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Yield and Quality of Natural Grassland Fodder in the Moravicki District

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Abstract: In the Moravicki District area, over 77,763ha or 46.4% of the total arable area (167,710 ha) are under grasslands with natural meadows and pastures covering 45,001 ha and 32,762 ha, respectively.

The aim of the investigations was to examine the floristic composition and green fodder yield and quality at a number of representative sites, having in mind the distribution of natural meadows and pastures.

The investigations were conducted at seven sites of the Moravicki District. A total of 12 natural grasslands were selected and used for sampling at an optimal plant growth and developmental stage for determination of fodder yield and quality. The distribution of good-quality species of grasses and legumes in phytocenoses of these grasslands was low, as opposed to the high share of other plants. Apart from a significant percentage of good-quality species of grasses and legumes considerably higher fodder yields with higher crude protein content were achieved on fertilised grasslands.

Key words: natural grasslands, floristic composition, yield, quality.

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Introduction

In Central Serbia, largely an upland region according to its orographic characteristics, over 38% of agricultural land is under grasslands.

In the Moravicki District area, over 77,763ha or 46.4% of the total arable area (167,710 ha) are under grasslands with natural meadows and pastures covering 45,001 ha and 32,762 ha, respectively. Apart from being an important source of good-quality fodder, natural grasslands are also of significance in terms of soil protection from erosion and biodiversity or gene fund preservation (Djordjevic-Milosevic et al., 1997). The areas in question are of extreme importance for the development of livestock production in the upland region since they often represent the main or the only source of livestock feed.

Average meadow and pasture yields range about 1.58 t ha⁻¹ and 0.39 t ha⁻¹, respectively (SG SCG, 2004), which is due to the absence of necessary cultural practices, primarily of fertilisation, and improper exploitation. By fertilisation and natural grassland exploitation scheme over 15 t ha⁻¹ of quality hay can be produced.

Despite the undoubted advantages of natural grasslands as fodder base this production in our country has not been given sufficient attention. Natural meadows and pastures are in rather bad condition and are being increasingly subjected to degradation processes. Low yields and unstable production and low fodder quality are induced by unfavourable floristic composition and high weed infestation (25-40%), or by small percentage of quality grasses and papilionaceae (Mijatovic, 1972). This is due to the absence of melioration measures, fertilisation in the first place, but also due to unfavourable environmental conditions and improper exploitation.

The aim of the investigations was to examine the floristic composition, green fodder yield and dry matter yield and quality at a number of representative sites, having in mind the distribution of natural meadows and pastures.

Material and Method

Investigations of the yield and quality of voluminous livestock feed at natural meadows and pastures of the Moravicki District were carried out over the 2005 growing season at twelve sites (I-XII). Sampling for green matter yield determination was carried out at the optimum plant growth and developmental stage.

Coupled with sampling for biomass yield determination (4 replications), 1 kg of green fodder samples were collected from the sites selected for determination of the floristic composition and analysis of the percentage of grasses, legumes and other species.

Dry matter yield determination was made after sample drying at 65°C (air-dry).

Standard methods were used to establish the dry matter quality: contents of crude proteins (CP), crude fibre (CF), crude fats (CFs) and crude ash (CA). Based on the chemical composition results the percentage of nitrogen-free extracts (NFE) was calculated.

As the yield and quality of natural meadow and pasture fodder were dependent on numerous factors (agroenvironmental conditions, fertilisation, exploitation method), in order to examine more thoroughly productive capacity of grasslands, soil samples were collected at a 0-20 cm depth for chemical analysis (pH, humus content, contents of nitrogen, phosphorus and potassium).

Soil conditions – Soil conditions of grasslands selected are very heterogeneous (Tab. 1).

Table 1. Chemical properties of natural grassland soils of the Moravicki District

Site	pH	Humus (%)	N (%)	mg/100 g soil	
				P ₂ O ₅	K ₂ O
IV	6.04	3.23	1.112	16.13	19.40
V	5.48	3.48	1.001	12.61	9.74
VI	5.05	3.03	1.007	16.24	11.03
VII	5.73	3.00	1.013	14.61	17.32
VIII	4.98	2.43	0.097	13.11	12.04
IX	4.25	3.11	0.087	11.78	12.73
X	5.15	3.60	1.001	12.24	14.04
XI	6.74	4.03	1.103	18.20	18.61

Based on the chemical composition of the surface layer (0-20 cm) soil pH showed neutral reaction (pH 6.74) at the XI site, weakly acid reaction (pH 6.04) at the IV site, and acid reaction at other sites, while the grassland at the IX site was characterised by very acid reaction (pH 4.25).

The soils examined had good to medium humus supply and good nitrogen supply in the top layer. They also had medium phosphorus and poor to medium potassium supplies (Tab. 1).

Research Results

The floristic composition of the grasslands – The presence of a great number of species (as many as over 200) on a small surface area is the basic floristic characteristic of our natural grasslands located in the uplands. From the agricultural point of view, they are classified into two families, *Poaceae* and *Fabaceae* and into a group of other species (weeds, minor, harmful and toxic plants). Apart from contributing to the floristic diversity of the grasslands, certain plants from the group of other species have an important nutritious value. Determination of the percentage of individual plant species is of high significance, bearing in mind that the yield and quality of fodder are the result of the floristic composition of the grasslands (Troxler and Charles, 1980; Fraser et al., 1997).

Average distribution of different grass species, legumes and other species in natural grasslands was 40.53%, 19.62% and 39.85%, respectively (Tab. 2).

Table 2. Distribution (in %) of grasses, legumes and other plant species in natural grasslands in the Moravicki District

Site	Distribution (in %)		
	Grasses	Legumes	Other
I	27.57	15.65	56.78
II	57.28	16.52	26.19
III	66.83	24.69	8.48
IV	35.28	15.04	49.68
V	27.19	33.68	39.13
VI	38.72	18.64	42.64
VII	61.74	14.27	23.90
VIII	62.38	34.12	3.50
IX	22.14	6.73	71.13
X	21.02	10.92	68.06
XI	13.07	19.93	67.00
XII	53.28	25.16	21.56
Average	40.53	19.62	39.85

The percentage of legumes and other plant species in the green matter yield indicated the state of the grassland, primarily the degree of degradation of these areas. Namely, the distribution of legumes ranged from 6.73% to 34.12%, depending on plant nutrition. As opposed to that, the share of grasses and other plants on non-fertilised soil was 22.14% and 71.13%, respectively. On fertilised areas, the percentage of grasses and legumes was considerably higher (62.38% and 34.12%, respectively), with the insignificant presence of other plants (3.50%), (Tab. 2). A positive mineral fertilisation effect on grass percentage was recorded by Lazarevic et al. (2004) and Alibegovic-Grbic et al. (2004). According to Radojevic et al. (1980) (cit. after Stosic et al., 2005), mineral fertilisation (NPK 15:15:15) led to increased grass distribution (from 65 to 85%) and decreased presence of other plants.

Environmental factors as well (precipitations, temperature, light distribution, soil fertility) can affect the floristic composition of grasslands and their yield and quality (Grynja and Kryszak, 1998).

Fodder yield – At the sites investigated, the green matter yield varied from 8.67 t ha⁻¹ to 23.00 t ha⁻¹ (Tab. 3).

Depending on soil properties, grassland condition etc. green fodder yields produced were 9.67-23.00 t ha⁻¹ and 8.67-11.37 t ha⁻¹ on natural meadows and pastures, respectively. Considerably higher green fodder yields (56.21%) were achieved on fertilised grasslands (sites VIII and IX) than on non-fertilised ones.

Table 3. Green fodder yield (t ha⁻¹) and dry matter quality (%) at the sites investigated

Site	Green fodder	CP	CF	CFs	CA	NFE
I	23.00	2.88	26.03	1.40	9.54	60.15
II	14.05	7.06	32.10	1.30	8.43	51.11
III	13.83	7.56	32.35	1.40	8.47	50.22
IV	14.00	8.81	24.31	2.20	9.94	54.74
V	8.67	4.13	21.45	2.30	6.10	66.02
VI	9.67	4.44	20.65	2.20	8.32	64.39
VII	11.05	6.94	23.91	2.80	7.08	59.27
VIII	17.23	7.38	19.12	0.90	7.41	65.19
IX	11.03	5.44	20.61	0.80	8.88	64.27
X	11.13	6.31	21.43	2.40	7.80	62.06
XI	11.37	3.94	23.37	2.70	8.05	61.94
XII	18.83	7.56	25.04	0.90	9.74	56.76
Average	14.75	6.04	24.20	1.78	8.31	59.67

Scientific and practical work experience throughout the world show that no plant production can be that easily, rapidly and efficiently increased solely by fertilisation as fodder production in grasslands. Fertilisation is also considered a fodder yield stabilisation factor particularly in drought conditions, due to rational water utilisation during organic matter synthesis.

Apart from the effect on the change in the floristic composition, Stevanovic et al. (2004), Nesic et al. (2004), Vuckovic et al. (2004), Alibegovic-Grbic et al. (2004) also underline that fertilisation can induce significant increases in dry matter yields of natural grasslands. Conversely, Kostuch et al. (1998) report that mineral fertilisers mostly induce yield increases and organic ones, apart from this, can bring about changes in the floristic composition.

Dry matter quality – The economic importance of natural grasslands is determined by two basic factors: a) plant cover quality (chemical composition or nutritive value of the cover plants) and b) fodder yield (Kojic et al., 2001). The dry matter chemical composition of natural grasslands is the result of fodder quality and as such it ranges widely depending on the environmental factors, cultural practices and developmental phenostage (Ivanovski et al., 2004).

The green fodder from the grasslands selected was characterised by diverse dry matter quality (tab. 3).

Average share of crude proteins was 6.04%, of crude fibre 24.20%, crude fats 1.78%, crude ash 8.31%, and the share of nitrogen-free extracts was 59.67%. As dry matter quality was the result of plant growth and developmental stage at the time of cutting, the percentage of quality legumes, grasses etc. the crude protein share on five grasslands ranged from 2.88% to 5.44%, 6-7% on two grasslands and their content exceeded 7% on five grasslands. The grasslands with a higher share of legumes and lower percentage of other plants were characterised by higher crude protein content (Tab. 3). Sawicki (1998) also reported that the higher legume

presence on grasslands induced increases in crude proteins and mineral matters, leading to fodder quality improvement.

The crude protein share in dry matter on fertilised grassland (site VIII) was considerably higher compared to the non-fertilised grassland. Fodder quality improvement by fertilisation can be attained directly (increased nutrient content) or indirectly (change in the floristic composition). Flipek and Kasperzsky (cit. after Ockoljic et al., 1983) determined that fertilisation considerably increased protein content and yield. Alibegovic-Grbic et al. (2004), on the other hand, stressed that the crude protein yield increase in fertilised variants resulted from an increase in dry matter yield rather than from a rise in their content.

Conclusion

Natural grasslands in the Moravicki District were at a degradation stage which was well underway, thus the low presence of good-quality grasses and legumes, as opposed to the high share of other plants in the phytocenoses of this grasslands.

Average presence of grasses, legumes and other minor species in the grasslands at the sites selected was 40.53%, 19.62% and 39.85%, respectively.

Apart from the regularly low biomass yields on natural grasslands in our country, and in the Moravicki District, at 12 sites of this area, very high green fodder yields were achieved being primarily the result of increased precipitations during the growing season.

In the grasslands where mineral fertilisers were used, considerably higher fodder yields and higher shares of quality grasses and legumes were achieved.

Dry matter quality was adequate, in terms of the distribution of nutritive plants in the phytocenoses of the natural grasslands investigated, with average contents of crude proteins, crude fibre, crude ash and NFE of 6.04%, 24.20%, 8.31% and 59.67%, respectively. The crude protein share on fertilised grasslands was considerably higher compared to that on the non-fertilised ones.

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PRODUKTIVNOST I KVALITET BIOMASE PRIRODNIH TRAVNJAKA MORAVIČKOG OKRUGA

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Rezime

Na području Moravičkog okruga, od ukupnih obradivih površina (167.710 ha), pod travnjacima se nalazi preko 77.763 ha ili 46,4%, od čega su prirodne livade zastupljene na 45.001 ha, a pašnjaci na 32.762 ha.

Cilj istraživanja je bio da se, s obzirom na zastupljenost prirodnih livada i pašnjaka, u više reprezentativnih lokaliteta sagleda floristički sastav, prinos i kvalitet biomase.

Istraživanja su obavljena u sedam lokaliteta Moravičkog okruga. Oda-brano je ukupno 12 prirodnih travnjaka sa kojih je u optimalnoj fazi porasta i razvića biljaka izvršeno uzimanje uzoraka za utvrđivanje prinosa i kvaliteta biomase. Zastupljenost kvalitetnih vrsta trava i leguminoza u fitocenozama ovih travnjaka je niska, nasuprot visokog udela ostalih biljaka. Pored značajnijeg učešća kvalitetnih vrsta trava i leguminoza na đubrenim travnjacima ostvareni su znatno veći prinosi krme sa većim sadržajem sirovih proteina.