

RESEARCH ON THE IMPROVEMENT OF THE BIOLOGICAL VALUE OF THE *Onobrychis viciifolia* Scop. SPECIES SEED MATERIAL

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Abstract

The research conducted at the Research and Development Station for Meadows, Vaslui (46°40'-36°10' north latitude and 27°44'-20°40' east longitude) during the 2020-2021 agricultural year, followed the analysis of the influence of the distance between rows and of the fertilization on the quality of the *Onobrychis viciifolia* Scop. species seed material, in seed crop, in the second year of vegetation. As a methodology, 2 factors were experienced: factor A representing the distance between rows with three graduations (a_1 - 25 cm, a_2 - 37.5 cm and a_3 - 50 cm) and factor B fertilization with 5 graduations (b_1 - unfertilized, b_2 - $N_{50}P_{50}$, b_3 - $N_{50}P_{50}K_{50}$, b_4 - $N_{100}P_{100}K_{100}$ and b_5 - cattle manure 20 Mg·ha⁻¹). The research showed that by sowing at a distance of 25 cm between rows, seeds with a lower percentage of abnormal germs were obtained, and by sowing at a distance of 37.5 cm between rows, seeds with a higher total germination value, a higher percentage of normal germs were obtained, a smaller number of hard seeds, a smaller number of dead seeds and a higher value of germination energy. The use of $N_{100}P_{100}K_{100}$ increased the total germination by 8.7% compared to the control in the variant sown at a distance of 37.5 cm between the rows.

Keywords: fertilization, distance between rows, germination - components.

INTRODUCTION

Onobrychis viciifolia Scop. (sainfoin) is one of the most valuable perennial legumes used in animal feed, for limiting soil erosion and to improve its fertility, by the amount of atmospheric nitrogen fixed by symbiosis and the large mass of roots it leaves in the soil (Moga I. and Schitea Maria, 2005).

The quality of the seed material has a special role to play in obtaining valuable productions. One of the most important characteristics of agricultural production of fodder plants in field conditions is the rapid and uniform germination capacity (Avci S. and Kaya M.D., 2013).

Total germination (G) is the

percentage of pure seeds capable of germinating and is represented by the percentage of normal germs to which is added the percentage of hard seeds, from the analysis sample. This quality indicator is very important, because the seed norm used to set up the future crop it (Ene T.A. and Mocanu V., 2016).

Researchers have used various methods over time to improve the germination of fodder legume seeds, among the most popular being thermal, chemical or mechanical scarification (Kimura E. and Islam M.A., 2012).

Of the physical treatments, only the removal of seed pods significantly increased the percentage of germination and the

germination rate of sainfoin, probably due to the inhibitory effect of seed pods (Majidi M.M. and Barati M., 2011).

The study carried out at the Research and Development Station for Meadows, Vaslui aimed at the

influence of different fertilization schemes, as well as different sowing distances between rows on the sainfoin seeds germination components, in the second year of vegetation, at the first cut.

MATERIAL AND METHOD

The research was conducted during the period of March 2019 to October 2020, at the Research and Development Station for Meadows, Vaslui (46°40'-36°10' north latitude and 27°44'-20°40' east longitude).

The researches analyzed the influence of distance between rows and fertilization on total seed germination (G), number of normal germs, number of hard seeds, number of abnormal germs and number of dead seeds of *Onobrychis viciifolia* Scop. species seed material, in seed crop, in the second year of vegetation, at the first cut.

The experience organized was bifactorial, 3 x 5 type and placed according to the method of subdivided plots, with the plot harvestable area of 13.5 m² (1.5 m x 9 m) and a total area of 20 m² (2 m x 10 m), in three replications. The studied factors were: A- the distance between rows with three graduations (a₁ - 25 cm, a₂ - 37.5 cm and a₃ - 50 cm) and B - fertilization with five graduations (b₁ - unfertilized, b₂ - N₅₀P₅₀, b₃ - N₅₀P₅₀K₅₀, b₄ - N₁₀₀P₁₀₀K₁₀₀ and b₅ - cattle manure 20 Mg·ha⁻¹).

The biological material used was represented by the *Anamaria* variety, created at the Research and Development Station for Meadows, Vaslui in 2006 (Silistru Doina and Avrănescu E., 2010).

The fertilizers were applied in spring, when the plants vegetation started. The manure used had the following composition: N-0.415%, P₂O₅-0.220% and K₂O-0.705%).

In the area where the researches were carried out, the agricultural year 2019-2020 was dry, less favorable for the sainfoin culture due to the small amounts of precipitation and especially their uneven distribution.

Total seed germination (%), number of normal germs (%), number of hard seeds (%), number of abnormal germs (%) and number of dead seeds (%) were determined at the Vaslui Territorial Inspectorate for the Quality of Seeds and Planting Material (SR 1634/1999).

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

RESULTS AND DISCUSSION

Total germination (G)

Analyzing the influence of the interaction between distance between rows and fertilization on seed total germination of sainfoin in seed culture in the second year of vegetation, at the first cut (table 1) it emerged that this indicator recorded the lowest value, respectively 84% in the variant a_3b_3 (sown at 50 cm between rows, fertilized with $N_{50}P_{50}K_{50}$), and the highest value in the variant a_2b_4 (sown at 37.5 cm between rows, fertilized with $N_{100}P_{100}K_{100}$) respectively 93.7%,

by 8.7% higher than the control.

The use of $N_{100}P_{100}K_{100}$ increased the total germination by 8.7% compared to the control in the variant sown at a distance of 37.5 cm between the rows.

Following the application of mineral or organic fertilizers, the seeds had a higher total germination, and sowing at a distance of 37.5 cm between rows led to the obtaining of seeds with the highest value of total germination.

Table 1

The influence of the interaction between distance between rows and fertilization on the total seed germination to sainfoin culture for seed, in the second year of vegetation, at the first cut

Variant		Total germination (%)	Differences		Significance
			%	%	
a_1 - 25 cm (control)	b_1 - unfertilized (control)	85.0	control	100	control
	b_2 - $N_{50}P_{50}$	85.0	0.0	100.0	
	b_3 - $N_{50}P_{50}K_{50}$	91.0	6.0	107.1	**
	b_4 - $N_{100}P_{100}K_{100}$	93.3	8.3	109.8	***
	b_5 - manure 20 Mg·ha ⁻¹	87.7	2.7	103.2	
a_2 - 37.5 cm	b_1 - unfertilized	88.0	3.0	103.5	*
	b_2 - $N_{50}P_{50}$	89.0	4.0	104.7	*
	b_3 - $N_{50}P_{50}K_{50}$	91.3	6.3	107.4	**
	b_4 - $N_{100}P_{100}K_{100}$	93.7	8.7	110.2	***
	b_5 - manure 20 Mg·ha ⁻¹	87.0	2.0	102.4	
a_3 - 50 cm	b_1 - unfertilized	85.0	0.0	100.0	
	b_2 - $N_{50}P_{50}$	84.7	-0.3	99.6	
	b_3 - $N_{50}P_{50}K_{50}$	84.0	-1.0	98.8	
	b_4 - $N_{100}P_{100}K_{100}$	86.3	1.3	101.5	
	b_5 - manure 20 Mg·ha ⁻¹	87.3	2.3	102.7	
LSD 0.5 = 3.9 %; LSD 0.1 = 5.2 %; LSD 0.01 = 6.8 %.					

Number of normal germs

Table 2 presents the results obtained after analyzing the influence of the interaction between distance between rows and

fertilization on the number of normal germs in the sainfoin seed culture, in the second year of vegetation, at the first cut.

Table 2

The influence of the interaction between distance between rows and fertilization on the number of normal germs to sainfoin culture for seed, in the second year of vegetation, at the first cut

Variant		Normal germs (%)	Differences		Significance
			%	%	
a ₁ - 25 cm (control)	b ₁ - unfertilized (control)	80.3	control	100	control
	b ₂ - N ₅₀ P ₅₀	83.7	3.4	104.2	
	b ₃ - N ₅₀ P ₅₀ K ₅₀	86.7	6.4	108.0	**
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	90.0	9.7	112.1	***
	b ₅ - manure 20 Mg·ha ⁻¹	84.7	4.4	105.5	*
a ₂ - 37.5 cm	b ₁ - unfertilized	85.3	5.0	106.2	*
	b ₂ - N ₅₀ P ₅₀	86.7	6.4	108.0	**
	b ₃ - N ₅₀ P ₅₀ K ₅₀	90.0	9.7	112.1	***
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	91.3	11.0	113.7	***
	b ₅ - manure 20 Mg·ha ⁻¹	86.0	5.7	107.1	**
a ₃ - 50 cm	b ₁ - unfertilized	84.0	3.7	104.6	
	b ₂ - N ₅₀ P ₅₀	78.3	-2.0	97.5	
	b ₃ - N ₅₀ P ₅₀ K ₅₀	80.3	0.0	100.0	
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	84.7	4.4	105.5	*
	b ₅ - manure 20 Mg·ha ⁻¹	84.3	4.0	105.0	
LSD 0.5 = 4.3 %; LSD 0.1 = 5.7 %; LSD 0.01 = 7.4 %.					

The values of this indicator ranged from 78.3%, 2% lower than the control in variant a₃b₂ (sown to 50 cm between rows, fertilized with N₅₀P₅₀) and 91.3 %, 11% higher than the control, in variant a₂b₄ (sown at 37.5 cm between rows, fertilized with N₁₀₀P₁₀₀K₁₀₀). Also, among the largest differences from the control were the variant a₁b₄ (sown at 25 cm between rows, fertilized with N₁₀₀P₁₀₀K₁₀₀) and variant a₂b₃ (sown at 37.5 cm between rows, fertilized with N₅₀P₅₀K₅₀), both registering values 9.7% higher than it.

The application of mineral or organic fertilizers has led to the production of seeds with a larger number of normal germs, and in terms of distance, the variants in which the seeds recorded a larger number of normal germs were those sown at 37.5 cm.

Number of hard seeds

The results obtained from the analysis of the influence of the interaction between distance between rows and fertilization on the number of hard seeds (table 3) showed that the values of this indicator ranged from 1% to variant a₂b₅ (sown at 37.5 cm between rows, fertilized with manure 20 Mg·ha⁻¹) and variant a₃b₁ (sown at 50 cm between rows, unfertilized) and 6.3% in variant a₃b₂ (sown at 50 cm between rows, fertilized with N₅₀P₅₀).

After applying the mineral or organic fertilizers, a smaller number of hard seeds were obtained, and sowing at 50 cm between rows in the climatic conditions of 2019-2020 generated seeds with the lowest value of the number of hard seeds.

Table 3

The influence of the interaction between distance between rows and fertilization on the number of hard seeds to sainfoin culture for seed, in the second year of vegetation, at the first cut

Variant		Hard seeds (%)	Differences		Significance
			%	%	
a ₁ - 25 cm (control)	b ₁ - unfertilized (control)	4.7	control	100	control
	b ₂ - N ₅₀ P ₅₀	1.3	-3.4	27.7	ooo
	b ₃ - N ₅₀ P ₅₀ K ₅₀	4.3	-0.4	91.5	
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	3.3	-1.4	70.2	ooo
	b ₅ - manure 20 Mg·ha ⁻¹	3.0	-1.7	63.8	ooo
a ₂ - 37.5 cm	b ₁ - unfertilized	3.7	-1.0	78.7	ooo
	b ₂ - N ₅₀ P ₅₀	2.3	-2.4	48.9	ooo
	b ₃ - N ₅₀ P ₅₀ K ₅₀	1.3	-3.4	27.7	ooo
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	2.3	-2.4	48.9	ooo
	b ₅ - manure 20 Mg·ha ⁻¹	1.0	-3.7	21.3	ooo
a ₃ - 50 cm	b ₁ - unfertilized	1.0	-3.7	21.3	ooo
	b ₂ - N ₅₀ P ₅₀	6.3	1.6	134.0	***
	b ₃ - N ₅₀ P ₅₀ K ₅₀	3.7	-1.0	78.7	ooo
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	1.7	-3.0	36.2	ooo
	b ₅ - manure 20 Mg·ha ⁻¹	3.0	-1.7	63.8	ooo
LSD 0.5 = 0.5 %; LSD 0.1 = 0.7 %; LSD 0.01 = 1.0 %.					

Number of abnormal germs

Abnormal germs are those in which at least one of the component anatomical parts is not developed normally and most likely will not be able to generate plants.

The percentage of abnormal germs will not add to the total germination value, because most likely having one or more component anatomical parts is not normally developed, they will not be able to generate plants.

The analysis of the influence of the interaction between distance between rows and fertilization on the number of abnormal germs (table 4) shown that this indicator recorded values between 2% in the variant a₁b₄ (sown at 25 cm between rows, fertilized with N₁₀₀P₁₀₀K₁₀₀) and 6% in variant a₂b₅ (sown at 37.5 cm between rows, fertilized with

N₅₀P₅₀). As a result of the use of mineral or organic fertilizers, seeds with a smaller number of abnormal germs have been generated, while in the case of sowing at greater distances the number of abnormal germs was higher.

Number of dead seeds

Analyzing the influence of the interaction between distance between rows and fertilization on the number of dead seeds (table 5) it emerged that this indicator had values between 4%, by 6.7 % less than the control in variant a₂b₄ (sown at 37.5 cm between rows, fertilized with N₁₀₀P₁₀₀K₁₀₀) and 12.3%, value by 1.6 % higher than the control in variant a₃b₃ (sown 50 cm between rows, fertilized with N₅₀P₅₀K₅₀).

The application of mineral or

organic fertilizers has led to the generation of dead seeds in smaller numbers, and by sowing at a

distance of 37.5 cm, the lowest value of the number of dead seeds was obtained.

Table 4

The influence of the interaction between distance between rows and fertilization on the number of abnormal germs to sainfoin culture for seed, in the second year of vegetation, at the first cut

Variant		Abnormal germs (%)	Differences		Significance
			%	%	
a ₁ - 25 cm (control)	b ₁ - unfertilized (control)	4.3	control	100	control
	b ₂ - N ₅₀ P ₅₀	4.0	-0.3	93.0	o
	b ₃ - N ₅₀ P ₅₀ K ₅₀	3.0	-1.3	69.8	ooo
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	2.0	-2.3	46.5	ooo
	b ₅ - manure 20 Mg·ha ⁻¹	4.0	-0.3	93.0	o
a ₂ - 37.5 cm	b ₁ - unfertilized	3.3	-1.0	76.7	ooo
	b ₂ - N ₅₀ P ₅₀	6.0	1.7	139.5	***
	b ₃ - N ₅₀ P ₅₀ K ₅₀	2.7	-1.6	62.8	ooo
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	2.3	-2.0	53.5	ooo
	b ₅ - manure 20 Mg·ha ⁻¹	5.3	1.0	123.3	***
a ₃ - 50 cm	b ₁ - unfertilized	4.3	0.0	100.0	
	b ₂ - N ₅₀ P ₅₀	5.3	1.0	123.3	***
	b ₃ - N ₅₀ P ₅₀ K ₅₀	3.7	-0.6	86.0	
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	4.3	0.0	100.0	
	b ₅ - manure 20 Mg·ha ⁻¹	4.0	-0.3	93.0	o
LSD 0.5 = 0.3 %; LSD 0.1 = 0.4 %; LSD 0.01 = 0.5 %.					

Table 5

The influence of the interaction between distance between rows and fertilization on the number of dead seeds to sainfoin culture for seed, in the second year of vegetation, at the first cut

Variant		Dead seeds (%)	Differences		Significance
			%	%	
a ₁ - 25 cm (control)	b ₁ - unfertilized (control)	10.7	control	100	control
	b ₂ - N ₅₀ P ₅₀	11.0	0.3	102.8	
	b ₃ - N ₅₀ P ₅₀ K ₅₀	6.0	-4.7	56.1	ooo
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	4.7	-6.0	43.9	ooo
	b ₅ - manure 20 Mg·ha ⁻¹	8.3	-2.4	77.6	
a ₂ - 37.5 cm	b ₁ - unfertilized	7.7	-3.0	72.0	o
	b ₂ - N ₅₀ P ₅₀	5.0	-5.7	46.7	ooo
	b ₃ - N ₅₀ P ₅₀ K ₅₀	6.0	-4.7	56.1	ooo
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	4.0	-6.7	37.4	ooo
	b ₅ - manure 20 Mg·ha ⁻¹	7.7	-3.0	72.0	o
a ₃ - 50 cm	b ₁ - unfertilized	10.7	0.0	100.0	
	b ₂ - N ₅₀ P ₅₀	10.0	-0.7	93.5	
	b ₃ - N ₅₀ P ₅₀ K ₅₀	12.3	1.6	115.0	
	b ₄ - N ₁₀₀ P ₁₀₀ K ₁₀₀	9.3	-1.4	86.9	
	b ₅ - manure 20 Mg·ha ⁻¹	8.7	-2.0	81.3	
LSD 0.5 = 2.6 %; LSD 0.1 = 3.5 %; LSD 0.01 = 4.5 %.					

Germination energy

The results obtained from the analysis of influence of the interaction between distance between rows and fertilization on seed germination energy of sainfoin in seed culture in the second year of vegetation, at the first cut (table 6) showed that this indicator recorded values between 63.7% in variant a_2b_1 (sown at 37.5 cm between rows, not fertilized) and 78.0 % in variant a_2b_2 (sown at 37.5 cm between rows, fertilized with $N_{50}P_{50}$). The differences obtained in the variants sown at a distance of 50

cm between rows were not statistically insured. Most variants fertilized with mineral fertilizers recorded positive values compared to the control. A germination energy value close to the maximum value, 77.7% was obtained by the variant a_1b_2 (sown at 25 cm between rows, fertilized with $N_{100}P_{100}K_{100}$). The application of mineral or organic fertilizers and sowing at 37.5 cm between rows, in the climatic conditions specific to the agricultural year 2019-2020 led to the obtaining of seeds with a higher germination energy.

Table 6

The influence of the interaction between distance between rows and fertilization on the seeds germination energy to sainfoin culture for seed, in the second year of vegetation, at the first cut

Variant		Germination energy (%)	Differences		Significance
			%	%	
a_1 - 25 cm (control)	b_1 - unfertilized (control)	68.0	control	100	control
	b_2 - $N_{50}P_{50}$	74.7	6.7	109.9	**
	b_3 - $N_{50}P_{50}K_{50}$	72.7	4.7	106.9	*
	b_4 - $N_{100}P_{100}K_{100}$	77.7	9.7	114.3	****
	b_5 - manure 20 $Mg \cdot ha^{-1}$	68.0	0.0	100.0	
a_2 - 37.5 cm	b_1 - unfertilized	63.7	-4.3	93.7	o
	b_2 - $N_{50}P_{50}$	78.0	10.0	114.7	****
	b_3 - $N_{50}P_{50}K_{50}$	73.3	5.3	107.8	*
	b_4 - $N_{100}P_{100}K_{100}$	74.7	6.7	109.9	**
	b_5 - manure 20 $Mg \cdot ha^{-1}$	70.0	2.0	102.9	
a_3 - 50 cm	b_1 - unfertilized	73.3	5.3	107.8	*
	b_2 - $N_{50}P_{50}$	68.3	0.3	100.4	
	b_3 - $N_{50}P_{50}K_{50}$	70.3	2.3	103.4	
	b_4 - $N_{100}P_{100}K_{100}$	72.0	4.0	105.9	
	b_5 - manure 20 $Mg \cdot ha^{-1}$	68.0	6.7	109.9	**
LSD 0.5 = 4.1 %; LSD 0.1 = 5.5 %; LSD 0.01 = 7.1 %.					

CONCLUSIONS

The agricultural year 2019-2020 was dry, with periods of water stress, in October 2019, April and August 2020 and, less favorable to

the sainfoin (*Onobrychis viciifolia* Scop.) crop, mainly due to the small amounts of fallen rainfall and their uneven distribution.

The distance between the rows at sowing had a different influence on the analyzed parameters, thus, by sowing at a distance of 25 cm between the rows, seeds with a lower percentage of abnormal germs were obtained, and by sowing at a distance of 37.5 cm between rows, seeds with a higher total germination value, a higher percentage of normal germs were

obtained, a smaller number of hard seeds, a smaller number of dead seeds and a higher value of germination energy.

The use of N₁₀₀P₁₀₀K₁₀₀ increased the total germination by 8.7%, the increase in the number of normal germs by 11% compared to the control in the variant sown at a distance of 37.5 cm between the rows.

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