Scientific Papers. Series A. Agronomy, Vol. LXVI, No. 1, 2023
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

RESEARCH ON THE INFLUENCE OF DISTANCE BETWEEN ROWS AND FERTILIZATION ON SOME MORPHOPRODUCTIVE ELEMENTS IN *Bromus inermis* Leyss. SPECIES

Elena-Manuela VACARCIUC[1], Cristian-Sorin GAVRILĂ[1], Mihai STAVARACHE[1], Simona DUMITRIU[1], Ioan PUIU[2], Costel SAMUIL[2]

[1]Research and Development Station for Meadows, Vaslui, Romania
[2]University of Life Sciences "Ion Ionescu de la Brad" from Iasi, 3 Mihail Sadoveanu Alley, Iasi, Romania

Corresponding author email: vacarciucelenamanuela@yahoo.ro

Abstract

The research conducted during the period 2021-2022, at the Research and Development Station for Meadows, Vaslui (46°40'-36°10' north latitude and 27°44'-20°40' east longitude) followed the influence of fertilization and the distance between rows on the plants height (cm), shoots number (shoots·m^{-2}), panicle length (cm), number of nodes per inflorescence, number of branches per inflorescence and seed production (kg·ha^{-1}) for smooth brome (Bromus inermis Leyss*.). The organized experience was bifactorial, 3 x 5 type, it was placed according to the method of subdivided plots, with the plot harvestable area of 20 m^2 (2 m x 10 m), in three replications, and the studied factors were: A - the distance between rows with three graduations and B - fertilization with five graduations. Following 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 and seed production were higher.*

Key words*: plants height, shoots number, panicle length, number of nodes per inflorescence, number of branches per inflorescence, seed production, Bromus inermis L.*

INTRODUCTION

Smooth brome (*Bromus inermis* Leyss.) it is a species of perennial grasses with high fodder value and high productivity and is used for the establishment of temporary grasslands (Liu et al., 2014).

This species is characterized by high tolerance to drought and low temperatures and average resistance to soil salinity.

The species is also used for the restoration of degraded meadows and the establishment of pastures (Liu et al., 2008; Antonova et al., 2015). In addition, the smooth brome species is of great importance in the feeding of animals, due to its high production capacity and good digestibility of feed (Dumlu et al., 2013; Unal and Mutlu, 2015). The species can also be used to prevent soil erosion due to the well-developed root system and the presence of stolons (Cinar et al., 2016; Saritas et al., 2017).

Seed production is undoubtedly of particular importance for oversowing or resowing permanent grasslands and the establishment of temporary grasslands by providing the necessary seed material. The technology of growing the seed batches of fodder species is different from the technology of fodder production, with a tendency to improve the morphological peculiarities of seed production and seed quality indices (Ene and Mocanu, 2016; Samuil et al., 2012).

MATERIALS AND METHODS

The purpose and objectives of the research conducted during the period of March to October 2021, at the Research and Development Station for Meadows, Vaslui (46°40'-36°10' N latitude and 27°44'-20°40' E longitude), were represented by the analysis of the influence of row spacing and fertilization on plant height (cm), shoots number (shoots·m^{-2}), panicle length (cm), number of nodes per inflorescence, number of branches per inflorescence and seed production (kg·ha^{-1}), at the smooth brome (*Bromus inermis* Leyss.), the seed crop, in the second year of vegetation.

To achieve the proposed purpose, it was organized a bifactorial experience, 3 x 5 type, placed according to the method of subdivided plots, with the plot harvestable area of 13.5 m^2 (1.5 m x 9 m), in three replications. The factors studied were: A - the distance between rows with three graduations (a_1 - 25 cm, a_2 - 37.5 cm and a_3 - 50 cm) and B - fertilization with five graduations (b_1 - unfertilized, b_2 - $N_{50}P_{50}$, b_3 - $N_{50}P_{50}K_{50}$, b_4 - $N_{75}P_{75}K_{75}$ and b_5 - $N_{100}P_{100}K_{100}$).

The biological material used was represented by the Mihaela smooth brome variety, variety approved in 2010 at the Research and Development Station for Meadows, Vaslui (Silistru, 2010).

Fertilizer was applied early in the spring, at the start of plant vegetation.

The plants height (cm) by measuring, in 3 repetitions, the shoots on the rows located 1 m from the edge of the plot.

The shoots number (shoots·m^{-2}) was determined by counting the shoots, in 3 repetitions, from 1 linear m of the rows located 1 m from the edge of the plot, then the obtained number was expressed to m^2.

Panicle length (cm) was determined by measuring the length of the panicle, from 1 linear m of the rows, then the obtained number was expressed to m^2.

Number of nodes per inflorescence was determined by counting the nodes on the inflorescence, from 1 linear m of the rows, then the obtained number was expressed to m^2.

Number of branches per inflorescence was determined by counting branches on inflorescence, from 1 linear m of the rows, then the obtained number was expressed to m^2.

Seed production (kg·ha^{-1}) was determined by weighing the manually harvested seeds on each variant, then reporting to the area unit.

The agricultural year 2021-2022 was a very dry year. The amount of precipitation was 250.2 mm lower than the annual average (533.2 mm), affecting the growth and development of plants. In terms of temperatures it was a warm year, less favorable to the growth and development of smooth brome plants. The results were statistically interpreted by analyzing the variance and calculating the least significant differences and by analyzing the correlations between the study parameters.

RESULTS AND DISCUSSIONS

Seed quality is essential for the establishment of new crops. The size of the seeds, their weight, the content of reserve nutrients are the main elements of seed quality on which the development of future *Bromus inermis* Leyss. plants depends (Marco and De, 1990; Smart and Moser, 1999; Snider et al., 2016; Sousa et al., 2016).

Analyzing the influence of the interaction between row spacing and fertilization on the plants height at the smooth brome seed crop in the second year of vegetation (Table 1), it emerged that this indicator had values between 118 cm at the a_1b_2 variant (row spacing 25 cm, fertilized with $N_{50}P_{50}$) and 129 cm at a_2b_3 variant (row spacing 37.5 cm, fertilized with $N_{50}P_{50}K_{50}$). In general, by sowing at greater distances between rows, higher values of this indicator were obtained, plants with a higher height namely.

From the point of view of the effect of fertilization on smooth brome plants, the tendency was generally to increase the height of the plants, with the increase in the doses of mineral fertilizers.

Analyzing the influence of the interaction between row spacing and fertilization on the number of shoots·m^{-2} (generative shoots) (Table 1), it is found that they generated values between 415 shoots·m^{-2} at the a_3b_1 variant (row spacing of 37.5 cm, unfertilized) and 1272 shoots·m^{-2} at the a_1b_4 variant (row spacing of 25 cm, fertilized with $N_{75}P_{75}K_{75}$).

Regarding the generative number of shoots·m^{-2}, for the variants where the sowing distance between rows was 25 cm, higher values were obtained than the sowing at greater distances.

By applying mineral fertilizers, the values for the number of shoots·m^{-2} had an increasing trend, and for the variants with maximum fertilization doses ($N_{100}P_{100}K_{100}$), the highest values were usually obtained.

Analyzing the influence of the interaction between row spacing and fertilization on the panicle length (Table 1.), It was found that they generated values between 17.3 cm at a_1b_5 variant (row spacing of 25 cm, fertilized with $N_{100}P_{100}K_{100}$) and 24.1 cm at a_3b_3 variant (row spacing of 50 cm, fertilized with $N_{50}P_{50}K_{50}$).

It was observed that the highest values at this indicator were obtained when sowing was carried out at a distance of 37.5 cm between rows or 50 cm between rows.

By applying mineral fertilizers the values had an increasing trend and stabilized when applying the $N_{50}P_{50}$ and $N_{50}P_{50}K_{50}$ doses, after which the values began to decrease.

In addition to correlations between study factors and analyzed parameters, correlations between study parameters such as the number of generative shoots and the length of the panicle were determined (Figure 1).

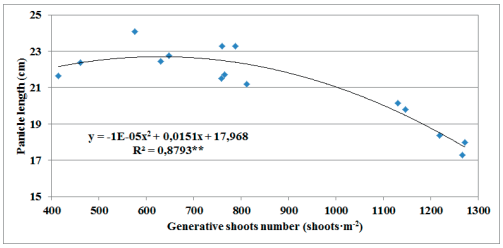

Figure 1. Correlation between generative shoots number and panicle length

The greater the distance between the rows, the smaller the number of shoots·m^{-2} and the longer the panicle was. When the shoots reached the range of 600-800 shoots·m^{-2}, the length of the panicle tended to stabilize, then decrease.

At a small number of shoots·m^{-2} the length of the panicle was higher, but they can be uneven and with few seeds per panicle, so the production can be less.

Analyzing the influence of the interaction between row spacing and fertilization on the number of nodes per inflorescence (Table 1), it was found that they generated values between 8.1 at the a_1b_5 variant (row spacing of 25 cm, fertilized with $N_{100}P_{100}K_{100}$) and 9.0 at the a_2b_3 variant (row spacing of 37.5 cm, fertilized with $N_{50}P_{50}K_{50}$) and a_2b_5 variant (row spacing of 37.5 cm, fertilized with $N_{100}P_{100}K_{100}$).

At this indicator, the highest values were obtained by sowing at a distance of 37.5 cm between rows and the administration of $N_{50}P_{50}$ mineral fertilizers.

Following the research, the positive correlation between the length of the panicle and the number of nodes per inflorescence was also revealed (Figure 2).

Analyzing the influence of the interaction between row spacing and fertilization on the number of branches per inflorescence (Table 1), it was found that they generated values between 25.8 at a_1b_5 variant (row spacing of 25 cm, fertilized with $N_{100}P_{100}K_{100}$) and 32.1 at a_1b_5 variant (row spacing of 50 cm, fertilized with $N_{50}P_{50}$).

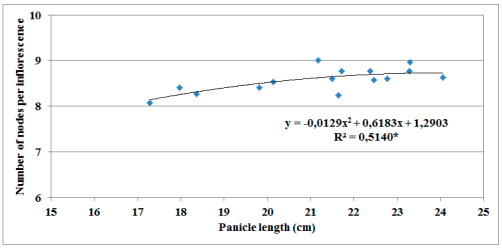

Figure 2. Correlation between panicle length and number of nodes per inflorescence

By applying $N_{50}P_{50}K_{50}$ mineral fertilizers doses, the number of branches per inflorescence had an increasing trend and stabilized, after which the values started to decrease. By sowing at 50 cm between rows the highest values were obtained.

The correlation between the length of the panicle and the number of branches per inflorescence was determined (Figure 3.). It was seen that the number of branches per inflorescence obtained almost constant values at all the factors studied, but by applying the established technologies at the longer sowing distance (37.5 cm between rows), the values were slightly higher.

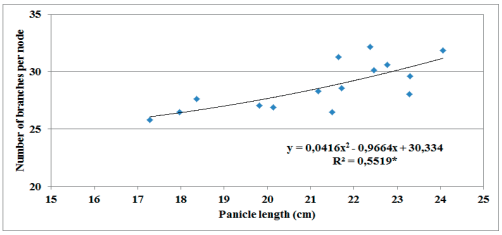

Figure 3. Correlation between panicle length and number of branches per node

The smooth brome plants that had the longer panicle generated a higher number of branches per inflorescence, and at the size of the panicle between 20-23 cm (the length of the panicle) the number of branches per inflorescence was higher and resulted in higher seed production.

Analyzing the influence of the interaction between row spacing and fertilization on seed production at the smooth brome seed crop in the second year of vegetation (Table 1), it was found that they generated values between 276 kg·ha^{-1} at the a_3b_2 variant (row spacing of 50 cm, fertilized with $N_{50}P_{50}$) and 437 kg·ha^{-1} at the a_1b_2 variant (row spacing of 25 cm, fertilized with $N_{50}P_{50}$).

By sowing at shorter distances between rows, 25 cm, higher seed yields were obtained than sowing at distances of 37.5 cm and 50 cm between rows.

By applying mineral fertilizers, the values had an increasing trend, the variants fertilized with $N_{75}P_{75}K_{75}$ achieving the highest values on average.

The correlation between the number of shoots·m^{-2} (generative shoots) and seed production (Figure 4), in the second year of vegetation, revealed that the higher number of generative shoots resulted in higher seed production.

In Figure 5 there are presented aspects of the experimental field (vegetation starting in the second year of exploitation of the smooth brome seeds production crop).

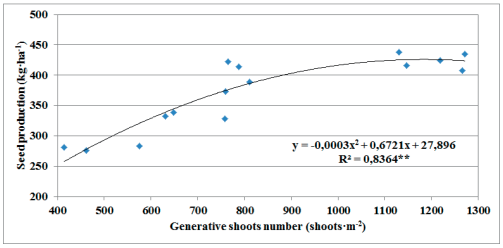

Figure 4. Correlation between generative shoots number and seed production

Figure 5. Aspects of the experimental field, in the second year of vegetation

Table1. Influence of the distance between rows and fertilization on some morphoproductive indicators of *Bromus inermis* Leyss. species

Variant			Plants height (cm)	Generative shoots number (shoots·m^{-2})	Panicle length (cm)	Number of nodes per inflorescence	Number of branches per inflorescence	Seed production (kg·ha^{-1})
a_1 - 25 cm (C)	b_1 - unfertilized (C)		116^{C}	1147^{C}	19.8^{C}	8.4^{C}	27.0^{C}	416^{C}
	b_2 - $N_{50}P_{50}$		118	1131	20.1	8.5	26.9	437
	b_3 - $N_{50}P_{50}K_{50}$		119	1219	18.4	8.3	27.6	424
	b_4 - $N_{75}P_{75}K_{75}$		122*	1272**	18.0	8.4	26.4	435
	b_5 - $N_{100}P_{100}K_{100}$		121*	1267**	17.3	8.1	25.8°	408
a_2 - 37,5 cm	b_1 - unfertilized		125***	758°°°	21.5	8.6	26.4	328°°°
	b_2 - $N_{50}P_{50}$		124**	760°°°	23.3**	8.8	28.0	373°°
	b_3 - $N_{50}P_{50}K_{50}$		129***	788°°°	23.3**	9.0**	29.6***	413
	b_4 - $N_{75}P_{75}K_{75}$		127***	765°°°	21.7	8.8	28.5*	422
	b_5 - $N_{100}P_{100}K_{100}$		127***	812°°°	21.2	9.0**	28.3*	388
a_3 - 50 cm	b_1 - unfertilized		122**	415°°°	21.6	8.2	31.3***	281°°°
	b_2 - $N_{50}P_{50}$		122*	461°°°	22.4*	8.8	32.1***	276°°°
	b_3 - $N_{50}P_{50}K_{50}$		124**	576°°°	24.1***	8.6	31.8***	283°°°
	b_4 - $N_{75}P_{75}K_{75}$		125***	631°°°	22.5*	8.6	30.1***	332°°°
	b_5 - $N_{100}P_{100}K_{100}$		122**	648°°°	22.8*	8.6	30.6***	339°°°
	LSD	*5%*	*5*	*75*	*2.4*	*0.5*	*1.2*	*30*
		1%	*7*	*101*	*3.2*	*0.6*	*1.7*	*40*
		0.1%	*10*	*134*	*4.3*	*0.8*	*2.2*	*54*

C - Control variant.

CONCLUSIONS

From the analysis of the obtained results it was differentiated that each of the factors studied influenced the morpho-productive parameters analyzed, but in the climatic conditions specific to the agricultural year 2021-2022 the results obtained were influenced to a large extent by the small amount of precipitation.

By sowing at longer distances between rows and applying mineral fertilizers, shoots with a higher height were generated.

By sowing at a distance of 25 cm between rows and maximum fertilization with mineral fertilizers, $N_{100}P_{100}K_{100}$, the highest number of shoots/m^2 was obtained.

By applying mineral fertilizers the length of the panicle was higher, and the highest values at this indicator were obtained when the sowing had a distance of 37.5 cm between rows or 50 cm between rows.

By applying mineral fertilizers the number of nodes per inflorescence also had a general trend of growth, the highest values being recorded at the sowing distance at 37.5 cm between rows.

The application of mineral fertilizers and sowing at shorter row spacing had a positive effect on seed production, resulting in higher yields on these variants.

ACKNOWLEDGEMENTS

The research topic is part of the project No. 26/20.01.2021, Project domain (according to the RDI 2014-2020 Strategy of MADR): Grassland culture.

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