



AGROSYM

BOOK OF PROCEEDINGS



*XVI International Scientific Agriculture Symposium
"Agrosym 2025"
Jahorina, October 2-5, 2025*



AGRO 2025
sym

BOOK OF PROCEEDINGS

**XVI International Scientific Agriculture Symposium
“AGROSYM 2025”**



Jahorina, October 2 - 5, 2025

BOTANICAL COMPOSITION OF PERMANENT GRASSLAND AND FORAGE QUALITY IN THE MUNICIPALITY OF LUČANI IN REPUBLIC OF SERBIA

Vladimir ZORNIĆ*¹, Nedeljko RACIĆ¹, Đorđe LAZAREVIĆ¹, Zoran LUGIĆ¹, Dalibor TOMIĆ², Nenad PAVLOVIĆ², Mirjana PETROVIĆ¹

¹Institute for forage crop Kruševac, Kruševac, Serbia

²Faculty of Agronomy, University of Kragujevac, Čačak, Serbia

*Corresponding author: vladimir.zornic@ikbks.com

Abstract

Livestock production depends on high-quality fodder, so it is necessary to assess the quality of fodder in order to balance the rations better and to ensure that the diet is as consistent and high-quality as possible all year long. The aim of the study was research botanical composition and the quality of hay in farms in the Municipality of Lučani, to identify animal production constraints in the hilly areas in Republic of Serbia. In 2025, 31 samples of meadow hay and 15 samples of alfalfa hay were collected from animal farms. The floristic composition of the meadow hay was determined by calculating the weight share of specific groups (grasses, legumes, and others). Biomass quality was assessed by using infrared spectrophotometry, and the content of protein, ADF, NDF, fat and minerals was determined. Meadow hay samples had a relatively low percentage of legumes, with samples containing up to 10% of legumes prevailing. The share of forbs was usually up to 10%, which is satisfactory, and the hay samples were dominated by grasses. The hay samples had a relatively low protein content, with samples containing less than 11% protein prevailing. The comparatively high levels of NDF and ADF suggested low digestibility and palatability. The alfalfa hay had a higher protein content than the meadow hay, ranging from 14% to 18%. This was due to alfalfa's greater potential for producing high-quality hay and its earlier mowing. Permanent grasslands have not been fully utilized because they are mowed relatively late and receive insufficient fertilization, but alfalfa fields have better management, which leads to much higher quality.

Key words: *legumes, proteins, hay, ADF, NDF.*

Introduction

Animal husbandry is an important part of agriculture because of it provides essential food for people and it reflecting the level of its development and the level of living standards in a country. The fact that meat and milk are crucial components of the population's diet makes livestock farming significant. Additionally, livestock production enables the balanced exploitation of natural resources and provides jobs for a large number of people (Thorton, 2010) particularly in Serbia's sparsely populated hilly and mountainous regions. The natural environment in Serbia, including topography, soil quality, and agro-ecological conditions, is ideal for primary arable agricultural production as well as the raising of animals, particularly sheep and cattle (Lugić *et al.*, 2025).

The Municipality of Lučani covers an area of 454 km² and extends from valley regions at about 300 m ASL, to hilly and mountainous regions at about 900 m ASL. It is characterized by a continental climate that is moderately influenced by the Mediterranean. The Municipality of Lučani had 4,040 registered agricultural households in 2021. The primary source of income for the local population in the past was cattle farming, followed by agricultural and fruit cultivation. Importing Simmental cows in the 1980s significantly improved cow breeds. According to data on livestock structure, the overall number of livestock decreased steadily until 2002, however,

during that period there was a noticeable increase in the number of pigs, sheep, and poultry. The increase in sheep numbers can be correlated with the percentage increase in the area covered by pastures and meadows. Given the climatic conditions, this type of livestock production should be promoted in that region.

According to the Veterinary Administration, Ministry of Agriculture, Forestry and Water management, 5,424 cattle were raised in the Municipality of Lučani, which is a comparatively small number of cattle. It is necessary to recover cattle breeding, which is the essential for agricultural development in each country.

Cheap and high-quality animal feed is a prerequisite for successful livestock production, as it accounts for 30 to 70% of total production costs (Alqaisi and Schlecht, 2021). The most suitable animal feed for ruminants is biomass obtained from perennial forage crops such as alfalfa or clover-grass mixtures, as well as permanent grasslands, which are most often preserved in the form of hay or silage (Boudalia *et al.*, 2024). When these crops and permanent grasslands are mowed at the right time and adequately maintained, they can provide high-quality forage that guarantees high and stable production throughout the year. Therefore, in order to balance the rations as much as possible, special attention must be paid attention to the production of high-quality fodder.

The goal of the study was estimation botanical composition and quality of hay produced on farms in the Municipality of Lučani in order to identify potential animal production constraints in the hilly areas in Republic of Serbia.

Material and methods

The research was conducted in the territory of the Municipality Lučani (Southwestern Serbia). Biomass samples from permanent grassland (31) and alfalfa crops (15) were collected for analysis in August 2024. Hay samples from permanent grasslands or alfalfa hay, weighing 1 kg were collected from 31 farms. The biomass samples were split into three groups: *Poaceae* species, *Fabaceae* species, and forbs. After separation, the mass of each group was measured, and the percentage of each group in the sample was computed.

Dry matter quality was determined by NIRS (Near-infrared spectroscopy): crude protein, ADF, NDF, ash, and fat content, in the laboratory of the Institute for Forage Crops Kruševac.

Results and discussion

The floristic composition and biomass production are significantly impacted by agro technical practices, which are influenced by agro ecological conditions. Hay with fewer than 10% legumes predominated in the samples from permanent grasslands (Figure 1). According to (Buchgraber *et al.*, 1994) this percentage is considered inadequate because ideal permanent meadow consists of: 50-60% grasses, 10–30% legumes and 10–30% non-leguminous forbs. Similar results were confirmed by Babić *et al.* (2019), who recorded that the legume share in the hay samples from Peštar plateau was very low, because out of 61 samples, even 29 contained no legumes, and 16 had less than 10% legumes. Low amounts of legumes were also found in the hay samples from Jadar valley and Azbukovica (Petrović *et al.*, 2023). The share of other species was relatively good, but the samples were dominated by grasses, which is consistent with results Zornić *et al.* (2022). Inadequate fertilization is the cause of the unfavorable relationship between some analyzed groups of plants in grasslands, as small amounts of mineral fertilizers are used or this measure does not apply at all. Using complex fertilizers with a high phosphorus content to improve the proportion of legumes, natural nitrogen fixation process improve and the quality of biomass, and its measurements should be regarded standard agricultural practice.

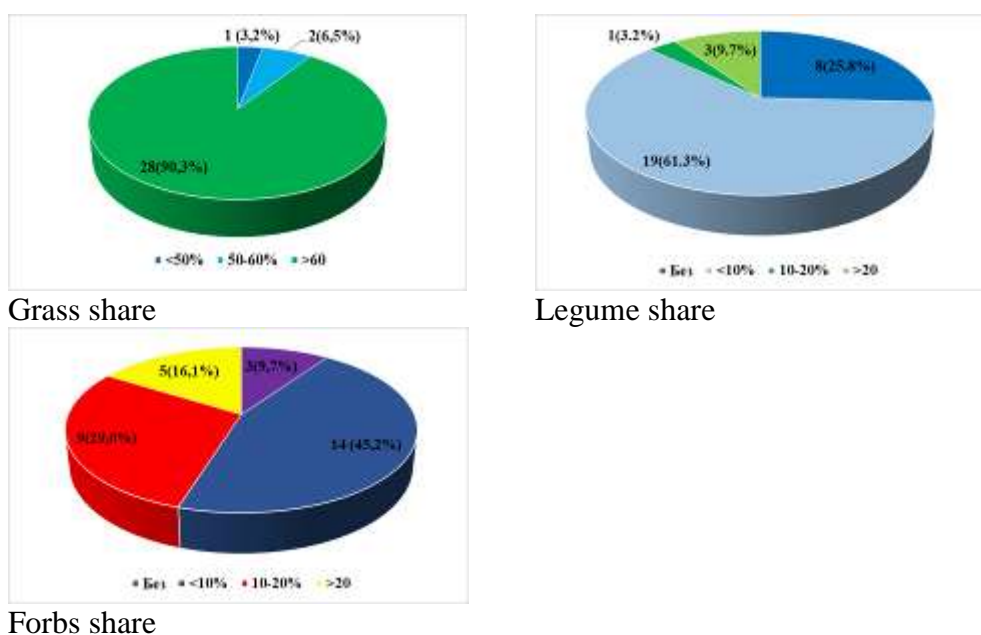


Figure 1. Share of main plant groups in biomass samples from permanent grasslands

Hay from permanent grasslands was not of adequate quality since samples with less than 8% protein (20 samples) predominated, whereas 13 samples had between 8 and 11% of crude protein and only 6 samples had more than 11% (Table 1). The recorded quality was not so much the result of an inadequate floristic composition, since grasses with usually high quality potential predominated in the samples. The low quality was a consequence of late mowing, because in this area, as in other areas of the Republic of Serbia, meadows are mowed relatively late. Babić *et al.* (2019) report similar findings, suggesting that biomass quality is generally low on the Pešter Plateau and grasslands as a resource are not utilized properly. The low quality of meadow hay was recorded in the southeastern part of Serbia (Zornić *et al.*, 2022), and in the region Jadar Valley and Azbukovica (Petrović *et al.*, 2023). Production in this area might be greatly increased with early mowing since, according to Zornić (2020), about 3 percent more protein can be gained by mowing at the start of heading rather than during the full flowering phase.

Table 1. Quality of permanent grassland biomass from Municipality of Lučani

	Лаб бр.	Proteins % ACM	ADF % ACM	NDF % ACM	Ash % ACM	Fat % ACM
1	676/24	6.7	46.8	78.8	5.8	1.1
2	680/24	8.5	45.6	73.5	4.4	1.7
3	683/24	7.9	43.5	71.4	4.8	1.7
4	688/24	13.6	39.1	63.9	6.0	2.4
5	692/24	6.9	42.7	72.2	5.1	1.5
6	697/24	7.7	46.3	79.0	5.5	1.4
7	701/24	5.9	40.9	77.4	6.3	1.2
8	704/24	<5	46.7	86.4	6.1	0.9
9	708/24	13.0	42.6	69.7	7.5	1.6
10	713/24	7.1	41.4	72.4	6.1	1.5

11	716/24	9.1	46.2	78.8	5.8	1.4
12	721/24	7.2	43.5	78.5	5.9	1.1
13	732/24	9.3	44.2	68.3	4.1	1.7
14	736/24	8.6	42.3	60.1	3.5	2.1
15	739/24	6.7	45.3	72.5	5.6	1.6
16	748/24	11.6	39.8	63.6	7.5	1.8
17	749/24	9.4	43.2	68.1	4.8	1.5
18	804/24	7.2	44.4	74.5	6.1	1.5
19	800/24	9.4	44.9	74.5	6.8	1.3
20	795/24	8.6	44.9	71.4	6.3	1.5
21	792/24	12.4	42.5	72.3	9.3	1.7
22	787/24	5.7	45.1	72.3	5.7	1.3
23	779/24	13.0	34.3	63.5	8.0	2.0
24	780/24	8.8	44.9	73.1	5.8	1.6
25	834/24	6.5	45.6	77.3	4.3	1.1
26	829/24	8.1	42.6	77.2	6.0	1.6
27	825/24	8.6	44.3	45.3	5.9	1.5
28	818/24	6.4	48.3	76.4	3.0	1.5
29	813/24	6.3	46.7	75.5	5.2	1.4
30	810/24	<5	52.4	82.1	3.6	0.9
31	743/24	9.6	48.9	73.2	4.1	1.5

Alfalfa hay showed a higher quality than meadow hay since, of the 15 hay samples studied, the majority of samples contained between 14 and 18% protein, while only two had protein levels below 14% (Table 2). The quality of alfalfa hay, sampled from the territory of the Municipality of Lučani, was significantly better than the quality of *meadow* hay, which is due to the greater potential of alfalfa for biomass quality. There is still a chance to improve the quality, because alfalfa hay can contain more than 20% protein (Radović *et al.*, 2009), and the amount of protein in alfalfa biomass varies depending on when it is harvested and the environmental factors (Katinski, 2017). The recorded quality of alfalfa hay is due to traditionally later mowing, but also due to inadequate storage, resulting in a decrease in the protein content of the biomass.

Table 1. Quality of alfalfa hay from Municipality of Lučani

	Лаб бр.	Proteins % ACM	ADF % ACM	NDF % ACM	Ash % ACM	Fat % ACM
1	675/24	14.1	39.6	62.8	7.2	2.0
2	693/24	15.0	40.9	58.4	6.4	1.9
3	705/24	17.2	32.0	44.6	6.4	2.7
4	709/24	18.1	37.3	51.9	7.5	2.0
5	712/24	17.4	36.0	55.1	7.2	2.3
6	717/24	14.6	40.4	57.3	6.1	1.0
7	735/24	13.7	37.3	55.6	5.4	2.1
8	803/24	15.1	41.2	61.9	6.5	1.8
9	796/24	12.0	43.9	71.4	8.9	1.4
10	791/24	17.7	43.9	76.1	6.4	1.4
11	775/24	17.3	36.9	52.3	6.0	2.2
12	830/24	15.6	41.1	59.6	7.5	1.8
13	826/24	17.7	39.0	51.8	6.8	2.2
14	817/24	15.2	32.5	50.6	6.8	2.4
15	744/24	20.8	34.5	52.0	8.5	2.3

Conclusion

Due to the dominance of grasses, the low share of legumes, and the presence of other species at a non-significant level, the floristic composition of the grasslands within the Municipality of Lučani territory is relatively inadequate.

The low quality of hay samples indicates that they are cut late, so this type of resource is not used adequately.

Alfalfa fields have better management, especially earlier mowing, which leads to much higher quality.

Acknowledgements

The research was supported by Ministry of Science, Technological Development and Innovation (Serbia) number 451-03-136/2025-03/ 200217.

References

- Alqaisi, O. Schleich, E. (2021). Feeding Models to Optimize Dairy Feed Rations in View of Feed Availability, Feed Prices and Milk Production Scenarios. *Sustainability*, 13(1), 215.
- Buchgraber, K., Deutsch, A., Gindl, G. (1994). *Zeitgemässe Grünland-Bewirtschaftung*. – Graz, Austria, 194.
- Babić, S., Lugić, Z., Sokolović, D., Petrović, M., Zornić, V., Anđelković, S., Lazarević, Đ. (2019). Botanical composition and forage quality of natural grasslands of Pešter highlands. *Proceedings of X international scientific agriculture symposium »Agrosym 2019«*, October 03-06., Jahorina, Bosnia and Hercegovina, pp. 542-547.

- Boudalia, S., Smeti, S., Dawit, M., Senbeta, E. K., Gueroui, Y., Dotas, V., Bousbia, A., Symeon, G. K. (2024). Alternative approaches to feeding small ruminants and their potential benefits. *Animals: an open access journal from MDPI*, 14(6), 904.
- Katanski, S. (2017). Prinos i kvalitet biomase lucerke (*Medicago sativa* L.) u zavisnosti od sistema gajenja -Doktorska disertacija, Univerzitet Novi sad, Poljoprivredni fakultet.
- Lugić, Z., Zornić, V., Petrović, M., Lazarević, Đ., Racić, N., Mandić, V., Babić, S. (2025). Status and prospects of livestock breeding and animal feed production in the Republic of Serbia in the context of climate change Jeep international scientific agribusiness conference MAK 2025, "Climate change and ecological sustainability in agriculture and food production in Serbia, the region and Southeast Europe" from January 30th to February 2nd, Kopaonik, Serbia
- Petrović, M., Zornić, V., Radović, J., Racić, N., Sokolović, D., Jerinić, S., Lugić, Z. (2023). An overview of the current state of grasslands in the Podrinje region as a source of healthy animal feed. *Proceedings of XIV international scientific agricultural symposium "Agrosym 2023"*, October 05-08 Jahorina, Bosnia and Hercegovina, pp.1127-1131
- Public presentation Municipality of Lučani <https://www.lucani.rs/> accessed July 15th
- Radović, J., Sokolović, D., Marković, J. (2009). Alfalfa-most important perennial forage legume in animal husbandry. *Biotechnology in Animal Husbandry*, 25 (5-6), 465-475.
- Thornton, P.K. (2010). Livestock production: Recent trends, future prospects. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 365, 2853–2867.
- Veterinary administration, Ministry of agriculture, forestry and water management, https://www.vet.minpolj.gov.rs/veterinarske_organizacije/Konkurs%20za%20PM%202017/Goveda.pdf, accessed July 21st
- Zornić, V. (2020). Effect of fertilisation, liming and plant development stage on the floristic composition, yield and quality of *Danthonietumcalycinae* grassland, Phd theses, University Kragujevac, Faculty of agronomy Cacak.
- Zornić, V., Petrović, M., Babić, S., Sokolović, D., Prijović, M., Tomić, D., Lazarević, Đ. (2022). Botanical composition and biomass quality in natural grasslands of Southeast part of Serbia. *Book of abstracts of the XIII international scientific agriculture symposium "Agrosym 2022"*, October 06-09, Jahorina, Bosnia and Herzegovina, pp. 245