

## RESEARCH REGARDING THE BEHAVIOUR OF SOME PERENNIAL GRASSES AND LEGUMES MIXTURES IN ORDER TO ESTABLISH TEMPORARY GRASSLAND EXPLOITED IN MEADOW REGIME

Margareta NAIE<sup>1</sup>, Elena TROTUȘ<sup>1</sup>, Alexandra-Andreea BUBURUZ<sup>1</sup>,  
Cornelia LUPU<sup>1</sup>, Alexandra LEONTE<sup>1</sup>

e-mail: naie.marieta@yahoo.com

### Abstract

In making perennial grasses and legume mixtures is envisaged that the species or varieties used to properly reflect the stationary conditions, the annual climatic variations sometimes influence different the components behavior, and therefore the productivity. The researches were conducted during 2013-2015 in the Agricultural Research - Development Station Secuieni, where was followed the influence of four nitrogen doses on a phosphorus agrofond in an experience of five mixtures of perennial grasses and legumes used in meadow regime. The nitrogen fertilizers are used in smaller doses in mixtures, because this element is provided by symbiotic bacteria living on the roots of legumes. The results showed that the dynamic of biomass accumulation was done in three growth cycles, for the first cycle it took 53 days, for the second cycle 42 days and for the third cycle 52 days. The highest production of 24.03 t/ha dry substance it was recorded at *Festuca arundinacea* 30% + *Dactylis glomerata* 20% + *Festuca pratensis* 20% + *Medicago sativa* 20% + *Trifolium pratense* 10% mixture and fertilized with N<sub>80+40</sub>P<sub>40</sub> dose, and the lowest of 14.59 t/ha d.s. was obtained at *Dactylis glomerata* 30% + *Lolium perene* 40% + *Medicago sativa* 20% + *Lotus corniculatus* 10% mixture in the unfertilized variant.

**Key words:** mixtures, perennial grasses, perennial legumes

The experimental results over time have highlighted the remarkable progress achieved in the area of temporary pastures, their effectiveness being dependent by the stationary conditions, the culture intensification and optimization degree, the biological material used, compatibility between species and how to manage (Deak D., 2012).

Temporary grasslands (sown) have a remarkable role in terms of improving soil characteristics. Thus, from the cultivation of grasslands is recorded an increase of the soil content in organic and mineral substances, its structure becomes stable, improves water and air regime, microbiological activity is developing intensively and the following crops after perennial grasses find the best growing conditions and give high yields (Sanz-Sáez Á. *et al* 2012).

In making mixtures will take into account the biological characteristics of species depending on the use and duration of the temporary pastures. Thus, for the meadows are used species with high waist, with growth rate close while for grassland prevails the midsize or low waist species, with different growth rate (to achieve better green mass

distribution on grazing cycles), high speed and energy for fog, resistance to soil compaction, greater vivacity etc. (Belesky D.P. *et al*, 2002, Sanderson M. A., *et al* 2005).

For the mixtures composition will take into account the competition ability (competitiveness). The introduction in mixtures of aggressive species alongside those with low competition ability lead to their elimination. Competition ability is a trait of species, however, is greatly influenced by environmental conditions and mode of exploitation (Leconte D., *et al*, 1991, Skinner R.H., *et al*, 2006, Lazaridou M., 2008).

The basic requirement to be taken into account in the composition of mixtures is that they form a vegetation cover well done, with high yields that continue to ensure balanced development of the vegetation cover to a lasting meadow well suited to the stationary conditions (Vintu V. *et al.*, 2010, Surmei-Balan M. *et al.*, 2012, Naie M. *et al*, 2015).

<sup>1</sup> Agricultural Research and Development Station Secuieni, Neamț

## MATERIAL AND METHOD

At the Agricultural Research – Development Station Secuieni from Neamt County, in the spring of 2013 was established an experience with two-factor by 4x3 type, in four repetitions, after subdivided parcels method. The A factor is represented by the fertilization with four graduations:  $a_1-N_0P_0$ ;  $a_2-N_{40}P_{40}$ ;  $a_3-N_{80}P_{40}$ ;  $a_4-N_{80+40}P_{40}$ , and the B factor, the mixture of perennial grasses and legumes, with three graduations:  $b_1$  – 85% grasses (60% *Dactylis glomerata* L. + 25% *Lolium perenne* L.) + 15% legumes (15% *Lotus corniculatus* L.);  $b_2$  – 90% grasses (20% *Dactylis glomerata* L. + 70% *Lolium perenne* L.) + 10% legumes (5% *Lotus corniculatus* L.+ 5% *Trifolium pratense* L.);  $b_3$  – 90% grasses (70% *Dactylis glomerata* L. + 20% *Bromus inermis* Leyss) + 10% legumes (10% *Lotus corniculatus* L.). The soil type from the the experimental field is chernozyom (SRTS, 2012) and is characterized by a weak acid pH (6.29), the humus content of 2.55 - 3.10%, middle-stocked in N and well in  $P_2O_5$  and  $K_2O$ . The area sown of the experimental plot was of 10 sqm and the harvested area of 8 sqm.

Following researches were achieved three production cycles both in 2014 and 2015. The usage of the studied mixtures mixtures was under grassland regime and were harvested in the grasses earing phenophase and in the legumes budding within 53 days for the first cycle, 42 days for the second cycle and 52 days for the third cycle.

The experiences harvesting was done at the height of 4-5 centimeters from the ground, with „Bertolini” moto - mower. For determining the floristic structure were harvested samples by the gravimetric method, from each plot, at every scythe and it was followed the floristic evolution on groups of species (grasses, legumes and species from other botanical families).

## RESULTS AND DISCUSSIONS

High yields and good quality of feed can be achieved through a proper fertilization, which highlight the productive potential of the species of perennial grasses and legumes used in simple or complex mixtures. The fertilizers affects not only the production but they produce changes in the floristic composition.

Thus, under the Agricultural Research - Development Station Secuieni conditions, was pursued the separate impact of fertilization on the fodder yield use for hay. The obtained results at the first scythe showed that, the dry matter yields were between 6.10 t/ha d. s. In the control variant and 9.16 t/ha d. s. in the variant fertilized with  $N_{80}P_{40}$  the production being statistically ensured as highly significant (table 1.).

At the second scythe, the dry substance

yields were between 7.13 t/ha of d. s. in the variant fertilized with  $N_{40}P_{40}$ , and 8.57 t/ha d. s. in the variant fertilized with  $N_{80} + 40P_{40}$ . Regarding the third scythe, the dry substance yields obtained ranged from 3.85 t/ha d. s. In the variant fertilized with  $N_{40}P_{40}$  and 4.49 t/ha d. s. in the variant fertilized with  $N_{80} + 40P_{40}$ .

Comparing the obtained forage yields, between the variants fertilized with nitrogen and phosphorus and the control variant, it appears that the variant fertilized with  $N_{80} + 40P_{40}$  kg/ ha dose, showed the highest production of fodder, of 21.81 t/ha, the difference compared to the control variant being positive distinctly significant, and the lowest production was of 17.39 t/ha d.s. in the control variant ( $N_0P_0$ ).

Also it was pursued the separate influence of the mixture on the feed production, thus the average yields of the two years of experimentation (2014-2015) had values between 17.61 t/ha d.s. in the variant sown with *Dactylis glomerata* 30% + *Lolium perenne* 40% + *Medicago sativa* 20% + *Lotus corniculatus* 10% mixture and 21.64 t/ha d.s. in the variant sown with *Festuca arundinacea* 30% + *Dactylis glomerata* 20% + *Festuca pratensis* 20% + *Medicago sativa* 20% + *Trifolium pratense* 10% mixture (table 2.).

The differences compared to the control variant at the analyzed variants were statistically ensured as follows: negative, significantly distinct in the variant *Dactylis glomerata* 30% + *Lolium perenne* 40% + *Medicago sativa* 20% + *Lotus corniculatus* 10%, positive, significant in *Bromus inermis* 30% + *Dactylis glomerata* 35% + *Onobrychis viciifolia* 35% and *Festuca pratensis* 45% + *Festuca arundinacea* 35% + *Trifolium pratense* 20% variants and very significant at *Festuca arundinacea* 30% + *Dactylis glomerata* 20% + *Festuca pratensis* 20% + *Medicago sativa* 20% + *Trifolium pratense* 10% variant.

Production is positively influenced by mineral fertilization, and the results that were obtained were both according to the doses of nitrogen applied, as well to the mixtures taken in study. The increase of nitrogen norm determined the production increase to a certain level after which it begins to stagnate and decline. The exploitation mode of temporary meadows proved to be an important factor in the level of yields achieved.

Analyzing the influence of the interaction between the perennial grasses and legumes mixtures and fertilization during the first year of production, it was noted that the highest yields were obtained with  $N_{80} + 40P_{40}$  fertilization, in *Dactylis glomerata* 20% + *Medicago sativa* 80% mixture, of 20.82 t/ha d.s. and *Festuca*

*arundinacea* 30% + *Dactylis glomerata* 20% + *Festuca pratensis* 20% + *Medicago sativa* 20% + *Trifolium pratense* 10% mixture, of 22.92 t/ha d.s.. Compared with the control variant, the obtained differences were statistically ensured as very significant.

As a general trend is observed the production increase in the second year of exploitation, 2015, at all the mixtures fertilized with different doses of mineral fertilizers (table 3).

Regarding the interaction influence between the mixtures of perennial grasses and legumes and fertilization, in the second year of production, it was observed that the highest yields were obtained at the N<sub>80</sub>P<sub>40</sub> fertilization in the *Bromus inermis* 30% + *Dactylis glomerata* 35% + *Onobrychis viciifolia* 35% mixture of 28.01 t/ha d.s.

Compared to the control variant (18.04 t/ha

d.s.), the differences of all studied variants were positive, very significant except the unfertilized variant with *Dactylis glomerata* 30% + *Lolium perenne* 40% + *Medicago sativa* 20% + *Lotus corniculatus* 10% mixture which is not statistically ensured.

Analyzing the interaction of the two studied factors (fertilization x mixtures) on the average yield, it has been found that it ranged between 14.59 t /ha d.s. in the variant sown with *Dactylis glomerata* 30% + *Lolium perenne* 40% + *Medicago sativa* 20% + *Lotus corniculatus* 10% mixture, unfertilized and 24.03 t/ha d.s. in the variant sown with *Festuca arundinacea* 30% + *Dactylis glomerata* 20% + *Festuca pratensis* 20% + *Medicago sativa* 20% + *Trifolium pratense* 10% fertilized with N<sub>80+40</sub>P<sub>40</sub>, the difference compared to the control variant is positive, very significant.

Table 1

**The influence of fertilization on average production of d.s., during 2014-2015, to used as hay**

Variant	Yield (t/ha d.s.)				
	First scythe	Second scythe	Third scythe	TOTAL	
a <sub>1</sub> - N <sub>0</sub> P <sub>0</sub> (mt)	6.10 <sup>Mt</sup>	7.43 <sup>Mt</sup>	3.86 <sup>Mt</sup>	17.39 <sup>Mt</sup>	
a <sub>2</sub> - N <sub>40</sub> P <sub>40</sub>	8.00 <sup>***</sup>	7.13	3.85	18.97	
a <sub>3</sub> - N <sub>80</sub> P <sub>40</sub>	9.16 <sup>***</sup>	8.01	4.28 <sup>*</sup>	21.45 <sup>**</sup>	
a <sub>4</sub> - N <sub>80+40</sub> P <sub>40</sub>	8.75 <sup>***</sup>	8.57	4.49 <sup>**</sup>	21.81 <sup>**</sup>	
DL	5%	0.82	1.22	0.37	2.25
	1%	1.17	1.76	0.53	3.24
	0.1%	1.73	2.59	0.78	4.77

Table 2

**The influence of mixture on average production of d.s., during 2014-2015, to used as hay**

Variant	Yield (t/ha d.s.)				
	First scythe	Second scythe	Third scythe	TOTAL	
b <sub>1</sub> - D.g.20% +M.s.80%(mt)	8.09 <sup>Mt</sup>	6.90 <sup>Mt</sup>	4.37 <sup>Mt</sup>	19.37 <sup>Mt</sup>	
b <sub>2</sub> - B.i.30%+D.g.35%+O.v.35%	9.05 <sup>*</sup>	7.46 <sup>*</sup>	4.01 <sup>o</sup>	20.51 <sup>*</sup>	
b <sub>3</sub> - D.g.30%+L.p.40%+M.s.20%+L.c.10%	7.37 <sup>oo</sup>	6.29 <sup>o</sup>	3.95 <sup>o</sup>	17.61 <sup>oo</sup>	
b <sub>4</sub> - F.a.30%+D.g.20%+F.p.20%+M.s.20%+T.p.10%	7.74	9.41 <sup>***</sup>	4.49	21.64 <sup>***</sup>	
b <sub>5</sub> - F.p.45%+F.a.35%+T.p.20%	7.76	8.86 <sup>***</sup>	3.79 <sup>oo</sup>	20.40 <sup>*</sup>	
DL	5%	0.39	0.54	0.30	0.89
	1%	0.59	0.82	0.45	1.34
	0.1%	0.94	1.31	0.72	2.15

Table 3

**The influence of interaction between mixture and fertilization on average production of d.s., during 2014-2015, to used as hay**

Variant		Yield (t/ha d.s.)		
		Average yield 2014	Average yield 2015	TOTAL
a <sub>1</sub> - N <sub>0</sub> P <sub>0</sub> (mt)	b <sub>1</sub> - D.g.20% +M.s.80%(mt)	16.39 <sup>Mt</sup>	18.04 <sup>Mt</sup>	17.22 <sup>Mt</sup>
	b <sub>2</sub> - B.i.30%+D.g.35%+O.v.35%	12.73 <sup>ooo</sup>	21.07 <sup>***</sup>	16.90
	b <sub>3</sub> - D.g.30%+L.p.40%+M.s.20%+L.c.10%	10.60 <sup>ooo</sup>	18.59	14.59 <sup>ooo</sup>
	b <sub>4</sub> - F.a.30%+D.g.20%+F.p.20%+M.s.20%+T.p.10%	18.14 <sup>***</sup>	20.70 <sup>***</sup>	19.42 <sup>***</sup>
	b <sub>5</sub> - F.p.45%+F.a.35%+T.p.20%	18.86 <sup>***</sup>	18.80 <sup>*</sup>	18.83 <sup>***</sup>

a <sub>2</sub> - N <sub>40</sub> P <sub>40</sub>	b <sub>1</sub> - D.g.20% +M.s.80%(mt)	15.94	20.37***	18.16**	
	b <sub>2</sub> - B.i.30%+D.g.35%+O.v.35%	15.95	23.99***	19.97***	
	b <sub>3</sub> - D.g.30%+L.p.40%+M.s.20%+L.c.10%	14.60 <sup>000</sup>	20.08***	17.34	
	b <sub>4</sub> - F.a.30%+D.g.20%+F.p.20%+M.s.20%+T.p.10%	17.22*	22.64***	19.93***	
	b <sub>5</sub> - F.p.45%+F.a.35%+T.p.20%	17.71***	21.20***	19.45***	
a <sub>3</sub> - N <sub>80</sub> P <sub>40</sub>	b <sub>1</sub> - D.g.20% +M.s.80%(mt)	17.56**	23.40***	20.48***	
	b <sub>2</sub> - B.i.30%+D.g.35%+O.v.35%	16.50	28.01***	22.25***	
	b <sub>3</sub> - D.g.30%+L.p.40%+M.s.20%+L.c.10%	15.37 <sup>00</sup>	22.97***	19.17***	
	b <sub>4</sub> - F.a.30%+D.g.20%+F.p.20%+M.s.20%+T.p.10%	19.84***	26.48***	23.16***	
	b <sub>5</sub> - F.p.45%+F.a.35%+T.p.20%	18.64***	25.70***	22.17***	
a <sub>4</sub> - N <sub>80+40</sub> P <sub>40</sub>	b <sub>1</sub> - D.g.20% +M.s.80%(mt)	20.82***	22.40***	21.61***	
	b <sub>2</sub> - B.i.30%+D.g.35%+O.v.35%	18.39***	27.47***	22.93***	
	b <sub>3</sub> - D.g.30%+L.p.40%+M.s.20%+L.c.10%	15.95	22.74***	19.35***	
	b <sub>4</sub> - F.a.30%+D.g.20%+F.p.20%+M.s.20%+T.p.10%	22.92***	25.13***	24.03***	
	b <sub>5</sub> - F.p.45%+F.a.35%+T.p.20%	18.38***	23.91***	21.15***	
DL		5%	0.33	0.65	0.56
		1%	0.44	0.87	0.76
		0.1%	0.58	1.15	1.00

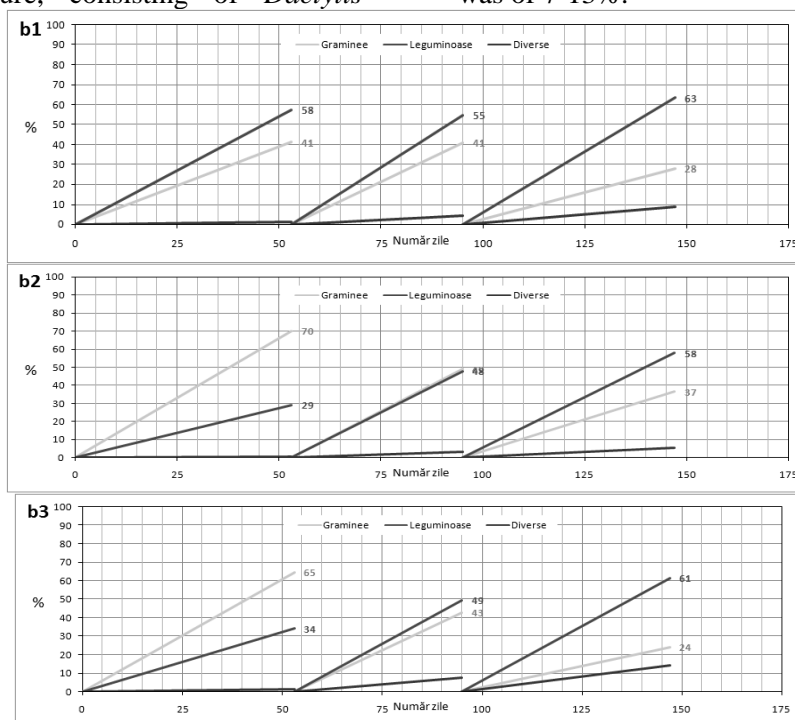
Following the obtained results in 2014 (*figure 1*) was found that the vegetation structure of b<sub>1</sub> mixture, consisting of *Dactylis glomerata* 20% + *Medicago sativa* - 80%, was favorable to legumes, with values of 55-63%. In b<sub>2</sub>-b<sub>5</sub> mixtures, the grasses dominated the vegetation structure, at the first scythe, the values obtained being of 63-70%. At the second and third scythes the report was changed in favor of pulses, the recorded values being of 48-68% in the second scythe and 57-63% in the third scythe. The coverage degree with species from various group progressed with the number of scythe, so at the third scythe the coverage degree was of 5-12%.

Analyzing the results of 2015 (*figure 2*) on the structure of the vegetation cover it was found that the b<sub>1</sub> mixture, consisting of *Dactylis*

*glomerata* 20% + *Medicago sativa* - 80%, were favorable to legumes, with values of 51-54%, remaining as in 2014 but in a smaller ratio. At the first scythe, in b<sub>2</sub>-b<sub>5</sub> mixtures, grasses dominated the vegetation structure, the values obtained being of 58-70%.

In b<sub>2</sub>-b<sub>4</sub> mixtures, at the second scythe ratio has changed in favor of legumes, the recorded values being of 52-55%, and in the third scythe grasses dominated the vegetation structure, the values obtained were between 57- 63% at third scythe. In b<sub>5</sub> mixture, the grasses dominated the vegetation structure at all three scythes.

The coverage degree with species from various group progressed with the number of scythe, so at the third scythe the coverage degree was of 7-13%.



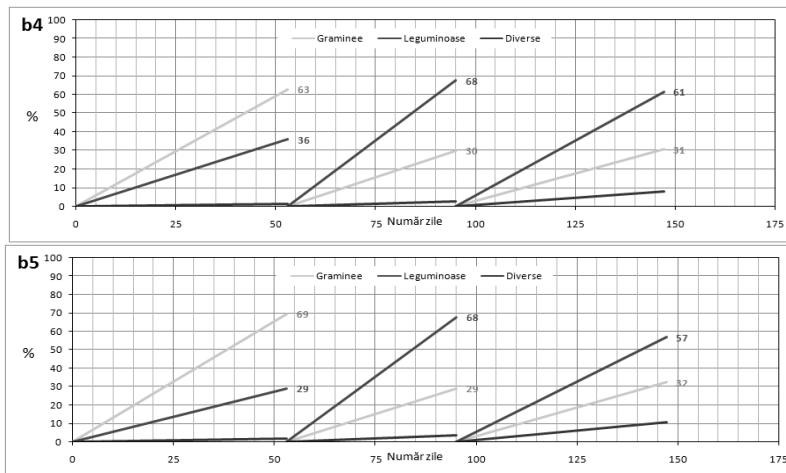


Figure 1 Dynamics of the vegetation cover at  $b_1$  (*D. glomerata* 20% + *M. sativa* 80%),  $b_2$  (*B. inermis* 30% + *D. glomerata* 35% + *O. viciifolia* 35%),  $b_3$  (*D. glomerata* 30% + *L. perenne* 40% + *M. sativa* 20% + *L. corniculatus* 10%),  $b_4$  (*F. arundinacea* 30% + *D. glomerata* 20% + *F. pratensis* 20% + *M. sativa* 20% + *T. pratense* 10%) and  $b_5$  (*F. pratensis* 45% + *F. arundinacea* 35% + *T. pratense* 20%) mixtures, in 2014, used as hay

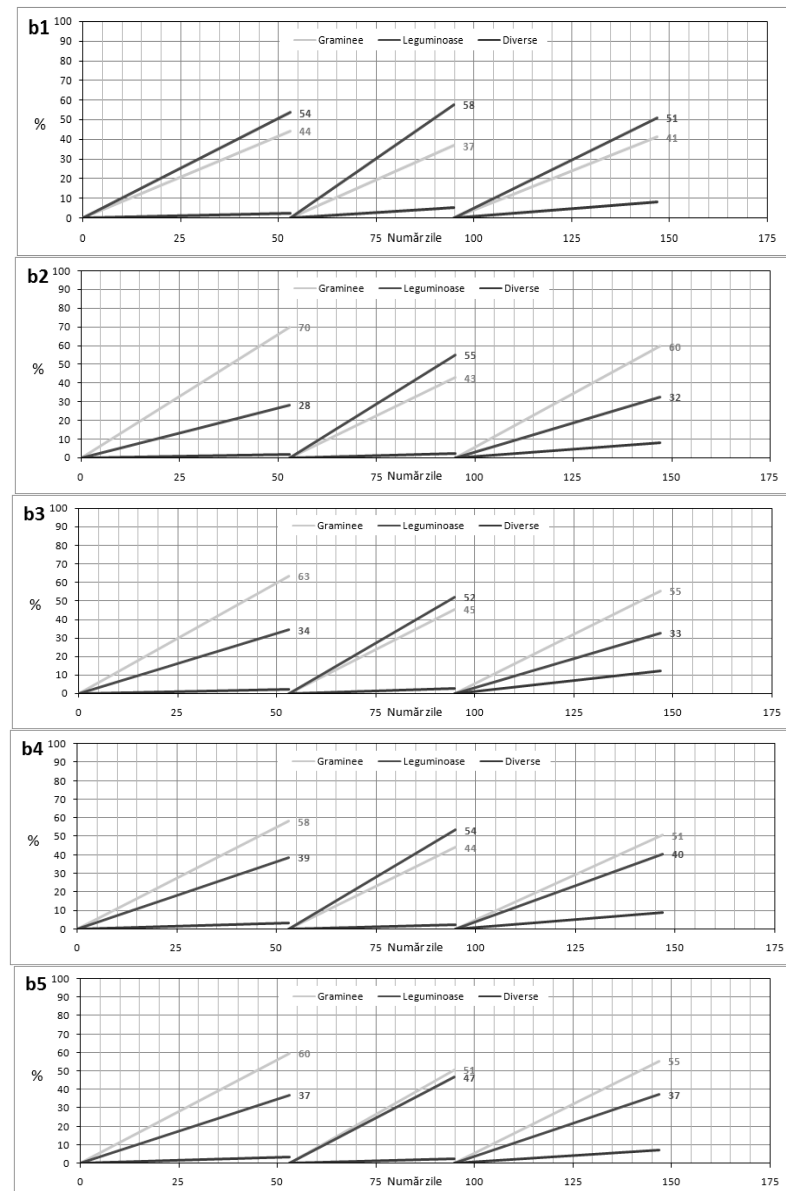


Figure 2 Dynamics of the vegetation cover cover at  $b_1$  (*D. glomerata* 20% + *M. sativa* 80%),  $b_2$  (*B. inermis* 30% + *D. glomerata* 35% + *O. viciifolia* 35%),  $b_3$  (*D. glomerata* 30% + *L. perenne* 40% + *M. sativa* 20% + *L. corniculatus* 10%),  $b_4$  (*F. arundinacea* 30% + *D. glomerata* 20% + *Festuca pratensis* 20% + *M. sativa* 20% + *T. pratense* 10%) and  $b_5$  (*F. pratensis* 45% + *F. arundinacea* 35% + *T. pratense* 20%) mixtures; in 2015, used as hay

## CONCLUSIONS

The nitrogen fertilization contributed in obtaining high yields of dry substances between 17.39 t/ha d.s. at N<sub>0</sub>P<sub>0</sub> (mt) and 21.81 t/ha d.s. at the variant fertilized with N<sub>80+40</sub>P<sub>40</sub> kg/ha.

The highest production of 21.64 t/ha d.s., was obtained from the variant sown with *Festuca arundinacea* 30% + *Dactylis glomerata* 20% + *Festuca pratensis* 20% + *Medicago sativa* 20% + *Trifolium pratense* 10% mixture.

The interaction of mixture x fertilization shows that the highest yield was obtained from the variant sown with *Festuca arundinacea* 30% + *Dactylis glomerata* 20% + *Festuca pratensis* 20% + *Medicago sativa* 20% + *Trifolium pratense* 10% mixture and fertilized with N<sub>80+40</sub>P<sub>40</sub>, of 24.03 t/ha d.s..

Between the quantities of nitrogen applied and the yields of dry substances at the studied mixtures were found positive correlations, the correlation coefficients were statistically ensured. Following the results obtained it is clear the positive effect of nitrogen fertilizers on the perennial grasses and legumes mixtures considered for the study.

At A.R.D.S. Secuieni, in the studied experiences were performed a total of 3 scythes, its usage has been for hay and the exploitation period was made at an interval of 53 days for the first cycle, 42 days for the second cycle and 52 days for the third cycle.

Due to the determinations made it was found that the percentage of grasses present in the mixtures decreases from the first scythe to the third scythe, instead the legumes percentage increases compared to the initial share of the mixture.

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