THE BEHAVIOUR OF SOME MIXTURES OF PERENNIAL GRASSES AND LEGUMES EXPLOITED IN MIXED REGIME UNDER CENTER OF MOLDOVA CONDITIONS

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Abstract

For the establishment of temporary meadows it is envisaged choosing the most suitable species of perennial grasses and legumes, with high adaptability to the use procedure planned for the cultivated area. In most temporary meadows changes occur in the floristic composition of the vegetation cover, determined by the use procedure, the aggression of the species from the mixtures and the climatic conditions evolution. The studies have followed the evolution of the vegetation cover under the influence of mineral fertilization and the used mixture. The researches were conducted during 2013 - 2014, in the Agricultural Research – Development Station Secuieni, Neamt county, where it was followed the influence of four doses of nitrogen on a phosphorus agri fund at an experience formed of three mixtures of perennial grasses and legumes used in mixed regime. The obtained results showed that the use period of the studied mixtures was of 168 days, and the grasses were prevailing in the vegetation cover at each harvest, with a participation percentage that manifested a slightly decreasing trend. The highest yield, of 13.04 t/ha d.s., was recorded at the mixture formed from *Dactylis glomerata* 60% + *Lolium perenne* 25% + *Lotus corniculatus* 15%, fertilized with $N_{80}P_{40}$, and the lowest one, of 6.08 t/ha d.s., was obtained in the same mixture, in the unfertilized variant, which highlights the need of fertilization of the temporary meadows for production intensification.

Key words: fertilization, grasses, legumes, mixtures.

The temporary meadows alongside the permanent ones provides the cheapest animal feed, being used as green mass by grazing or mowing or administered to the manger, as hay, semi hay or silage during calves. These have an important role in restoring soil physicochemical properties, in antierosion protection and in land biological drainage.

Although the area occupied with permanent grasslands is large, the yields achieved by them are small and of lower quality, due to some limiting factors of the environment, of not applying certain improvement works, as well as due to some socio – economic factors, and therefore it is require their replacement with temporary meadows.

The establishment of temporary meadows gives the possibility of establishing the perennial forage grasses and legumes species depending on the area's natural conditions and of numeric and percentage ratios of association in the mixtures.

To obtain high yields of forage it has passed from the sowing in pure culture of perennial grasses and legumes, to the ultivation in mixture. This creates productions that are more evenly distributed during the vegetation period, reduce fertilizers requirements towards the pure culture and it is realize an optimum energy – proteic ratio for animal feed. The production increases towards the pure culture are between 15 and 25% (Moga et al., 1996; Dragan L., 2007; Mosimann E., 2002).

The temporary meadows determines livestock productions (meat, milk, wool, etc.) higher by 8-10% compared to permanent meadows and have a lower rate of animal illness (Gheorghiu T., 1995; Mihai Gh., 2006).

MATERIAL AND METHOD

In the spring of 2013 was established in the experimental field of the Agricultural Research - Development Station Secuieni, from Neamt county, an experience with two factors of 4x3 type, after the

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subdivided parcels method, in four repetitions. 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 is chernozem (SRTS, 2012) and it is characterized by a poorly acid pH (6.29), the humus content of 2.55-3.10%, middle stocked in N and well stocked in P_2O_5 and K_2O.

The sown surface of the experimental plot was of 10 m^2 (sqm), of which 8 m^2 have been harvested. In the seeding year were performed three uniformisation mowings.

In the researches carried out at A.R.D.S. (S.C.D.A.) Secuieni, the use of the studied mixtures was mixed: a harvest in grassland regime, at the earing of dominant grasses and the legumes budding, and four harvests in grazing simulation regime, at 28 days.

The background fertilization was made with phosphate fertilizers administered in the fall, and those based on nitrogen were administered in early spring at vegetation startup, except the N_{80+40} graduation, which difference was administered after the first scythe.

The harvesting was done with „Bertolini" moto mower, at a height of 4-5 centimeters from the ground.

To determine the floristic structure were collected samples after the gravimetric method, from each plot, at every scythe and it has been followed the species floristic evolution (grasses, legumes and species from other botanical families).

From a climate perspective, in 2013/2014 agricultural year the recorded temperatures were with 0.5°C higher than the multiannual average (8.7°C), and the precipitations have recorded a deficit of 49.3 mm compared with the multiannual average (548 mm).

RESULTS AND DISCUSSIONS

Due to the researches conducted at A.R.D.S. Secuieni it was observed that the studied mixtures of perennial grasses and legumes, had presented a high adaptability to the pedoclimatic conditions in which they were experimented and they have positively responded to the management. Thus, moderately fertilized with chemical fertilizers these are suitable in intensive culture and can be used in mixed regime (grassland, grazing simulation).

In the first year of use, 2014, the obtained results show that the nitrogen fertilization led to the obtaining of dry matter yields, ranging between 7.32 t/ha d.s. at N_0P_0 (unfertilized control) and 12.31 t/ha d.s. at the variant fertilized with $N_{80}P_{40}$ kg/ha, with very significant production increases, compared to the control variant (*table 1*).

Analyzing the separate impact of the mixture, it was found that the forage production ranged betwee 9.99 t/ha d.s. at the mixture formed from *Dactylis glomerata* 60% + *Lolium perenne* 25% + *Lotus corniculatus* 15% (untreated control) and 10.43 t/ha d.s. at the mixture formed from *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5%, with a significant production increase compared to the control variant (*table 2*).

Due to the conducted research it was found that the mixture formed from *Dactylis glomerata* 60% + *Lolium perenne* 25% + *Lotus corniculatus* 15% presents high adaptability to the climatic conditions of the area, realizing a production of over 13.0 t/ha d.s at the $N_{80}P_{40}$ fertilization (table 3).

Analyzing the behavior of the mixtures of perennial grasses and legumes, in 2014, in unfertilization conditions, it was found that the highest production was obtained at the mixture formed from *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5%, of 8.71 t/ha d.s. It was found that the mixtures of *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5% and *Dactylis glomerata* 70% + *Bromus inermis* 20% + *Lotus corniculatus* 10%, have achieved very significant production increases compared to the control variant (*table 3*). At the $N_{40}P_{40}$ fertilization, it was noted by higher production the mixture *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5%, achieving 11.90 t/ha d.s. with an increase compared to the control statistically ensured as very significant.

The productions obtained at the mixtures fertilized with $N_{80}P_{40}$, were the highest with values between 11.94 t/ha d.s. at *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5% and *Dactylis glomerata* 70% + *Bromus inermis* 20% + *Lotus corniculatus* 10% mixtures and 13.04 t/ha d.s. at *Dactylis glomerata* 60% + *Lolium perenne* 25% + *Lotus corniculatus* 15% mixture. Compared with the control variant, the yield differences were statistically ensured, with very significant increases.

At the $N_{80+40}P_{40}$ fertilization, was noted by higher production, the *Dactylis glomerata* 70% + *Bromus inermis* 20% + *Lotus corniculatus* 10% mixture, achieving 11.39 t/ha d.s., with an increase compared to the control statistically

ensured as very significant.

Analyzing the interaction between fertilization and mixture on the production, it was found that these ranged from 6.08 t/ha d.s. at the unfertilized variant and sown with *Dactylis glomerata* 60% + *Lolium perenne* 25% + *Lotus corniculatus* 15% mixture and 13.04 t/ha d.s. at the same mixture but at the variant fertilized with $N_{80}P_{40}$ (*tablel 3*).

Between the dry substances production at the tested mixtures of perennial grasses and legumes and the nitrogen fertilization were found positive correlations, the correlation coefficients were statistically ensured as significant distinct *(figure 1)*.

Table 1

The influence of fertilization on the d.s. production, in the first year of exploitation

Variant		Production (t/ha d.s.)					
		I scythe	II scythe	III scythe	IVscythe	V scythe	Total
a_1 - N_0P_0 (control)		3.92^{Mt}	1.87^{Mt}	1.53^{Mt}	1.38^{Mt}	0.77^{Mt}	7.32^{Mt}
a_2 - $N_{40}P_{40}$		5.90***	2.79***	2.50***	2.09***	1.35***	11.19***
a_3 - $N_{80}P_{40}$		6.73***	2.98***	2.59***	2.16***	1.66***	12.31***
a_4 - $N_{80+40}P_{40}$		5.66***	2.76***	1.78*	1.37	1.14**	10.20***
DL	*5%*	*0.48*	*0.19*	*0.20*	*0.28*	*0.20*	*0.60*
	1%	*0.69*	*0.27*	*0.29*	*0.40*	*0.29*	*0.87*
	0.1%	*1.01*	*0.40*	*0.43*	*0.59*	*0.43*	*1.26*

Table 2

The influence of the used mixture on the d.s. production, in the first year of exploitation

Variant		Producţia (t/ha s.u.)					
		I scythe	II scythe	III scythe	IV scythe	V scythe	Total
b_1 - D.g.60%+L.p.25%+L.c.15% (control)		5.43^{Mt}	2.48^{Mt}	2.08^{Mt}	1.76^{Mt}	1.25^{Mt}	9.99^{Mt}
b_2 - D.g.20%+L.p.70%+L.c.5%+T.p.5%		5.61	2.64	2.18	1.75	1.22	10.43*
b_3 - D.g.70%+B.i.20%+L.c.10%		5.61	2.69	2.04	1.74	1.23	10.34
DL	*5%*	*0.34*	*0.22*	*0.14*	*0.16*	*0.14*	*0.41*
	1%	*0.52*	*0.35*	*0.21*	*0.25*	*0.21*	*0.62*
	0.1%	*0.83*	*0.57*	*0.34*	*0.39*	*0.33*	*1.00*

Table 3

The influence of the interaction between mixture and fertilization on the d.s. production, in the first year of exploitation

Variant		Production (t/ha d.s.)					
		I scythe	II scythe	III scythe	IV scythe	V scythe	Total
a_1 - N_0P_0 (control)	b_1 - D.g.60%+L.p.25%+L.c.15% (mt)	3.22^{Mt}	1.55^{Mt}	1.31^{Mt}	1.17^{Mt}	0.84^{Mt}	6.08^{Mt}
	b_2 - D.g.20%+L.p.70%+L.c.5%+T.p.5%	4.72***	2.24***	1.75***	1.66***	0.85	8.71***
	b_3 - D.g.70%+B.i.20%+L.c.10%	3.82**	1.82**	1.52***	1.30**	0.63^{ooo}	7.16***
a_2 - $N_{40}P_{40}$	b_1 - D.g.60%+L.p.25%+L.c.15%	5.61***	2.59***	2.61***	2.05***	1.28***	10.81***
	b_2 - D.g.20%+L.p.70%+L.c.5%+T.p.5%	6.24***	2.97***	2.69***	2.17***	1.43***	11.90***
	b_3 - D.g.70%+B.i.20%+L.c.10%	5.84***	2.82***	2.21***	2.05***	1.34***	10.87***
a_3 - $N_{80}P_{40}$	b_1 - D.g.60%+L.p.25%+L.c.15%	7.19***	3.07***	2.78***	2.45***	1.74***	13.04***
	b_2 - D.g.20%+L.p.70%+L.c.5%+T.p.5%	6.65***	2.83***	2.46***	2.01***	1.64***	11.94***
	b_3 - D.g.70%+B.i.20%+L.c.10%	6.35***	3.05***	2.54***	2.02***	1.60***	11.94***
a_4 - $N_{80+40}P_{40}$	b_1 - D.g.60%+L.p.25%+L.c.15%	5.69***	2.72***	1.63***	1.38***	1.13***	10.04***
	b_2 - D.g.20%+L.p.70%+L.c.5%+T.p.5%	4.84***	2.50***	1.83***	1.14	0.96*	9.17***
	b_3 - D.g.70%+B.i.20%+L.c.10%	6.45***	3.06***	1.88***	1.58***	1.34***	11.39***
DL	*5%*	*0.38*	*0.16*	*0.10*	*0.11*	*0.12*	*0.45*
	1%	*0.51*	*0.21*	*0.13*	*0.15*	*0.16*	*0.60*
	0,1%	*0.67*	*0.28*	*0.17*	*0.19*	*0.20*	*0.79*

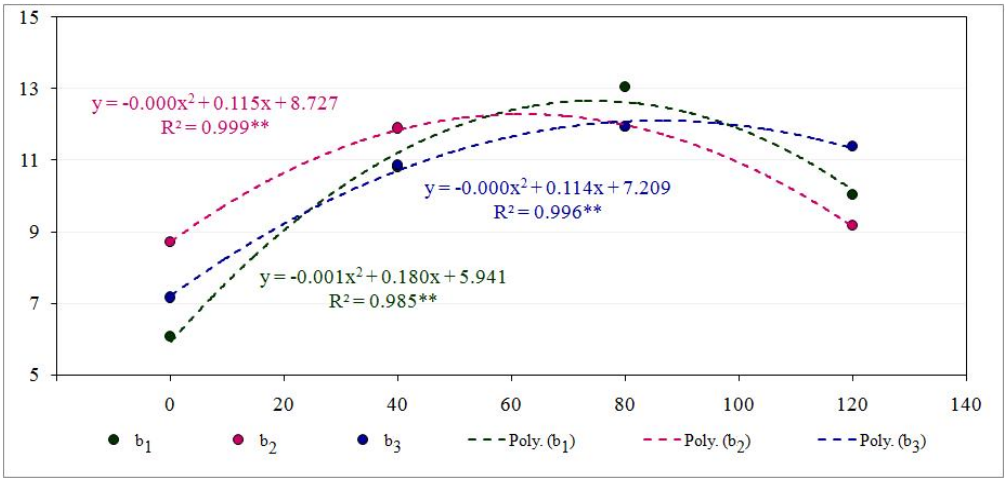

Figure 1 **The correlation between the amount of applied nitrogen and the dry substances production, in 2014**

Regarding the mode of biomass accumulation by the studied mixtures, it was found that at the first scythe the highest production was obtained at the mixtures formed from *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5% and *Dactylis glomerata* 70% + *Bromus inermis* 20% + *Lotus corniculatus* 10%, of 5.61 t/ha d.s.. The productions obtained at the other scythes had a decreasing trend from the second scythe to the fifth scythe. It was found that the using period at the studied mixtures was of 168 days *(figure 2)*.

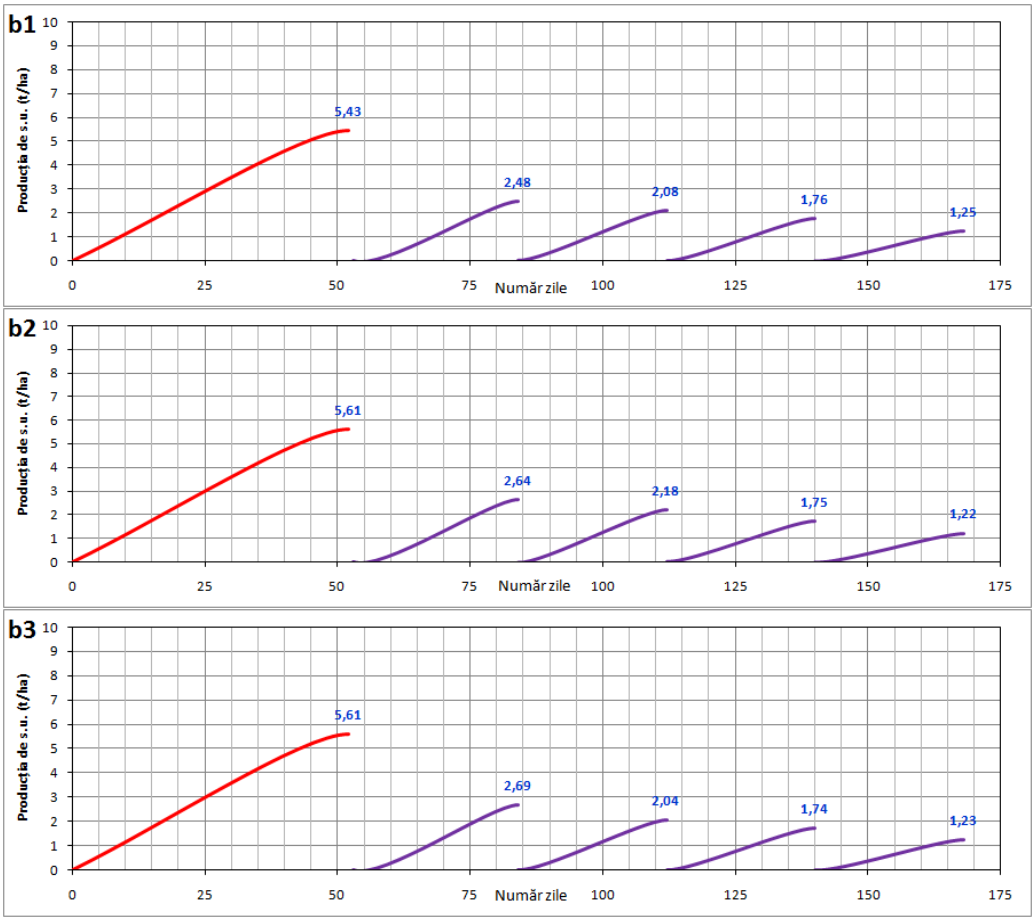

Figure 2 **The dynamics of biomass accumulation at the mixtures b_1 (*Dactylis glomerata* L. - 60% + *Lolium perenne L.* - 25% + *Lotus corniculatus* L. - 15%), b_2 (*Dactylis glomerata* L. - 20% + *Lolium perenne* L. - 70% + *Lotus corniculatus* L. - 5% + *Trifolium pratense* L. - 5%), b_3 (*Dactylis glomerata* L. - 70% + *Bromus inermis* Leyss - 20% + *Lotus corniculatus* L. - 10%)**

It may be noted that in the structure of the vegetation cover, the share of perennial grasses and legumes species from the mixtures, have ranged in all the harvesting cycles. Thus, at b_1 mixture, formed from *Dactylis glomerata* 60% + *Lolium perenne* 25% + *Lotus corniculatus* 15%, the share of grasses from the vegetation cover structure decreased, the obtained values were between 75 - 63%.

At b_2 mixture, formed from *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5% the grasses have reduced their participation share in the structure of the vegetation cover, the recorded values ranged between 54 - 63%.

In case of b_3 mixture, formed from *Dactylis glomerata* 70% + *Bromus inermis* 20% + *Lotus corniculatus* 10% the grasses represented 70-81% of the vegetation cover structure.

At all the studied mixtures, it is found that the legumes participation percentage increased compared to the initial share in mixture and kept constant at all harvesting levels *(figure 3)*.

The share of the species from diverse group has increased with the scythe number, so that at the fifth scythe the participation degree in the vegetation composition was of 10 - 13%.

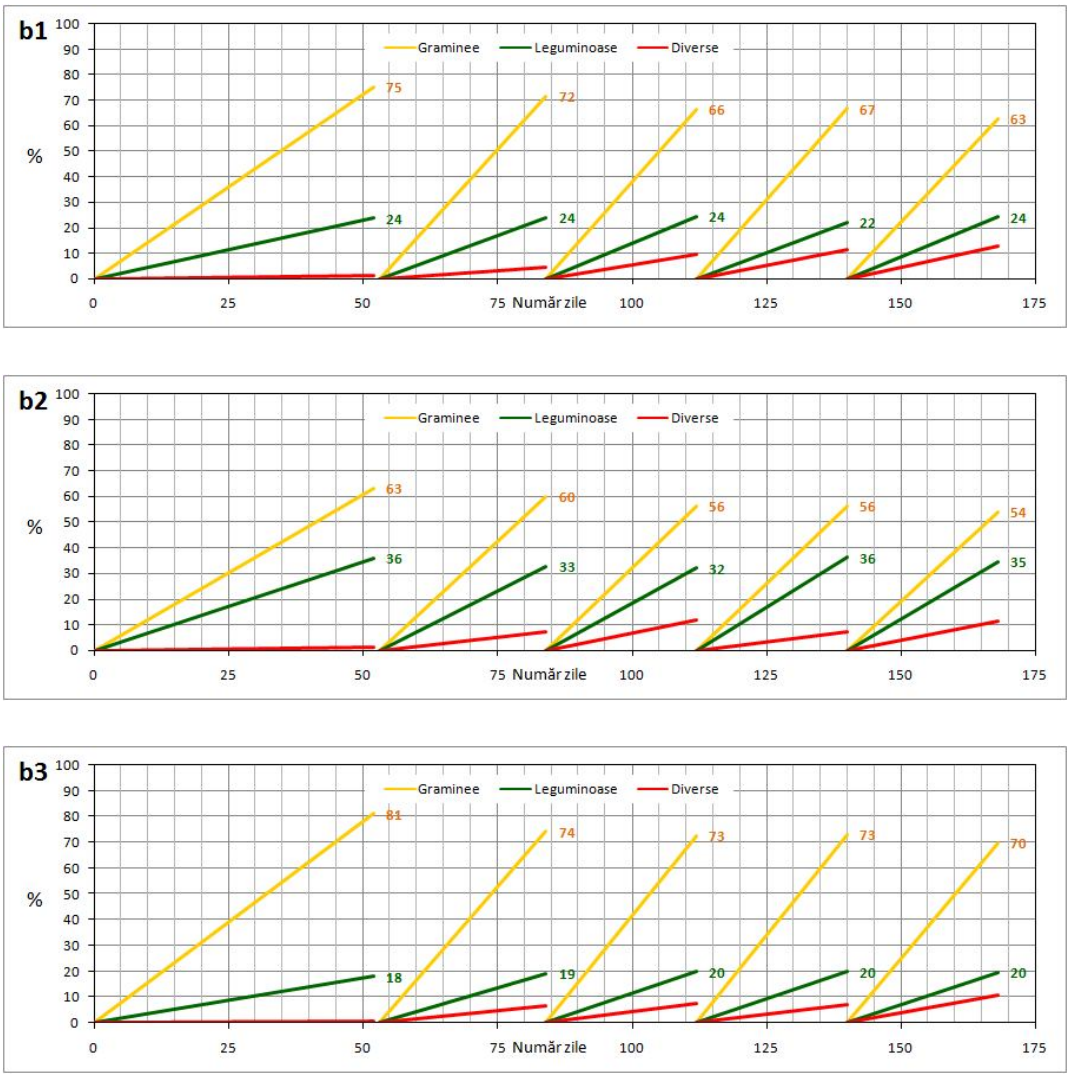

Figure 3 **The dynamics of biomass accumulation and the share of the species groups in the mixture composition - b_1 (*Dactylis glomerata* L. - 60% + *Lolium perenne L.* - 25% + *Lotus corniculatus* L. - 15%), b_2 (*Dactylis glomerata* L. - 20% + *Lolium perenne* L. - 70% + *Lotus corniculatus* L. - 5% + *Trifolium pratense* L. - 5%), b_3 (*Dactylis glomerata* L. - 70% + *Bromus inermis* Leyss - 20% + *Lotus corniculatus* L. - 10%)**

CONCLUSIONS

The nitrogen fertilization has contributed at the obtaining of high yields of dry substance, between 10.20 t/ha d.s. at $N_{80+40}P_{40}$ and 12.31 t/ha d.s. at the variant fertilized with $N_{80}P_{40}$ kg/ha.

Among the studied mixtures, the highest production was obtained at the mixture formed from *Dactylis glomerata* 20% + *Lolium perenne* 70% + *Lotus corniculatus* 5% + *Trifolium pratense* 5%, of 10.43 t/ha d.s..

The mixture x fertilization interaction shows that the highest yield, of 13.04 t/ha d.s., was obtained at the variant sown with *Dactylis glomerata* 60% + *Lolium perenne* 25% + *Lotus corniculatus* 15% and fertilized with $N_{80}P_{40}$.

Between the amount of nitrogen applied and the production of dry matter at the studied mixtures, were found positive correlations, the correlation coefficients were statistically ensured (significant distinct).

In A.R.D.S. Secuieni conditions, in 2014 were done 5 scythes, the use mode was mixed, and the exploitation period was of 168 days.

As a result of the made determinations it was found that the grasses percentage presented in the mixtures decreases from the first scythe to the fifth scythe, instead the legumes percentage increases from the initial share from the mixture.

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REFERENCES

Dragan Lenuta, 2007 – *Progress in improving forage crop technologies*. Analele INCDA Fundulea, vol. LXXIV - Anniversary: 151-158.

Dragan Lenuta, Schitea Maria, Oprea Georgeta, 2013 - *Behavior of some alfalfa cultivars sown in spring indifferent mixture variants.* Analele INCDA Fundulea, vol. LXXXI: 57-65.

Gheorghiu T., 1995 – *Increased yields achieved on temporary meadows, irrigated by intense harnessing with youth cattle and sheep*. Scientific Papers of the Research and Production Institute for Meadows Culture Magurele - Braşov, vol. XVII:193-202.

Iacob T., Dumitrescu N., Vintu V., Samuil C., Trofin Alina, 1998 – *The temporary grasslands yield from Moldova forest steppe, used through grazing*. Lucr. St. U.A.M.V Iasi, Agronomy series, vol. 41, p. 374 – 380.

Mihai Gh., 2006 – Grasslands crop. Ed. AcademicPress, Cluj-Napoca.

Mosimann E., 2002 - *Mélanges fourragers pour une durée de trois ans. 1. Facteurs influençant la proportion de légumineuses*. Revue suisse d'agriculture, 34 (3): 99-106.

Samuil C., Vintu V., Sirbu C., and Surmei Gabriela Mihaela, 2012 – *Behaviour of fodder mixtures with alfalfa in North-Eastern Romania*. Romanian Agricultural Research, No. 29, 227-235

Sanz-Sáez Á., Erice G., Aguirreolea J., Muñoz F., Sánchez-Diaz M., Irigoyen J.J., 2012 - *Alfalfa forage digestibility, quality and yield under future climate change scenarios vary with Sinorhizobium meliloti strain*. Journal of Plant Physiology, 169:782-788.

Tomić Z., Bijelić Z., Zujović M., Simić A., Kresović M., Mandić V., Marinkov G., 2011 – *Dry matter and protein yield of alfalfa, orchard grass, meadow fescue, perennial ryegrass and their mixtures under the influence of various doses of nitrogen fertilizer*. Biotechnology in Animal Husbandry, 27 (3):1219-1226.

Vintu V., Talpan Irina, Ionel A., Samuil C., 2010 - *Influence of mixture and fertilization on the behavior of some grasses and perennial legume species on temporary pastures in the Moldavian forest speppe*. Romanian Journal of Grassland and Forage Crops, No 1. ISSN 2068-3065, 81-91 p.

Vîntu V.., Iacob T., Dumitrescu N., Samuil C., 1996 – *Contributions to the establishment of perennial grass mixture to setting up temporary meadows, used for grazing, in lower Jijiei and Bahlui Depression*. Cercet. Agr. in Moldova, vol.1-2, p.185-189.