

THE EFFECT OF THREE TECHNOLOGICAL FACTORS ON SOME QUANTITATIVE INDICES OF *PHASEOLUS COCCINEUS*

EFFECTUL INTERACȚIUNII A TREI FACTORI TEHNOLOGICI ASUPRA UNOR INDICI CANTITATIVI ȘI CALITATIVI LA *PHASEOLUS COCCINEUS*

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Abstract.

The species Phaseolus coccineus has multiple uses, in food, its nutritional characteristics being similar to those of P. vulgaris, but the size of the grain advantage it among consumers, but, also as an ornamental plant, being used in landscape compositions for its lush foliage and impressive size of the flower racemes. In Romania, there are a large number of local populations of this species, without any cultivar being released. Thus, the aim of this study is to evaluate the interaction of three technological factors on some quantitative and qualitative traits in runner beans. In 2022, a trifactorial experiment was set up in the teaching field of the vegetable growing discipline, to analyzing the interaction of two support systems, (pyramid and trellis), with three local populations (Cozia 1, Cozia 2, and Cozia 3), with three types of fertilization (unfertilized, organic fertilizer, and chemically fertilized). Following data collection, the results were statistically analyzed, the means being expressed as the interaction of two experimental factors. For the characters Mass of beans/nest, average number of pods/nest, and average number of beans/pod, the Pyramid x Cozia 3 variant stood out, for the mass of grains/hectare the Trellis x Cozia 2 variant obtained 5.7 t/ha, and the highest result for MMB, was obtained by the Cozia 1 x Chemical variant.

Key words: runner bean, support system, fertilization, yield

Rezumat

Specia Phaseolus coccineus are multiple utilizări, în alimentație, caracteristicile sale nutriționale fiind asemănătoare cu cele ale P. vulgaris, dar mărimea bobului o avantajează în rândul consumatorilor, dar și ca plantă ornamentală, fiind folosită în compoziții peisagistice pentru frunzișul luxuriant și mărimea impresionantă a racemelor florale. În România, există un număr mare de populații locale ale acestei specii, fără a fi omologat vreun cultivar. Astfel, scopul acestui studiu este de a evalua interacțiunea a trei factori tehnologici asupra unor caractere cantitative și calitative la fasolea mare. În anul 2022, a fost înființat un

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experiment trifactorial în câmpul didactic al disciplinei legumicultură, pentru analizarea interacțiunii a două sisteme de susținere, (piramidă și spalier), cu trei populații locale (Cozia 1, Cozia 2 și Cozia 3), cu trei tipuri de fertilizare (nefertilizat, fertilizat organic și fertilizat chimic). În urma colectării datelor, rezultatele au fost analizate statistic, mediile fiind exprimate ca interacțiune a doi factori experimentali. Pentru caracterele Masa de boabe/cuib, numărul mediu de păstăi/cuib și numărul mediu de boabe/hectar varianta Piramidă x Cozia 3, pentru masa de boabe/hectar varianta Trellis x Cozia 2 a obținut 5,7 t/ha, iar cel mai mare rezultat pentru MMB, a fost obținut de varianta Cozia 1 x Chimic.

Cuvinte cheie: fasole mare, sistem de susținere, fertilizare, randament

INTRODUCTION

The species *Phaseolus coccineus* has multiple uses, as food, its nutritional characteristics being similar to those of *P. vulgaris*, [Teliban, 2015] but the size of the grain gives it an advantage among consumers [Labuda, 2010; Munteanu et al., 2007], as an ornamental plant, being used in landscape compositions for its habits and leaves and impressive size of the floral racemes [Popa, 2010; Hamburda and Munteanu, 2016].

Large bean cultivars respond positively to chemical and organic fertilization but also to abundant irrigation [Stan et al., 2003].

In Romania, there are a large number of local populations of this species, without any cultivar being released [Giurca, 2009; Popa, 2010; Brezeanu et al., 2018]. The most important risk factors are atmospheric and soil drought under critical plant development phases and climatic accidents. Thus, the aim of this study was to evaluate the interaction of three technological factors on some quantitative and qualitative traits in field bean.

MATERIAL AND METHOD

In the year 2022, a trifactorial experiment with three replications was set up in the teaching field of the subject of vegetable growing, to analyze the interaction of two support systems (pyramid and row), with three local populations (Cozia 1, Cozia 2 and Cozia 3), with three types of fertilization (unfertilized, organic and chemically fertilized). During the growing period, specific technological works were applied and at the end of the growing period the following parameters were analyzed: average mass of grains/pod, average mass of grains/ha, mass of a thousand grains, number of pods/pod, number of grains in the pods. Following the data collection, the results were statistically analyzed using Duncan test, at $p \leq 0.05$, the means being expressed as the interaction of two experimental factors $\pm$ standard error.

RESULTS AND DISCUSSIONS

The results obtained regarding the main productivity elements and the physiological characterization of the interaction of fertilization with support systems (Table 1) highlight statistically significant results for all analyzed indicators, such that the highest mass of grains/nest was obtained by the Pyramid x

Organic variant, of 263.33 g/nest, while the Trellis x Chemical variant obtained the highest results for the mass of grains/ha, of 5605.33 kg/ha. This variant also obtained the highest mass of 1000 grains, respectively 1754.67 g.

Table 1

Results on the productivity elements of the interaction between support systems and fertilization

Variant	Beans weight/ nest (g)	Beans mass/ha (kg)	MMB (g)
Pyramid x Unfertilized	238.33 ± 2.19 bc	2974.00 ± 28.10 c	1659.67 ± 17.84 ab
Pyramid x Organic	263.33 ± 1.20 a	3286.33 ± 16.13 c	1571.33 ± 7.31 b
Pyramid x Chemic	253.33 ± 1.45 ab	3162.00 ± 20.55 c	1619.67 ± 11.89 ab
Trellis x Unfertilized	196.67 ± 4.26 e	4921.00 ± 108.21 b	1651.33 ± 80.14 ab
Trellis x Organic	213.00 ± 10.79 de	5316.67 ± 267.91 ab	1716.33 ± 64.99 ab
Trellis x Chemic	224.00 ± 8.33 cd	5605.33 ± 210.19 a	1754.67 ± 60.00 a

The results obtained regarding the interaction of fertilization with support systems, on the quality indicators of runner beans (Table 2) obtained significant differences mostly between the support systems. Regarding the average number of pods/nest, the Pyramid x Chemical variant achieved the highest results, 77 pods/nest. This character can positively correlate with the average number of grains/pod, respectively 2.49 grains/pod, the same result was also achieved by the Pyramid x Organic variant.

Table 2

Results on the interaction of support systems with fertilization on quality indicators

Variant	No. pods/nest environment	No. medium beans/pod
Pyramid x Unfertilized	72.00 ± 0.00 a-c	2.45 ± 0.01 a
Pyramid x Organic	76.00 ± 1.00 ab	2.49 ± 0.02 a
Pyramid x Chemic	77.00 ± 0.58 a	2.49 ± 0.02 a
Trellis x Unfertilized	64.33 ± 2.19 c	2.24 ± 0.04 b
Trellis x Organic	66.00 ± 5.13 bc	2.30 ± 0.06 b
Trellis x Chemic	70.00 ± 5.03 a-c	2.26 ± 0.07 b

Regarding the analysis of the results obtained regarding the main productivity elements and the physiological characterization of the interaction of fertilization with local populations (Table 3) we can observe that the data obtained are statistically significant. The mass of grains/nest and the mass of grains/ha are positively correlated in this case, and obtained the highest results in the Cozia 3 x Chemical variant, of 251.33 g/nest, respectively 4636.33 kg/ha.

The mass of a thousand grains obtained the highest results in the Cozia 1 x Chemical variant, 1791.67 g. We can conclude that the productivity traits obtained

the best results in the case of chemical fertilization, depending on the population taken into study.

Table 3

Results on the interaction of local populations with fertilization on key productivity factors

Variant	Beans mass/nest (g)	Beans mass/ha (kg)	MMB (g)
Cozia 1 x Unfertilized	212.33 ± 8.57 cd	3775.00 ± 180.29 b	1708.67 ± 88.08 a-c
Cozia 1 x Organic	229.67 ± 3.38 a-d	4126.67 ± 77.82 ab	1745.33 ± 80.74 ab
Cozia 1 x Chemic	219.00 ± 8.33 b-d	4005.67 ± 204.72 ab	1791.67 ± 48.27 a
Cozia 2 x Unfertilized	207.67 ± 10.33 d	3936.33 ± 214.43 ab	1667.33 ± 12.02 abc
Cozia 2 x Organic	243.00 ± 11.59 ab	4549.33 ± 278.36 a	1609.00 ± 12.53 bc
Cozia 2 x Chemic	246.33 ± 5.04 ab	4509.33 ± 115.93 a	1687.33 ± 26.69 a-c
Cozia 3 x Unfertilized	232.67 ± 3.28 a-d	4131.00 ± 56.67 ab	1591.00 ± 12.86 c
Cozia 3 x Organic	241.00 ± 14.64 a-c	4228.67 ± 376.53 ab	1577.33 ± 21.54 c
Cozia 3 x Chemic	251.33 ± 9.96 a	4636.33 ± 222.64 a	1582.00 ± 22.55 c

From the analysis of the results regarding the interaction of fertilization with local populations, on the quality indicators of runner beans (Table 4) we can observe that the data are statistically significant for all the analyzed traits. The highest average number of pods/nest was determined by the Cozia 3 x Chemical variant, 81 pods/nest, the average number of grains in pods was obtained by the Cozia 3 x Unfertilized variant, 2.43 grains/pod.

Table 4

Results on the interaction of local populations with fertilization on quality indicators

Variant	No. pods/nest	No. of beans/pod
Cozia 1 x Unfertilized	65.67 ± 0.67 cd	2.33 ± 0.04 ab
Cozia 1 x Organic	62.33 ± 1.45 d	2.42 ± 0.02 a
Cozia 1 x Chemic	63.33 ± 4.18 d	2.41 ± 0.04 a
Cozia 2 x Unfertilized	67.00 ± 4.04 b-d	2.27 ± 0.03 b
Cozia 2 x Organic	75.67 ± 3.93 a-c	2.39 ± 0.04 ab
Cozia 2 x Chemic	77.00 ± 1.00 ab	2.39 ± 0.04 ab
Cozia 3 x Unfertilized	72.00 ± 1.00 a-d	2.43 ± 0.03 a
Cozia 3 x Organic	75.33 ± 5.04 a-c	2.38 ± 0.04 ab
Cozia 3 x Chemic	81.00 ± 3.61 a	2.34 ± 0.04 ab

The results obtained regarding the main productivity elements and the physiological characterization of the interaction of the support system with local populations (Table 5) highlight the variant Pyramid x Cozia 3 as having the best results for the mass of grains/nest, 273 g. Regarding the mass of grains/ha, the

variant Trellis x Cozia 2 obtained the highest value, 5712.33 kg/ha. The highest value for MMB, 1780.33 g was found in the variant Trellis x Cozia 1.

Table 5

Results on the main productivity elements of the interaction of the support system with local populations

Variant	Beans mass/nest (g)	Beans mass/ha (kg)	MMB (g)
Pyramid x Cozia 1	245.67 ± 1.86 b	3062.67 ± 24.77 c	1717.00 ± 13.32 ab
Pyramid x Cozia 2	236.67 ± 4.18 b	2951.33 ± 52.45 c	1592.67 ± 30.86 ab
Pyramid x Cozia 3	273.00 ± 2.08 a	3408.33 ± 24.44 c	1540.67 ± 10.04 b
Trellis x Cozia 1	194.67 ± 3.67 d	4875.67 ± 90.67 b	1780.33 ± 125.69 a
Trellis x Cozia 2	228.67 ± 6.33 bc	5712.33 ± 159.17 a	1715.67 ± 64.89 ab
Trellis x Cozia 3	210.00 ± 14.57 cd	5255.67 ± 365.09 ab	1625.67 ± 13.35 ab

The interaction of the support system with local populations on the quality indicators of runner beans (Table 6) obtained statistically significant results, thus the average number of pods/nest correlates positively with the average number of grains/pod, the highest values being obtained by the Pyramid x Cozia 3 variant, 82.33 g/nest and 2.51 grains/pod. The highest percentage of grains was also obtained by the pyramid type system, combined with the Cozia 2 population, 79.29% grains, while the trellis type system combined with the Cozia 3 population obtained the highest percentage of pods, 24.59%.

Table 6

Results on the interaction of the support system with local populations on quality indicators

Variant	No. pods/nest environment	No. medium beans/pod
Pyramid x Cozia 1	67.67 ± 0.33 bc	2.48 ± 0.02 a
Pyramid x Cozia 2	75.00 ± 1.15 ab	2.45 ± 0.01 a
Pyramid x Cozia 3	82.33 ± 0.33 a	2.51 ± 0.01 a
Trellis x Cozia 1	59.67 ± 3.38 c	2.30 ± 0.04 b
Trellis x Cozia 2	71.00 ± 3.21 b	2.24 ± 0.05 b
Trellis x Cozia 3	69.67 ± 4.67 b	2.26 ± 0.06 b

CONCLUSIONS

Analyzing bean production per hectare, we note that the best results were obtained through the following interactions:

In the case of combining the support system with fertilization, the Trellis x Chemic variant offered a production of 5.6 t/ha, being the most efficient.

When the interaction between the local population and fertilization type was analyzed, Cozia 3 x Chemic generated the best result, with 4.6 t/ha.

Regarding the combination of the support system and local population, the Trellis x Cozia 2 variant was the most productive, reaching 5.7 t/ha.

These data highlight the importance of optimizing these factors to maximize agricultural production.

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