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Journal of Food, Agriculture & Environment Vol.11 (3&4): 790-794. 2013 *www.world-food.net*

Element content, botanical composition and nutritional characteristics of natural forage of Şanlıurfa, Turkey

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Received 3 June 2013, accepted 26 October 2013.

Abstract

This study was carried out to assess the macro and micro element contents of forage plants in natural pasture, Şanlıurfa, Turkey. *Bromus inermis, Aegilops biuncialis* Vis., *Vicia hybrida* L., *Vicia mollis, Vicia palaestina* Boiss, *Vicia cracca* L. subsp. *stenophylla, Vicia sativa* subsp. *nigra* var. *nigra, Trigonella mesopotamica, Trifolium purpureum* var. *purpureum, Trifolium repens* var. *repens, Trifolium tomentosum* L., *Trifolium campestre, Onobrychis gracilis, Onobrychis crista-galli* (L.) Lan., *Medicago sativa, Medicago truncatula* var. *truncatula, Medicago orbicularis (*L.) Bart., *Lathyrus cassius, Hippocrepis unisiliquosa* subsp. *unisiliquosa, Astragalus hamosus, Pisum sativum* subsp. *sativum* var. *arvense, Lens culinaris* Medik. and *Cicer echinospermum* P.H. Davis (Endemic) were identified and used to determine macro and micro element analysis, crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF). Macro and micro element contents in the plants were found to be species and family dependent. The micro elements were in the ranges: B 4.1-13.4, Cu 2.3-4.8, Fe 90.9-1211, Mn 10.6-40.3, Na 140.2-553.6, Al 44.8-852.7 and Zn 8.0-27.8 mg/kg, the macro elements having values of N (1.27-2.95 %), P (383.5-850.9 mg), K (4127-12310 mg), Ca (3059-13830 mg) and Mg (602-1728 mg), respectively.

Key words: Macro and micro elements, forage plants, nutritional characteristic, Şanlıurfa.

Introduction

Şanlıurfa's natural pastures are approximately 234,537 ha. The number of species found in this area is 7.4% of the flora in Turkey. The rate of genera is 27.9%, the rate of families is 41.8%, and the endemic species are 1.4% of the flora in Turkey [1, 2]. The pasture areas in this region of the country have most vulnerable, weak vegetation (10-15%)[2].

The natural pastures have been affected negatively because of excessive and irregular grazing. Most areas of primary vegetation have been exposed to succession and degradation and thus, primary steppe vegetation has been changed to secondary position. Şanlıurfa is one of the least studied places in terms of natural vegetation zones [3-6]. The number of individuals and young plants of forage crops has been decreased under effects of grazing [4].

In the region, livestock are made based on grazing. The pastures are under the supervision of the large flocks owners or they are used as accomplice by villagers. There is no possibility to reach reliable statistics on this issue because of the destruction of the pastures largely. Nevertheless, it is considered 1.5 million tons of hay produced by pastures of the region. It has reinforced the view that the most important forage resources of the region are the pastures [3, 7].

The pastures of the region are destroyed because of excessive grazing over many years. According to calculations made on a large cattle units (like cow) grazing in a period of one month must be allocated 6.3 hectares of pasture, while the fact that half, that can be given three hectares [7]. These values show that the pastures of region are used over grazing capacity and valuable plant which are in very low rates is concluded. Climax vegetation is lost in all these pastures. In the region the mechanization of agriculture applications in parallel to the excessive increase of the population gradually decreased in favor of agriculture and pasture areas. Even worse, the new agricultural land was converted to the position of the main inputs in the form of livestock feed crops or no attention is given to agriculture.

The objectives of this study were to examine determination of macro and micro elements and some nutritional characteristics of natural forage plants of Şanlıurfa, Turkey.

Materials and Methods

Study regions: Şanlıurfa which states in Turkey's Southeast Anatolia region lies between 37°49'12" - 40°10'00" east of the meridian 36°41'28" - 37°57'50" north latitude. The altitute of Şanlıurfa is about 500 m and surrounded by places 600-800 m in elevation. The city Şanlıurfa (Fig. 1) is situated in semi-arid region of Mediterranean climate. In this region, the days are hot and arid in summer, mild and rainy in winter.

The climate of the region was evaluated according to the records of Şanlıurfa Meteorology Station (Table 1). As shown according to the records, the climate is dry for a long period from June to October [8].

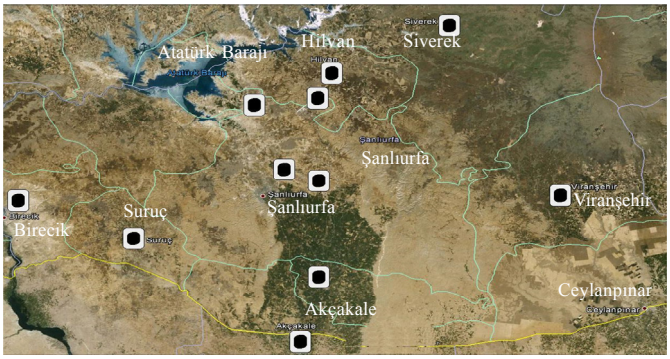

Figure 1. Location map of study area.

Table 1. The bioclima type and rainfall regime of research area (Şanlıurfa).

Elevation (m)	P (mm)	M (°C)	m (°C)	Q	PE	S	Bioclima type
547	457.8	46.8	-6.8	42.94	7.2	0.18	Semi-arid, cold winter

P: The average annual rainfall (mm), M: The average maximum temperature of the warmest month (°C), m: The average minimum temperature of the coldest month (°C), PE:Summer rainfall (mm), S:Drought index S=PE/M, Q:Rainfall-Temperature precedent Q = 2000 x P/(M + m + 546.6) (M-m).

Forage plants from Şanlıurfa's natural pastures were collected at different locations as Osmanbey Village, Akçakale, Hilvan, Akziyaret, Halfeti, Birecik, Suruç, Viranşehir, Bozova, Siverek, Germüş village, Kızlar village, Karaköprü, Kırlarbaşı village. The fodders were collected, dried. Plant species were identified [5, 9, 10] and samples were kept in Herbarium of Biology Department, Harran University.

Soil analysis: Some characteristics of the soil samples used in this study were determined in samples taken from 0 to 15 cm depth. After soil samples were air dried and passed through a sieve with 2 mm size, some soil properties were determined as follows; soil reaction pH 1:1 (w/v) soil water suspension by pH meter [11]. Electrical conductivity (EC) in the soil samples suspension by EC meter [11]. $CaCO_3$ contents by volumetric method [12]. Organic matter contents were determined by the wet oxidation method with $K_2Cr_2O_7$ [13]. Some soil chemical properties are given in Table 2.

Plant analysis: The samples were washed with distilled water and evaporated at room temperature. These samples were oven dried at 65°C for 24 h and ground into fine powder using pestle and mortar and sieved through 20 mesh sieve. The dried powdered samples were used for the analysis. Samples (1 g) were treated with a few drops of hydrogen peroxide, kept overnight and evaporated to dryness. One ml of perchloric acid was added and heated to dryness. Five ml of hydrochloric acid was added to each of the samples and the solution was diluted with deionized double distilled water to 50 ml [14]. The solution was subjected to atomic absorption spectophotometry for macro and micro elements[14].

To determine the botanical composition, samples were dried at room temperature without disturbing the original structure. Samples were analyzed to determine the nutritive value of the pastures. Nutritive value parameters included dry matter (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and crude ash. Samples were dried at 60°C for 48 h and ground to pass through 1 mm screen. Contents of DM and CP were determined using the proximate analysis [15]. Concentrations of ADF and NDF were determined using the detergent system [16].

Table 2. Selected some soil chemical properties in 0-15 cm of soil.

Forage species	EC dS/m	pH	% $CaCO_3$	P_2O_5 kg/da	K_2O kg/da	Organic matter %
Grasses						
Bromus inermis	0.51	7.79	27.3	6.1	15.1	2.71
Aegilops biuncialis Vis.	1.76	7.61	30.2	6.9	76.3	1.59
Legumes						
Vicia hybrida	1.40	7.76	4.9	8.8	133.9	4.70
Vicia hybrida L.	1.65	7.66	20.8	34.5	207.5	22.1
Vicia mollis	1.53	7.72	6.9	12.3	186.9	3.98
Vicia palaestina Boiss	1.53	7.66	31.1	4.2	60.4	0.89
Vicia cracca L. subsp. *Stenophylla*	1.85	7.52	20.3	8.3	79.6	1.86
Vicia sativa subsp. *nigra* var. *nigra*	1.57	7.49	20.5	65.0	174.9	9.22
Vicia palaestina Boiss.	1.18	7.67	21.6	36.3	209.5	2.38
Trigonella mesopotamica	1.59	7.44	28.5	14.7	110.1	2.48
Trigonella mesopotamica	1.42	7.76	30.4	4.2	60.4	0.89
Trifolium purpureum var. *purpureum*	1.23	7.54	1.1	8.9	140.4	3.07
Trifolium repens var. *repens*	1.62	7.59	28.2	15.6	142.6	3.05
Trifolium tomentosum L.	1.41	7.65	6.0	8.2	151.2	4.73
Trifolium campestre	1.58	7.51	26.7	14.3	147.8	2.9
Onobrychis gracilis	1.23	7.54	1.1	8.9	140.4	3.07
Onobrychis crista-galli (L.) Lan	1.20	7.82	27.4	5	71.2	2.90
Medicago sativa	1.24	7.78	35.7	7.7	88.0	2.97
Medicago truncatula var. *truncatula*	1.39	7.40	2.6	11.8	164.1	1.68
Medicago orbicularis (L.) Bart.	1.96	7.60	14.4	34.5	156.6	1.97
Lathyrus cassius	1.24	7.78	35.7	7.7	88.0	2.97
Hippocrepis unisiliquosa subsp. *unisiliquosa*	1.88	7.44	29.6	9.8	86.4	1.94
Astragalus hamosus	1.61	7.18	18.2	11.9	129.6	1.27
Pisum sativum subsp. *sativum* var. *arvense*	1.51	7.67	8.9	7.2	152.5	4.32
Lens culinaris Medik.	1.59	7.44	28.5	14.7	110.1	2.48
Cicer echinospermum P.H. Davis (Endemic)	1.47	7.70	1.5	9.36	110.1	3.83

Results and Discussion

In the studied soils, pH was 7.18-7.79, organic matter (%) 0.89-4.73% and electrical conductivity (EC) 0.51-1.88 dS/m (Table 2).

Table 3 represents the concentration of macro and micro elements in pasture plants. Among micro nutrients, Al (852.7 mg/ kg) was found in greater amount in *Trifolium campestre*, while *Medicago truncatula* var. *truncatula* contained lesser amount (44.75 mg/kg) of Al. The concentration of zinc in *Vicia palaestina* Boiss., *Aegilops biuncialis* Vis., *Vicia hybrida* L., *Lens culinaris* Medik. and *Trigonella mesopotamica* was 27.84, 26.78, 25.10, 19.92 and 18.19 mg/kg, respectively (Table 3). Accumulation of mineral elements in plants depends on soil properties, cultivation, fertilization system and climate[17, 18]. Morever, various plant species have a different ability to accumulate elements, even if they are grown under the same conditions [17, 19, 20].

The concentration of boron in *Trifolium repens* var. *repens* was in greater amount (13.35 mg/kg), while lesser amount was found in *Bromus inermis* (4.054 mg/kg).

Table 3. Concentration of micro and macro elements (mg/kg) in the pasture plants.

Species	Micro elements							Macro elements				
	B	Cu	Fe	Mn	Na	Al	Zn	N (%)	P	K	Ca	Mg
Bromus inermis	4.1	3.0	434.1	28.7	140.2	228.5	11.7	1.3	443.9	4127	8863	679.2
Aegilops biuncialis Vis.	5.9	2.9	355.4	23.9	218.9	253.7	26.8	1.5	530.1	6047	3059	602.0
Vicia hybrida L.	12.1	4.3	585.0	26.30	259.5	346.0	25.1	2.9	742.3	9692	12690	1516
Vicia mollis	8.5	3.2	217.0	18.10	553.6	103.9	12.0	2.8	720.8	7272	5788	969.5
Vicia palaestina Boiss.	9.5	4.1	846.8	34.39	328.1	699.0	27.8	2.8	703.4	8799	11250	1459
Vicia cracca L. subsp. *Stenophylla*	5.8	2.6	332.7	15.30	169.9	193.3	13.9	2.7	427.3	5255	9669	1044
Trigonella mesopotamica	10.9	3.03	712.5	20.61	147.6	550.9	18.2	2.9	449.4	6167	13640	1151
Trifolium resupinatum var. *resupinatum*	9.5	3.5	303.2	16.7	584.0	218.0	13.9	2.4	724.5	9762	7549	1229
Trifolium campestre	11.9	4.5	1211	40.3	310.5	852.7	15.9	2.6	708.0	7473	11870	1728
Trifolium tomentosum L.	7.1	3.5	344.1	18.1	511.2	240.4	10.9	2.0	691.1	5481	4877	1099
Trifolium purpureum	13.2	3.3	195.6	14.8	293.7	162.4	12.8	2.1	777.3	7819	7935	937.4
Trifolium repens var. *repens*	13.4	3.9	428.5	20.3	535.2	303.3	14.8	2.8	957.1	12310	13830	2285
Medicago truncatula var. *truncatula*	12.2	2.9	90.9	8.670	199.1	44.8	9.9	2.5	554.6	7350	5945	1005
Medicago sativa	12.1	3.9	618.5	25.1	194.2	382.5	11.8	2.8	640.3	8488	13480	1277
Lathyrus cassius	7.4	2.9	439.5	17.7	205.0	342.2	8.4	2.4	411.1	5561	11430	974.8
Hippocrepis unisiliquosa subsp. *unisiliquosa*	8.4	3.7	779.3	29.7	306.9	649.4	11.9	2.1	389.5	5395	7569	960.2
Astragalus hamosus	9.9	3.8	226.9	12.5	310.8	154.8	15.6	1.6	850.9	8927	7203	925.1
Onobrychis crista-galli (L.) Lam.	4.2	2.3	373.6	14.4	244.7	222.3	16.7	2.7	383.5	4283	6087	763.0
Pisum sativum subsp. *sativum* var. *arvense*	10.5	4.8	943.2	32.03	257.5	344.8	12.9	2.5	594.2	6596	9214	1344
Lens culinaris Medik.	7.4	3.7	183.7	20.30	246.6	119.9	19.9	2.9	607.3	7552	10220	1338
Medicago orbicularis (L.) Bart.	11.5	3.1	182.1	10.57	295.0	122.1	8.0	2.7	445.6	5753	7471	923.0

Iron contents of the cereals were 434.1 and 355.4 mg/kg for *Bromus inermis* and *Aegilops biuncialis* vis., respectively (Table 3). Iron contents of the legumes were found in greater amount in *Trifolium campestre* (1211 mg/kg), *Pisum sativum* subsp. *sativum* var. *arvense* (943.2 mg/kg), *Vicia palaestina* Boiss. (846.8 mg/kg), *Hippocrepis unisiliquosa* subsp. *unisiliquosa* (779.3 mg/kg), respectively. Lesser amount of iron was found in *Medicago truncatuta* var. *truncatula* (90.94 mg/kg).

Manganese contents of the grasses were found in *Bromus inermis* (28.68 mg/kg) and *Aegilops biuncialis* Vis. (23.99 mg/kg). In legumes, the manganese concentration was found higher in *Trifolium campestre* (40.26 mg/kg), *Vicia palaestina* Boiss. (34.39 mg/kg) and *Pisum sativum* subsp. *sativum* var. *arvense* (32.03 mg/kg), respectively (Table 3), while lesser amount of manganese was found in *Medicago truncatula* var. *truncatula* (8.670 mg/kg).

Soegaard and Weisbjerg [21] reported that Mn, Cu, Zn and Fe contents of *Trifolium repens* examined in the research were 51.4, 6.7, 17.9 and 89.4 mg/g, respectively. Biologically, zinc plays a key role in plants. Zinc containing enzyme include dehydrogenase, superoxide dismutase, RNA polymerase and alkaline phosphatase[22]. These zinc containing enzymes play integral role in carbohydrate, protein and oxine metabolisms [17]. On the other hand, according to Juknevicius and Sabiene [23], low Cu and Zn accumulation in pasture plants could be their low plant availability related to the soil pH fertilization.

In case of sodium, high concentration of the essential element was recorded in *Trifolium resupinatum* var. *resupinatium, Vicia mollis*, *Trifolium repens* var. *repens* and *Trifolium tomentosum* L. (584, 553.6, 535.2 and 511.2 mg/kg dry weight, respectively).

Table 3 represents the concentration of calcium, nitrogen, potassium, sodium, phosphorus and magnesium. *Trifolium repens* var. *repens* showed 13,830 mg/kg dry weight of calcium which was maximum among the samples examined. On the other hand, most of the samples presented various concentration of potassium in them and maximum concentration of the macro element was recorded in *Trifolium repens* var. *repens* (12,310 mg/ kg dry weight). Potassium contents of the other legumes were found in greater amount in *Trifolium resupinatum* var. *resupinatum* (9762 mg/kg), *Vicia hybrida* L. (9692 mg/kg), *Astragalus hamosus* (8927 mg/kg), *Vicia palaestina* Boiss (8799 mg/kg), *Medicago sativa* (8488 mg/kg), respectively (Table 3). Lesser amount of potassium was found in *Bromus inermis* (4127 mg/kg) and *Onobrychis crista-galli* (L.) Lam. (4283 mg/kg).

High soil potassium can have a negative effect on yield and crop quality. In particular, low magnesium in grasses, when they are the primary feed for cattle, can result in hypomagnesemia or grass tetany. This is mainly a problem in pasture systems [24]. Forage crops have a high demand for phosphorus and potassium. High phosphorus was recorded in *Trifolium repens* var. *repens*, *Astragalus hamosus*, *Trifolium purpuretum* and *Vicia hybrida* L. (957.1, 850.9, 777.3 and 742.3 mg/kg dry weight, respectively). Lesser phosphorus was found in *Onobrychis crista-galli* (L.) Lam. and *Hippocrepis unisiliquosa* subsp. *unisiliquosa* (383.5 and 389.5 mg/kg, respectively) (Table 3). Thus, it is critical that soil levels of these nutrients be built up in preparation for growing forage plants. Phosphorus and potassium are relatively immobile in the soil. High stomatal K requirement is reported for photosynthesis [22, 25]. It is known that P concentration is related to the rate of photosynthesis, but it decreases the conversion of fixed carbon into starch [26].

Nutritional analysis of plants is reported in Table 4. Protein value turned out to be high in *Trigonella mesopotamica* (18.44%), *Vicia hybrida* L. (18.32%), *Lens culinaris* Medik. (18.13%) and low in *Bromus inermis* (7.97%) (Table 4).

Crude ash values of these samples varied from 8.57 to 16.9% being lowest in *Onobrychis crista-galli* and highest in *Lens culinaris* Medik. (Table 4). The ADF of *Bromus inermis* (38.7%) was much higher than in *Trigonella mesopotomica* (19.4%).

Dry matter content of *Vicia cracca* L. subsp. *stenophylla* (50.37%) was higher than *in Vicia palaestina* (40.82%) (Table 4). Animals consuming these forages would most likely require some energy supplementation. ADF and NDF values determined in *Bromus inermis* were higher than in other plants.

There are changes in nutrient element composition of plants as a result of changes in botanical composition. Protein content in *Trifolium repens* var. *repens* (17.79%) was higher than reported [20].

Table 4. Wet and dry weight, dry matter (%), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and crude ash contents of pasture plants.

Species	Site	Wet weight (g)	Dry weight (g)	% Dry matter	% CP	% ADF	% NDF	% Ash
Grasses								
Bromus inermis	Hilvan	830	370	44.58	7.97	38.7	56.1	11.1
Aegilops biuncialis Vis.	Osmanbey Village	741.50	316	42.62	9.27	29.1	50.9	9.9
Legume								
Vicia hybrida	Suruç	518	75	14.48	14.49	29.2	43.7	7.9
Vicia hybrida L.	Bozova	338	97	28.70	18.32	26.2	31.9	14.7
Vicia mollis	Suruç	925	226	24.43	17.59	28.9	42.8	9.0
Vicia palaestina Boiss.	Osmanbey Vilage	196	80	40.82	17.74	26.2	37.1	11.6
Vicia cracca L. subsp. *Stenophylla*	Germüş Village	270	136	50.37	16.76	25.2	37.0	13.1
Vicia sativa subsp. *nigra* var. *nigra*	Osmanbey Village	150	40	26.67	16.74	26.6	47.6	13.1
Vicia palaestina Boiss.	Siverek	310	84	27.10	16.78	25.5	32.5	13.9
Pisum sativum subsp. *sativum* var. *arvense*	Hilvan	655.5	215	32.80	15.18	27.8	40.5	13.9
Trigonella mesopotamica	Kızlar village	465	128	27.53	18.44	19.4	24.3	13.1
Trigonella mesopotamica	Osmanbey Campus	651.5	198	30.40	14.25	30.2	32.8	13.9
Trifolium tomentosum L.	Karaköprü	222	76	34.23	12.71	35.6	48.0	8.65
Trifolium resupinatum var. *resupinatum*	Karaköprü	250	78	31.2	15.00	30.7	38.6	11.5
Trifolium resupinatum var. *resupinatum*	Hilvan	655.2	177	27.02	16.15	29.3	34.3	12.5
Trifolium campestre	Bozova	186.9	70	37.46	16.17	25.9	34.4	17.4
Trifolium purpureum	Birecik	141.8	38	26.76	13.06	21.6	46.7	10.8
Trifolium purpureum var. *purpureum*	Birecik	142	38	26.81	14.31	29.3	33.3	11.8
Trifolium repens var. *repens*	Hilvan	1341.9	242	18.03	17.79	23.7	28.4	14.8
Hippocrepis unisiliquosa subsp. *unisiliquosa*	Viranşehir	332.3	101	30.40	12.96	24.7	40.4	10.3
Astragalus hamosus	Kırlarbaşı Village	960	245	25.52	9.93	27.0	37.7	11.1
Onobrychis gracilis	Hilvan	740	205	25.52	16.57	31.7	40.7	8.57
Onobrychis crista-galli (L.) Lan	Akziyaret	730	260	35.62	15.67	26.6	39.0	12.1
Medicago truncatula var. *truncatula*	Osmanbey Village	388.2	103	26.53	15.68	27.6	37.3	9.84
*Medicago orbicularis (*L.*)* Bart.	Halfeti	300	90	30.00	16.86	27.2	37.4	8.92
Cicer echinospermum P.H. Davis (Endemic)	Suruç	151.4	51	33.70	14.63	26.1	34.3	11.5
Lathyrus cassius	Osmanbey Village	375.5	116	30.89	14.78	31.5	40.1	10.2
Lens culinaris Medik.	Bozova	284	86	30.28	18.13	20.9	29.2	16.9
Medicago sativa	Osmanbey Village	300	105	35.00	17.38	29.6	35.1	13.9
Hippocrepis unisiliquosa subsp. *unisiliquosa*	Siverek	332.3	101	30.40	12.96	24.7	40.4	10.3
Astragalus hamosus	Akçakale	960	245	25.52	9.93	27.0	37.7	11.1
Onobrychis gracilis	Birecik	740	205	27.70	16.57	31.7	40.7	8.57

Conclusions

In legumes, pH sensitivity is related primarily to the nitrogen fixation process, thus the crop can suffer from nitrogen deficiency. An ecological aspect of the role of nutrient elements is reflected in the interaction of plants with environmental factors. Different kinds of plants showed different order of nutrient elements.

References

[1]Cevheri, C. and Polat, T. 2009. The past, present and future of the fodder plants in Şanlıurfa. Harran Univ. J. Agri. **13**:63-76.

[2]Sayan, M. S., Anlarsal, M. E. and Başbağ, M. 2010. Güneydoğu Anadolu Bölgesi'nde yem bitkileri tarımının mevcut durumu sorunları ve çözüm önerileri. HR.Ü. Z.F. Dergisi. **14**:59-67.

[3]Adıgüzel, N. and Aytaç, Z. 2001. Flora of Ceylanpınar state form (Şanlıurfa - Turkey) Fl. Medit **11**:333-362.

[4]Atamov, V., Cevheri, A. C. and Parmaksız, A. 2004. Şanlıurfa Doğal Mer'a Yembitkileri, XVII Ulusal Biyoloji Kongresi, Adana.

[5]Davis, P. H. 1988. Flora of Turkey and The East Aegean Islands. Vol. 1-10, Edinburgh University Press, Edinburgh.

[6]Saya, Ö., Ertekin, A. S. and Özden, H. Ç. 2001. GAP Yöresindeki Endemik ve Tıbbi Bitkiler. Çevre Vakfı Yayınları, Diyarbakır.

[7]Anonymous 2005. Şanlıurfa il Çevre ve Orman Müdürlüğü. Şanlıurfa, 70 p.

[8]Anonymous 2001. T. C. Başbakanlık Devlet Meteoroloji İşleri Genel Müdürlüğü. Meteoroloji Bülteni, Ankara, No: A-09:28.

[9]Donner, J. 1990. Flora of Turkey. Linzer Biol. Beitr., pp. 1-10.

[10]Güner, A., Özhatay, N. and Başer, K. H. C. 2000. Flora of Turkey and The East Aegean Islands. Vol. 11. Edinburgh University Press, Edinburgh.

[11]Rowell, D. L. 1996. Soil Science: Methods and Applications. Longman, Harlow.

[12]Martin, A. E. and Reeve, R. 1955. A rapid manometeic method for determining soil carbonate. Soil Science **79**:187-198.

[13]Walkley, A. and Black, I. A. 1934. An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Science **37**:29–38

[14]Kaçar, B. and İnal, A. 2008. Bitki Analizleri, Nobel Yayın. No. 1241, Ankara, pp. 115-892.

[15]AOAC 1998. Official Methods of Analysis. 16th edn. AOAC International, Gaithersburg, MD.

[16]Van Soest, P. J. and Robertson, J. B. 1979. Systems of analyses for evaluation of fibrous feed. In Pidgen, W. J., Balch, C. C. and Graham, M. (eds). Workshop on Standardization of Analytical Methodology for Feeds. Int. Dev. Res. Center, Ottava.

[17]Lee, J., Masters, D. G., White, C. L., Grace, N. D. and Judson, G. J. 1999. Current issues in trace element nutrition of grazing livestock in Australia and New Zealand. Aust. J. Res. **50**:1341-1364.

[18]Mikhailova, E. A., Bryant, R. B., Cherney, D. J. R., Post, C. J. and Vassenev, I. 2000. Botanical composition, soil and forage quality under different management regimes in Russian grasslands. Agriculture, Ecosystems and Environment **80**:213-226.

[19]Grytsyuk, N., Arapis, T. G., Perepelyatnikova, L., Ivanova, T. and Vynograds'ka, V. 2006. Heavy metal effects on forage crop yields and estimation of element accumulation in plants as affected by soil. Science of Total Environment **354**:224-231.

[20]Milchunas, D. G. and Lauenroth, W. K. 1993. Quantitative effects of grazing on vegetation and soils over a global range of environments. Ecol. Monogr. **63**:327-366.

[21]Soegaard, K. and Weisbjerg, M. B. 2007. Herbage quality and competitiveness of grassland legumes in mixed swards. Grassland Science in Europe **12**:166-169.

[22]Kaçar, B. and Katkat, V. 2009. Bitki besleme kitabı. Nobel yayıncılık. No. 849, Ankara, pp. 160-213.

[23]Juknevicius, S. and Sabiene, N. 2007. The content of mineral elements in some grasses and legumes. Ekologija **1**:44-52.

[24]Avcı, M., Kaplan, O., Vertürk, M. and Aslan, M. 2006. Nutrient and botanical composition of pasture in Ceylanpınar agriculture farm. YYÜ Vet. Fak. Derg. **17**:9-13.

[25]Bengtsson, H., Öborn, I., Jonsson, S., Nilsson, I. and Anderson, A. 2003. Field balances of some mineral nutrients and trace elements in organic and conventional dairy farming - a case study at Öjebyn, Sweden. European Journal of Agronomy. **20**:101-116.

[26]Gierus, M., Kleen, J., Loges, R. and Taube, F. 2012. Forage legume species determine the nutritional quality of binary mixtures with perennial ryegrass in the first production year. Animal Feed Science and Technology **172**:150-161.