

SUMMARY

Keywords: *cropping system, fertilization, productivity, forage quality, species competitiveness*

Temporary meadows are set up in arable land or, with certain limitations, in place of natural grasslands with different degradation elements, to obtain higher forage production with higher quality.

The most important element of technology in the establishment of a sown meadow is the establishment of the floristic structure, which conditions the density and uniformity of the crop, and, achieving an optimal ratio between the component species (especially between grasses and leguminous species), choosing the way of harvest (mowing, grazing with animals, mixed use), and, a balanced energy-protein ratio of the forage and duration of use.

In this context, **the purpose of the research carried out in the period 2020-2023 was to analyze the behavior of the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species, in simple mixtures for sown grasslands, under the conditions of the northern Moldavian Forest-Steppe.**

The objectives of the doctoral thesis were represented by the analysis of the influence of the culture system and fertilization on growth, development, biomass accumulation, and, the interspecific competitiveness and quality of feed obtained in the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species.

The activities carried out to achieve these objectives were represented by the analysis of the number of shoots·m⁻², the height and dynamics of plant height and feed production, analysis of RYT (Relative Yield Total) and CR (Competition Rate) indices, analysis of feed content in crude protein (CP), and, NDF (neutral detergent fiber) and the analysis of the feed content in ADF (fiber detergent acid), the calculation of the amount of crude protein exported by the feed produced (Q_{CP}) and the calculation of the relative feed quality (RFQ).

The doctoral thesis is structured in **two parts** and includes **seven chapters**.

In **the part of general considerations**, which includes 37 pages (20.1% of the doctoral thesis volume), representing chapters I, II and III, a documentary study is made on the basis of the specialized literature, in order to know the current state of research, from the country and abroad, regarding the technology of cultivation and exploitation of temporary meadows, as well as documentation regarding the natural conditions of the research area.

Chapter I presents the **importance of temporary grasslands**, showing their spread globally and in our country, the advantages of cultivating temporary grasslands, the basic technology for setting up temporary meadows and the morphological and biological peculiarities of the studied species, respectively *Festuca arundinacea* Schreb. and *Trifolium pratense* L..

Chapter II includes **research on the establishment and management of grasslands sown from abroad and from our country**. There are presented, selectively and chronologically, the conclusions of some research relevant to the research topic of the doctoral thesis, through which were followed the influence of different elements of technology on growth, development, accumulation of biomass, and, the interspecific competitiveness and quality of the forage obtained in the main fodder perennial grasses and leguminous species used in mixtures intended for the establishment of temporary meadows.

Chapter III describes **the natural conditions of the area of experimentation**. The research was conducted at Student Research and Practice Station Ezăreni, belonging to the University of Life Sciences "Ion Ionescu de la Brad" from Iași (47°05'-47°10' North latitude and 27°28'-27°33' Eastern longitude).

The current relief of the Ezăreni Station is integrated in the general geomorphological type of the Moldavian Plain. In the research area, there is a boreal climate with an average multiannual rainfall of 517.8 mm and an average multiannual temperature of 9.7°C.

The soil in the experimental field is a cambic chernozem, in the layer of 0-30cm with a pH between 6.68 - 7.01, medium supplied with humus (2.40%), medium supplied with total nitrogen (N) (1.78%) and medium supplied with mobile phosphorus (P) (26.00 ppm).

Natural grassy vegetation has a Forest-Steppe climate characteristic.

In **the own contribution part**, which includes 79.9% of the doctoral thesis volume (147 pages), representing introduction, summary, chapters IV, V, VI, VII, conclusions and recommendations, the results of the research on the behavior of *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species in simple mixtures for sown meadows, under the conditions of the northern Moldavian Forest-Steppe are presented.

Chapter IV presents the **purpose, objectives and activities of the research carried out, the material and research method used**, the cultivation technology applied during the research period and description of climatic conditions during the research period.

In order to achieve the purpose and objectives pursued, it was organized, in spring 2021, in the experimental field of the discipline of "Meadows and fodder plants culture" from Ezăreni Farm, an experience based on the two-factor subdivided plots method, 5 × 5 type, in 3 replications, having the dimensions of a plot of 4 × 3 m (12 m²), the harvestable area of 6 m² (3 × 2 m) and the total experience area of 47 × 20 m (940 m²).

The biological material used was represented by the species *Festuca arundinacea* Schreb. (tall fescue) Vio Jucu variety, approved in 2012, created at

U.A.S.V.M. Cluj Napoca and *Trifolium pratense* L. (red clover) David Liv variety, approved in 2015, created at Livada Agricultural Research-Development Station.

The applied methodology was the one according to the norms of experimental technique in agriculture, the standardised methods applied at international and national level, and the results were statistically analyzed through the analysis of variance, calculation of limit differences and analysis of regressions between studied factors and analyzed parameters.

During the research period, namely the 2020-2023 agricultural period, the average temperature was higher than the multiannual average, in each of the study years, by 0.9-2.2°C.

The total amount of rainfall was higher than the multi-annual, but unevenly distributed average, with periods of water stress between September - November 2021, May - August 2022, in October 2022 and March 2023 and in May - June 2023.

In general, the 2010-2023 agricultural period can be characterized as favorable to the installation of the studied species, but less favorable to their exploitation.

Chapter V presents **the results on the influence of the crop system and fertilisation on the growth, development and accumulation of biomass in *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species**.

During the research period, the 2020-2023 agricultural period, in each of the three years of exploitation, in the species and mixtures studied, three cuts were made, but only one has been harnessed by mowing (the second cut in the first year of vegetation and the first cut in the II and III years of vegetation), the other cuts being of cleansing. Depending on the year of vegetation, the number of shoots generated varied between 296 shoots·m⁻² (third year of vegetation) to the variant represented by *Trifolium pratense* L. (100%) species, fertilised with N₁₅₀P₁₅₀ and 2035 shoots·m⁻² (first year of vegetation) at the variant

formed by the mixture of *Festuca arundinacea* Schreb. (25%) and *Trifolium pratense* L. (75%) species, unfertilised.

In the first year of vegetation the highest number of shoots was obtained when the *Trifolium pratense* L. species was present, and in the second and third year of vegetation, when *Festuca arundinacea* Schreb. species was present, due to the genetic potential (vivacity) of *Trifolium pratense* L. species and unfavorable climatic conditions.

Regardless of the year of vegetation, fertilization with NP type complex mineral fertilizers led to the obtaining of a greater number of shoots per unit area.

Depending on the year of vegetation, the height of the shoots was between 32 cm (first year of vegetation) in the variant represented by *Festuca arundinacea* Schreb. (100%) species, unfertilised and 82 cm (third year of vegetation) in variantes represented by the *Festuca arundinacea* Schreb. (100%) species unfertilised or fertilised with N₅₀P₅₀ and N₇₅P₇₅.

In the first and second year of vegetation the highest shoots were obtained when the species *Trifolium pratense* L. species was present, and in the third year of vegetation, when *Festuca arundinacea* Schreb. species was present.

Regardless of the vegetation year, fertilization with NP type complex mineral fertilizers led to obtaining higher shoots.

In the first year of vegetation the obtained production was between 2.87 Mg·ha⁻¹ at the variant represented by *Festuca arundinacea* Schreb. (100%) species, unfertilised and 7.33 Mg·ha⁻¹ at the variant formed by the mixture of *Festuca arundinacea* Schreb (75%) and *Trifolium pratense* L. (25%) species, fertilised with N₇₅P₇₅.

In the second year of vegetation the obtained production was between 1.81 Mg·ha⁻¹ at the control variant represented by *Festuca arundinacea* Schreb. (100%) species, unfertilised and 8.06 Mg·ha⁻¹ at the variant represented by the *Trifolium pratense* L. (100%) species, fertilised with N₇₅P₇₅.

In the third year of vegetation the obtained production was between 2.82 Mg·ha⁻¹ at the variant represented by *Festuca arundinacea* Schreb (100%) species, unfertilised and 6.05 Mg·ha⁻¹ at the variant formed by the mixture of *Festuca arundinacea* Schreb (75%) and *Trifolium pratense* L. (25%) species, fertilised with N₁₅₀P₁₅₀.

In the first and second vegetation years, the highest productions were made when the *Trifolium pratense* L. species was present, and in the third year of vegetation, when *Festuca arundinacea* Schreb. species was present.

Regardless of the year of vegetation, fertilization with NP type complex mineral fertilizers led to higher dry matter productions.

Fertilization with doses of N₁₀₀P₁₀₀ and N₁₅₀P₁₅₀, in the second and third year of vegetation, favored the growth and development of *Trifolium pratense* L. species plants., especially if the species was 25% and 50% in the mixture and where the competition of *Festuca arundinacea* Schreb. species was manifested.

Chapter VI presents the results on the influence of the crop system and fertilisation on the competitiveness in *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species.

In the case of the study carried out in the 2020-2023 period, on the Ezareni Farm, Iasi, the interspecific competitiveness was influenced by the percentage of participation in the sowing norm of the species in the mixture, the NP type complex mineral fertilizers administered and the biological peculiarities of the studied species, but, most importantly, by the climatic conditions specific to each agricultural year.

The RYT (Relative Yield Total) index, which characterizes the species used in the mixture regarding the ecological resources used, one in relation to the other, recorded, in the first year of vegetation,

values >1 , showing that the species *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species are antagonistic.

In the second year of vegetation the RYT index recorded values <1 , except for variants fertilised with $N_{150}P_{150}$, showing that the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species occupy different ecological niches, it does not compete for the same vegetation factors, and in the third year of vegetation the RYT index recorded values >1 , showing that the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species it competes for at least one of the vegetation factors, due to the recorded precipitation deficit in the agricultural year 2022-2023.

During the study period, 2020-2023, depending on the vegetation year, the CR index (Competition Rate) which characterizes the species used in the mixture, regarding the mutual competitiveness, for the *Festuca arundinacea* Schreb. species it was higher than *Trifolium pratense* L. species at a percentage of participation in the mixture of 75% and 50%, respectively, regardless of the fertilization variant, the species being more competitive and the variants in which the *Festuca arundinacea* Schreb., species recorded very low values of the CR index were those in which the percentage of participation was 50% and 25%, respectively, the species being considered very weakly competitive.

The values of the RYT and CR indices, under the climatic conditions specific to the 2020-2023 agricultural period, showed that, although under normal conditions the grasses and legumes do not compete with each other, the *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species have in common the water factor, which becomes the most important one.

Chapter VI presents the results on the influence of the crop system and fertilisation on the quality of forage obtained in *Festuca arundinacea* Schreb. and *Trifolium pratense* L. species.

In the second and third vegetation years the crude protein content (CP) of the obtained forage was between 11.74 % for the control variant represented by *Festuca arundinacea* Schreb (100%) species, unfertilised and 17,83 % in the variant represented by *Trifolium pratense* L. (100%) species, fertilised with $N_{100}P_{100}$.

The highest values of the crude protein content (CP) were obtained when the *Trifolium pratense* L. species, was present and fertilization with NP type complex mineral fertilizers led to a forage higher crude protein content.

On average, over the 2021-2023 period, the total amount of crude protein exported through the harvested forage ranged from $272.7 \text{ kg}\cdot\text{ha}^{-1}$ at the control variant represented by *Festuca arundinacea* Schreb (100%) species, unfertilised and $1061.4 \text{ kg}\cdot\text{ha}^{-1}$ at the variant formed by the mixture of *Festuca arundinacea* Schreb. (25%) and *Trifolium pratense* L. (75%) species, fertilised with $N_{150}P_{150}$.

In the second and third years of vegetation, regardless of the fertilization variant, the highest RFQ (Relative Forage Quality) values, calculated on the basis of the NDF (Neutral Detergent Fiber) and ADF (Acid Detergent Fiber) content, were determined when *Trifolium pratense* L. was present.

Regardless of the species or mixture of cultivated perennial grasses and leguminous species, fertilization with higher doses of NP type complex mineral fertilizers led to obtaining a feed of lower relative quality.

Depending on the agricultural year, by the presence of *Trifolium pratense* L. species in a higher percentage, the quality class of the obtained forage can be increased, from 3-4 (low - middle), at 2-1 (good - very good) or even 0 (excellent).

In the **final part of the doctoral thesis** are presented the **conclusions and recommendations** drawn from the research and a **selection of the bibliography consulted** for the realization of the doctoral thesis.