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GRASSLAND MANAGEMENT FOR HIGH FORAGE YIELD AND MINERAL COMPOSITION IN KOSOVO

SUMMARY

Wild grass communities may play an important role for natural and semi-natural grassland quality, but other plant species present in botanical composition may affect both yield and quality negatively. The field experiment were carried out on a field study was conducted in the central part of Kosovo, respectively Lipjani location 15 km near the capitol city of Prishtina. The area is characterized by flat topography; black soil (smonica, vertisol) is the dominant soil type. The field survey was carried out during year 2012 with aim of determining the fresh, draw yield per unit area (m^2) and mineral composition in grassland include important elements; Iron, Calcium, Cupper, Magnesium, Zinc etc. The experiment was designed as a randomized complete with four replication. The plot sizes were 81.5x 8m per plot or 12 m2. The fertilization also was used in quantity 80 kg N ha -1. In experiment was including four treatments: C- Control (normal cutting without harrowing); Cutting regime include; A-One week early without harrowing, B- One week later without harrowing and H-With harrowing. The results for quality traits include Fresh weight (FW) and Dry weight (DW) from our results reported with wide genetic variation and showed a significant effects for level of probability LSDp=0.05. The results were obtained in our study demonstrated that substantial differences in mineral composition exist in grasslands. The four treatments had considerable variation in mineral composition. The Aluminum (Al) and Calcium (Ca) content ranged from 0.36 to 0.19 and 5.07 to 7.31 g kg-1 respectively. The analysis of traits according to Pearson correlations, are ascertained variable values of the phenotypic correlation coefficient.

Keywords: Grassland, treatments, yield, mineral composition, correlation.

INTRODUCTION

Grasslands represent a land-use which is effective and has great economical importance in the European agriculture. Grasslands represent an important and effective source of energy and proteins to ruminants, and combine high yield stability and draught resistance with low tillage operations and

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pesticide use and thus leading to good environmental conditions. Furthermore, good management practice in grasslands provides high potential of carbon sequestration in soils, resulting in climate change mitigation (Stosic *et al*., 2005%; Alibegovic and Custovic., 2002). Yield and quality of grasslands are largely dependent on botanical composition (i), cutting/grazing regimes (ii), fertilization regimes (iii) and (iv) moisture regimes. The general fertilization input on grasslands in the studied area is very low (Statistical office of Kosova., 2006;Stosic *et al*., 2005). Grasses belong to the family Poacae (Gramineae). About 750 genera and 12000 species occur in all climatic zones, and legumes are important for the high quality of their forage and their ability to fix atmospheric N, through symbiotic bacteria in their root nodules (Batello *et al*., 2008). Wild grass communities may play an important role for natural and semi-natural grassland quality, but other plant species present in botanical composition may affect both yield and quality negatively. Thus, quality of grasslands is very much dependent on botanical composition. Domestication of temperate grasses has mainly taken place during the past 250 years and systematic selection is little over a century old. Choice of pasture species and cultivars depend on the prevailing agro-ecological conditions as well as the use to which the pasture will be put; pasture as a crop has a high degree of species substation (Batello *et al*., 2008). Forage quality depends largely on the present plant communities, and therefore, inventarisation of the most important phytocenosis is a helpful tool as a base for improvements of forage quality on a given grassland. The divergence in composition observed between replicate communities has shown to be most conspicuous in experimental treatments in which each species was represented by a single genotype (Whitlock *et al*., 2007). The potential of forages to meet the mineral needs of livestock is important to stress, since grasslands to a large extend supply ruminants with their demands for essensial minerals. Life itself in animals is hinged on mineral elements as the beating of heart is brought about by balance between some minerals in the fluid bathing the heart muscle (McDowell *et al*., 2007). The agricultural plants are a moderate to very good source of a variety of nutrients, including minerals, protein and healthy fats (Aliu *et al*., 2012). Kosovo has an area of 10.887 km2 or 1.1 million ha, about 430.00 ha forested or 39.1% and 577.000 ha are agriculture land or 52%. From the total agricultural surface, with Grasses are 166.769 hectares or 28.90%, meadow 86000 hectares or 14.90% and with forage crops 38000 hectares or 6.59% (MAFRD, 2002). In Kosovo there are two distinguished climate conditions: Kosovo- area with continental recognized by extreme temperature (altitudes in this region are from 510-570m) and Dukagjini area with modified climate conditions with the influence from the Adriatic see through river Drini bardhe (altitudes are from 350- 450m) Summer temperatures in these region sometimes reach more 35-40°C resulting to high evapotranspiration. The average annual rainfall in Kosovo is around 720 mm but can reach to more than 1000 mm in the mountains. The altitude in Kosovo varies from 270-2656 meters above sea level

(HMIK., 2008). The objective of our results was to investigate productivity and mineral composition with different treatments in grassland of Kosovo.

MATERIAL AND METHODS

Description of the study area. The field experiment was conducted in the central part of Kosovo, respectively Lipjani location 15 km near the capitol city of Prishtina. The area is characterized by flat topography; black soil (smonica, vertisol) is the dominant soil type. The overall climate in these regions is a continental type with long and hard winter and hot summer, with temperatures sometimes exceeding 35 °C, resulting in high evapotranspiration. The area has an annuall rainfall usually in the range of 700-750 mm (HMIK, 2008).

Field survey. The field survey was carried out during year 2012 with aim of determining the fresh, draw yield and mineral composition in grassland including important elements; Iron, Calcium, Cupper, Magnesium, Zinc etc.

Field Experimental Design (FED). The experiment was designed as a randomized block design with four replication. The plot size were 81.5x 8m per plot or 12 $m^{2.}$ The fertilization also was used in quantity 40 and 80 kg N ha^{-1}. In experiment was including four treatments: C- Control (normal cutting) ; Cutting regime include; A-One week early without harrowing, B- One week later without harrowing and H-With harrowing. Cutting regime based on optimal phenological plant development increase the yield and improves the forage quality. We have applied only one cutting regime of forage. Samples for the determination of dry matter (DM) content, botanical and chemical composition were taken from cut herbage mass in four replicates for each treatment. The fresh weight (FW) was determined by $1m^2$, while the Dry Weight (DW) was determined after drying for 24 hours at 65 ^{0}C.

Methods for determined the mineral content. The samples were decomposed with concentrated HNO3 at 250°C in UltaClave from Milestone (Milestone microwave Ultraclave III). The samples were diluted to 10 % concentrated HNO3 before analysis. The determination of elements were done on ICP_OES (inductively coupled plasma optical emission spectrometry) with an Perkin Elmer Optima 5300 DV instrument (Perkin Elmer,Inc 2004 Shelton, USA). This analysis was done at The Norwegian University of Life Sciences, Department Environmental Sciences, Ås, Norway. After harvesting, samples from the cut grass at each plot, from sampling of 1 kg fresh matter, was sorted by hand in a) Dominant grasses, b) Dominant legumes, c) Dominant weeds (dicotyledons), d) Other grasses, e) Other legumes, f) Other weeds (dicotyledons). The botanical composition which is dominant in our experimental field was; *Medicago spp, Dactylis glomerata, Festuca pratensis, Vicia liaca,and some others plants include ; Con vollvolus arevese, Mentha spp, Galium verum, Silena vulgaris*.

Statistical Analyses. Duncan’s multiple range test was used to compare means and significance was accepted at LSD*p*=0.05 level of probability.

Statistical analysis was performed using the statistical program of MINITAB-14, SPSS.version.19 (SPSS., 2012) and Excel program.

RESULTS

The results for quality traits include Fresh weight (FW) and Dry weight (DW) from our results reported with wide genetic variation and showed significant effects at all treatments for level of probability LSDp=0.05. (The estimation mean (μ) of FW was 1823.179 g m-2. Results are presented in Table 1.

Table 1. Average values for fresh weight and dry matter

Treatments*	Fresh weight (gm^{-2})	%	Dry weight (gm^{-2})	%	D=FW-DW
Control	1256.70^{c}	59.92	503.05^{ab}	40.04	753.65
A	2400.03^{a}	73.00	648.23^{a}	27.00	1751.8
B	1910.98^{b}	65.42	660.63^{a}	34.57	1250.35
H	1725.02^{b}	74.42	441.22^{b}	25.57	1283.78
Average	1823.179	68.19	563.28	31.795	1259.89

*Notes: C-control without harrowing; A- one week early without harrowing; B-One week later without harrowing; H- With harrowing.

The treatment coded A (with cutting regime one week early) for FW and DW compare to other treatments are with higher significant differences. The genetic variations among extreme values between treatments were +1143.33 g m^{-2} or expressed on relative value the genetic variation was 62.71%. The differences between two treatments A (one week early) and B (one week later) also are with high variation (+489.05 g m^{-2}) or with genetic variation 26.82%. These differences can be attributed to differences in genetic makeup of the botanical composition and cutting regime. Statistical analysis test applied and compare with experimental mean was a significant at LSD*p*=0.05 probability level. The results clearly indicated that all treatments produced the highest yield or FW (68.19 %), while with DW the average values were 31.79%. Results are summarized in Table 1**.**

The present collection showed appreciable genotypic variation for mineral composition is perhaps the most important source? for variation characteristics in the plant. The results were obtained in our study demonstrated that substantial differences in mineral composition exist in grasslands. The four treatments which were including in study had considerable variation in mineral composition. The Aluminum (Al) and Calcium (Ca) content ranged from 0.19 to 0.36 and 5.07 to 7.31 g kg^{-1} respectively**.** The differences for Copper (Cu), potassium (K), Nitrogen (N) between treatments was not significantly for level of probability (Table2).

Table 2. The average content with mineral composition in grasses

Treatment*	Al gkg^{-1}	Ca gkg^{-1}	Cu gkg^{-1}	Fe gkg^{-1}	K gkg^{-1}	Mg gkg^{-1}	Mn gkg^{-1}	Na gkg^{-1}	P gkg^{-1}	Zn gkg^{-1}
C	0.19^{b}	5.92^{a}	0.050^{a}	0.14^{b}	22.74^{a}	1.20^{b}	0.04^{c}	0.032^{a}	2.53^{ab}	0.019^{a}
A	0.23^{b}	7.31^{a}	0.050^{a}	0.21^{ab}	23.08^{a}	1.55^{a}	0.05^{b}	0.097^{a}	2.62^{ab}	0.021^{a}
B	0.19^{b}	5.07^{a}	0.075^{a}	0.15^{b}	21.50^{a}	1.20^{b}	0.06^{a}	0.023^{a}	2.30^{b}	0.025^{a}
H	0.36^{a}	7.07^{a}	0.112^{a}	0.27^{a}	25.16^{a}	1.38^{a}	0.06^{a}	0.030^{a}	2.83^{a}	0.024^{a}
Average	0.242	6.342	0.071	0.19	23.12	1.33	0.20	0.045	2.57	0.022

* Notes: C-control without harrowing; A- one week early without harrowing; B-One week later without harrowing; H- With harrowing

The obtained results of Iron (Fe) and Magnesium (Mg) showed that had higher variation between studied treatments (0.27 to 0.14 and 1.20 to 1.38 gkg^{-}1) for level of probability LSD*p*=0.01. Overall average value of Iron (Fe) was 0.19 g kg^{-1}and for magnesium (Mg) 1.33 g kg$^{-1.}$ The treatment (H) with harrowing shoved the higher average values for Iron (Fe) and Magnesium (Mg) on values 0.27 and 1.38 g kg^{-1}, respectively. Compare with Control (C) the differences for Iron (Fe) were +0.13 g kg^{-1} or expressed in percentage 68.42%. While for Magnesium the differences were +0.18 g kg^{-1} or 13.5 %. Overall mean for Manganese (Mn) was 0.20 g kg^{-1}, while genetic variation between treatments were +0.14 or with variation 70%. Also, the content of Phosphorus (P), Natrium (Na) and Zinc (Zn) was very interesting. In Figure.1 Clearly showed that the total deviation of overall average values for each treatment compared with the control was higher. With higher deviation which is manifested in our research in relation to the control was for Calcium (Ca) which has a very high genetic variation in relation to the control on values (-1.27 and +0.97), this value were realized in treatment B one week latter without harrowing. Also, the significant differences were realized for Potassium (K), and Manganese (Mn) with different extreme values.

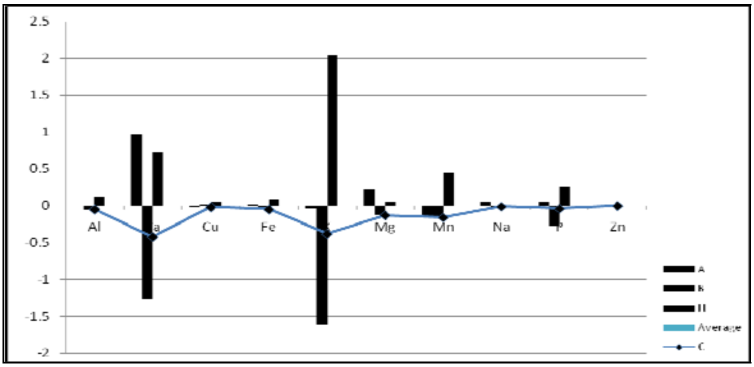

Figure.1.Variation for mineral composition between treatments

From the correlative analysis of traits according to Pearson, are ascertained variable values of the phenotypic correlation coefficient. We observed a high positive correlations (r=0.95**) between Aluminum (Al) and Iron (Fe), Calcium (Ca) and phosphorus (P) (r= 0.70**). There were significant correlation (r=0.78**) between Magnesium (Mg) and Natrium (Na). The some positive correlation was also observed in copper with Potassium (K), Magnesium (Mg), Manganese (Mn), and Natrium (N). Results are presented in Table 3.

DISCUSIONS

Total yield, mineral contents in fodder crops are highly dependent on the phenological stage; hence these parameters will be measured at different cutting times. Since cutting regimes affect botanical diversity and legume persistence, weed registrations will also be an important observation for optimizing cutting regimes. Therefore, field experiments will be carried out to make improvements in different grassland systems and to demonstrate effects of cutting regimes on botanical composition and on yield and forage quality (e.g. mineral contents). Different species of legumes may have different sensitivity to cutting intensity, and may also have different competitive abilities against weeds. Cutting regime based on optimal phenological plant development increase the yield and improves the forage quality. Therefore, field experiments with legume species related to cutting regimes will be conducted by using different legumes/grass mixtures. Better distribution can be achieved with earlier cutting (Stsic *et al*., 2007). There is a potential of improving cutting regimes based on the need for optimizing dry mater yield and quality. From the information available on the general agronomic practices and lack of any systematic management of grasslands in Balkan region, we feel that the improvements in both cutting regimes and botanical composition are likely to have a significant impact on improving grassland management in the region. Grasslands play a very important role in food security and poverty alleviation, particularly in developing countries, because are among the largest biomes in the world (Aleksandros *et al*., 2006). Evaluation of the primitive cultivars and their germplasm needs to use to develop new cultivars that are more productive and of greater food value (Aliu *et al*., 2011.). The nutritive values have been defined as the amount of feed ingested and the efficiency with which nutrients are extracted from a given feed (Norton *et al*., 1995). Chemical composition of the forage is a major determinant in animal production (Skerman and Riverso, 1990). Calcium (Ca) plays a major role in plant growth and development and in the maintenance and modulation of various cell function, especially related to membrane structure and function and to cell wall structure (Palta P., 2010). The lactating cow has a very much higher nutrient requirement than the beef animal and is therefore the first class of stock to show up any deterioration in pasture quality (Stobss, 1975). Legumes are known to be richer in Calcium (Ca) than grasses Minson, 1983). Quantities of minerals in cultivated plants are influenced by numerous complex factors including genotype, soil, environmental conditions and nutrition interactions (WHO. 2002).

Table 3. The coefficient correlation among mineral composition in grassland

Traits		Al	Ca	Fe	Cu	K	Mg	Mn	Na	P	Zn
Al	PC	1	0.281	0.959**	-0.080	0.377	0.228	0.547*	-0.030	0.409	0.205
Ca	PC	0.281	1	0.303	-0.047	0.354	0.674**	0.169	0.498*	0.704**	-0.027
Fe	PC	0.959**	0.303	1	-0.127	0.227	0.393	0.523*	0.133	0.284	0.019
Cu	PC	-0.080	-0.047	-0.127	1	0.194	0.084	0.208	0.035	0.165	-0.153
K	PC	0.377	0.354	0.227	0.194	1	0.083	0.341	-0.301	0.672**	0.190
Mg	PC	0.228	0.674**	0.393	0.084	0.083	1	0.216	0.780**	0.285	0.160
Mn	PC	0.547*	0.169	0.523*	0.208	0.341	0.216	1	-0.030	0.212	0.471
Na	PC	-0.030	0.498*	0.133	0.035	-0.301	0.780**	-0.030	1	-0.023	0.119
P	PC	0.409	0.704**	0.284	0.165	0.672**	0.285	0.212	-0.023	1	-0.187
Zn	PC	0.205	-0.027	0.192	-0.153	0.190	0.160	0.471	0.119	-0.187	1

** Correlation is significant at the 0.01 *and 0.05 level

CONCLUSIONS

These results obtained from this study show that mineral composition and qualitative traits (yield) showed significant differences between treatments which exhibited a higher differences and also had a significant correlation between studied parameters. The content of mineral composition (except Natrium) to treatment with harrowing compared with the values for other mineral compositions were positive. But, with higher value of FW is determined to treatment one week later without harrowing.

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UPRAVLJANJE TRAVNATIM POVRŠINAMA RADI VISOKOG PRINOSA STOČNE HRANE I MINERALNOG SASTAVA NA KOSOVU

SUMMARY

Zajednice samonikle trave igraju važnu ulogu u kvalitetu prirodnih i polu-prirodnih travnatih površina, ali ostale vrste bilja u botaničkom sastavu mogu imati negativan uticaj i na prinos i na kvalitet. Ogled je izveden tokom terenskog ispitivanja u centralnom dijelu Kosova, na lokaciji Lipjani, 15 km od glavnog grada Prištine. Ovu oblast karakteriše ravna topografija; crnica (smonica, vertisol) je preovlađujući tip zemljišta. Terensko ispitivanje je izvršeno tokom 2012. godine, sa ciljem utvrđivanja svježeg prinosa po jedinici površine (m^2) a mineralni sastav na travnatim površinama obuhvatio je značajne elemente: gvožđe, kalcijum, bakar, magnezijum, cink, itd. Ogled je postavljen po potpuno slučajnom sistemu u četiri ponavljanja. Veličina parcela je iznosila 81.5x 8m po parceli, odnosno 12 m^2. Izvršeno je i đubrenje, u količini od 80 kg N ha-1. Eksperiment je obuhvatio četiri tretmana: C- kontrola (normalno košenje bez grabuljanja); režim košenja je obuhvatio; A-jedne sedmice rano, bez grabuljanja, B- jedne sedmice kasnije, bez grabuljanja, i H- sa grabuljanjem. Rezultati dobijeni u smislu odlika kvaliteta obuhvatili su svježu masu (FW) i suvu masu (DW). Dobijeni rezultati su pokazali značajnu genetičku varijaciju i ukazali na značajan efekat na nivo vjerovatnoće LSDp=0,05. Rezultati dobijeni u našoj studiji su pokazali da na travnatim površinama postije značajne razlike u mineralnom sastavu. Četiri tretmana su pokazala značajne varijacije u mineralnom sastavu. Sadržaj aluminijuma (Al) i kalcijuma (Ca) kretao se od 0,36 do 0,19, odnosno 5,07 do 7,31 g kg^{-1}. Analizom odlika prema Pirsonovoj korelaciji utvrđene su vrijednosti varijable fenotipskog koeficijenta korelacije.

Keywords: travnjaci, tretmani, prinos, mineralni sastav, korelacija.