

THE BEHAVIOR OF RED CLOVER AND ITALIAN RYEGRASS MIXTURE, FERTILIZED WITH GULLE AND MANURE

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Abstract

It is well known that red clover (*Trifolium pratense* L.) has a good agricultural value when is cultivated in wet and cold areas, with annual rainfall of 600 mm. Italian ryegrass (*Lolium multiflorum* Lam.) requires special climatic conditions, but is complementary with red clover. This mixture is often used by farmers due to the high productivity and quality of the feed. The objective of this study is to track the performance of mixture *Trifolium pratense* L. + *Lolium multiflorum* Lam. in both gulle and farmyard manure fertilization management, according to the specific conditions of Subcarpathian Basin Cobatesti-Simonesti, Harghita, Romania. In the experiment were used four graduations of fertilization both with gulle (0 t gulle/ha, 5 t gulle/ha, 10 t gulle/ha and 20 t gulle/ha) and manure (0 t manure/ha, 10 t manure/ha, 30 t manure/ha and 50 t manure/ha). Floristic composition was determined by gravimetric method and the results were interpreted by appropriate statistical methods. After two experimental years it was noticed that mixture's production suffered significantly influenced by both types of fertilizers. When larger quantities of fertilizer are applied, Italian ryegrass becomes very aggressive, being dominant in the mixture.

Key words: gulle, grass/clover, farmyard manure, mixture, Sub-Carpathian Basin.

INTRODUCTION

Red clover has been an important forage crop since the Middle Ages and the agricultural cultivar has been widely grown since the 17th century. It is found in fields and meadows throughout Europe and North America and prefers deep, rich, dry or moderately moist soils, being adapted to cooler areas (Rotar and Carlier, 2010). Red clover culture has a long tradition in Romania, but in mixture with Italian ryegrass is mostly used in Transylvania area. Romanian farmers cultivate the mixture of Italian ryegrass and red clover, observed by us in this study, due to the high productivity and quality of the feed. We aimed by this study to provide a deep and comprehensive analysis of the mixture *Trifolium pratense* L. + *Lolium multiflorum* Lam under different treatments: gulle and manure fertilization, with special attention to its productivity, floristic composition and protein content.

MATERIALS AND METHODS

Our experience was located in Transylvania region on a loamy soil with pH 6.7. The

experimental area is characterized by annual temperatures average around 9.8^oC and by total annual rainfall of 553 mm year⁻¹. The experience was established in 2009 and carried out for a period of three years (between 2009 and 2011). The experimental field was installed after the subdivided parcels method, in 4 repetitions. Every variant was fertilized with two types of fertilizer, a liquid one (gulle) and a solid one (manure), in 4 different doses.

The agrochemical composition of gulle and manure was determined on/by the Agency for Pedological and Agrochemical studies from Mures and is presented in Table 1.

Gulle fertilization was applied in the following doses: F1 = 0 gulle, F2 = 5 Mg gulle ha⁻¹, F3 = 10 Mg gulle ha⁻¹, F4 = 20 Mg gulle ha⁻¹. Fertilization with manure was as follows: F1 = 0 manure, F2 = 10 Mg manure ha⁻¹, F3 = 30 Mg manure ha⁻¹, F4 = 50 Mg manure ha⁻¹. The statistic part was made according to variance analysis and statistical interpretation method by using the Duncan test. Floristic studies were performed using the Gravimetric Method (known also as the weighing method), which is used more in studies conducted on sown

grassland. This method is commonly used to record changes that occur in grassland vegetation subjected to the action of certain

treatments aimed to improve its quality, or when the usage category is subjected to some changes (Rotar and Carlier, 2010).

Table 1. The agrochemical composition of fertilizers

Nr. Crt.	Type of fertilizer	Agrochemical content (ppm)			
		N-NO ₃	N (Nitrogen)	P (Phosphorus)	K (Potassium)
1	Gulle	1461	0.730	112	3438
2	Manure	1150	0.815	645	2694

RESULTS AND DISCUSSIONS

As is predicted in literature, crop dry mixture consisting of *Trifolium pratense* L. + *Lolium multiflorum* Lam. is influenced by gulle application (De Vlieghe and Carlier, 2008). At the maximum dose applied we obtained a yield difference of 1.03 Mg ha⁻¹ DM. Soil and climate conditions, very favorable for red clover and Italian ryegrass (clay content, pH,

etc.) led a higher value to the crop control variant, of 13.88 Mg ha⁻¹ DM. This and the large area occupied by red clover in 2010 (48%) made the differences between the first crop fertilization with 5 Mg gulle ha⁻¹ (which has negative graduations, -0.39) and the second one with 10 Mg gulle ha⁻¹ (graduations value 0.74). Manure applied to this mixture gives a similar increase of harvest, of 1.29 Mg ha⁻¹ DM than the application of 50 Mg ha⁻¹ manure (Table 2).

Table 2. Influence of fertilization with gulle on Dry matter content (2010).

Fertilization graduation	Production of DM (t/ha)	Difference (%)	Semnification	Production of DM (t/ha)	Difference (%)	Semnification	Mean
	2010			2011			
F1 (0 Mg gulle ha ⁻¹)	13.88	0.00	-	5.60	0.00	-	9.74
F2 (5 Mg gulle ha ⁻¹)	13.49	-0.39	-	8.01	4.41	***	10.75
F3 (10 Mg gulle ha ⁻¹)	14.62	0.74	**	10.92	5.32	***	12.77
F4 (20 Mg gulle ha ⁻¹)	14.91	1.03	***	10.94	5.34	***	12.92
F1 (0 Mg manure ha ⁻¹)	13.88	0.00	-	5.13	0.00	-	19.01
F2 (10 Mg manure ha ⁻¹)	13.65	-0.23	-	7.15	2.02	***	10.4
F3 (30 Mg manure ha ⁻¹)	14.62	0.74	**	8.23	3.10	***	11.42
F4 (50 Mg manure ha ⁻¹)	15.17	1.29	***	11.43	6.30	***	13.30

DL 2010 gulle (p 5%) 0.42; DL 2010 gulle (p 1%) 0.60; DL 2010 gulle (p 0.1%) 0.88
 DL 2010 manure (p 5%) 0.48; DL 2010 manure (p 1%) 0.68; DL 2010 manure (p 0.1%) 1.01
 DL 2011 gulle (p 5%) 0.25; DL 2011 gulle (p 1%) 0.36; DL 2011 gulle (p 0.1%) 0.53
 DL 2011 manure (p 5%) 0.36; DL 2011 manure (p 1%) 0.52; DL 2011 manure (p 0.1%) 0.77

In 2011, the strongest response is observed to the first graduation of fertilization with gulle, 4.41 Mg ha⁻¹ DM. By doubling the dose of it to 10 Mg gulle ha⁻¹, we observed a difference in yield to the previous application of 0.91, a difference that justifies this dose. Dose increasing up to 20 Mg gulle ha⁻¹ is not justified in this mix because the difference between the application of 20 Mg gulle ha⁻¹ and 10 Mg gulle ha⁻¹ is only 0.02 Mg ha⁻¹ DM, the higher fertility being explained by the large percentage of occupation of 63% by *Lolium multiflorum* Lam. Manure application in 2011, lead to harvest differences at all graduation fertilization, between 2.02 Mg ha⁻¹ DM when

10 Mg manure ha⁻¹ is applied and 6.3 Mg ha⁻¹ DM when 50 Mg manure ha⁻¹ is applied. 50 Mg manure ha⁻¹ application causes differences in DM from 6.3 Mg ha⁻¹ DM to 4.28 Mg ha⁻¹ DM on 10 Mg manure ha⁻¹ and 3.20 Mg ha⁻¹ DM, on 30 Mg manure ha⁻¹).

In terms of floristic composition from the second year, the species *Trifolium pratense* L. reduces its percentage of participation to 48% on the fertilization with gulle (Figure 1), and to 51% on the fertilization with manure, such that in 2011 decreased to 35% for fertilization with gulle and 32% for the fertilization with manure. It was noticed that the mixture had a good behavior, with a reduced participation of weed

of 2% in 2010, to fertilized variants, 2% in 2011, to the variant fertilized with gulle and 1% in the variant fertilized with manure. *Lolium multiflorum* Lam. sp. increases its coverage to both fertilization variants. Generally the intensive culture system is detrimental to *Trifolium pratense* L. and significantly reduce their participation, thus increasing the percentage of coverage of *Lolium multiflorum* Lam.

The protein content of the forage produced depends on many factors from which the most important are the time of harvest, the percentage of species in the mixture and fertilization. Thus, it can be seen that on both fertilization variants (with gulle and manure), once the doses of fertilizers are increased grows also the protein content of the feed (Figure 2).

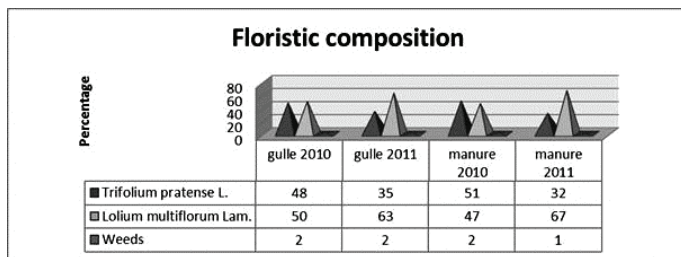


Figure 1. The floristic composition of *Trifolium pratense* L. and *Lolium multiflorum* Lam.

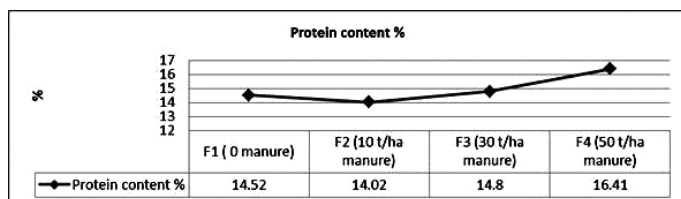


Figure 2. Effect of fertilization on the crude protein content

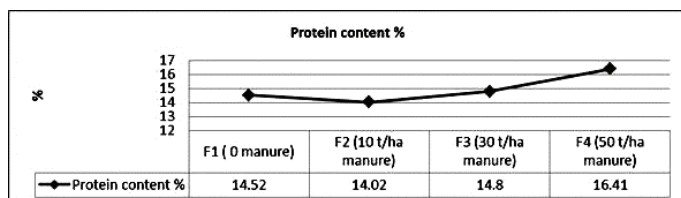


Figure 3. Effect of fertilization on the crude protein content

CONCLUSIONS

Analyzing the DM and green mass production obtained for the mixture consisting in *Trifolium pratense* + *Lolium multiflorum* we conclude that the mixture is extremely favorable for the conditions encountered in the study area, showing its full capacity of production. This mixture is a valuable forage crop, able to exploit specific soil and climate conditions, with high economic efficiency.

Even on high doses of fertilizers (gulle and manure) the vegetation's response was positive, leading us to recommend this highly productive mixture for the region of Transylvania.

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