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Production potential and quality of lucerne feed

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Abstract: Abstract: Production properties in three cultivars of lucerne (NS Slavija, NS Novosadjanka H-11 and Evropa) were followed under the environmental conditions of Northern Metohija over the three-years' time. Hay yield and its components were also monitored, being as follows: plant height, foliage surface index (FSI) and its share in an overall dry matter yield as well as the ash and nitrogen-free extractive matter quality parameters (NFM).

In addition to its highest yield of 14,0 t/ha, NS Slavija also had the highest values in the majority of characteristics under way (foliage surface index, its share in entire content of dry matter, the contents of crude fat matter and crude ash).

Key words: lucerne, cultivar, yield, yield components, dry matter, quality.

Introduction

Lucerne is of paramount importance to producing high quality feeds. For its good quality and achieving high and stable yields, which can be utilised over a longer while, lucerne ranks as the most highly usable plant species. Its is primarily characterised by a noticeably high yielding potential of its dry matter of up to 15-18 t/ha⁻¹ without and of up to 25 t/ha⁻¹ with irrigation, respectively, (Miskovic, 1986) as well as by its remarkably high quality.

Despite favourable environmental conditions for its cultivation and the fact that a range of its domestic excelling quality and highly yielding cultivars exists in inland conditions, rather low average yields of hay of up to 5,43 t/ha⁻¹ (Jankovic, 2004) have been achieved as yet. On the other hand, these yields have been recorded to even be of up to 15 t/ha⁻¹ (Lukic, 2000) on the better producing

holdings and under more suitable conditions combined with the appropriate agronomical measures. Thus, visibly high lucerne yields of up to 13 – 22 t/ha⁻¹ were reported by Djukic et al., (1992), Katic et al., (1993), Lukic et al., (1992), Radovic et al., (2004).

In addition to being familiar with yield and its components, one ought to closely cope with their chemical composition, too, meaning that the nutritional value of dry matter deserves mention. Also, as the most important and reliable trait of lucerne quality is considered crude protein content found to mainly depend on the cultivar itself, on its developmental stage and on growing conditions benefiting lucerne most. As far as crude protein share is concerned, Zeljer et al., (1985) Santrucek et al., (1988), Katic et al., (2001), Radovic et al., (2004) found its imparting dry matter in the range from 18,0 to 22,1 %, respectively.

Keeping in mind a high importance of the lucerne, the study was aimed at monitoring yield, its components and quality under the conditions of Northern Metohia, thereby making contributions to a better knowledge of the traits of lucerne cultivars under consideration and to furthering high quality feed production, too.

Materials and method

The production traits of lucerne were analysed by setting up the trial using random split-block- design with four replications. The elementary plot was 5 m² (5 x 1m) by size with an inter-spacing of 20 cm. Spring sowing proceeded using 15 kg/ha seeds. The research soil was of alluvium type with potato used as the preceding crop fertilised with manure. Over the trial, the two commonly used agrotechnical measures from the primary tillage to the pre-seeding preparation, fertilisation, sowing and environmental protection were used.

Three cultivars of lucerne picked out for sowing were, as follows: NS – Slavija, NS- Novosadska H – 11 and Evropa.

Over the experimentation, the following parameters were being observed: hay yield (y/ha⁻¹), plant height (cm), leaf share in the total yield of dry matter (%), and foliage surface index (FSI).

Feed quality (% dry matter) comprised: the content of crude proteins (CP), those of crude cellulose (CC), crude fat matter (CFM), ash (CA) and that of nitrogen-free extractive matter (NFM).

The obtained results were worked out following the analysis of variance on a year basis, the individual differences being determined by LSD test.

Results and Discussion

Hay yield – Over the three years' time comprising one year of planting establishing and two years of its full utilisation, the yield averaged 13,0 t/ha⁻¹ (tab.1) being the highest in the cultivar NS Slavija (14,0 t/ha⁻¹) and somewhat lower (12,9 and 12,2 t/ha⁻¹, respectively) in those of Evropa and NS Novosadska H-11. During the first year (Ao), i.e. the year of planting

establishing, the yield averaged $5,7 \text{ t ha}^{-1}$ which could be considered efficient, whereas in the second (A_1) and in the third year (A_2) much higher yields ($17,5$ and $16,0 \text{ t/ha}^{-1}$, respectively) were achieved. So high yields attained in the second and in the third year of the feed utilisation were in agreement with results obtained by Djukic et al., (1992), Katic, et al., 1993) Lukic (2001), Radovic et al., (2004).

Tab.1. Hay yield of the lucerne cultivars (t/ha^{-1})

Cultivar	Year			Average
	I (A_0)	II (A_1)	III (A_2)	
NS-Slavija	5.9	18.6	17.6	14.0
NS-Novosad. H-11	5.5	16.1	14.9	12.2
Evropa	5.6	17.8	15.4	12.9
Mean	5.7	17.5	16.0	13.0
LSD 0.05	0.3	2.2	1.4	
0.01	0.5	3.5	2.3	

Yield components – Plant height is referred to as an essential component of the lucerne yield. The higher lucerne plants are, the higher differences in regeneration speed are, which does not necessarily mean the higher yielding potential as is clearly seen when comparing the obtained results on yield and on height of the cultivars being chosen. As can be seen from the tab.2., the average height of the lucerne cultivars amounted to $58,4 \text{ cm}$, with the highest mean value established in NS Novosadjanka H-11 ($59,6 \text{ cm}$), succeeded by those in Evropa ($58,4 \text{ cm}$) and in NS Slavija ($57,6 \text{ cm}$). Similar results on the height in 12 lucerne cultivars ($45,2\text{-}55,0\text{cm}$) were obtained by Lukic and Kraljevic-Balalic (2001) while its mean value of $63,5 \text{ cm}$ registered in 10 genotypes was revealed by Djukic (2004).

Tab.2. Yield components in lucerne cultivars

Cultivar	Plant height (cm)	Foliar surface index (FSI)	Leaf share (%)
NS-Slavija	57.6	4.0	45.7
NS-Novosad. H-11	58.0	3.7	45.1
Evropa	59.6	3.8	44.8
Mean	58.4	3.8	45.2
LSD 0.05	1.9	1.9	
0.01	3.2	3.2	

Foliage surface index (FSI) as the ratio between foliage total and foliage soil surface unit measure is considered a significant component of the dry matter yield. The highest FSI was recorded in NS Slavija (4,0) and slightly lower in Evropa and NS Novosadjanka H – 11 (3,8 and/or 3,7), the obtained values of which were in full agreement with the hay yield being accomplished. Thus, Petkova et al., (1996) reported about somewhat higher values of the FSI (4,3 for

the three-leaf and 5,2 for the multi-leaf lucerne genotypes, respectively) whereas Miskovic (1986) reported FSI values to have even been more than 14 of a suitable feed crop density of up to 500 plants/m² at the very beginning of flowering.

Leaf sharing in entire dry matter yield also represents its important component, thereby indirectly signifying its quality. The average share of the leaves in the total yield of the dry matter (tab.2.) of 45,2% could be considered high. The highest leaf share was evidenced in the NS Slavija (45,7%) followed by those in Novosadjanka H – 11 (45,1%) and Evropa (44,8%). It is worth mentioning that the cultivars with higher leaf sharing achieved higher hay yield. Slightly higher values of the leaf share of 48% were reported by Miskovic (1986), the remaining values, fairly matching the currently obtained ones, being recorded by Prudnikov et al., (1988) of 46,2% and by Djukic et al., (2004) of 45,13% in 10 cultivars.

Dry matter quality – the indices of dry matter contained in lucerne cultivars are outlined in tab.3. Thus, the selected cultivars had a highly high content of crude proteins averaging 20,31%. Based on the division proposed by Ivanov (1980), the cultivars under consideration fall under the group with a high content of crude proteins (above 20%). The cultivar NS Novosadjanka H-11 was reported to have the highest (20,63%) and Evropa the lowest content of crude proteins (20%). Additionally, Katic et al., (2001) reported the content of crude proteins in 10 cultivars of lucerne to average 18,62% ranging from 17,57% (NS Medijana) to 19,49% (Vuka). The currently obtained research results, well-matching the previously obtained ones, were reported by Stevovic et al., (2004) for the cultivar NS Slavija with averagely contained crude proteins of 19,05% and those of Medijana of 20,30% as well as those by Djukic et al., (2004) embracing 10 genotypes of lucerne with crude proteins averaging 20,98%.

Tab. 3. Chemical composition of dry matter in the lucerne cultivars (%)

Cultivar	Crude proteins	Crude cellulose	Crude fat matter	NFM	Ash
NS Slavija	20.31	25.57	2.39	32.46	7.91
NS-Novosadj. H-11	20.63	25.01	2.35	32.38	7.76
Evropa	20.00	25.49	2.34	33.65	7.62
M e a n	20.31	25.36	2.36	32.83	7.76
LSD 005	1.16	1.50	0.18	2.68	0.40
001	1.93	2.48	0.30	4.45	0.66

The mean content of the crude cellulose amounted to 25.36% (tab.3) the highest being recorded in NS Slavija (25,57%) and the lowest in NS Novosadjanka H–11 (25.01%). Slightly lower content of the crude cellulose (the mean of lucerne of 24.86% for 10 cultivars) was evidenced by Katic et al., (2001) whereas much higher ones embracing 17 cultivars various by origin were reported by Radovic et al., (2004) ranging from 34.54% to 44.69%, respectively.

Further, crude fat matter averaged 2,36% ranging from 2.34% (Evropa) to 2,39% (NS Slavija) (Tab.3). The obtained results are in agreement with those of Bosnjak et al., (1988), Santrucek et al., (1988) Cobic et al., (1991) and Katic et al., (2001), too.

Further, the share of NFM importantly envigorating lucerne cultivars averaged 32,8% (Tab.5), its highest value being evidenced in Evropa (33,83%) and nearly the same ones in Slavija and NS Novosadjanka H-11 of 32,46% and 32,38%, respectively. Similar results were reached by Bosnjak and Stjepanovic (1987) for Evropa (32,8%) whereas Katic et al., (2001) established NFM content in 10 lucerne cultivars to range from 33,97% to 37,19%. Finally, its slightly higher values in the range from 37,16% (NS Medijana) to 39,11% (NS Slavija) were revealed by Stevovic et al., (2004).

Crude ash averaged 7,76% (tab.5.) ranging from 7,62% in Evropa to 7,91% in NS Slavija. Similarly, 7,6% ash content was recorded by Cobic et al., (1991) and Kunc (1995), followed by somewhat higher contents of 8,90% and 9,87%, respectively, determined by Stevovic et al., (2004) and Katic et al., (2001), respectively.

Conclusion

Lucerne growing was likely to efficiently go on under the environmental conditions of Northern Metohija.

The highest lucerne yield was recorded in NS Slavija (14,0 t /ha⁻¹) and the lowest one in NS Novosadjanka H-11 (12,2t /ha⁻¹). The cultivar NS Slavioja was found to possess the highest FIS (4,0) and the highest leaf share in the total of dry matter yield (45,7%), the highest plants of 59,6 cm being determined in Evropa.

As far as the dry matter quality along with crude proteins and crude cellulose are concerned and most importantly indicating yield quality, NS Novosadjanka H-11 stood out for the highest crude protein content of 20,63% and also for the lowest crude cellulose one of 25,01%, too.

Finally, the highest crude fat matter content (2,39%) and that of crude ash (7,91%) were recorded in NS Slavija, the highest NFM share (33,65%) being evidenced in Evropa.

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PRIZVODNI POTENCIJAL I KVALITET KRME SORTI LUCERKE

- originalni naučni rad -

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Rezime

U agroekološkim uslovima severne Metohije u trogodišnjem periodu analizirane su proizvodne osobine lucerke (NS Slavija, NS Novosađanka H-11 i Evropa). Praćeni su prinos sena i komponente prinosa: visina biljaka, indeks lisne površine (ILP) i udeo lista u ukupnom prinosu suve materije, kao i parametri kvaliteta suve materije: sadržaj sirovih proteina, sirove celuloze, sirovih masnih materija, sirovog pepela i udeo bezazotnih ekstraktivnih materija (BEM).

Pored najvećeg prosečnog prinosa sena (14,0 t/ha) sorta NS Slavija je imala najveće vrednosti za većinu ostalih ispitivanih svojstava (ILP, udeo lista u ukupnom sadržaju suve materije, sadržaj sirovih masnih materija i sirovog pepela).