SPECIES PRODUCTIVITY RESEARCH FOR *Festuca arundinacea* Schreb AND*Trifolium pratense* L. CULTIVATED ALONE OR IN SIMPLE MIXTURES, IN THE FIRST YEAR OF VEGETATION, UNDER THE CONDITIONS OF THE MOLDAVIAN FOREST-STEPPE

Teodora ZAIȚ (GRAPAN)[*,], Adrian-Ilie NAZARE[*], Costel SAMUIL[*], Vasile VÎNTU[*,***]**

[*]*University Of Agricultural Science And Veterinary Medicine, 3 Mihail Sadoveanu Alley, 700490 Iași, România*
[**]*Corresponding author e-mail*: teodora_grapan@yahoo.com
[***]*coordinator*

Abstract

The purpose of the research carried out in 2021 within the Ezăreni Farm (47°05'-47°10' north latitude and 27°28'-27°33' east longitude) which belongs to the Didactic Station of the University of Life Sciences Iasi, was to determine the productivity of Festuca arundinacea Schreb and Trifolium pratense L. species, cultivated alone or in simple mixtures, under the conditions of the Moldavian forest-steppe. The studied factors were: the species or mixture of perennial grasses and legumes, with 5 gradations, respectively a_1 - Festuca arundinacea Schreb (100%); a_2 - Festuca arundinacea Schreb (75%) and Trifolium pratense L. (25%); a_3 - Festuca arundinacea Schreb (50%) and Trifolium pratense L. (50%); a_4 - Festuca arundinacea Schreb (25%) and Trifolium pratense L. (75%); a_5 - Trifolium pratense L. (100%) and fertilization with mineral fertilizers, with 5 gradations: b_1 - unfertilized; b_2 - $N_{50}P_{50}$; b_3 - $N_{75}P_{75}$; b_4 - $N_{100}P_{100}$; b_5 - $N_{150}P_{150}$. The dry matter productions obtained were between 2.87 t/ha for Festuca arundinacea Schreb species (100%), unfertilized and 7.33 t/ha for the mixture consisting of Festuca arundinacea Schreb (75%) and Trifolium pratense L. (25%), fertilized with $N_{75}P_{75}$.

Keywords: *percentage of mixture participation, NP fertilization, yield, correlation*.

INTRODUCTION

Obtaining the highest possible fodder production from the temporary meadows largely depends on the species and varieties used, the types of mixtures, the fertility of the soils and the applied technologies, etc. The researches carried out by various authors have followed the behaviour of some species and varieties of perennial grasses and legumes in complex mixtures, taking into account the species used, the percentage of participation of the species in the sowing rate, the way of exploitation and maintenance of temporary meadows (Albayrak S. and Türk M., 2013; Delgado I. et al., 2014). The advantages offered by the culture of mixtures of perennial grasses and legumes are listed by Rotar I., 1993; Aamlid T.S., 1999; Vîntu V. et al., 2004; Naie M. et al., 2015, and consist of: increased productivity; increase in the protein

content of grasses in the presence of legumes, high protein production as a result of the presence of legumes; reducing the amount of nitrogen-based fertilizer as a result of fixing atmospheric nitrogen by means of bacteria *Rhizobium* sp. from the root nodules of legumes.

For mixtures of perennial grasses and legumes, along with fertilization, the choice of the percentage of participation in the mixture of the two groups of species is a very important criterion, on which the production of dry matter obtained depends.

MATERIAL AND METHOD

The purpose of the research was to determine the productivity of *Festuca arundinacea* Schreb and *Trifolium pratense* L. species, cultivated alone or in simple mixtures, under the conditions of the Moldavian forest-steppe.

For this purpose, in the spring of 2021, an experiment was established in the experimental field of the Ezăreni Farm (47°05'-47°10' north latitude and 27°28'-27°33' east longitude) belonging to the Didactic Station of the Iasi University of Life Sciences, according to the method of subdivided plots with two factors (of the 5x5 type), in 3 repetitions, having the dimensions of a plot of 4 x 3 m (12 m^2), and the harvestable surface of 6 m^2, the total surface of the experience being of 940 m^2 (47 x 20 m).

The studied factors were:

A - The species or mixture of perennial grasses and legumes, with 5 gradations: a_1 - *Festuca arundinacea* Schreb (100%); a_2 - *Festuca arundinacea* Schreb (75%) and *Trifolium pratense* L. (25%); a_3 - *Festuca arundinacea* Schreb (50%) and *Trifolium pratense* L. (50%); a_4 - *Festuca arundinacea* Schreb (25%) and *Trifolium pratense* L. (75%); a_5 - *Trifolium pratense* L. (100%)

B - fertilization with mineral fertilizers, with 5 graduations: b_1 - unfertilized; b_2 - $N_{50}P_{50}$; b_3 - $N_{75}P_{75}$; b_4 - $N_{100}P_{100}$; b_5 - $N_{150}P_{150}$. Fertilizers were applied before sowing.

The biological material taken in the study was represented by *Festuca arundinacea* Schreb (tall grass) - the Vio Jucu variety created at the U.S.A.M.V. Cluj Napoca in 2012 and *Trifolium pratense* L. (red clover) - the David Liv variety created at the Livada Agricultural Development Research Station in 2015.

The amount of green mass per hectare was determined by weighing the production obtained after each scythe on the harvestable surface of 6 m^2 and reported per hectare.The content in dry matter (s.u.) was determined by drying in an oven, at a temperature of 105ºC, for 3 hours; standard - SR ISO 6496/2001.

A sample of 2 kg of green mass was taken from the green mass sample and analyzed gravimetrically for the two component species.

The results were interpreted statistically by the analysis of variance and the calculation of the limit differences and by the analysis of the correlation between the percentage of participation in the mixture of the two species and the achieved production of dry matter.

The study area is characterized by temperate continental climatic conditions, and in the agricultural year 2020-2021 it was a favourable year for mixtures of perennial grasses and legumes, with temperatures and precipitation above the multiannual ones.

RESULTS AND DISCUSSION

For mixtures of perennial grasses and legumes, along with fertilization, the choice of the percentage of participation in the mixture of the two groups of species represents a very important criterion on which the production of dry matter obtained depends.

Analysing the behaviour of the species *Festuca arundinacea* Schreb and *Trifolium pratense* L. cultivated alone or in simple mixtures formed between them, under different conditions of fertilization with complex mineral fertilizers based on nitrogen and phosphorus, within the Ezăreni Farm, Iasi, in the 2020-2021 agricultural year (table 1), from the point of view of the forage productions obtained, in the case of the influence of the interaction between the species or mixture of perennial grasses and legumes and fertilization with mineral fertilizers on this parameter, it emerged that the values obtained were between 2.87 t/ha in variant a_1b1, *Festuca arundinacea* Schreb species (100%), unfertilized and 7.33 t/ha in variant a_4b_3, the mixture consisting of *Festuca arundinacea* Schreb (75%) and *Trifolium pratense* L. (25%), fertilized with $N_{75}P_{75}$.

In general, regardless of the species or mixture of perennial grasses and legumes grown, fertilization with complex mineral fertilizers based on nitrogen and phosphorus resulted in higher dry matter yields. Except for the variants in which the *Festuca arundinacea* Schreb species was cultivated (100%), the differences obtained compared to the control variant for all the other variants studied were very significant.

Analysing the influence of the species or the mixture of perennial grasses and legumes on dry matter production, it emerged that the values obtained were between 3.00 t/ha in variant a_1, *Festuca arundinacea* Schreb species (100%) and 5.83 t/ha ha at variant a_4, the mixture consisting of *Festuca arundinacea* Schreb (25%) and *Trifolium pratense* L. (75%) (table 2). From the analysis of the influence of fertilization with mineral fertilizers on the production of dry matter, it emerged that the values obtained were between 4.49 t/ha in variant b_5, fertilized with $N_{150}P_{150}$ and 5.16 t/ha in varinata b_3, fertilized with $N_{75}P_{75}$ (table 3).

Table 1

Influence of the interaction between the species or mixture of perennial grasses and legumes and fertilization with mineral fertilizers on dry matter production

Variant		Production (t/ha s.u.)	Difference (t/ha s.u.)	% compared to control	Significance	*F.a.* (t/ha s.u.)	*T.p.* (t/ha s.u.)
a_1	b_1	2,87	Control	100	Control	2,87	0
	b_2	3,14	0,27	109,6	*	3,14	0
	b_3	3,05	0,18	106,4		3,05	0
	b_4	3,03	0,16	105,5		3,03	0
	b_5	2,89	0,02	100,9		2,89	0
a_2	b_1	4,65	1,78	162,2	***	2,09	2,56
	b_2	4,73	1,86	164,8	***	2,41	2,32
	b_3	3,92	1,05	136,6	***	1,78	2,13
	b_4	5,65	2,78	197,1	***	2,28	3,37
	b_5	4,58	1,71	159,6	***	2,08	2,49
a_3	b_1	5,44	2,58	189,8	***	1,93	3,51
	b_2	5,48	2,62	191,3	***	1,97	3,52
	b_3	4,90	2,03	170,9	***	1,50	3,40
	b_4	6,21	3,34	216,6	***	2,68	3,53
	b_5	5,35	2,48	186,6	***	1,79	3,56
a_4	b_1	5,16	2,29	179,9	***	1,34	3,82
	b_2	5,58	2,71	194,5	***	1,75	3,83
	b_3	7,33	4,46	255,5	***	3,40	3,93
	b_4	5,63	2,76	196,2	***	1,58	4,04
	b_5	5,44	2,58	189,8	***	1,31	4,13
a_5	b_1	4,39	1,53	153,2	***	0	4,39
	b_2	5,28	2,42	184,3	***	0	5,28
	b_3	5,46	2,59	190,4	***	0	5,46
	b_4	5,28	2,41	184,0	***	0	5,28
	b_5	4,21	1,34	146,8	***	0	4,21
		DL5%	*0,27*				
		DL1%	*0,36*				
		DL0,1%	*0,47*				

Table 2

Influence of species or mixture of grasses and legumes on dry matter production

Variant	Production (t/ha s.u.)	Difference (t/ha s.u.)	% compared to control	Significance	*F.a.* (t/ha s.u.)	*T.p.* (t/ha s.u.)
a_1	3,00	Control	100	Control	3,00	0
a_2	4,70	1,71	157,0	***	2,13	2,57
a_3	5,48	2,48	121,7	***	1,97	3,50
a_4	5,83	2,83	129,4	***	1,88	3,95
a_5	4,92	1,93	109,4	***	0	4,92
	DL5%	*0,24*				
	DL1%	*0,34*				
	DL0,1%	*0,52*				

From the point of view of statistical assurance, positive differences, with statistical assurance, were obtained for fertilization variants b_3 and b_4.

The production of dry matter is conditioned by the genetic potential of the species and the vegetation factors, and in the case of mixtures between grasses and perennial legumes, by the reciprocal cooperation between the species of the two botanical families.

As a result of the research carried out, it emerged that fertilization with high doses of mineral fertilizers, in the first year of vegetation, does not favor the growth and development of leguminous species, in the case of *Trifolium pratense* L., because the symbiotic mechanism is affected.

Figure 1 shows the positive correlation between the percentage of participation in the mixture of the species *Festuca arundinacea* Schreb and *Trifolium pratense* L. and the dry matter production of each of them.

Table 3

Influence of fertilization with mineral fertilizers on dry matter production

Variant	Production (t/ha s.u.)	Difference (t/ha s.u.)	% compared to control	Significance	*F.a.* (t/ha s.u.)	*T.p.* (t/ha s.u.)
b_1	4,50	Control	100	Control	1,65	2,86
b_2	4,84	0,34	107,6		1,85	2,99
b_3	4,93	0,43	109,5	*	1,95	2,98
b_4	5,16	0,65	114,6	**	1,91	3,24
b_5	4,49	-0,01	99,8		1,62	2,88
	DL5%	*0,36*				
	DL1%	*0,53*				
	DL0,1%	*0,79*				

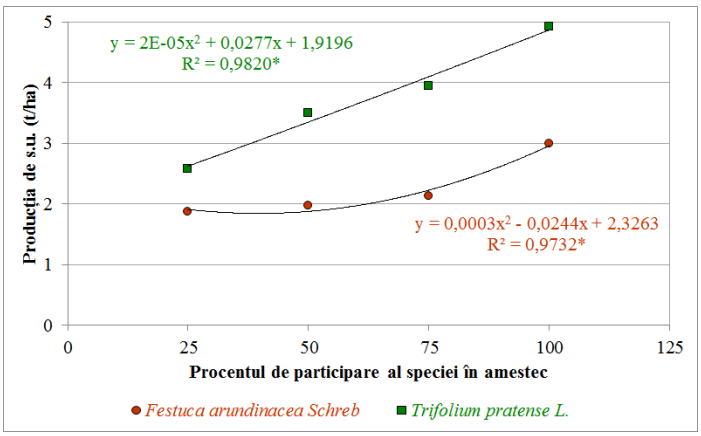

Figure 1 Correlation between the percentage of participation in the mixture of the species *Festuca arundinacea* Schreb and *Trifolium pratense* L. and dry matter production

CONCLUSIONS

In general, regardless of the species or mixture of perennial grasses and legumes grown, fertilization with complex mineral fertilizers based on nitrogen and phosphorus resulted in higher dry matter yields.

Fertilization with high doses of mineral fertilizers, in the first year of vegetation, does not favor the growth and development of leguminous species, in this case the species *Trifolium pratense* L., because the symbiotic mechanism is affected.

Between the percentage of participation in the mixture of the species *Festuca arundinacea* Schreb and *Trifolium pratense* L. and the dry matter production of each, there was a positive correlation, for both species studied.

The main recommendation derived from the research carried out is to cultivate the two species, respectively *Festuca arundinacea* Schreb and *Trifolium pratense* L., in a mixture, with percentages between 25-75%, in fertilization conditions with doses close to $N_{75}P_{75}$, in order to achieve a well-cohered plant cover and consistent forage production.

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