The Evolution of a Forage Mixture with Red Clover among Four Experimental Years

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ABSTRACT

Grassland productivity is a complex attribute defined by a series of interdependent indices with important role in the characterization of one grassland culture productivity. Among this the most important are the soil-climatic conditions, the technology applied, floristic composition, forage quality, etc. The present paper aims to follow the behaviour of a forage mixture with red clover among fourth experimental year. We followed the behaviour of a complex mixture consisting of *Trifolium pratense* (15%), *Lolium perenne* (20%), *Festulolium* (25%), *Festuca arundinacea* (25%) and *Phleum pratense* (15%) 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. The experimental area is characterized by an average annual temperature of 10.4^0C C and average annual rainfall of 523.2 mm. Soil type is faeoziom vertic clay. The mixture was sown on 12.5 cm and 25 cm distances between rows and they 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 and V4-N100P60K80. The experimental parcels were mowed 3 times /year. Analysing the complex forage mixture we observed an interesting evolution among the fourth experimental years. Fertilization with medium amounts of nitrogen seemed to have a favourable influence on forage mixture productivity. The results showed that the forage mixture studied can generate high productivity and quality if adequate technology is applied.

Keywords: *forage, mixture, red clover, fertilization.*

INTRODUCTION

The production of quality forage has a significant role in rational production of meat and milk, especially when we take into account that animal feeds make the largest portion in livestock production expenses. A suitable choice of grass-leguminous mixture is a prerequisite for the production of quality animal feeds and thus for a greater production of meat and milk (Lazarevic *et al*., 2005). Grass-leguminous mixtures have a high production potential (over 20 t dry matter /ha) but the level of their utilization depends on the climatic and soil conditions as well as on the technology applied (fertilization, distance between rows, species). The forage resulted from complex mixtures has an optimum balance of nutrients and thus has a great digestibility and is better preferred by animals. Red clover in mixture with other legume and grass species provides a high-quality forage (Picasso *et al*., 2011).

The aim of our study was to follow the behaviour of a complex forage mixture with red clover among four experimental year and thus to highlight the optimum climatic conditions and technology required for high productivity. In this regard we specifically observed the incensement in dry matter production among four experimental year and the behaviour of the species which form

the mixture under different technologies.

MATERIALS AND METHODS

The research was carried out in the experimental field from Agricultural Research and Development Station Turda. Experiences were installed in the spring of 2012 and were observed for a period of 4 years (until 2015). The climate specific to the experimental areas is temperate-continental with 8,9°C annual average temperature of the last 50 years and annual rainfalls ranging between 325 mm and 671 mm. The mean monthly rainfall and temperatures that were observed during the experiment are in Fig. 1.

The soil of the experimental area is classified as typical clay faeoziom. Our analyses were conducted on a forage mixture consisting in *Trifolium pratense* (15%), *Lolium perenne* (20%), *Festulolium* (25%), *Festuca arundinacea* (25%) and *Phleum pratense* (15%). Sown was made on 2 different distances between rows, namely 12,5 cm and 25 cm. the experimental variants were treated with complex fertilizer in 4 different doses as follows: V1- control variant,

unfertilized, V2-N50P60K80, V3- N75P60K80 and V4-N100P60K80. The experimental plot were mowed 3 times /year. Statistical analyze was performed with Polifact.

RESULTS AND DISCUSSIONS

Our results pointed out that in climatic condition specific to the year 2013 the best results are achieved on the variants sown on 25 cm between rows and under the fertilization with N75P60K80.

The highest dry matter production registered in the year 2013 was recorded on V2, variant sown on 25 cm between rows and fertilized with N50P60K80 (Tab. 1). Intensification of fertilization regime up to N100P60K80 is not justified in this case since lead to a decrease in dry matter production (from 13,77 t/ha on V2 down to 11,30 t/ha on V4).

The highest increase compared to control of 4,92 t/ha was recorded on V3 sown on 12,5 cm.

In the year 2014 when the highest increase in dry matter production was recorded on V3 - sown
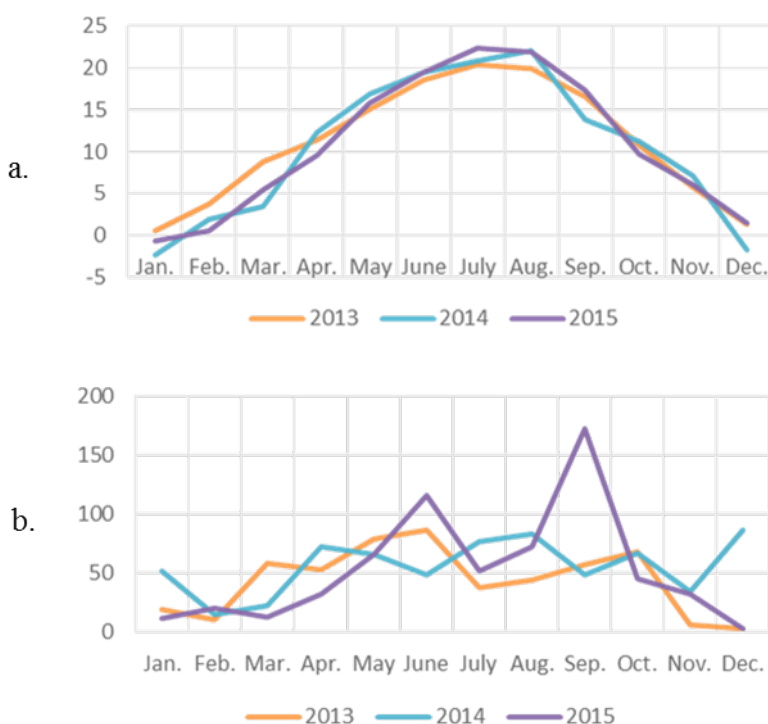

Fig. 1. Monthly average temperature (a) and rainfalls (b)
recorded in 2013-2015

Tab. 1. The influence of experimental factors on dry matter production in 2013

Dist. between rows	Fertilizer applied	Production [t/ha]	Percent	Difference	Signif
	V_1 - 0 kg/ha	8,57	100,0	0,00	Mt.
12,5 cm	V_2 - N_{50} P_{60} K_{80}	12,30	143,5	3,73	***
	V_3 - N_{75} P_{60} K_{80}	13,49	157,4	4,92	***
	V_4 - N_{100} P_{60} K_{80}	12,08	140,9	3,51	***
	V_1 - 0 kg/ha	9,68	100,0	0,00	Mt.
25 cm	V_2 - N_{50} P_{60} K_{80}	13,77	142,2	4,08	***
	V_3 - N_{75} P_{60} K_{80}	12,12	125,2	2,44	***
	V_4 - N_{100} P_{60} K_{80}	11,30	116,7	1,62	***

DL(p 5%) 0,36   DL (p 1%) 0,54   DL (p 0.1%) 0,87

Tab. 2. The influence of experimental factors on dry matter production in 2014

Dist. between rows	Fertilizer applied	Production [t/ha]	Percent	Difference	Signif
	V_1 - 0 kg/ha	10,14	100,0	0,00	Mt.
12,5 cm	V_2 - N_{50} P_{60} K_{80}	11,48	113,2	1,34	***
	V_3 - N_{75} P_{60} K_{80}	12,59	124,2	2,45	***
	V_4 - N_{100} P_{60} K_{80}	11,24	110,8	1,10	***
	V_1 - 0 kg/ha	10,69	100,0	0,00	Mt.
25 cm	V_2 - N_{50} P_{60} K_{80}	11,53	107,9	0,84	***
	V_3 - N_{75} P_{60} K_{80}	12,01	112,3	1,32	***
	V_4 - N_{100} P_{60} K_{80}	11,91	111,4	1,22	***

Tab. 3. The influence of experimental factors on dry matter production in 2015

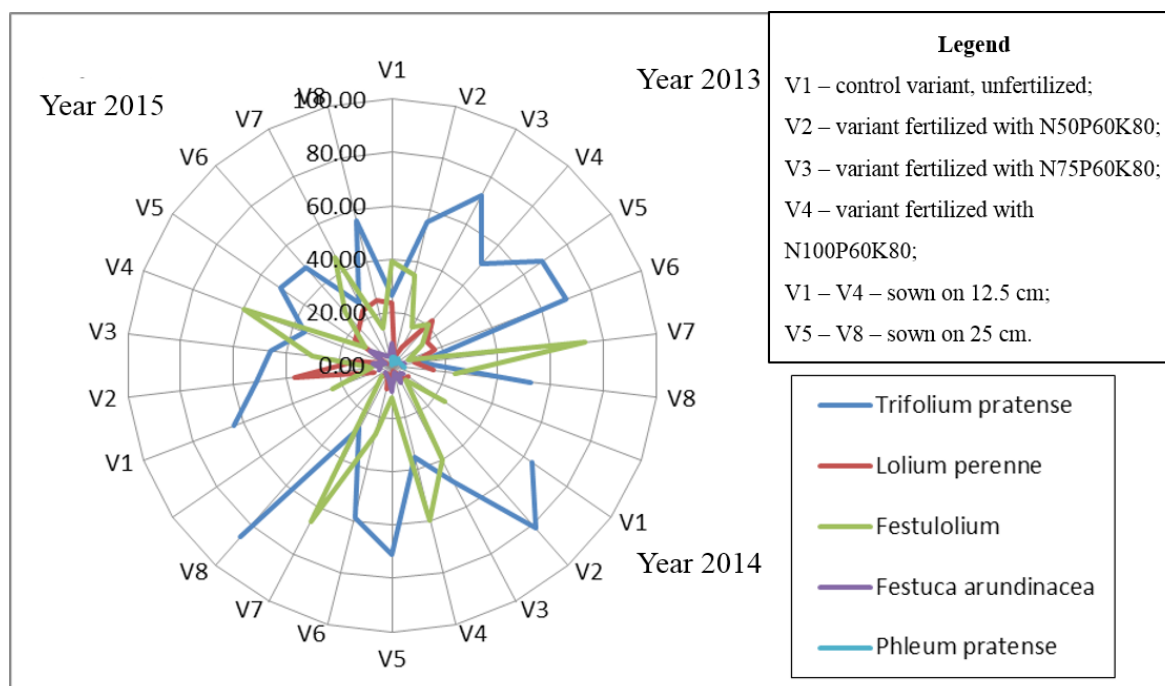| Dist. between rows	Fertilizer applied	Production [t/ha]	Percent	Difference	Signif
	V_1 - 0 kg/ha	9,10	100,0	0,00	Mt.
12,5 cm	V_2 - N_{50} P_{60} K_{80}	9,38	103,0	0,28	***
	V_3 - N_{75} P_{60} K_{80}	9,39	103,1	0,29	***
	V_4 - N_{100} P_{60} K_{80}	9,94	109,2	0,84	***
	V_1 - 0 kg/ha	9,69	100,0	0,00	Mt.
25 cm	V_2 - N_{50} P_{60} K_{80}	10,08	104,0	0,39	***
	V_3 - N_{75} P_{60} K_{80}	10,18	105,0	0,49	***
	V_4 - N_{100} P_{60} K_{80}	10,61	109,4	0,92	***

Fig. 2. The evolution of floristic composition

on 12.5 cm; fertilized with N75P60K80 (Tab. 2).

An interesting evolution was observed in the year 2015 when the highest productions were recorded on the variants sown on 25 cm between rows, on the variant fertilized with maximum amount of N (Tab. 3). Increases in production as a result of the treatment applied were much lower than those registered in the previous 2 years but the results were very significant from statistical point of view.

Analysing the floristic composition we observed that species ability to compete was strongly influenced by the climatic conditions and the inputs applied (Fig. 2). As we expected red clover recorded a high percent of participation in the vegetation cover in the first experimental years but once with the fourth experimental years its perenity went lower giving uo their place to festulolium. We observed also that festulolium was positively influenced by fertilization with N75P60K80 and the sown distance of 25 cm between rows since in this specifically conditions this grass species occupied the highest percent of participation in the vegetation cover in 2 experimental years (2013 and 2014).

CONCLUSIONS

Our results showed that the highest dry matter production (13.77 t/ha) was registered in 2013, on V2, sown on 25 cm, and fertilized with N50P60K80. The analyze of floristic composition highlighted a different behavior of the species studied as a result of the technology applied. The highest productivity of this forage mixture was achieved on an average temperature of 10.4ºC and a rainfall regimen of 523.3 mm.

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