RESEARCH REGARDING THE BEHAVIOUR OF CERTAIN BEAN BIOTYES (Vicea faba L.) UNDER CONDITIONS OF DIFFERENTIATED FERTILIZATION

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Abstract. *The researches were carried out in 2017-2019, in the experimental field from the Experimental Didactic Station of the Banat's University of Agricultural Sciences and Veterinary Medicine of "King Mihai I of Romania" from Timişoara. The experiments were organized on a cambic chernozem soil , wet groundwater (slightly gleyic), slightly decarbonated, on loessoid deposits - dusty, loamy - clay, with pH -6.10 and a humus content of 2.58%.In terms of climate, according to Koppen, the climate falls within the formula c.f.b.x., namely a temperate climate, with rainfall throughout the year, but with a deficit in the summer months. Three biotypes were studied in the research, namely the Bioro variety and two populations. The research included a two-factor experiment with three repetitions. Fertilization was performed with variable doses of nitrogen fertilizers, applied on a constant background of P60K60. On average, on the fertilizer doses, the highest yield of 4523 kg/ha was obtained for the Purple population, followed by the White population with 3871 k ha, both populations exceeding the yield for the Bioro variety, for which the yield was only 3404 kg/Ha. The protein content was close, varying between 24.61% in the Purple population and 25.37% in the White population. In this paper, statistical correlations were made based on the following parameters from the laws of distribution of the random variable X like: mean, dispersion, standard deviation, which we will note by λ. Be it two estimated values* λ_1^* *and* λ_2^* *found from two selection variables. In other words, the dispersion is the square mean of the deviation from the mean. From the definition relations it is observed that the narrower the interval in which the values of* x_i *are concentrated, the smaller the dispersion and vice versa. Dispersion is also called variance. The error we are working with is 0.05 in all cases of comparing the means.*

Key words: *broad bean (Vicia faba), fertilization, protein content*

INTRODUCTION

Vicia faba L. is the traditional cereal vegetable from Romania. In recent decades, its cultivation has declined considerably due to changing the growing systems in many areas, wherever it was cultivated in the past. Broad beans (var. Major) are often grown as a home garden crop, among the types (minor, equina, major) that are grown in Romania.

The broad bean (Vicia faba) is one of the oldest cultivated plants, mentioned ever since the Bronze Age [Bîlteanu Gh.1978; Mlesniţă, V. 1986; Zamfirescu N., et al.,1965], much appreciated as a food plant by Egyptians, Jews and Greeks. Romanians used the broad bean in combination with wheat to make bread, while the green beans were used with soups or mashed, etc. [David Gh., et al. 2010 ; Moldovan S., et al 2010; Niţă S., 2012; Niţă S., et al.,2011 ;Niţă S., 2005; Zamfirescu N., et al, 1965].

Currently, the main grain-producing regions in Romania are Bucovina, Oltenia and Maramureș [SAGHIN, GH., 1996]. Several investigations have been carried out in order to obtain information on the diversity. Vicia faba, L. is one of the most common vegetable crops in Egypt, used mainly for human nutrition [KASEM F.E.A. 2012] due to the fact that it is a source of vitamins, minerals and starch. Moreover, it is an alternative source of protein.

[HEUZÉ V., et al, 2018; CHAIEB N., et al.,2011; SMITH L.A., et al, 2013]. Many regions such as China, the Middle East, the Mediterranean region, Ethiopia, Central and East Asia, Oceania and the Americas produce Faba beans.

It is considered a multipurpose crop, used not only as food, but also used as fodder (hay, silage and straw) or green manure, due to its high nitrogen content [HEUZÉ V., et al., 2018; SINGH A.K., et al., 2013].

Vicia faba L. is an adaptable plant that can grow in different climatic conditions [SINGH A.K., et al., 2013]. In addition, it is a plant tolerant to biotic and abiotic stress [SINGH A.K., et al., 2013, KASEM F.E.A. 2012]. It grows in soils with different pH values ranging from 6.5 to 9.0 [JENSEN E.S., et al, 2010], while the maximum fixation of N by nodule bacteria requires a neutral environment compared to alkaline .

This plant has unique potentials in the biological fixation of N (symbolic with Rhizobium); it could reach up to 300 kg N ha-1 [SINGH A.K., et al 2013.], therefore, it contributes effectively to soil fertility [GASIM S., AND LINK W., 2007], and considered an effective choice for the harvesting system [JENSEN E.S., et al. 2010]. The branches that grow the beans should not use large amounts of nitrogen fertilizers compared to other crops [CHAIEB N., et al.,2011].

MATERIALS AND METHODS

The research was carried out in 2017-2019, in the experimental field from the Experimental Didactic Station of the Banat's University of Agricultural Sciences and Veterinary Medicine of "King Mihai I of Romania" from Timişoara, the experiments were organized on a cambic chernozem soil, wet groundwater (slightly gleyic), slightly decarbonated, on loessoid deposits - dusty, loamy - clay, with pH -6.10 and a humus content of 2.58%.

Three biotypes were studied in the research, namely the Bioro variety and two populations.

The research included a bifactorial type experiment, with three repetitions, having the following graduations of the factors:

Factor A - biotype - a1 - Bioro variety; a2 - White population; a3 – Purple population.

Factor B - nitrogen dose, applied on a constant background of P60K60; b1 - NO - Mt; b2 - N30; b3 - N50; b4 - N70.

Fertilization was performed with variable doses of nitrogen fertilizers applied on a constant background of P60K60.

The cultivation technology was specific to the species, from which we mention: the precursor plant was autumn wheat, the soil works consisted of stubble softening, autumn plowing at 23 - 25 cm, under which phosphorus and potassium fertilizers were incorporated, the germination bed consisted of a work with the cultivator, in the spring after the soil wilting and nitrogen fertilization, the sowing was carried out in March, at a distance between rows of 50 cm., depth 7 - 8 cm, with a density of 50 bg / m2 .

RESULTS AND DISCUSSIONS

The yield results obtained are presented in table 1, which shows that the yields were approximately 2994 kg/ha for the Bioro variety in the nitrogen-free version and 4876 kg/ha for the Purple Population in the N70 fertilized version.

On average, on the fertilizer doses, the highest yield of 4523 kg/ha was obtained for the Purple population, followed by the White population with 3871 kg/ha, both populations exceeding the Bioro variety yield, in which the yield was only 3404 kg/ha. In the White

Population, the yield increase was 14% compared to the Bioro variety and 33% of the Purple Population, both being statistically assured as very significant.

At each biotype, the crop increased with the nitrogen dose, the highest increase of 17% being at the level of the N50 dose, on average on the three biotypes.

Increasing the dose to N_{70} is not economically motivated, the increase in yield being only 22% higher than that achieved at the dose of N_{50}.

Table 1.

Yields obtained from beans (Vicia Faba) in Timişoara

Factor A Cultivated variety	Factor B-Dose of N on a constant background of $P_{60}K_{60}$				Averages of factor A			
	N_o	N_{30}	N_{50}	N_{70}	Yield (kg/ha)	%	Difference (kg/ha)	Significance
Bioro variety	2994	3289	3577	3757	3404	100		
White population	3461	3756	4044	4224	3871	114	467	xxx
Purple population	4113	4408	4696	4876	4523	133	1119	xxx

DL 5 % = 140 kg/ha;
DL 1 % = 187 kg/ha;
DL 0,1 % = 246 kg/ha

Averages of factor B

Specification	N_0	N_{30}	N_{50}	N_{70}
Yield (kg/ha)	3523	3818	4106	4286
%	100	108	117	122
Difference (kg/ha)		295	583	763
Significance		xxx	xxx	xxx

DL 5 % = 68 kg/ha; DL 1 % = 102 kg/ha; DL 0,1 % = 165 kg/ha

Variation in the protein content

Table 2 and figure 1. show the variation of the average protein content depending on the biotype.

It results that in the three biotypes the protein content was close, varying between 24.61% in the Purple population and 25.37% in the White population.

Table 2

Variation of the average protein content according to biotype.

Specification	Bioro	White population	Purple population
Average protein content	25,0	25,37	24,61
Difference	Mt	0,37	-0,39

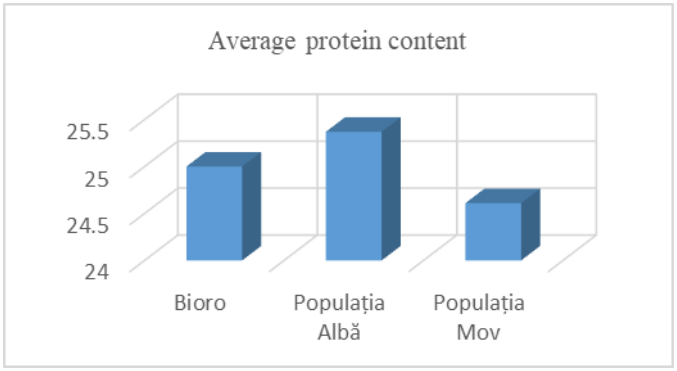

Fig. 1. Variation of the average protein content (%) depending on the biotype

Table 3 and Figure 2 show the protein production by biotype, according to fertilization levels.

The protein production in the mentioned context was 842 kg/ha for the Bioro variety and 1018 kg/ha for the Purple population.

Table 3

Protein yield kg/ha depending on biotype on average by levels of fertilization.

Specification	Bioro	White population	Purple population
Yield kg/ha	842	993	1018
Difference	Mt	151	176

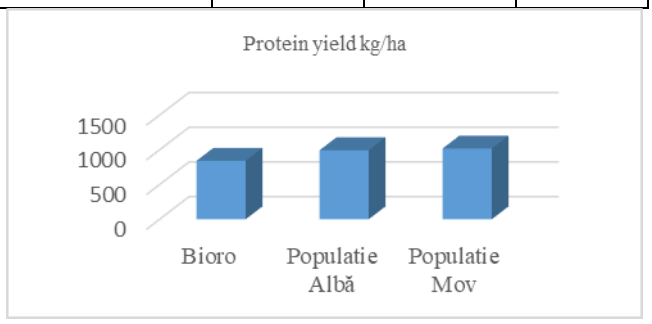

Fig. 2. Protein yield (kg/ha) depending on the biotype on average by levels of fertilization.

Evolution of the number of pods/plant

Table 4 shows the number of pods/plant of the Bioro variety and the two populations.

It results that on average on the experimental cycle the number of pods was between 10 for the White Population and 17 for the Bioro variety.

For the White Population, the averages are different from the Bioro variety, and for the Purple Population the averages are not different from the Bioro variety.

Table 4

Number of pods/plant

	No. of pods/ BIORO plant	*No. of pods/White plant*	*No. of pods/Purple plant*
Average	17,125	10,125	14,375
Variance	28,65	16,25	35,58333333
P(T<=t) two-tail		0,000259825	0,18008261

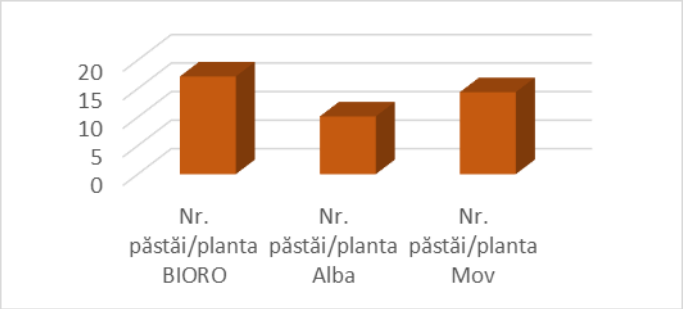

Fig.3 Number of pods/plant

Table 5 shows the number of beans/plant for the Bioro variety and the two populations.

It results that on average on the experimental cycle, the number of beans was between 22 for the White Population and 37 for the Bioro variety. For the White Population, the averages are different from the Bioro variety, and they are not different from the Bioro variety compared to the Purple Population.

Table 5

Number of beans/plant

	No. of beans/ BIORO plant	*No. of beans/White plant*	*No. of beans/Purple plant*
Average	37,75	22,1875	31,375
Variance	97	58,5625	115,05
P(T<=t) two-tail		2,8425	0,090141815

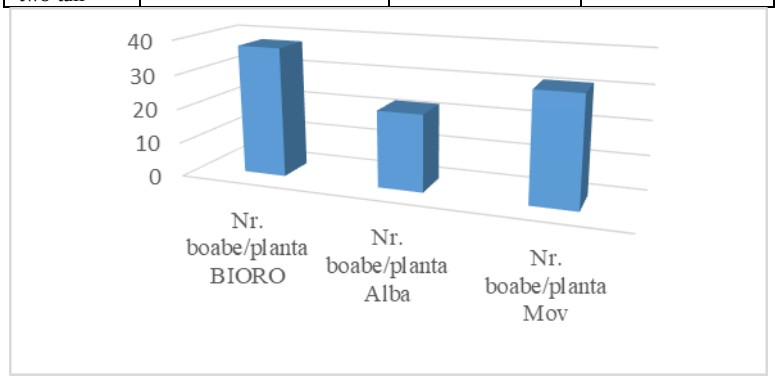

Fig. 4. Number of beans/plant

În tabelul 6 sunt prezentate rezultatele determinărilor efectuate în condiţiile cernoziomului cambic freatic umed în anul 2019, privind numărul de boabe/păstatie. Se constată că numărul de boabe/păstaie a fost cuprins între 2,16 la Populația Albă și 2,48 la soiul Bioro. Mediile nu sunt diferite fata de soiul Bioro la cele două populații.

Table 6 presents the results of the determinations performed in the conditions of the wet groundwater cambic chernozem in 2019, regarding the number of beans/pod. It is found that the number of beans/pod was between 2.16 for the White Population and 2.48 for the Bioro variety. The averages are not different from the Bioro variety in the two populations.

Table 6

Number of beans/pod

	No. of beans/ BIORO pod	*No. of beans/White pod*	*No. of beans/Purple pod*
Average	2,4875	2,1625	2,3375
Variance	0,627833333	0,8585	0,343833333
P(T<=t) two-tail		0,295078894	0,547640082

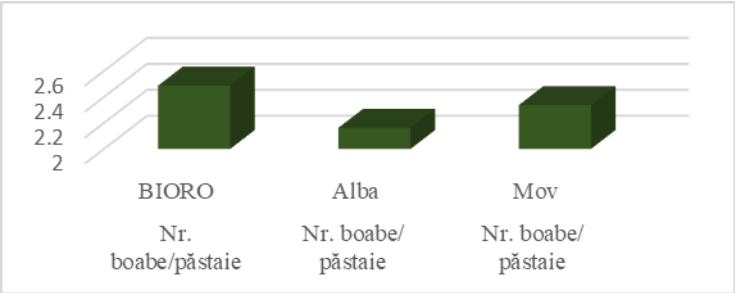

Fig. 5 Number of beans/pod

Table 7 shows the weight of the beans/plant. As it results from this table, the highest weight of the beans was registered in the Purple Population and the lowest weight in the Bioro Variety. From a statistical point of view, the averages are different for the two populations compared to the Bioro variety.

Table 7

Beans/plant weight

	Beans/plant weight *BIORO*	Beans/plant weight *White*	Beans/plant weight *Purple*
Average	16,300625	21,89	26,400625
Variance	10,97540625	34,31484	54,18020625
P(T<=t) two-tail		**0,0028532**	**5,9232**

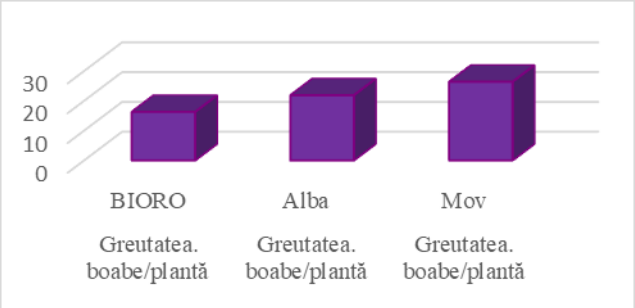

Fig. 6 Beans/plant weight

CONCLUSIONS

The research is part of the current concern of developing strategies in agriculture, which should respond from a technical point of view, to the imperative of reducing costs, in order to reduce environmental pollution.

In this sense, the objective of our own research was to increase the area of beans cultivation in the Timiş Plain. At present the species is cultivated mainly in Transylvania and northern Moldavia. The motivation is the high protein content of the beans and the large production capacity, which in France exceeded 5000 kg/ha, in Germany about 4000 kg/ha, and in England over 3500 kg/ha.

In the Timiş Plain, by applying applied technologies, yields between 4000-5000 kg of beans/ha can be obtained.

The populations studied are valuable and motivate their introduction into an improvement program.

If the seeds are not treated when sowing with specific bacterial preparations, fertilization with doses of 30 - 50 kg/ha nitrogen, applied on a background of P60K60 is motivated.

The amount of protein obtained, to which the biological amount of nitrogen accumulated in the soil is added, motivates further research.

Yields showed that the three biotypes reacted favorably to nitrogen fertilization, due to non-bacterialization of the seed at sowing with species-specific bacterial preparations.

From a statistical point of view, the averages regarding the weight of the beans/plant are different in the two Populations compared to the Bioro Variety.

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