RESEARCH FOR COMPETITION RELATIONS BETWEEN THE *Festuca arundinacea* Schreb. and *Trifolium pratense* L. SPECIES CULTIVATED IN SIMPLE MIXTURES

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Abstract

Purpose of research carried out in 2022 at Ezăreni Farm (47°05'-47°10 ' North latitude and 27°28'-27°33' Eastern longitude) belonging to the Iaşi University of Life Sciences, was to analyze the competitiveness of the species *Festuca arundinacea* Schreb. and *Trifolium pratense* L., grown alone or in simple mixtures, under different conditions of fertilization with complex mineral fertilizers, under the climatic conditions from Moldavian Forrest Steppe. The studied factors were: species or mixture of grasses and perennial legumes, with 5 graduations, 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 graduations, respectively b_1 - unfertilized, b_2 - $N_{50}P_{50}$; b_3 - $N_{75}P_{75}$; b_4 - N_{100}; b_5 - $N_{150}P_{150}$. In the second year of vegetation, the RYT index (Relative Yield Total) recorded values >1, except for variants fertilized with $N_{150}P_{150}$, showing that the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species competes for the same vegetation factors, and the CR index for the *Festuca arundinacea* Schreb. species was higher than in the case of the *Trifolium pratense* L. species only at a percentage of participation in the mixture of 75%, under fertilization conditions, in which case the species was more competitive.

Key words: mixture percentage, fertilization, RYT (Relative Yield Total), CR (Competition Rate)

The formation of mixtures of perennial grasses and leguminous species for feed must be conditioned by the biological properties of the species, in accordance with the use and duration of existence of temporary grasslands (Maruşca T., 2001, Belesky D.P. *et al*., 2002). The ability of each species to compete will also be considered when compiling mixtures of perennial grasses and leguminous species. This is a species trait, but it is greatly influenced and to a large extent by pedoclimatic conditions and the exploitation mode (Skinner R.H. *et al*., 2006, Lazaridou M., 2008, Stanciu A.Ş. *et al*., 2015).

Fertilization on temporary meadows influences their production capacity, obtaining a feed of better quality. It also leads to a change in the structure of vegetation, the species of grasses being, as a rule, advantageous and there is also a change in the properties of the soil and the activity of microorganisms in the soil (Kleczek C., 1991).

Through research carried out in the 2021-2022 agricultural year, at Ezăreni Farm belonging to the Iaşi University of Life Sciences, was to analyze the competitiveness of the species *Festuca arundinacea* Schreb. and *Trifolium pratense* L., grown alone or in simple mixtures, under different conditions of fertilization with complex mineral fertilizers.

MATERIAL AND METHOD

Purpose of research was to analyze the competitiveness of the species *Festuca arundinacea* Schreb. and *Trifolium pratense* L., grown alone or in simple mixtures, under different conditions of fertilization with complex mineral fertilizers, under the climatic conditions from Moldavian Forrest Steppe.

To achieve the proposed goal, in the spring of 2021, an experience was established in the experimental field of Ezăreni Farm (47°05'-47°10 ' North latitude and 27°28'-27°33' Eastern longitude) belonging to the Iaşi University of Life Sciences, by subdivided plots method with two factors (5 × 5 type), in 3 replications, having the dimensions of a plot of 4 x 3 m (12 m²), and the harvestable area of 6 m², the total area of experience being 940 m² (47 × 20 m).

The factors studied were: A - species or mixtures

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of perennial grasses and leguminous species, with 5 graduations: 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 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 - $N_{150}P_{150}$. in the first year of vegetation, the fertilizers were applied before sowing, and from the second year of vegetation, in early spring.

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

The amount of green mass per hectare was determined by weighing the production obtained from each cut on the harvest area of 6 m^2 and then reported to hectare.

The dry matter content (D.M.) of each repetition was determined by drying on the oven at 105 ° C for 3 hours; standard - SR ISO 6496/2001.

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

The calculation of the RYT index (Relative Yield Total), which characterizes the species used in the mixture with respect to the ecological resources used, one in relation to the other and was done with the relationship (Zuo Y. *et al.*, 2010):

RYT = YAB/YAA + YBA/YBB, where:

YAB = D.M. production for A species, in mixture culture;

YAA = D.M. production for A species, in pure culture;

YBA = D.M. production for B species, in mixture culture;

YBB = D.M. production for A species, in pure culture.

Depending on the result obtained, the following three situations can be encountered:

- when RYT > 1, species occupy different eco-niches;

- when RYT = 1, species use common resources;

- when RYT < 1, species are in antagonism relatio.

The calculation of the CR index (Competition Rate), which characterizes the species used in the mixture, in terms of mutual competitiveness and has been calculated with the relationship (Zuo Y. şi colab., 2010):

CR = (YAB/YAA x ZAB)/(YBA/YBB x ZBA) , werw:

YAB = D.M. production for A species, in mixture culture;

YAA = D.M. production for A species, in pure culture;

ZAB = proportion of species A and B in mixture;

YBA = D.M. production for B species, in mixture culture;

YBB D.M. production for B species, in pure culture;

ZBA = proportion of species B and A in mixture;

Depending on the result obtained, the following three situations can be encountered:

- when CR > 1, species A is more competitive than species B;

- when CR = 1, the species are just as competitive;

- when CR < 1, species A is less competitive than species B.

The results were statistically interpreted by analyzing the variance and calculating the least significant differences.

The study area is characterized by continental temperate climatic conditions. The 2021-2022 agricultural year it was less favorable year for mixtures of perennial grasses and leguminous species, with periods of water stress, especially in May, June and July.

RESULTS AND DISCUSSIONS

The analysis of the influence of the interaction between the mixture used and the fertilization with nitrogen and phosphorus-based mineral fertilizers, on the interspecific relations in the second year of vegetation, showed that the RYT index (*figure 1*) recorded values were > 1, except for variants fertilized with $N_{150}P_{150}$. This result showed that the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. competes for the same vegetation factors. In the second year of vegetation the plants are at a high productive potential, they have the aerial part, but especially the more debated underground part. Thus, competition is manifested for vegetation factors in the case of unfertilized or fertilized variants with $N_{50}P_{50}$, $N_{75}P_{75}$ and $N_{100}P_{100}$ doses, while in variants fertilized with $N_{150}P_{150}$ the values of the RYT index were > 1.

In the second year of vegetation, the CR index for the *Festuca arundinacea* Schreb. species was higher than for the *Trifolium pratense* L. species only at a mixed participation rate of 75%, under fertilization conditions, in which case the species was more competitive. The variants in which the *Festuca arundinacea* Schreb. species recorded small and very small values of the CR index were those in which the participation percentage was 50% and 25% respectively. In this case the species is considered weakly competitive (*table 1*).

The values of the CR index for the *Trifolium pratense* L. species were lower, in the case of

variants in which it had a participation of 25%, which shows a lower competitiveness, compared to the *Festuca arundinacea* Schreb. species. The variants in which the *Trifolium pratense* L. species

registered large and very high values of the CR index were those in which the participation percentage was 50% and 75% respectively. In this case the species is considered very competitive.
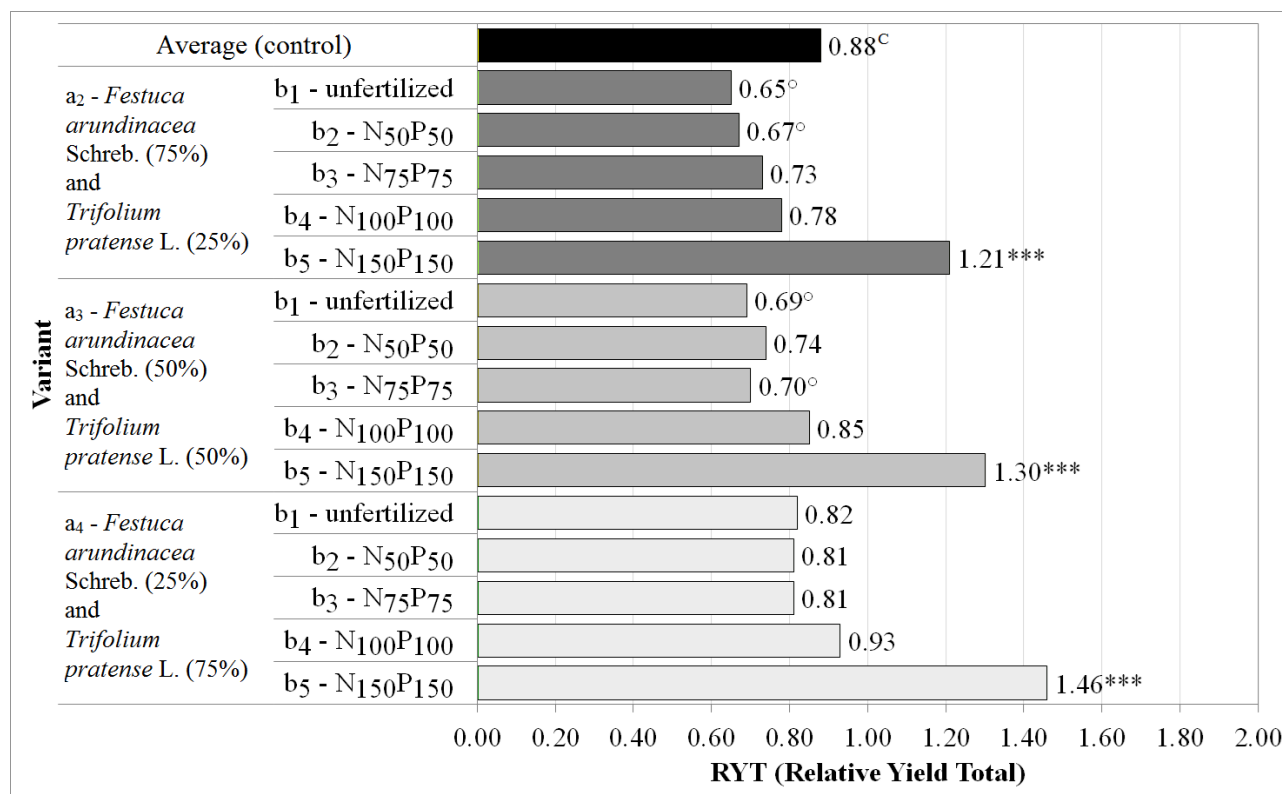

Figure 1 **The influence of the interaction between the culture system used and fertilization on the RYT index (Relative Yield Total), at the first cut, in the second year of vegetation**

Table 1

The influence of the interaction between the culture system used and fertilization on the CR index (Competition Rate), at the first cut, in the second year of vegetation

Variant		RYT	CR *F.a.**	CR *T.p.**
Average (control)		0.88^{Mt}	0.95^{Mt}	15.99^{Mt}
a2 - *Festuca arundinacea* Schreb. (75%) and *Trifolium pratense* L. (25%)	b1 - unfertilized	0.65^{o}	2.42	0.41^{000}
	b2 - $N_{50}P_{50}$	0.67^{o}	1.91	0.52^{000}
	b3 - $N_{75}P_{75}$	0.73	1.82	0.55^{000}
	b4 - $N_{100}P_{100}$	0.78	2.81**	0.36^{000}
	b5 - $N_{150}P_{150}$	1.21***	3.86***	0.26^{000}
a3 - *Festuca arundinacea* Schreb. (50%) and *Trifolium pratense* L. (50%)	b1 - unfertilized	0.69^{o}	0.23	4.33^{000}
	b2 - $N_{50}P_{50}$	0.74	0.22	4.57^{000}
	b3 - $N_{75}P_{75}$	0.70^{o}	0.24	4.20^{000}
	b4 - $N_{100}P_{100}$	0.85	0.27	3.72^{000}
	b5 - $N_{150}P_{150}$	1.30***	0.31	3.21^{000}
a4 - *Festuca arundinacea* Schreb. (25%) and *Trifolium pratense* L. (75%)	b1 - unfertilized	0.82	0.04	26.32***
	b2 - $N_{50}P_{50}$	0.81	0.03	39.63***
	b3 - $N_{75}P_{75}$	0.81	0.02	42.98***
	b4 - $N_{100}P_{100}$	0.93	0.03	39.26***
	b5 - $N_{150}P_{150}$	1.46***	0.01	69.54***
	LSD 0.5	0.17	1.24	1.40
	0.1	0.25	1.68	1.90
	0.01	0.33	2.28	2.55

*: F.a. = Festuca arundinacea, T.p. = Trifolium pratense

Intraspecific competition is a consequence

of the mass effect and occurs between individuals

of the same species, for space, minerals, light and water. The mass effect of intraspecific competition is regulated by homeostatic mechanisms or by human intervention, indicating that individuals can maintain a stronger species. On the one hand, interspecific competition determines which species and how many species can coexist within the same community; on the other hand, interspecific competition affects population dynamics, changes the structure of the species and the structure of the community (Rotar I., 1993).

CONCLUSIONS

Analysis of the influence of the interaction between the mixture used and fertilization with nitrogen and phosphorus-based mineral fertilizers, on the interspecific relations in the second year of vegetation, showed that the RYT index recorded values > 1, except for variants fertilized with $N_{150}P_{150}$, showing that the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species compete for the same vegetation factors.

In the second year of vegetation, the CR index for the *Festuca arundinacea* Schreb. species was higher than for the *Trifolium pratense* L. species only at a mixed participation rate of 75%, under fertilization conditions, in which case the species was more competitive.

The variants in which the *Festuca arundinacea* Schreb. species recorded small and very small values of the CR index were those in which the participation percentage was 50% and 25%, respectively, in which case the species is considered weakly competitive. These aspects were highlighted inversely-proportional in the case of the *Trifolium pratense* L. species.

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