

THE BEHAVIOR OF THE MIXTURE FORMED BY *TRIFOLIUM PRATENSE*, *MEDICAGO SATIVA*, *LOLIUM PERENNE*, *FESTULOLIUM*, *PHLEUM PRATENSE* AND *DACTYLIS GLOMERATA* UNDER THE INFLUENCE OF MINERAL FERTILIZATION

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Abstract

*This paper aims to track the behavior of a complex mixture consisting of *Trifolium pratense* (10%), *Medicago sativa* (30%), *Lolium perenne* (10%), *Festulolium* (25%), *Phleum pratense* (15%) and *Dactylis glomerata* (10%) under the influence of mineral fertilization in the climatic conditions specific Plateau of Transylvania, Romania. Experience was installed in the spring of 2012 after the subdivided parcels method in 8 variants in 4 repetitions, each plot having size of 50 m² (10l X 5 L). The mixture was sown on 2 densities namely 12.5 cm and 25 cm distances between rows. Variants were fertilized in early March with complex NPK and ammonium nitrate (33.3%) in four different doses: V₁ control variant, unfertilized, V₂- N₅₀P₆₀K₈₀, V₃- N₇₅P₆₀K₈₀, V₄- N₁₀₀P₆₀K₈₀. The experimental parcels were mowed 3 times / year. In order to fulfill the purpose of the present study, results on green mass production, dry matter yield and the evolution of floristic composition of the mixture recorded in 2013 are presented. The species from the mixture had a good reaction to mineral fertilizer. The results registered helped us to recommend the most suitable mixture (in terms of sown-density and fertilization regime) for the soil-climatic conditions specific to the area taken in study.*

Keywords: mixture, behavior, reaction, species, fertilization.

INTRODUCTION

The most important link to establish the structure of sown grassland is in establishing sown grassland is grassland flora, which makes:

density and uniformity of culture, achieving an optimal ratio between the component species (especially between grasses and legumes), exploitation mode (meadow, pasture, mixed-use), a balanced energy-protein ratio of the feed, the duration of use. For the establishment of sown grassland in general forage mixtures are preferred compared to monocultures. This type of culture has an important role in preventing soil erosion and N mineral fertilizer conservation. It also helps in weeds control and ensures greater longevity of the culture. The advantages of complex mixtures compared to monoculture are due to species-specific niches complementarity (Hoekstra *et al.*, 2013). A good

example of this is the interaction between species, whether or not able to fix nitrogen was shown to be materialized in significant increases in yield (Nyfeler *et al.*, 2011).

Alfalfa (*Medicago sativa* L.) is the main forage crop in Romania (Maria Schitea, 2010). Vast spread of alfalfa in the Mediterranean is particularly due to its high capacity to adapt to arid climate, its high yield and high nutritional quality (Annicchiarico *et al.* 2013). Unlike alfalfa clover is strongly influenced by humidity who sketched productivity. This is mainly due to the root system, which on clover is less developed (Varga *et al.*, 1998).

MATERIALS AND METHODS

This paper aims to track the behavior of a complex mixture consisting of *Trifolium pratense* (10%), *Medicago sativa* (30%), *Lolium perenne* (10%), *Festulolium* (25%), *Phleum pratense* (15%) and *Dactylis glomerata* (10%) under the influence of mineral fertilization in the climatic conditions specific Plateau of Transylvania, Romania. Experience was installed in the spring of 2012 in experimental fields located inside the Agricultural Research and

Development Station Turda. Experimental area is characterized by an average annual temperature (2013) 10.4⁰ C and average annual rainfall of 523.2 mm. Soil type is faeoziom vertic clay.

The experience has been installed after the subdivided parcels method in 8 variants in 4 repetitions, each plot having size of 50 m² (10l X 5 L). The mixture was sown on 2 densities namely 12.5 cm and 25 cm distances between rows. Variants

were fertilized in early March with complex NPK and ammonium nitrate (33.3%) in four different doses: V₁ control variant, unfertilized, V₂-N₅₀P₆₀K₈₀, V₃-N₇₅P₆₀K₈₀, V₄-N₁₀₀P₆₀K₈₀. The experimental parcels were mowed 3 times / year. The recorded data were

statistically processed using Polifact program. In order to fulfill the purpose of the present study, results on green mass production, dry matter yield and the evolution of floristic composition of the mixture recorded in 2013 are presented.

RESULTS AND DISCUSSIONS

⇒ *Results on green mass and dry matter production recorded from the variants sown at 12.5 cm distance between rows*

The complex mixture consisting in *Trifolium pratense* (10%), *Medicago sativa* (30%), *Lolium perenne* (10%), *Festulolium* (25%), *Phleum pratense* (15%) and *Dactylis glomerata* (10%) had a good reaction to mineral fertilization with N₅₀P₆₀K₈₀ (Table 1). At this graduation the maximum yield increase was recorded, both for the production of green mass (143.1%) and for the production of dry matter (152.8%). In which concerns green mass production the mixture studied recorded values between 27.61 t green mass / ha (control variant, V₁) and 39.50 t green mass/ ha (V₂-fertilized with N₅₀P₆₀K₈₀). It

seems that the intensive fertilization regime hasn't a positive effect on the production of green mass which decreases from 39.50 t green mass/ ha (V₂-fertilized with N₅₀P₆₀K₈₀) to 34.90 t green mass/ ha (V₄-fertilized with N₁₀₀P₆₀K₈₀).

Dry matter production follows, as expected the path of green mass production. Values of dry matter production between 8.96 t DM / ha (control variant V₁) and 13.69 t DM / ha (V₂-fertilized with N₅₀P₆₀K₈₀) were recorded. Increasing the dose of fertilizer above this value result in lower dry matter production up to 11.60 t DM / ha (V₄-fertilized with N₁₀₀P₆₀K₈₀).

Table 1

The influence of mineral fertilization on green mass and dry matter production on the variants sown on 12.5 cm distance between rows

Fertilization graduations	Production [t/ha]		Percent		Difference		Significance	
	Green mass	DM	Green mass	DM	Green mass	DM	Green mass	DM
V ₁ - 0 kg/ha	27,61	8,96	100,0	100,0	0,00	0,00	Mt.	Mt.
V ₂ - N ₅₀ P ₆₀ K ₈₀	39,50	13,69	143,1	152,8	11,89	4,73	***	***
V ₃ - N ₇₅ P ₆₀ K ₈₀	35,83	12,68	129,8	141,5	8,22	3,72	***	***
V ₄ - N ₁₀₀ P ₆₀ K ₈₀	34,90	11,60	126,4	129,5	7,29	2,64	***	***

*DL(p5%)0,00 DL(p1%)0,00 DL (p 0.1%) 0,00

**DL (p 5%)0,69 DL (p 1%)1,00 DL (p 0.1%) 1,47

⇒ **Results on green mass and dry matter production recorded on variants sown on 25 cm distance between rows**

Alike the variants sown on 12.5 cm between rows, the maximum yield increase from the variants sown at 25 cm distance between rows (141.47% on green mass production and 123% on dry matter production) was recorded on the variant fertilized with N₅₀P₆₀K₈₀ (Table 2).

Green mass production ranged between 24.45 t green mass / ha and 34.59 t green mass / ha. Increasing the dose of

fertilizer leads to lower crop up to 31.44 t green mass / ha (V₃-fertilized with N₇₅P₆₀K₈₀).

Dry matter production recorded values between 8.78 t DM / ha on control variant V₁ and 10.80 t DM / ha on the variant fertilized with N₅₀P₆₀K₈₀. Intensification of fertilization regime results in reduced dry matter production up to 10.39 t DM / ha (V₃-fertilized with N₇₅P₆₀K₈₀).

Table 2

The influence of mineral fertilization on green mass and dry matter production on the variants sown on 25 cm distance between rows

Fertilization graduations	Production [t/ha]		Percent		Difference		Significance	
	Green mass	**DM	*Green mass	**DM	*Green mass	**DM	*Green mass	**DM
V ₁ -0 kg/ha	24,45	8,78	100,0	100,0	0,00	0,00	Mt.	Mt.
V ₂ - N ₅₀ P ₆₀ K ₈₀	34,59	10,80	141,47	123,0	10,14	2,02	***	***
V ₃ - N ₇₅ P ₆₀ K ₈₀	31,44	10,39	128,58	118,33	6,99	1,61	***	***
V ₄ - N ₁₀₀ P ₆₀ K ₈₀	33,84	10,47	138,40	119,24	9,39	1,69	***	***

* DL (p 5%) 0,00

DL (p 1%) 0,00

DL (p 0.1%) 0,00

** DL (p 5%) 0,01

DL (p 1%) 0,01

DL (p 0.1%) 0,01

Analysis of green mass and dry matter production (Table 3) highlights the superiority of variants seeded at 12.5 cm density, which recorded the highest values of green mass and dry matter production (on all fertilization graduations). Also can be observed that the highest

yield was registered on the variants fertilized with N50P60K80, both variants seeded 12.5 cm density (where we have 39.50 t green mass / ha and 12.68 t DM / ha) and on variants seeded at 25 cm density (where we have 34.59 t green mass / ha and 10.80 t DM/ ha).

Table 3

Interactions Sown Density- Fertilization

Symbol		Variant		%		Difference		Significance	
Fertilization	Sown density	Green mass	DM	Green mass	DM	Green mass	DM	Green mass	DM
V ₁ - 0 kg/ha	D0-average	26,03	8,87	100,0	100,0	0,00	0,00	Mt.	Mt.
	12.5	27,61	8,96	88,8	90,7	-3,49	-0,92	000	-
	25	24,45	8,78	78,6	88,8	6,65	1,1	***	*
V ₂ - N ₅₀ P ₆₀ K ₈₀	D0- average	37,04	11,74	100,0	100,0	0,00	0,00	Mt.	Mt.
	12.5	39,50	12,68	123,5	118,2	7,52	1,95	***	*
	25	34,59	10,80	108,16	100,65	2,61	0,07	000	0
V ₃ - N ₇₅ P ₆₀ K ₈₀	D0- average	33,64	12,04	100,0	100,0	0,00	0,00	Mt.	Mt.
	12.5	35,83	13,69	106,5	113,7	2,19	1,65	***	*
	25	31,44	10,39	93,5	86,3	-2,19	-1,65	000	0
V ₄ - N ₁₀₀ P ₆₀ K ₈₀	D0- average	34,37	11,03	100,0	100,0	0,00	0,00	Mt.	Mt.
	12.5	34,90	11,60	101,5	105,2	0,53	0,57	**	-
	25	33,84	10,47	98,5	94,8	-0,53	-0,57	00	-

* DL (p 5%) 0,24

DL (p 1%) 0,43

DL (p 0.1%) 0,96

** DL (p 5%) 1,47

DL (p 1%) 2,62

DL (p 0.1%) 5,63

⇒ *Results on floristic composition evolution*

Analysing the floristic composition of variants seeded at 12.5 cm distance between rows, highlighted alfalfa great ability to compete, which dominated the mixture. This species occupies the highest percentage of

participation in the grassy carpet structure (Figure 1). The highest percentage of participation is registered on the variant fertilized with V₃-fertilized N₇₅P₆₀K₈₀. This is followed by Festulolium which on the variant

V₄-fertilized with the maximum dose of N₁₀₀P₆₀K₈₀, dominated all other species from the mixture. Red clover records the highest

percentage in the grassy carpet structure on variant V₁, control variant, unfertilized. Worst trend was followed by timothy.

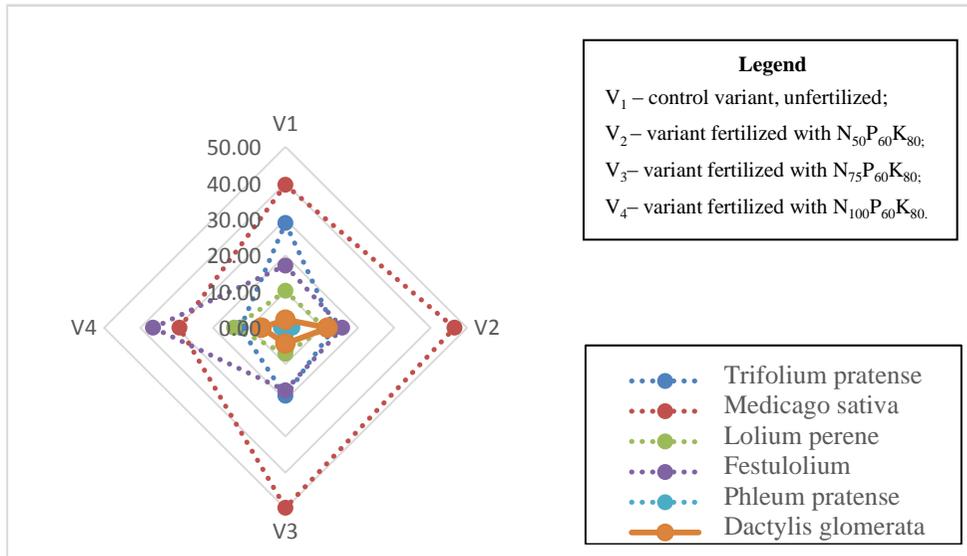


Figure 1. The influence of mineral fertilization on floristic composition on the variants sown on 12.5 cm distance between rows

Similar results are also observed on the variants seeded on 25 cm distance between rows (Figure 2). Also in this case alfalfa dominates the mixture studied. Species ranking remains the same, alfalfa being followed by Festulolium. Unlike variants seeded at 12.5 cm between rows, where alfalfa recorded the maximum percent of participation in the structure of the grassy carpet on V₃- variant fertilized with N₇₅P₆₀K₈₀, on variants seeded at 25 cm distance between rows, alfalfa recorded the highest percentage in variant

V₄-fertilized with N₁₀₀P₆₀K₈₀, and Festulolium on variant V₂-fertilized with N₅₀P₆₀K₈₀. Red clover has a behavior similar to that observed on variants seeded at 12.5 cm between rows, recording the highest percentage of participation in sward on control variant (V₁). However the area occupied by this species is smaller on the variants sown at 25 cm between rows, compared to those sown at 12.5 cm distance between rows. Timothy has a relatively flat route, recording the lowest percentage of participation in the mixture also

on the variants seeded at 25 cm distance between rows. Clover and timothy reaction can be explained by the fact that moisture requirements of these species were not insured, because

the year 2013 was a relatively dry year (underrepresented rainfall associated with high temperatures). Cocksfoot and timothy share the same feed space.

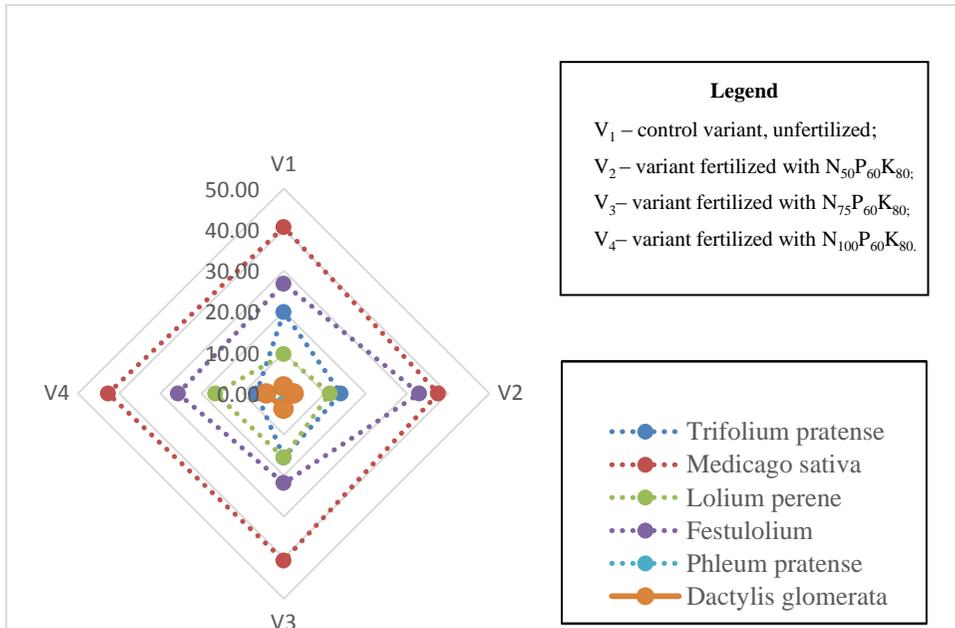


Figure 2. The influence of mineral fertilization on the variants sown on 25 cm distance between rows

CONCLUSIONS

Analysing the mixture formed by *Trifolium pratense* (10%), *Medicago sativa* (30%), *Lolium perenne* (10%), *Festulolium* (25%), *Phleum pratense* (15%) and *Dactylis glomerata* (10%) emphasize positive interactions that occur between species. Legumes (alfalfa and clover) are complementary to other species in the mixture to which they

brings an additional contribution of symbiotic fixed N (expressed both in the production of green mass and at the level of dry matter). Thus it can be seen that the highest average production of green mass and dry matter are registered on the variant V₄, where the proportion of all grasses grow to the detriment of legumes.

Floristic composition analysis are in accordance to Varga *et al.*, 1998 which underlined the fact that clover has a weaker capacity of competition compared to alfalfa, being strongly influenced by soil moisture.

The results obtained recommends that the mixture studied should be sown 12.5 cm distance between rows, sown-density where maximum values were recorded both in which concerns green mass and dry matter production (at all fertilization graduations). Species in the mixture had the

best reaction when they were fertilized with N₅₀P₆₀K₈₀. Floristic composition analysis highlights alfalfa's dominance to the other species from the mixture. From the data registered it seems that the intensification of fertilization regime has a positive influence on *Festulolium*. *Phleum pratense* recorded the lowest percentage of participation in the mixture studied on all experimental variants, aspect relied also by other research developed up to this moment, considering the low rainfall that characterized 2013.

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