RESEARCH ON THE INFLUENCE OF SOME ELEMENTS OF TECHNOLOGY ON MORPHO-PRODUCTIVE PARAMETERS IN *Bromus inermis* Leyss. SPECIES

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Abstract

The research-conducted during the period 2022-2023 at the Research and Development Station for Meadows, Vaslui, aims to evaluate the influence of fertilization and the distance between plant rows on the plants height (cm), shoots number (shoots·m^{-2}), panicle length (cm), number of nodes per inflorescence and number of branches per inflorescence for smooth brome (Bromus inermis Leyss.*), variety Mihaela. A bifactorial experiment, 3×5 type, was set up according to the method of subdivided plots, with the plot harvestable area of 20 m^2, in three replicates and the studied factors were the distance between rows with three graduations and fertilization with five graduations being studied the interaction between the two factors. During the growing season, numerous plant measurements were made according to the proposed methodology. Within the study, it was found that by applying mineral fertilizers and by sowing at bigger distances between rows higher plants were obtained, with a higher number of shoots·m^2, also the panicle length, the number of nodes per inflorescence and number of branches per inflorescence were higher.*

Key words**: **plants height, shoots number, panicle length, number of nodes per inflorescence, number of branches per inflorescence

INTRODUCTION

Smooth brome is a perennial grass species that is found in temperate areas of Asia, Europe and North America. It has a high drought and frost tolerance, it is widely used for growing grasslands, and for their improvement as well as for soil and water conservation in semi-arid regions (Samuil et al., 2010; Salesman and Thomsen, 2011; Samuil et al., 2012; Saeidnia et al., 2019; Saeidnia et al 2022). Given the advantages that perennial fodder grasses have in agriculture and the importance of fodder for animal feeding, it can be a valuable replacement for annual plants in drought conditions. In the areas with periodic drought in summer, grass yield, plant persistence and restoration are the most important agronomic characteristics (Annicchiarico et al., 2011; Pecetti et al., 2011).

Perennial grasses are the main fodder crops because their expansion area is quite large, they are spread from the tropics to the extreme northern regions. Their role is significant in the agricultural system: soil protection from water and wind erosion, soil organic matter enrichment, soil physical and mechanical properties improvement and help to infiltrate water from precipitation (Goloborodko and Dymov, 2019). *Bromus inermis* Leyss. belongs to perennial species of the family Poaceae, is a perennial grass grown in arid and warm regions, and its service life can be more than 30 years (Shi et al., 2007).

The high value of the smooth brome feed can be explained by the significant number of vegetative shoots, with more leaves, than generative ones. In addition, the leaves, especially on vegetative shoots, contain more nutrients (Marinich and Antonets, 2021).

Smooth brome is used in animal nutrition (Heroy et al., 2017; Rautio et al., 2012). The fodder value is good and due to the leaf-rich vegetative mass, it is consumed very well by all animals. (Vasylenko et al., 2020; Nizam and Tuna, 2020).

Field management practices such as seeding, fertilization, irrigation, and weed control are crucial for seed growers to improve seed yield. Research on cool-season grasses has shown that agronomic practices like plant density, fertilization, and residue management can significantly impact the level of seed yield and quality (Deleuran et. al., 2013; Ou et al., 2021).

The purpose and objectives of the research, carried out at the Research and Development Station for Meadows Vaslui were represented by the analysis of the influence of row spacing and fertilization on plants height (cm), shoots number (shoots·m^{-2}), panicle length (cm), number of nodes per inflorescence, number of branches per inflorescence at the smooth brome (*Bromus inermis* Leyss.) in the seed crop, in the third year of vegetation. The aim of the study was to enhance the cultivation technology of *Bromus inermis* Leyss.

MATERIALS AND METHODS

The research was carried out between September 2022 and October 2023, within the Research and Development Station for Meadows (RDSM) Vaslui (46°40'-36°10' north latitude and 27°44'-20°40' east longitude).

To achieve the proposed goal a bifactorial experience, 3×5 type, was organized involving three sowing distances between rows and five fertilization doses (Table 1). The experience was placed according to the method of subdivided plots, in three replicates (Photo 1).

Table 1. Experiment set-up

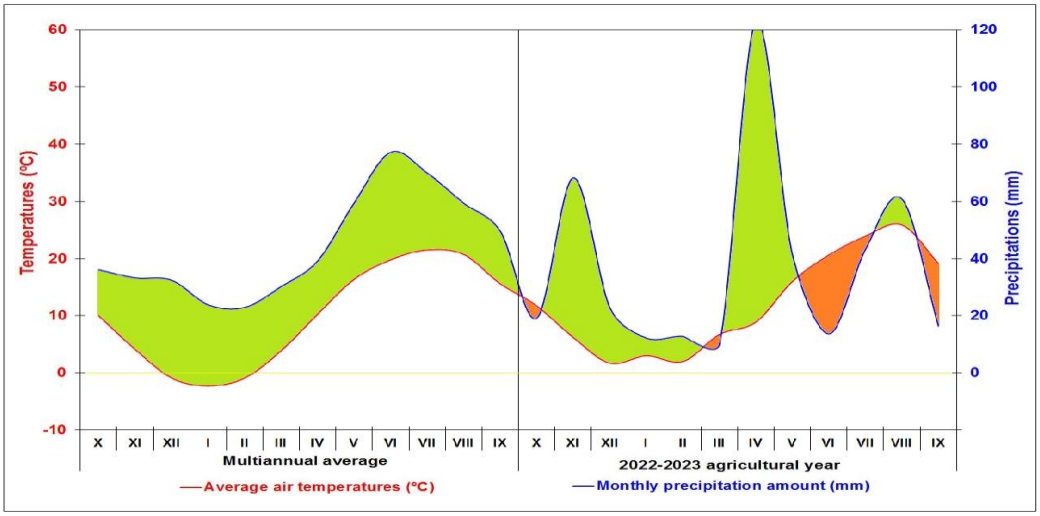
Bromus inermis Leyss. variety	Variant number	Variant	
		row distance	Fertilizers doses
MIHAELA	V_1-C*)	25 cm	unfertilized
	V_2		$N_{50}P_{50}$
	V_3		$N_{50}P_{50}K_{50}$
	V_4		$N_{75}P_{75}K_{75}$
	V_5		$N_{100}P_{100}K_{100}$
	V_6	37.5 cm	unfertilized
	V_7		$N_{50}P_{50}$
	V_8		$N_{50}P_{50}K_{50}$
	V_9		$N_{75}P_{75}K_{75}$
	V_{10}		$N_{100}P_{100}K_{100}$
	V_{11}	50 cm	unfertilized
	V_{12}		$N_{50}P_{50}$
	V_{13}		$N_{50}P_{50}K_{50}$
	V_{14}		$N_{75}P_{75}K_{75}$
	V_{15}		$N_{100}P_{100}K_{100}$
*) C: control			

The studied factors were: the distance between rows with three graduations (25 cm, 37.5 cm and 50 cm) and fertilization with five graduations (unfertilized, N50P50, $N_{50}P_{50}K50$, $N_{75}P_{75}K_{75}$ and $N_{100}P_{100}K_{100}$ being studied the interaction between the two factors (respectively 15 variants, V_1 ... V_{15}'s). The biological material used is represented by the Mihaela smooth brome variety registered at the Research and Development Station for Meadows (RDSM) Vaslui in 2010 (Silistru, 2010). Fertilizers

were applied early in the spring, at the start of plant vegetation.
The plants height (cm) was determined at the full development of the plants (11.02.2023) as follows: the height (cm) of 60 plants from the middle of each variant was measured and the average was made.

Photo 1. A general view from the experimental field

The shoots number (shoots·m^{-2}) was determined by counting the shoots on each variant, on one linear meter of the rows, then the obtained number was expressed to m^{-2}.
Panicle length (cm) was determined by measuring the length of the panicles, on one linear meter of the rows, then the obtained number was expressed to m^{-2}.
The number of nodes per inflorescence was determined by counting the nodes on the inflorescences, on one linear meter of the rows, then the obtained number was expressed to m^{-2}.
The number of branches per inflorescence was determined by counting the branches on the inflorescences, on one linear meter of the rows, then the obtained number was expressed to m^{-2}.
The agricultural year 2022-2023 was a very dry year in terms of rainfall (Figure 1.).
There was recorded rainfall below the multiannual average, the amount of precipitation was 443.6 mm, the deviation being a negative one of 89.6 mm precipitation.
The results were statistically analized statisticaly by analyzing the variance and calculating the least significant differences and by analyzing the correlations between the studied parameters.



(green - optimal period; orange - water deficit period)
Figure 1. Climadiagram of the 2022-2023 agricultural year

RESULTS AND DISCUSSIONS

Analyzing the influence of the interaction between row distance and fertilization on the plants height at the smooth brome seed crop, in the third year of vegetation (Table 2.), it emerged that this indicator had values ranging from 136 cm to the V_1 variant (the distance between rows of 50 cm, unfertilized) and 154 cm to the V_5 variant (the distance between rows of 25 cm, fertilized with $N_{100}P_{100}K_{100}$). Significant negative statistical significance values were obtained at the V_6 and V_7 variants and very significant statistical significance at the V_{11} variant. Significant positive statistical significance values were obtained at V_{10} and very significant statistical significance at V_4, V_5, V_{14}, and V_{15} variants.

By sowing at smaller distances between rows and full administration of mineral fertilizers, plants with higher height were obtained.

Table 2. Influence of the distance between rows and fertilization on some morphoproductive indicators of *Bromus inermis* Leyss. species, variety Mihaela

Variant		Plants height (cm)	Generative shoots number (shoots·m^{-2})	Panicle length (cm)	Number of nodes per inflorescence	Number of branches per inflorescence
V_1-C*)		144 C	1141 C	22.0 C	8.7 C	37.7 C
V_2		144	1203	20.9	9.1	38.0
V_3		148	1155	21.8	9.1	36.4
V_4		150***	1157	21.8	9.3**	37.2
V_5		154***	1128	20.0°	8.9	33.9°°°
V_6		138°	727°°°	19.8°	9.2**	35.6°°°
V_7		138°	773°°°	19.1°°	8.8	33.3°°°
V_8		144	878°°°	19.9°	8.4	34.0°°°
V_9		147	787°°°	21.2	9.4***	38.1
V_{10}		150*	705°°°	20.8	9.7***	38.6
V_{11}		136°°°	749°°°	21.1	9.3**	37.7
V_{12}		140	824°°°	20.0°	9.6***	34.3°°°
V_{13}		143	905°°°	23.4	9.9***	37.8
V_{14}		152***	911°°°	23.7	9.3*	34.1°°°
V_{15}		152***	755°°°	23.9	9.8***	39.4*
LSD	*0.5*	*5*	80	2.0	0.4	1.7
	0.1	*6*	107	2.7	0.5	2.2
	0.01	*8*	139	3.5	0.7	2.9

C*) - Control variant.

From the point of view of the effect of fertilization on smooth brome plants, the tendency was generally growing with increasing the doses of mineral fertilizers.

Analyzing the influence of the interaction between row distance and fertilization on the number of shoots·m^{-2} (generative shoots) at the smooth brome for seed, in the third year of vegetation (Table 2.), it is found that they values between 705 shoots·m^{-2} at V_{10} variant (the distance between rows of 37.5 cm, fertilized with $N_{100}P_{100}K_{100}$) and 1203 shoots·m^{-2} to V_2 variant (the distance between rows of 25cm, fertilized with $N_{50}P_{50}$) were obtained. At this indicator, values with very significant negative statistical significance were obtained for V_6, V_7, V_8, V_9, V_{10}, V_{11}, V_{12}, V_{13}, V_{14}, and V_{15} variants.

At variants sown at smaller distances between rows at 25 cm, a higher number of shoots·m^{-2} were obtained compared to sowing at greater distances between rows.

By administrating mineral fertilizers also the number of shoots·m^{-2} had a general tendency to grow.

By sowing at 25 cm between rows and fertilizing with $N_{50}P_{50}K_{50}$, under the pedoclymatic conditions of the agricultural

year 2022-2023, a higher number of shoots·m^{-2} was obtained.

Studying the influence of the interaction between row distance and fertilization on the panicle length at the smooth brome for seed, in the third year of vegetation (Table 2.), it was found that values ranging from 19.1 cm at V_7 variant (the distance between rows of 37.5 cm, fertilized with $N_{50}P_{50}$) and 23.9 cm at V_{15} variant (the distance between rows of 50 cm, fertilized with $N_{100}P_{100}K_{100}$) were obtained. Significant negative statistical significance values were obtained at the variants V_5, V_6, V_8, and V_{12} and statistically significant distinctly at the variant V_7.

At this indicator the highest values were obtained at the variants sown at the distance of 50 cm between the rows and administrating mineral fertilizers in higher doses.

Analyzing the influence of the interaction between row distance and fertilization on the number of nodes per inflorescence at smooth brome for seed, in the third year of vegetation (Table 2.), it was found that values between 8.4 number of nodes per inflorescence at variant V_8 (the distance between rows of 37.5 cm, fertilized with $N_{50}P_{50}K_{50}$) and 9.9 number of nodes per inflorescence at V_{13} variant (the distance between rows of 50 cm, fertilized with $N_{50}P_{50}K_{50}$) were obtained. The results indicate that compared to the control, all variants showed positive values. The V_{14} variant showed significant statistical significance, while the V_4, V_6, and V_{11} variants showed distinctly significant statistical significance. Additionally, the V_9, V_{10}, V_{12}, V_{13}, and V_{15} variants displayed very significant statistical significance.

At the variants sown at 50 cm between the rows the highest values were obtained, while very large differences did not differ in variants with different doses of fertilization.

Analyzing the influence of the interaction between row distance and fertilization on the number of branches per inflorescence (Table 2.), it was found that values between 33.3 number of branches per inflorescence at variant V_7 (the distance between rows of 37.5 cm, fertilized with $N_{50}P_{50}$) and 39.4 number of branches per inflorescence at V_{15} variant (the distance between rows of 50 cm, fertilized with $N_{100}P_{100}K_{100}$) were obtained. At this indicator, only one variant achieved significant positive statistical significance V_{15}. While variants V_5, V_6, V_7, V_8, V_{12}, and V_{14} obtained very significant negative statistical significance.

By sowing at a distance of 37.5 cm and 50 cm between rows, plants with a higher number of branches per inflorescence were obtained.

And by applying mineral fertilizers, the values obtained had a tendency to grow, with the increase of the applied doses.

Following the results obtained it was noted that each of the factors studied influenced the morpho-productive parameters analyzed, but in the climatic conditions of the agricultural year 2022-2023, the results were also largely influenced by low rainfall and the previous year's atmospheric drought was also felt this year.

In addition to the correlations between studied factors and analyzed parameters, correlations between studied parameters were also determined.

A positive correlation between the number of nodes per inflorescence and the length of the panicle to the smooth brome for the seed could also be carried out. The longer the distance between the rows, the length of the panicle increased and the number of floors per inflorescence was increasing (Figure 2.).

At a longer panicle length, the number of floors increased, but in the range of 19.5-23 cm, there were several plants with a constant number of nodes per inflorescence.

Following the research carried out, the correlation between the number of branches per inflorescence and the length of the panicle with positive statistical significance (Figure 3.) could also be determined. When the length of the panicle was between 22-24 cm, the number of branches per inflorescence was higher. The longer the length of the panicle was, the more the number of branches per

inflorescence increased, stabilizing between 24-26 cm.

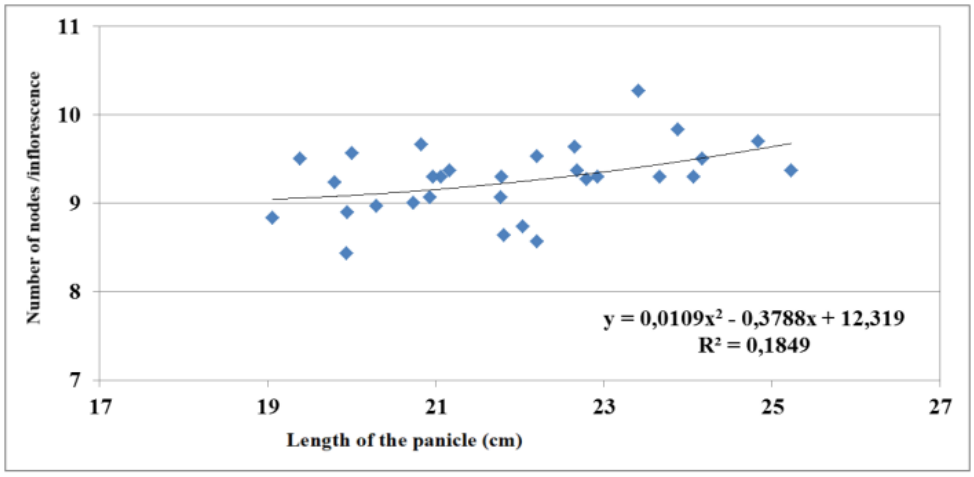


Figure 2. The correlation between the number of nodes per inflorescence and the length of the panicle on the smooth brome for seed, in the third year of vegetation.

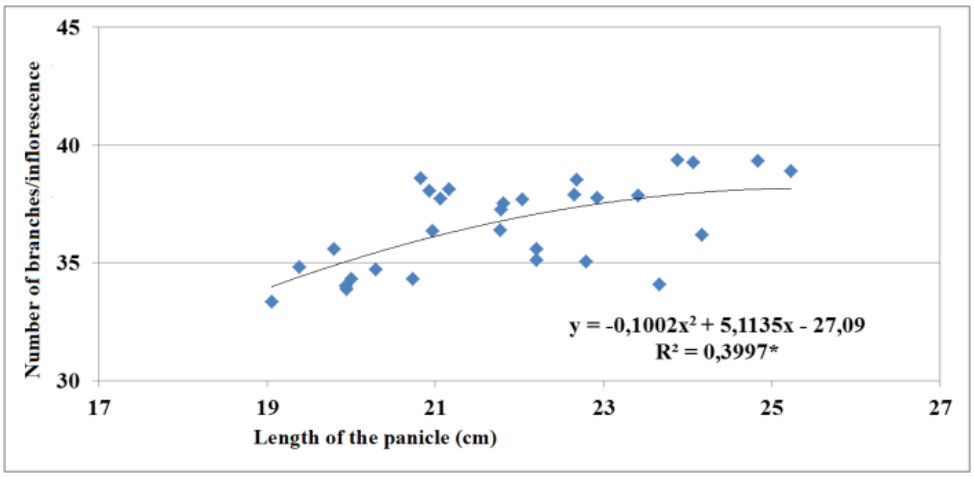


Figure 3. The correlation between the number of branches per inflorescence and the length of the panicle on the smooth brome for seed, in the third year of vegetation.

The study carried out in the agricultural year 2022-2023 generated comparable results with other researchers who studied the number of nodes per inflorescence and the number of branches per inflorescence, those being the main factors affecting the production of smooth brome according to Majidi, et al., 2016.

CONCLUSIONS

The results showed that all of the studied factors had an impact on the morphologically-productive parameters analyzed under climatic conditions during the agricultural year 2022-2023.

In the climatic conditions specific to the agricultural year 2022-2023 the distance between rows had a different influence on the analyzed paramentars. Thus, by sowing at the distance of 25 cm between the rows, a greater number of generative shoots·m^{-2} was obtained. By sowing at 50 cm between the rows were obtained plants with a higher height, with a larger length of the panicle, a higher number of nodes per inflorescence, but also a higher number of branches per inflorescence.

Fertilization with $N_{75}P_{75}K_{75}$ produced the most significant differences, with the morphoproductive elements achieving the highest values at most of the analyzed indicators, regardless of the distance between rows when sowing.

The studied factors at which the obtained values excelled from the point of view of the morphoproductive elements in the third year of vegetation, were sowing at 25-37.5 cm row spacing and fertilization with $N_{75}P_{75}K_{75}$.

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