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Full Length Research Paper

Nutritive value of the genetically divergent genotypes of lucerne *(Medicago sativa* L.*)*

Vidica Stanaćev[1]*, Dragan Dukic[1], Stanimir Kovčin[1], Milanka Drinić[2], Nikola Puvača[1] and Vladislav Stanaćev[3]

[1]University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, Serbia.
[2]University of Banjaluka, Faculty of Agriculture, Vojvode Stepe Stepanovića 75, Bosnia and Herzegovina.
[3]Tehnooprema d.o.o., Production, Engineering and Trading with Technological Equipment, Bačka Topola, Serbia.

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The results of two years investigation of nutritive value of 5 lucerne genotypes are presented in this paper. In the course of three utilization cycles the average amount of crude protein was 197.0 g kg^{-1} DM; crude fibres, 235.9 g kg^{-1} DM; crude fat, 15.3 g kg^{-1} DM; crude ash, 78.0 g kg^{-1} DM; NFE 379.6 g kg^{-1} DM, respectively. Average energy value (NEL) was 5.31 MJ kg^{-1}. The highest content of crude protein was found in NS-Slavija (199.4 g kg^{-1} DM). Višelisna was found to have the lowest content of crude fiber (219.9 g kg^{-1} DM). Genotype Luzelle was the richest in crude fat (16.9 g kg^{-1} DM) and in crude ash (81.7 g kg^{-1} DM), while Višelisna was the richest in NFE (394.0 g kg^{-1} DM), and energy value (NEL 5.36 MJ kg^{-1} DM). In the second cycle of lucerne utilization the highest content of crude protein was obtained (211.3 g kg^{-1} DM), while the lowest content of crude fibres was (218.6 g kg^{-1} DM). The difference between the genotypes was not significant, but opposite to that the differences between the cuttings were found to be significant.

Key words: Chemical composition, genotypes, lucerne.

INTRODUCTION

In the world, as well as in Serbia, lucerne is one of the most important perennials used as a forage in animal nutrition. Lucerne in Serbia is grown on 192.800 ha with average yields of 5.0 t/ha dry matter (SG SCG, 2005). Under the average agroecological conditions and at the regular system of exploitation longevity of lucerne is 5 - 7 years.

Lucerne as such is the excellent feed for all the species and categories of domestic animals. After the further stages of processing, the obtained products can be used as component for concentrated feed.

The chemical composition of lucerne dry matter depends on cuts. Crude protein tends to be lower in aged lucerne plants while the content of crude fibres increases. Nitrogen free extracitves (NFE) part slightly varies mostly in the fourth cut and at full bloom (Ocokoljević et al., 1977; Negovanović et al., 1992).

*Corresponding author. E-mail: vidica.stanacev@gmail.com.

Having in mind the importance of lucerne for the nutritrion of animals and for improvement of animal husbandry in general, the purpose of this study was to examine the nutritive value of genetically divergent genotypes. The results should be the contribution to the knowledge of the most important quantitative traits in lucerne as well as to its improvement in Serbia.

MATERIALS AND METHODS

For the purpose of studing the nutritive value of the genetically divergent genotypes of lucerne a trial was carried out in the spring, 2002 at the Forage Crops Department (Ao).

In order to study the nutritive value, five lucerne genotypes were involved, NS-Slavja and NS-Bačka ZMS-I (both from Serbia), Luzelle and F_1 Saponull x 63-28P (both from France) and Višelisna (A x 93/3) from Bulgaria. The nutritive value of dry matter was examined in 2003 (A_1) and for this purpose the first growth (C_1) was used and in 2002 (A_2) the first (C_1) and the second growth (C_2) were used.

In all the cases cutting was done at the beginning of the blooming stage (13.05.2003; 06.06.2004; 21.06.2004). After the cutting, the

Table 1. Nutritive value of cultivars and genotypes of lucerne.

Cultivar	Year (A)	DM	Content, g/kg DM					NEL
Genotype (G)	Cutting (C)	%	CP	CF	Fat	Ash	NFE	MJ/kg DM
1. NS-Slavija	A_1:C_1	91.01	187.1	234.2	11.8	77.5	399.5	5.44
	A_2:C_1	88.05	202.6	224.4	15.8	78.0	359.7	5.49
	A_2:C_2	93.14	208.5	255.1	15.1	76.7	376.0	5.00
Average (1)		90.73	199.4	237.9	14.2	77.4	378.4	5.31
2. Luzelle (F)	A_1:C_1	90.01	173.6	229.2	12.1	80.1	405.1	5.43
	A_2:C_1	87.92	208.8	236.0	19.2	82.4	332.8	5.45
	A_2:C_2	93.07	195.0	258.2	19.3	82.6	375.6	4.95
Average (2)		90.33	192.4	241.1	16.9	81.7	372.1	5.28
3. Višelisna (B)	A_1:C_1	91.15	173.8	226.0	12.6	81.0	418.1	5.43
	A_2:C_1	87.89	217.8	191.6	21.1	75.8	372.6	5.62
	A_2:C_2	92.99	203.1	242.2	15.9	77.4	391.3	5.02
Average (3)		90.67	198.2	219.9	16.5	78.1	394.0	5.36
4. Sap.x63-28P (F)	A_1:C_1	91.05	190.1	227.4	12.8	73.5	406.7	5.49
	A_2:C_1	87.80	211.2	225.4	19.0	74.8	347.6	5.52
	A_2:C_2	92.94	193.7	264.0	14.4	76.5	380.8	4.96
Average (4)		90.59	198.3	238.9	15.4	74.9	378.8	5.32
5. NS-Bačka ZMS I	A_1:C_1	90.86	180.6	250.8	10.4	76.6	390.2	5.39
	A_2:C_1	88.05	215.9	215.8	17.7	83.4	347.7	5.50
	A_2:C_2	92.92	194.1	258.2	13.0	73.4	390.5	4.99
Average (5)		90.61	196.9	241.6	13.7	77.8	376.1	5.29
Average G (1-5)		90.58	197.0	235.9	15.3	78.0	379.6	5.31
Average (C)	A_1:C_1	90.80	181.0	233.5	11.9	77.7	403.9	5.43
	A_2:C_1	87.94	211.3	218.6	18.6	78.9	352.0	5.51
	A_2:C_2	93.01	199.0	255.5	15.5	77.3	382.8	4.98
LSD (G)	0.05	-	14.2	18.9	2.9	5.5	17.1	-
	0.01	-	20.7	27.5	4.1	8.0	24.9	-
LSD (C)	0.05	-	6.9	16.8	2.5	1.4	15.6	-
	0.01	-	9.9	23.6	3.5	1.9	21.9	-
CV (%)		2.39	7.25	8.20	8.2	4.14	6.43	4.63

moisture content has been determined by drying at 60°C, while the samples were used for the analysis of chemical composition of dry matter. Research of quality of dry matter was carried out in the laboratory for the control of feeds at the Faculty of Agriculture in Novi Sad. The quality of dry matter (DM) was determined by the standard methods; crude proteins (CP) by Kjeldahl; crude fibres (CF) and crude ash (CA) by Wende and crude fat (CF) by Soxlet. Based on the chemical composition content of nitrogen free extract (NFE) was calculated. Concentration of Ca, P and K was obtained by the flame photometric method.

According to the pattern given by Obračević (1990) and Glamočić (2000) an average energy value of feeds for lactation (NEL) was calculated based on the results of chemical analysis.

The results obtained were processed statistically by analysis of variance (ANOVA). The significance between the treatments was determined by LSD test. Coefficients of variations (CV%) were also calculated.

RESULTS

The results of chemical analyses of dry matter of five genotypes of lucerne point out, more or less, an equal quality of dry matter in all five genotypes, while the differences between cuttings are confirmed coefficients of varations (Table 1).

Since lucerne is primarily a protein-rich forage plant, the

results of the chemical analyses on protein content in all five genotypes during three cycles of utilization were rather equal: in average 197.0 g/kg DM, or from 192.4 g/kg (Luzelle) to 199.4 g/kg DM (NS-Slavija). Nevertheless, somewhat higher content of CP was found in NS-Slavija (199.4 g/kg), Sponull x 63-28P (198.3 g/kg DM) and Višelisna (198.2 g/kg DM). Besides crude protein content, the crude fibre content is the second important parameter of the lucerne quality. The average content of crude fibre in all five lucerne genotypes was 235.9 g/kg DM (Luzelle) and 241.6 g/kg DM (NS-Bačka ZMS I), with significant differences.

In spite of the fact that lucerne is not considered an energy crop, its crude fat content confirms its energy potential, with the average fat content of 15.3 g/kg DM, that is, from 13.7 g/kg DM (NS-Bačka ZMS-I) to 16.9 g/kg DM (Luzelle). The differences among the genotypes proved to be significant. As for the crude ash content the genotypes proved to have in average 78.0 g/kg DM, that is from 74.9 g/kg DM (Saponull x 63-28P) to 81.7 g/kg DM (Luzelle), with significant differences. Nutritive value of the lucerne dry matter is influenced by the NFE content. The average NFE content was 379.6 g/kg DM, or from 371.2 g/kg DM (Luzelle) to 394.0 g/kg DM (Višelisna), with significant differences (Table 1).

As for the effect of cuttings on the quality of lucerne dry matter in the first year, in the first cutting the lowest yield of CP was found (181.0 g/kg DM) while in the second year, in first cutting the CP content was highest (211.3 g/kg DM), while at the same time the crude fibre content was lowest (218.6 g/kg DM). In the second year and in second cutting was obtained the highest crude fat content (18.6 g/kg DM) and the highest crude ash content (78.9 g/kg DM). The highest NFE content was achieved in the first year (403.9 g/kg DM) (Table 1).

DISCUSSION

Sikora and Bošnjak (1972) reported that during three years 20 cultivars of lucerne of different origin had crude protein content from 20.01% (Nagyszenasi) to 25.26% (Postawskaja) and the crude ash content from 7.04% (Istria population) to 8.56% (Nagyszenasi), with highly significant differences.

Sauvant et al. (2002) reported that 1073 samples of lucerne with 90.6% DM had 18-19% CP , 25.7% crude fibres, 2.6% crude fat, 10.6% ash and 32.7% NFE. Dukic et al. (2004) point out that ten genotipes of lucerne had in average 209.1 g/kg DM crude protein and of them Saponull x 63-28P had 215.1 g/kg DM. Dukic et al. (2007) also found that 10 Serbian cultivars as well as three synthetics of lucerne grown on different locations had CP 174.7-205.2 g/kg DM, CF 217.9-307.0 g/kg DM and NFE 326.0-416.0 g/kg DM.

The results obtained are in agreement with those reported by Čobić et al. (1991) and Dukic et al. (1994). On the other hand, Guy et al. (1991) and Emil et al. (1997) inform that the cultivar Europe was achieved in the first and second growths NEL 5.61 MJ/kg DM, while the genotype, 63-28P had 5.89 MJ/kg DM. According to the same authors the cultivar Europe had digestibility of organic matter *in vitro* of 62.8% and genotype 63-28P had 67.7%, with highly significant differences.

According to these results the quality of dry matter was very good in all genotypes but the differences between the genotypes were not highly significant. However, it can be considered that nutritive value was affected significantly by genotype, cutting (C_1, C_2, C_3) and the interaction genotype x environment.

Conclusions

Based on the obtained results in two years investigation of nutritive value of genetically divergent genotipes during three cycles of exploatation, the following conclusions can be made:

1. All the genotypes involved in this investigation proved to have dry mater of very good quality. By cutting lucerne at the begining of blooming there was obtained an average crude protein 197.0 g/kg DM or 192.4-199.4 g/kg
2. DM. The differences were not significant.
The average content of crude fibre was 235.9 g/kg DM, crude fat 15.3 g/kg DM, ash 78.0 g/kg DM and NFE 379.6 g/kg DM. The differences among genotypes were significant.
3. Energy value of dry matter was rather uniform, with an average NEL of 5.31 MJ/kg DM.
4. If the cycles (C_1, C_2, C_3) of exploitation are compared, their influence on the quality of dry matter was highly significant and it can be considered that the quality of dry matter was significantly affected by genotype, cutting and genotype x environment.
5. Certain variability in the chemical composition of dry matter can be used as a source of genetic variability in the process of developing new cultivars of lucerne such as cultivars of special importance like Višelisna, Luzelle (grazing type) and Saponulle x 63-28P (saponine free).

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