.) herbs*. Animal Science Journal, **79**, 83-88.
5. **AOAC** (1990): *Official methods of analysis 15th ed. Association of official analytical of official chemicals*. Washington, DC, USA.

- 6. Comakli B, Dasci M, Koc A** (2008): *The Effects of traditional grazing practices on upland rangeland vegetation and forage quality*. Turkish Journal of Veterinary Animal Sciences, **32**, 259-265.
- 7. DAFF** (2014): *Feed requirements and forage quality*. Available at: <http://www.daff.qld.gov.au/animal-industries/dairy/feed-and-nutrition/feed-requirements-and-forage-quality> Accessed November 2014.
- 8. Edmeades DC, Perrott KW** (2004): *The calcium requirements of pastures in New Zealand*. New Zealand Journal of Agricultural Research, **47**, 11-21.
- 9. Erdem F** (2014): *Determination the digestibility of Juncus acutus by in-vitro gas production and its effect on ruminal cellulolytic bacteria by real-time PCR methods*. PhD. Thesis, Ondokuz Mayıs University, Samsun, Turkey. (article in Turkish with an English abstract).
- 10. Ergun A, Tuncer SD, Colpan I, Yalcin S, Yildiz G, Kucukersan MK, Kucukersan S, Sehu A, Sacakli P** (2013): *Feeds, feed hygiene and technology*. Pozitif Mat. Ankara, Turkey.
- 11. Garmo TH, Frosli A, Hoie R** (1986): *Levels of copper, molybdenum, sulphur, zinc, selenium, iron and manganese in native pasture plants from a mountain area in southern Norway*. Acta Agriculturae Scandinavica, **36(2)**: 147-161.
- 12. Goering HK, Van Soest PJ** (1970): *Apparatus, reagent, procedures and applications. In forage fiber analyses*. USDA Agriculture Handbook no. 379.
- 13. Hedtcke JL, Undersander DJ, Casler MD, Combs DK** (2002): *Quality of forage stockpiled in Wisconsin*. Journal of Range Management, **55**, 33-42.
- 14. Holmes C.W, Wilson GF, Mackenz IE, Flux DS, Brookes IM, Davey AWF** (2007): *Milk production from pasture*. Palmerston North, New Zealand. Massey University.
- 15. Martins D, Barros L, Carvalho AM, Ferreira IFCR** (2011): *Nutritional and in vitro antioxidant properties of edible wild greens in Iberian Peninsula traditional diet*. Food Chemistry, **125(2)**: 488-494.
- 16. Naser MS, Afshar MA, Amir RS, Ali MA, Ghassem MB** (2008): *Quack grass (Agropyron repens L.): As ruminant feed*. Reseach Journal Environmental Sciences, **2**, 228-233.
- 17. Ozbucak TB, Akcin OE, Yalcin S** (2007): *Nutrition contents of the some wild edible plants in Central Black Sea Region of Turkey*. International Journal of Natural and Engineering Sciences, **1**, 11-13.
- 18. Pullanagari RR, Yule IJ, Tuohy MP, Hedley MJ, Dynes RA, King WM** (2012): *Proximal sensing of the seasonal variability of pasture nutritive value using multispectral radiometry*. Grass and Forage Science, **68(1)**:110-119.
- 19. Sano H, Tamura Y, Shiga A** (2008): *Tissue responsiveness and sensitivity to insulin in sheep led plantain and orchard grass and exposed to cold*. New Zeal Journal of Agricultural Research, **46**, 169-173.
- 20. SAS 9.2** (2006): *SAS Institute Inc. SAS Campus Drive, Cary NC, 27513*.
- 21. Sekeroglu N, Ozkutlu F, Deveci M, Dede O, Yilmaz N** (2006): *Evaluation of some wild plants aspect of their nutritional values used as vegetable in Eastern Black Sea Region of Turkey*. Asian Journal Plant Science, **5(2)**: 185-189.

22. Stewart AV (1996): *Plantain (Plantago lanceolata) – a potential pasture species*. Proceedings of the New Zealand Grassland Association, **58**, 77–86.

23. TR MFWA (2013): *Turkey's important wetlands, Ramsar sites*. Republic of Turkey. Book issued by Ministry of Forestry and Water Affairs (TR MFWA). T Meric and SS. Cagirankaya (Ed.). Press: Kayihan Ajans Ankara, Turkey.

24. TSI (1991): *Animal feeds-metabolic (convertible) energy determination (chemical method)*. TSI No: 9610. Turkish Standards Institute, Ankara, Turkey.

25. TUBITAK (2010): Buletin August, 104.

26. Van Soest PJ, Robertson JB (1979): *Systems of analyses for evaluation of fibrous feed*. In, W.J. Pigden, C.C. Balch, M. Graham (Eds) Proceeding International Workshop on Standardization of Analytical Methodology for Feeds. 49-60. International Development and Research Center, Ottawa, Canada.

27. Wilkinson JM, Allen JD, Tunnicliffe R, Smith M, Garnsworthy PC (2014): *Variation in composition of pre-grazed pasture herbage in the United Kingdom, 2006–2012*. Animal Feed Sciences and Technology, **196**, 139-144.

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