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Qualitative changes in the fodder obtained from forage legumes and *Lolium multiflorum* in the ecological conditions of Eastern Europe

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SUMMARY – *Lolium multiflorum* is cultivated in Romania in pure stands and in simple mixtures (with a legume) and it covers about 30% in forage-based farms. The purpose of this work is to present the behaviour of some annual mixtures of Italian ryegrass var. westerwoldicum and Berseem clover under the influence of the environmental conditions of Romanian West Plain, and being cropped as fresh fodder. In accordance with the results obtained, the quantity and quality of the fodder is better in mixture stands in comparison with *Lolium multiflorum* pure stands. The contribution of the species to the mixture has a great impact on dry matter yield and crude protein content.

Keywords: *Lolium multiflorum*, pure stand, mixtures, quality.

RESUME – *"Changements qualitatifs concernant le fourrage obtenu à partir de legumes fourragères et de* Lolium multiflorum *dans les conditions écologiques de l'Europe de l'Est". Le ray-grass italien est cultivé en Roumanie en culture pure et en mélange simple (avec une légumineuse), et cette espèce représente environ 30% des fermes ayant une base fourragère. Les objectifs de ce travail consistent à présenter le comportement de quelques mélanges de* Lolium multiflorum *et* Trifolium alexandrinum*, sous l'influence des conditions de milieu des plaines de l'ouest de la Roumanie, ce mélange étant cultivé pour fourrage. Selon les résultats obtenus, la quantité et la qualité des productions de fourrage sont meilleures pour les cultures en mélange en comparaison aux cultures pures des ray-grass italiens. La part des espèces dans le mélange présente une grande influence sur la production de matière sèche et la teneur en protéines brutes.*

Mots-clés : Lolium multiflorum*, cultures pures, mélange, qualité.*

Introduction

The principal benefits of intercalating Italian ryegrass with Berseem clover are: conducts to the increase of total dry matter production and forage quality, decreases the used quantity of mineral fats, improves the soil quality, also are assured increased productions for successive cultures (Agnieszka Szyszkowska, Jozef Sowinski, 2001).

The quality of the forage which is produced in the spring (digestibility, energy, proteins, minerals) remains of very good quality since before the end of flowering of Italian ryegrass and until the apparition of the first flower buds at the legumes.

Materials and method

The experience was placed on the experimental fields of University of Agricultural Sciences and Veterinarian Medicine of Banat Timisoara. The settlement is in West Plane of Romania, and the soil on witch the experiences have been placed is a cambic chernozem. The most droughty months are June and July. In the vegetation period, the temperatures have been raised, over the multi-annual media in the both experimental years, on the base of low precipitations, which got to different harvest results. As a biologic material we used Gorby breed of *Trifolium alexandrinum*, and Wesley breed of *Lolium multiflorum var. westerwoldicum*. The study was based on the cultures of Italian ryegrass (L.m.) and Berseem clover (T.a.), in pure culture and also in mixture in different percentages. Variants without fertilizer (N0) and with chemical fertilizers (N100, $P_2O_5$50, K_2O50) were studied. In this paper the dry matter productions obtained in the two experimental years (2006 and 2007 at two cuts) are

presented. In the year 2007 the dry matter production dynamics, at first cut was studied in 3 different stages of vegetation (51– Inflorescence emerged from sheath; 61– Beginning of flowering; 69– End of flowering), taking as witness Italian ryegrass. The analysis of the vegetation stages was made according to the BBCH code. The results interpretation has been done according to the three factorial analysis of variance.

Results and discussion

The production results in both of the studied years are presented in Table 1. In 2006 – in an unfertilized system, at all the variants were registered productions very significant superior to the witness. In an fertilized system the biggest dry matter yield in the mixture (10.1 t/ha) was registered at the variant Italian ryegrass 50% + Berseem clover 50%.

Table 1. Significance of yield differences (D.M. t/he) of the studied variants

Specification	N0 Year 2006		Year 2007		N100 Year 2006		Year 2007	
	Average (t/ha)	Difference/ Signif.	Average (t/ha)	Difference/ Signif.	Average (t/ha)	Difference/ Signif.	Average (t/ha)	Difference/ Signif.
Lolium multiflorum	4.73		4.32		7.79		6,44	
Trifolium alexandrinum	8.87	4.14 ^{xxx}	8.32	4 ^{xxx}	10.4	2.6 ^{xxx}	5,74	2.62 ^{xxx}
L.m.75%+T.a.25%	6.34	1.61 ^{xxx}	5.87	1.55 ^{xxx}	8.6	0.8 ^{xx}	6,52	1.31 ^{xx}
L.m.50%+T.a.50%	7.54	2.81 ^{xxx}	7.14	2.82 ^{xxx}	10.1	2.3 ^{xxx}	7,44	2.83 ^{xxx}
L.m.25%+T.a.75%	8.38	3.56 ^{xxx}	7.88	3.55 ^{xxx}	9.82	2.02 ^{xx}	6,12	2.21 ^{xxx}
LSD 5%	0.15		0.15		0.58		0.61	
LSD 1%	0.22		0.22		0.85		0.89	
LSD 0.1%	0.33		0.33		1.28		1.34	

Legend: *Lolium multiflorum* – L.m.; *Trifolium alexandrinum* – T.a.

In 2007, the dry matter yields in the unfertilized system were smaller than in 2006. The maximum value at the mixtures was registered at the variant Italian ryegrass 25% + Berseem clover 75% - 7.88 t/he dry matter. In an fertilized system at the mixtures, the variant Italian ryegrass 50% + Berseem clover 50% in 2007 has registered the biggest production adds (2.83 t/ha) towards the witness. The production differences between the two experimental years are due to the variation of the climatic factors.

In Fig. 1 we present the apportion on cuts in percentage of the total production. In Italian ryegrass, as expected, the first cut represent 90.2% from the total production. On the other hand, in the first and second cuts of both years, the total dry matter yield is bigger in Berseem clover than in Italian ryegrass and the apportion on cuts is more equilibrated (Table 2).

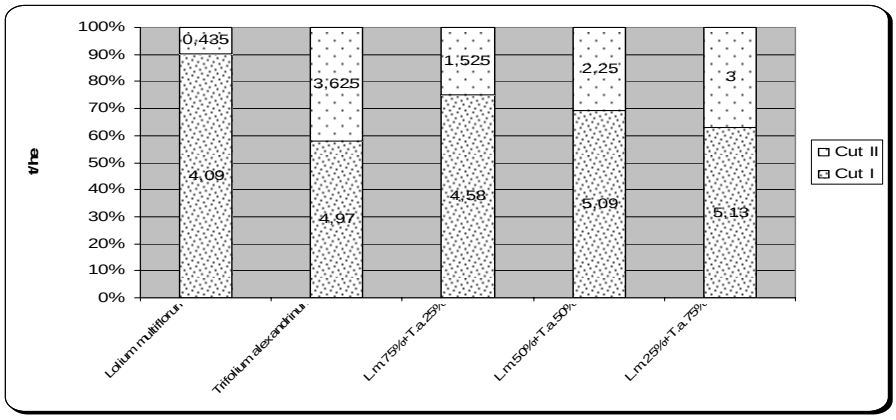

Fig.1. The apportion on cuts of the medium dry matter yield at the studied variants (t/ha).

Table 2. The significance of production differences between variants, treatments and phenophases

Specification		51		61		69				
		Average	Diff. / Signif.	Average	Diff. / Signif.	Average	Diff. / Signif.	Average	Relative value	Diff. / Signif.
Lolium multiflorum	F.	5.64	2.52^{xx}	6.1	2.54^{xx}	6.44	2.5^{xx}	4.8	100	
	Wh.F	3.12		3.56		3.94				
Trifolium alexandrinum	F.	4.96	0.74	5.52	1.08^{x}	5.74	0.92^{x}	4.95	103.13	0.15
	Wh.F	4.22		4.4		4.82				
L.m.75%+ T.a.25%	F.	5.74	1.94^{xx}	6.3	2.44^{xx}	6.5	2.08^{xx}	5.1	106.32	0.3^{x}
	Wh.F	3.8		3.86		4.42				
L.m.50%+ T.a.50%	F.	6.67	2.35^{xx}	7.22	2.36^{xx}	7.44	2.44^{xx}	5.91	123.29	1.11^{xxx}
	Wh.F	4.32		4.86		5				
L.m.25%+ T.a.75%	F.	5.34	0.4	5.9	1.3^{x}	6.12	1.14^{x}	5.31	110.69	0.51^{xx}
	Wh.F	4.49		4.6		4.98				
	Average	4.87		5.23		5.54		LSD 5% 0.2 t/ha; 1% 0.37 t/ha; 0.1% 0.5 t/ha		
	Diff. / Signif.			0.36^{xxx}		0.66^{xxx}				

LDS 5%=0.15 t/ha; 1%= 0.2 t/ha; 0.1%= 0.26 t/ha
Legend: With ferilizers – F, Without fertilizers - Wh. F.

From Table 2 analysis we can observe the influence of the fertilizers on the dry matter yield and also on the protein production. Thus Italian ryegrass proves to be a forage plant with an excellent reaction at the fertilizers doses, the obtained ads were in a 2.5 t/ha amount in all the phenophases.

In the variant in which Berseem clover is cultivated alone, the treatments influence is insignificant in phenophase 51. In the next harvesting phases, the used fertilizers doses conduct to an increase of the dry matter yield , the 1.08 t/ha and 0.92 t/ha adds are statistically assured.

In Table 2 it can be observed the fact that at all the mixture variants, the medium dry matter yield exceeds the witness Italian ryegrass. The most valuable variant is Italian ryegrass 50% + Berseem clover 50%, in which the dry matter yield exceed the witness Italian ryegrass, the difference of production is very significant bigger.

Chemical analysis yields results similar to those reported in the literature (Fulkerson W. J. *et al.* 2007; Abas *et al*., 2005). The results reflect the influence of grass type as well as the management treatment.

The protein content increase slowly with the fertilizer in the case of *Lolium multiflorum*, (2.5%, as can be seen from the Table 3). In the case of *Trifolium alexandrinum* the rise of crude protein content seems to be significantly (approx. 6.2%).

On the other hand, the concentration of crude protein increased in mixture in both cases. The content of other studied mineral (Ca respectively P) did not change with the composition of mixture or with the management treatment. Treatment with fertilizer significantly increased the digestibility of mixtures, but did not change ME (metabolized energy MJ/kg DM) and NDF level, compared with the control (Table 4), having a large quantity of *Lolium multiflorum*.

The effect of composition of mixture regarding the digestibility, ME, and NDF levels is shown in Table 5.

As it can be seen from the Table 5 data, the ME content of A and B type was significantly ($P<0.01$) lower than that of other type, although the difference was only 0.3 – 0.6 MJ/kg DM. Digestibility varied in the same manner to ME among pasture composition. Type A was highest in NDF, whereas the crud protein was lowest (Table 3).

Table 3. The chemical composition of the forage

Specification	Dry matter %	Crud ash %	Crude fiber %	NDF %	ADF %	Crude protein %	Crude fat %	K %	Ca %	P %
Without fertilizer										
Lolium multiflorum	91.87	8.24	26.52	46.3	24.9	16.2	1.98	3.27	0.49	0.37
Trifolium alexandrinum	89.71	9.72	32.25	52.7	33.5	23.4	2.82	2.71	1.28	0.28
L.m.75%+T.a.25%	91.18	8.52	21.42	47.84	31.74	17.7	2.01	3.1	0.67	0.3
L.m.50%+T.a.50%	90.77	8.87	23.52	48.75	33.85	20.6	2.14	2.8	1.07	0.29
L.m.25%+T.a.75%	89.94	9.12	30.67	50.25	35.25	21.57	2.34	2.78	1.10	0.28
With fertilizer										
Lolium multiflorum	92.35	10.64	28.73	48.5	30.25	18.8	2.56	3.98	0.51	0.68
Trifolium alexandrinum	90.54	18.45	30.45	54.6	36.65	29.8	3.42	3.01	1.40	0.56
L.m.75%+T.a.25%	94.04	11.25	25.63	45.23	30.28	19.21	2.57	3.72	0.78	0.66
L.m.50%+T.a.50%	92.35	11.63	24.71	52.68	32.75	24.34	2.97	3.34	1.14	0.59
L.m.25%+T.a.75%	91.89	12.18	29.47	52.34	33.48	26.52	3.26	3.11	1.20	0.58

Table 4. The influence of management treatment on the quality of mixture

Management treatment	ME [MJ/kg DM]	NDF[%]	Digestibility [%]
A-without fertilizer	10.8	47.5	71.5
B- with fertilizer	10.5	47.2	74.2

Table 5. The influence of the composition of the mixture on its quality properties

Composition of mixtures [%]	ME [MJ/kg DM]	NDF[%]	Digestibility [%]
A) L_M (75%)+ T_A(25%);	10.2	50.25	71.5
B) L_M (50%)+ T_A(50%);	10.5	48.75	73.6
C) L_M (25%)+ T_A(75%)	10.8	47.20	74.3

Conclusions

The climatic factors, mineral fertilizers and the moment of harvesting have influenced the quantity and quality of the forage at Italian ryegrass, Berseem clover and mixtures, in the 2 experimental years in this way: in 2007 the dry matter yield at all the variants was smaller then in 2006 due to the climatic factors (high temperatures and low precipitation):

(i) Mineral fertilizers conduct to an increase of production of more than 50% at the variant in which Italian ryegrass is alone in culture and at the variants in which Italian ryegrass is in 75% and 50%;

(ii) The variant that registered the biggest medium dry matter yield, compared to the witness variant Italian ryegrass was the mixture Italian ryegrass 50% + Berseem clover 50%. The dry matter yield determined dynamically, increased with the advance in vegetation. The production adds are very significantly bigger at phenophases 61 and 69 than at the phenophase 5;

(iii) The fertilizer significantly increased the crude protein content, but had no effect on the crude fat and mineral content. The fertilization treatment input considerably the digestibility of mixtures, but did not change ME and NDF levels.

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