INFLUENCE OF FERTILIZATION ON FORAGE QUALITY OF THE SIMPLE MIXTURES BETWEEN *Bromus inermis* Leyss. AND *Onobrychis viciifolia* Scop.

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Abstract

Temporary meadows are an important source of feed through both productivity and the quality of the forage obtained. Biomass quality obtained from temporary grassland is influenced by component species, their proportion in the mixture and by management system and use. The results of the study conducted revealed that the mineral fertilization achieve a higher quality forage, mainly influenced the type of mixture used and dosage. Thus, the highest content of crude protein, of 17.7 % (g·100 g^{-1} DM), was recorded in the mixture *Brous inermis* Leyss. 25% + *Onobrychis viciifolia* Scop. 75%, fertilized with $N_{100}P_{100}$, the difference compared to the control is very significant.

Key words: temporary meadows, CP, NDF, ADF, RFQ

Mixtures of perennial grasses and legumes are recommended to be set up either in place of degraded permanent grasslands or arable land. Legumes present a richer content in the amount of protein, grasses compensate by the carbohydrate content and legumes benefit from fixed nitrogen when they grow together. Therefore, grass - legume mixtures can be more productive than when a species is cultivated in monoculture system (Vîntu V. *et al*, 2008, Albayrak S., Türk M., 2013).

The forage quality means a set of chemical features, organoleptic, nutritional and sanitation, which expresses the degree to which they meet the nutritional requirements of the animal body, according to biological fund, exploitation technology and animal nutrition technology (Pop I. M. *et al*, 2006). The composition and nutritional value of forage is extremely varied, both between types of feed, as well as in a certain type of feed, depending on a variety of factors (Wilkins R.J., 2000).

Fertilization with microelements helps to improve the chemical composition of forage and also the floristic structure. Prevention deficiencies in micronutrients of the forage are achieved by fertilization with organic or mineral fertilizer with microelements (Ryser J.P. *et al*, 2001). The quality of forage depends on "nutritional value" (the potential to provide nutrients, digestibility and their contents), the amount of forage intake and the presence of elements that degrade the quality (Ball D. *et al*, 2001).

The basic component of plants that compose forage is the cell. Plant cell consists of: primary cell wall (ADF consisting of cellulose and lignin), second wall (NDF consisting of hemicellulose, cellulose and lignin), cytoplasm and vacuole (Orloff S.B., Putnam D.H., 2007). Crude protein content shows the amount of nitrogen found in forage. Usually forage crude protein content varies with plant species that compose forage, the development stage of the plant at harvest and applied fertilization (Schroeder J.W., 1996). Crude protein content of the vegetables ranges on average from 13 to 19%, while the percentage of the grass is between 8 and 14%.

MATERIAL AND METHOD

The current study was conducted on a temporary meadow, organized in Ezareni farm, which is found in the Didactic Station of the University of Agricultural Sciences and Veterinary Medicine, is located on land sloping, with NE exposition, the soil type is cernoziom cambic weak leachate, loam-clay, humus content 4.2-4.8%, middle stocked with phosphorus (30-37 ppm.) and very well stocked in mobile potassium (235-320 ppm.), pH 6.5 to 6.9 in the soil layer 0-20 cm. The studied experiment analyzes two factors placed after the randomized blocks method in three repetitions with the objective of studying the role of mineral fertilizers in various doses, on the values that express the quality of the forage at species and simple mixture smooth brome (*Bromus inermis* Leyss.) and sainfoin (*Onobrychis viciifolia*

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Scop.): determination of CP forage content (crude protein); the determination of NDF content (neutral detergent fiber); the determination of ADF content (acid detergent fiber); calculation of relative forage quality (RFQ). To achieve the objectives, it was organized in the spring of 2014, an experiment which studies two factors of type 5 x 4, with the following factors: *Factor A = culture system, with five graduations:* a_1 - *Bromus inermis* Leyss.100 % (control); a_2 - *Bromus inermis* Leyss. 75% + *Onobrychis viciifolia* Scop. 25%; a_3 - *Bromus inermis* Leyss. 50% + *Onobrychis viciifolia* Scop. 50%; a_4 - *Bromus inermis* Leyss. 25% + *Onobrychis viciifolia* Scop. 75%; a_5 -*Onobrychis viciifolia* Scop.100 %; *Factor B = fertilization with four graduations:* b_1 - *nefertilizat* - (control), b_2 - $N_{50}P_{50}$ kg/ha; b_3 - $N_{100}P_{100}$ kg/ha; b_4 - $N_{150}P_{150}$ kg/ha. Harvest was made at sainfoin flowering (25%), and the results were interpreted statistically by analysis of variance and limit differences calculation. The calculation of relative forage quality RFQ (Relative Forage Quality) was conducted using the following equation (Ward R., Ondarza M.B., 2008; Linn J.G., Martin N.P., 2012):

$$RFQ = \frac{DMI \times TDN}{1,23},$$

DMI (dry matter intake) = 120/NDF (%);
TDN (total digestible nutrients) = 4,898 + 89,796 x NEL (%);
NEL (net energy lactation) = 1,085 - 0,0124 x ADF (Mcal/kg);

For cataloging the obtained forage quality, we have used these quality classes (*table 1*):

Table 1

Feed quality classes according to the values of CP, NDF, ADF and RFQ (Marsalis M.A. *et al*, 2009)

Quality classes	PB ($g \cdot 100\ g^{-1}$ DM)	NDF ($g \cdot 100\ g^{-1}$ DM)	ADF ($g \cdot 100\ g^{-1}$ DM)	RFQ
0 - Excelent	>19	<40	<31	>151
1 - Very good	17-19	40-46	31-35	125-151
2 - Good	14-16	47-53	36-40	103-124
3 - Middle	11-13	54-60	41-42	87-102
4 - Weak	8-10	61-65	43-45	75-86
5 - Very weak	<8	>65	>45	<75

RESULTS AND DISCUSSIONS

Analyzing the influence of interaction between species or used mixture and fertilizer on plants content of CP ($g \cdot 100\ g^{-1}$ DM) (*table 2*) it is noted that the higher crude protein content of 17.7 $g \cdot 100\ g^{-1}$ DM it was recorded in the mixture *Brous inermis* Leyss. 25% + *Onobrychis viciifolia* Scop. 75%, fertilized with $N_{100}P_{100}$, the difference compared to the control is very significant. A high crude protein content, of 17.1 $g \cdot 100\ g^{-1}$ DM was recorded in variant with *Onobrychis viciifolia* Scop. 100%, unfertilized (N_0P_0). The lowest crude protein content of 11.6 $g \cdot 100\ g^{-1}$ DM was recorded in the control variant, with *Brous inermis* Leyss. 100%, unfertilized (N_0P_0).

Analysis of the influence on interaction between species or mixture used and fertilization on plant NDF content is observed that the highest content in NDF, of 61.5 $g \cdot 100\ g^{-1}$ DM, was recorded in variant with *Onobrychis viciifolia* Scop. 100%, fertilized with $N_{150}P_{150}$. A high NDF content, of 60.3 $g \cdot 100\ g^{-1}$ DM, a close to maximum content was recorded in the mixture *Brous inermis* Leyss. 25% + *Onobrychis viciifolia* Scop. 75%, fertilized with $N_{150}P_{150}$. The lowest NDF content of 41.3 $g \cdot 100\ g^{-1}$ DM it was recorded in the control variant (*Brous inermis* Leyss. 100%, unfertilized).

Analysis of the influence on the interaction between species or used mixture and fertilizer in the plant ADF content (*table 2*) it is noted that the highest content in the ADF, of 45.5 $g \cdot 100\ g^{-1}$ DM, it was obtained from variant with only *Onobrychis viciifolia* Scop. 100% fertilized cu $N_{150}P_{150}$. The lowest content in the ADF, of 29.7 $g \cdot 100\ g^{-1}$ DM, it was registered in the control variant (*Brous inermis* Leyss. 100%, unfertilized).

Regarding the influence of interaction between species or used mixture and fertilizer on forage quality relative (RFQ) is observed that the highest value RFQ of 165 was recorded in the control variant (*Brous inermis* Leyss. 100%, unfertilized). The lower RFQ of 83 was obtained from variant with only *Onobrychis viciifolia* Scop. 100% fertilized cu $N_{150}P_{150}$.

Forage quality obtained was quantified using the parameters analyzed (CP, NDF, ADF and RFQ). Thus, if the influence of the interaction between the species or the mixture used and fertilization on the quality of the biomass obtained was a trend for improvement the content of CP with the increase in the amount of nutrients (based on NP) applied and with increased proportion in the mixture of *Onobrychis viciifolia* Scop. species.

On the other hand the digestibility of forage obtained, influenced by the values that represent the content of plant cell walls (NDF and ADF), followed a negative trend compared to the CP content. Accumulation of cell walls (NDF and ADF) shows a lower value relative forage quality (RFQ) resulting a reduction of expendability în obtained forage.

Table 2

The influence of interaction between species or used mixture and fertilizer on forage quality

Variant		CP	NDF	ADF	RFQ
		(g·100 g^{-1} DM)			
a_1 - *Brous inermis Leyss.* 100% (control)	b_1- N_0P_0 (control)	11.6^{C}	41.3^{C}	29.7^{C}	165^{C}
	b_2 - $N_{50}P_{50}$	11.7	42.9	33.9**	148^{oo}
	b_3 - $N_{100}P_{100}$	12.7*	50.5***	36.6***	120^{ooo}
	b_4 - $N_{150}P_{150}$	13.7***	51.1***	37.8***	116^{ooo}
a_2 - *Brous inermis Leyss.* 75% + *Onobrychis viciifolia Scop.* 25%	b_1 - N_0P_0	12.4	42.8	34.1***	148^{oo}
	b_2 - $N_{50}P_{50}$	13.3***	44.4	36.3***	138^{ooo}
	b_3 - $N_{100}P_{100}$	14.8***	52.5***	38.7***	111^{ooo}
	b_4 - $N_{150}P_{150}$	14.7***	53.3***	40.1***	107^{ooo}
a_3 - *Brous inermis Leyss.* 50% + *Onobrychis viciifolia Scop.* 50%	b_1 - N_0P_0	14.5***	44.2	36.0***	139^{ooo}
	b_2 - $N_{50}P_{50}$	14.3***	47.7***	38.5***	123^{ooo}
	b_3 - $N_{100}P_{100}$	16.5***	54.2***	40.3***	105^{ooo}
	b_4 - $N_{150}P_{150}$	16.3***	57.5***	42.0***	95^{ooo}
a_4 - *Brous inermis Leyss.* 25% + *Onobrychis viciifolia Scop.* 75%	b_1 - N_0P_0	15.7***	45.0*	39.2***	129^{ooo}
	b_2 - $N_{50}P_{50}$	15.9***	49.0***	40.8***	115^{ooo}
	b_3 - $N_{100}P_{100}$	17.7***	56.1***	42.2***	97^{ooo}
	b_4 - $N_{150}P_{150}$	16.7***	60.3***	43.5***	88^{ooo}
a_5 - *Onobrychis viciifolia Scop.* 100%	b_1 - N_0P_0	17.1***	46.0**	41.0***	122^{ooo}
	b_2 - $N_{50}P_{50}$	16.4***	49.5***	42.6***	110^{ooo}
	b_3 - $N_{100}P_{100}$	16.5***	57.8***	44.6***	90^{ooo}
	b_4 - $N_{150}P_{150}$	15.5***	61.5***	45.5***	83^{ooo}
	LSD 0.05 =	*0.9*	*3.2*	*2.5*	*13*
	LSD 0.01 =	*1.2*	*4.3*	*3.3*	*17*
	LSD 0.001 =	*1.6*	*5.6*	*4.3*	*22*

Analyzing the influence of the species or mixture used on the crude protein content (*table 3*) it is noted that the highest content of 16.4 g·100 g^{-1} DM, it was registered both in the mixture *Brous inermis* Leyss. 25% + *Onobrychis viciifolia* Scop. 75%, and also in the variant with just *Onobrychis viciifolia* Scop. 100%, differences compared to the control being very significant. Lowest content of crude protein of 12.3 g·100 g^{-1} DM was obtained in the control variant (*Brous inermis* Leyss. 100%). Influence of species or mixture used on plants NDF content is observed that in variant *Onobrychis viciifolia* Scop. 100% was obtained the highest content of plants in NDF of 53.7 g·100 g^{-1} DM, and the lowest of 46.5 g·100 g^{-1} DM, it was recorded in the control variant (*Brous inermis* Leyss. 100%).

Influence on plants ADF content of used mixture and species showed that the highest content in the ADF, of 43.4 g·100 g^{-1} DM was obtained on the variant were *Onobrychis viciifolia* Scop. had 100%, and the lowest of 34.5 g·100 g^{-1} DM, was recorded in control plot (*Brous inermis* Leyss. 100%).

Analysis of species or mixture used influence on the relative forage quality (RFQ) revealed that studied variants caused significant differences compared to control (*table 3*). In control variant *Brous inermis* Leyss. 100% was obtained the highest relative forage quality, of 137, and the lowest, of 101, was registred in *Onobrychis viciifolia* Scop. 100%, variant.

In terms of content on CP obtained, the study showed that a share of the species *Onobrychis viciifolia* Scop. in the mixture results an increase of the quality from grade 3 (middle) to 2 or 1 (good or very good).

In terms of forage content obtained in ADF and NDF, a larger share of the species *Onobrychis viciifolia* Scop.in the mixture causes a decline in its quality from grade 1 (very good) to grade 2 or 3 (good or middle).

Table 3

Influence of species or used mixture on forage quality

Variant		CP	NDF	ADF	RFQ
		(g·100 g^{-1} DM)			
a_1 - *Brous inermis Leyss.* 100% (control)		12.3^{C}	46.5^{C}	34.5^{C}	137^{C}
a_2 - *Brous inermis Leyss.* 75% + *Onobrychis viciifolia Scop.* 25%		13.7*	48.3	37.3	126
a_3 - *Brous inermis Leyss.* 50% + *Onobrychis viciifolia Scop.* 50%		15.3**	50.9*	39.2*	115^{o}
a_4 - *Brous inermis Leyss.* 25% + *Onobrychis viciifolia Scop.* 75%		16.4***	52.6*	41.4**	107^{oo}
a_5 - *Onobrychis viciifolia Scop.* 100%		16.4***	53.7**	43.4***	101^{ooo}
	LSD 0.05 =	*1.4*	*4.2*	*3.7*	*16*
	LSD 0.01 =	*2.0*	*6.2*	*5.4*	*23*
	LSD 0.001 =	*3.1*	*9.3*	*8.1*	*34*

Analyzing the influence of fertilization on crude protein content (*table 4*) is observed that the highest content of 15.6 % g·100 g^{-1} DM, it was recorded in variant fertilized with $N_{100}P_{100,}$ and the lowest content of 14.0 % g·100 g^{-1} DM, was obtained in the control variant (N_0P_0).

The influence of fertilization on plant NDF content showed that the highest content of 56.8 g·100 g^{-1} DM, it was recorded in variant fertilized with $N_{150}P_{150}$ and the lowest content of 43.9 g·100 g^{-1} DM, was obtained in the control variant (N_0P_0).

Fertilization had influence over the plants ADF content, causing the recording of significant differences with increasing fertilizer rates. Thus, the highest content of plants ADF, of 41.8 g·100 g^{-1} DM, it was recorded at fertilized variant $N_{150}P_{150,}$ and the lowest, of 36,0 g·100 g^{-1} DM, was obtained from unfertilized variant (control variant). Analyzing the influence of fertilization on the relative forage quality (RFQ) of obtained biomass, it was observed that the higher RFQ, of 141, was obtained from control variant (N_0P_0), while the lowest RFQ of 98 was recorded in $N_{150}P_{150}$variant.

On average, application of fertilizers based on nitrogen and phosphorus did not change feed grade obtained, in terms of its content in CP. Values obtained falling within in class quality 2 (good). Greatest influence was manifested on the values of NDF, ADF and RFQ, where the forage quality was reduced from quality class 1 (very good) to quality class 3 (middle).

Table 4

Influence of fertilization on forage quality

Variant		CP	NDF	ADF	RFQ
		(g·100 g^{-1} DM)			
b_1 - N_0P_0 (control)		14.0^{C}	43.9^{C}	36.0^{C}	141^{C}
b_2 - $N_{50}P_{50}$		14.3	46.7	38.4	127^{o}
b_3 - $N_{100}P_{100}$		15.6*	54.2***	40.5**	105^{ooo}
b_4 - $N_{150}P_{150}$		15.4*	56.8***	41.8***	98^{ooo}
	LSD 0.05 =	*1.4*	*5.6*	*3.0*	*14*
	LSD 0.01 =	*1.8*	*7.4*	*4.0*	*19*
	LSD 0.001 =	*2.4*	*9.7*	*5.2*	*25*

CONCLUSIONS

In mixtures of *Brous inermis* Leyss. and *Onobrychis viciifolia* Scop. fertilized with chemical fertilizers based on nitrogen and phosphorus it was observed a trend for improvement in the CP content once with increasing amounts of fertilizer (based on NP) applied and also with increasing proportion of the species *Onobrychis viciifolia* Scop. in the mixtures.

Digestibility of forage obtained influenced by the values that represent content in plant cell walls. NDF and ADF, followed a negative trend compared to the CP content.

If it is desired to produce a good to very good quality forage. both in terms of protein and energy from the study conducted. it is recomanded the use of a mixture composed from *Brous inermis* Leyss. 50% + *Onobrychis viciifolia* Scop. 50% fertilized moderately with $N_{50}P_{50}$.

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