

# THE STUDY OF THE INFLUENCE OF THE PLANTING DISTANCE ON THE EARLY PRODUCTION OF CERTAIN RUNNER BEAN CULTIVARS (*PHASEOLUS COCCINEUS* L.) FOR PODS, IN THE ENVIRONMENT OF THE POLYTUNNEL

## STUDIUL INFLUENȚEI DISTANȚEI DE PLANTARE ASUPRA PRODUCȚIEI TIMPURII LA UNELE CULTIVARE DE FASOLE MARE (*PHASEOLUS COCCINEUS* L.) PENTRU PĂSTĂI, ÎN CONDIȚII DE SOLAR

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**Abstract.** The objective of this paper is to evaluate the cultivation possibilities of the runner bean for pods in the polytunnel, in the Romanian conditions and taking into account different planting distances. This factor has a major influence on the production of the runner bean culture, the species being sensitive to light. Research was performed within the Teaching Facility of USAMV (University of Agronomic Sciences and Veterinary Medicine) Iasi in 2014, on a culture of runner bean (*Phaseolus coccineus* L.), created in the polytunnel by planting the seedlings in nests, with three different densities (20, 25 and 33 thousand nests/ha), using four cultivars from Great Britain (Lady Di, Desiree, Polestar and White Apollo). The obtained results indicate to us the fact that the highest early productions for the culture of runner bean created in the polytunnel by planting the seedling are obtained at lower densities of 20 and 25 thousand nests/ha.

**Key words:** runner bean for pods, planting distances, polytunnel

**Rezumat.** Lucrarea își propune evaluarea posibilităților de cultivare a fasolei mari pentru păstăi în solarii, în condițiile din România, luându-se în considerare distanțe diferite de plantare. Acest factor prezintă o influență majoră asupra producției la cultura de fasole mare, specia fiind pretențioasă la lumină. Cercetările au fost realizate la Stațiunea Didactică a USAMV Iași, în anul 2014, la o cultură de fasole mare (*Phaseolus coccineus* L.), înființată în solar prin plantarea răsadului în cuiburi, câte două plante la cuib, cu trei densități diferite (20, 25 și 33 mii cuiburi/ha), utilizând patru cultivare provenite din Marea Britanie (Lady Di, Desiree, Polestar și White Apollo). Rezultatele obținute ne indică faptul că cele mai ridicate producții timpurii pentru cultura de fasole mare înființată în solar prin plantarea răsadului se obțin la densități de 20 și de 25 mii cuiburi/ha.

**Cuvinte cheie:** fasole mare pentru păstăi, distanțe de plantare, solar.

## INTRODUCTION

The culture of runner bean for pods in protected environments is not known

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in Romania, although the results from other countries recommend this culture system (Klaus L., 2013). Research focused on this topic have been conducted worldwide, in Great Britain, Netherlands, France, etc., but in our country there were no concerns in this regard, one of the reasons being probably the confusion between the runner bean and the common bean, as well as the lack of an adequate cultivation assortment (Munteanu N., 1985, Popa Lorena-Diana, 2010, Popa Lorena-Diana and Munteanu N., 2009).

The distributing companies and/or the producers of seeds for this culture also make some recommendations for the species that they promote, according to the existing specialized literature worldwide. The creation of the culture in the field can be achieved by seedling, its production beginning from the second decade of April, or by direct sowing, the period for the creation of the culture being divided from May up to July. The sowing depth is of 5 cm, at a distance of 30 cm between the seeds/ nests on a row, sowing being done in lanes of 45 + 105 cm (<http://www.marshalls-seeds.co.uk/>, <http://www.thompson-morgan.com/>, <http://www.tozerseeds.com/eu/en/>).

The assortment for the polytunnels generally comprises climbing cultivars (indeterminate growth), in consequence the culture of runner bean for pods requiring support systems. As assortment, different cultivars are used in the culture, finding both climbing varieties such as White Apollo, Lady Di, Polestar, Desiree, Scarlet Empire, Celebration, Firestorm, Moonlight etc. and some dwarf cultivars, of which we mention Hestia, Jackpot Mixed (<http://www.marshalls-seeds.co.uk/>, <http://www.thompson-morgan.com/>).

Because the need to diversify the range of vegetables is well known, as well as some technological features of this culture (Munteanu N., 1985, Hidalgo R. et al., 1986), our research aim at assessing the cultivation possibilities of this species in polytunnels, in the conditions of Romania, establishing as main objectives the study of the influence of the cultivar and of the density on the culture and on its harvest.

## **MATERIAL AND METHOD**

The experiment was organized in a covered polytunnel, with dimensions of 40x10 m in the experimental conditions from the Teaching Facility of USAMV Iasi, in 2014. The experimental conditions are determined by a soil of medium-levigated chernozem type (cambic), environment stocked with nutrients.

The biological material was represented by for varieties of runner bean for pods from Great Britain (Lady Di, Desiree, Polestar and White Apollo). A brief description of the cultivars from the study is presented in table 1.

The experiment is of bifactorial type, according to the two studied factors:

- factor A – the assortment used with four gradations: a1 = Lady Dy; a2 = Desiree; a3 = Polestar; a4 = White Apollo.
- factor B – the density of the culture, expressed by three gradations: b1 = 33000 nests/ha (100 x 30 cm); b2 = 25000 nests/ha (100 x 40 cm); b3 = 20000 nests/ha (100 x 50 cm).

The experiment was organized in a device of subdivided parcels, with three replications and in each replication of the parcel six nests were planted.

The culture was created by planting the seedling in nests on June 3<sup>rd</sup>. In order to obtain the seedling, three seeds in nutritious pots (9 x 9 x 10 cm) were sowed on May 20<sup>th</sup>, the substrate consisting of peat. The obtained seedling was planted in equidistant rows of 100 cm, two plants in the nest, at the distances determined by the experimental protocol.

Table 1

**Type of runner bean used in the experiment**

Type		Source	Reference Data		Presence/absence of threads in the pod
No. crt.	Cultivar		Color of the flowers	Color of the seeds	
1.	Lady Di	Great Britain	Red	Violet with black arabesque	No threads
2.	Desiree	Great Britain	White	White	No threads
3.	Polestar	Great Britain	Red	Violet with black arabesque	No threads
4.	White Apollo	Great Britain	White	White	No threads

During the vegetation period care works consisted of hand and mechanical weeding, phytosanitary treatments, radicular and foliar fertilization, drip irrigation, trellising and pinching the plants.

During the experiment, determinations of the amount of the early harvest were done, the data being processed by appropriate statistical and mathematical methods. The harvesting of the pods in order to determine early production was performed at three different dates, July 21<sup>st</sup>, July 26<sup>th</sup> and July 31<sup>st</sup>.

## RESULTS AND DISCUSSIONS

The experimental results obtained during the experiment from 2014 are shown in the table below:

Table 2

**Production results for the three planting distances (kg/ha)**

No. crt.	Cultivar	30 cm	40 cm	50 cm	Average ( $\bar{x}$ )
1.	Lady Di	7264	6240	8250	7251
2.	Desiree	1651	3684	3468	2934
3.	Polestar	5514	8177	6683	6791
4.	White Apollo	875	2654	3069	2199
Average ( $\bar{x}$ )		3826	5189	5368	4794

In 2014, the early production of pods varied in extremely high limits, between 875 kg/ha to 8250 kg/ha, while the experimental average was 4794 kg/ha.

Compared to the experimental average, the highest production increase of 12% was recorded at a distance of 50 cm. The distance of 40 cm determined a production increase of 8%, both variants being assured at a statistically significant level.

It is important to note that the distance of 30 cm between pods determined productions under the level of the experimental average, thus being able to appreciate that such distance is too small, resulting in a density that is too high, where plant "inconvenience" each other in what concerns the nutritious space and the light space.

The comparative analysis of the production results for the three experimental distances is shown in Table 3.

Table 3

The comparative analysis of the early production according to the distances between nests

No. crt.	Planting distance	Production		Production differences between distances and their significance			
		t/ha	% compared to $\bar{x}$	D1=30 cm	D2=40 cm	D3=50 cm	average ( $\bar{x}$ )
1.	D1=30 cm	3826	80	-	-1363 <sup>0</sup>	-1542 <sup>0</sup>	-968
2.	D2=40 cm	5189	108	1363 <sup>x</sup>	-	-179	395
3.	D3=50 cm	5368	112	1542 <sup>x</sup>	179	-	574
	Average ( $\bar{x}$ )	4794	100	968	-395	-574	-

LSD5% = 1290,36 kg/ha

LSD1% = 1757,88 kg/ha

LSD0,1% = 2362,55 kg/ha

For the distance of 30 cm between nests on a row (table 4), the Lady Di variety (7264 kg/ha) has made statistically assured productions at a significant level compared to the experimental average (3826 kg/ha). Positive differences distinctly significant compared to the average were also recorded in the case of the Polestar variety, obtaining a production increase of 1688 kg/ha.

Table 4

Production results for the distance of 30 cm

No. crt.	Cultivar	Production		Difference compared to $\bar{x}$	Significance of the differences
		t/ha	% compared to $\bar{x}$		
1.	Lady Di	7264	190	3438	xxx
2.	Desiree	1651	43	-2175	00
3.	Polestar	5514	144	1688	x
4.	White Apollo	875	23	-2951	000
	Average ( $\bar{x}$ )	3826	100	0	

LSD5% = 1290,36 kg/ha

LSD1% = 1757,88 kg/ha

LSD0,1% = 2362,55 kg/ha

The results regarding the distance of 40 cm are presented in table 5.

Table 5

Production results for the distance of 40 cm

No. crt.	Cultivar	Production		Difference compared to $\bar{x}$	Significance of the differences
		t/ha	% compared to $\bar{x}$		
1.	Lady Di	6240	120	1051	-
2.	Desiree	3684	71	-1505	0
3.	Polestar	8177	158	2988	xxx
4.	White Apollo	2654	51	-2535	000
	Average ( $\bar{x}$ )	5189	100	0	

LSD5% = 1290,36 kg/ha

LSD1% = 1757,88 kg/ha

LSD0,1% = 2362,55 kg/ha

In the case of the distance between nests of 40 cm, the early production of pods ranged from 2654 kg/ha (White Apollo) to 8177 kg/ha (Polestar). In these conditions, the average of the experiment was 5189 kg/ha.

The Polestar variety recorded productions superior to the average level, with very significant positive differences towards it.

In the case of the distance between nests of 50 cm, productions ranged from 3069 kg/ha (White Apollo) and 8250 kg/ha (Lady Di) (Table 6). The highest production, Lady Di - 8250 kg/ha, assures a production increase of 54% compared to the average of the experiment (5368 kg/ha).

Table 6

Production results for the distance of 50 cm

No. crt.	Cultivar	Production		Difference compared to $\bar{x}$	Significance of the differences
		t/ha	% compared to $\bar{x}$		
1.	Lady Di	8250	154	2882	xxx
2.	Desiree	3468	65	-1900	00
3.	Polestar	6683	124	1315	x
4.	White Apollo	3069	57	-2299	00
Average ( $\bar{x}$ )		5368	100	0	

LSD5% = 1290,36 kg/ha

LSD1% = 1757,88 kg/ha

LSD0,1% = 2362,55 kg/ha

In the case of the interaction cultivar x distance (table 7), the early production from 2014 varied from 875 kg/ha (White Apollo x 30 cm) to 8250 kg/ha (Lady Di x 50 cm). The difference between the combinations of the two factors varied between -3919 kg/ha ( $a_4b_1$  with average) and 3456 kg/ha ( $a_1b_3$  with average).

Highly significant production increase has been recorded in the case of the comparison of the following combinations with the average:  $a_1b_1$  (2470 kg/ha),  $a_1b_3$  (3456 kg/ha) and  $a_3b_2$  (3383 kg/ha). Highly significant negative differences were recorded after comparing the two combinations of factors with the average:  $a_2b_1$  (-3143 kg/ha) and  $a_4b_1$  (-3919 kg/ha).

Table 7

Comparative results between the combinations cultivar x distance between nests on a row (AxB)

No. crt.	Studied factors	Production		Difference compared to $\bar{x}$	Significance of the differences
		t/ha	% compared to $\bar{x}$		
1.	$a_1b_1$	7264	152	2470	xxx
2.	$a_1b_2$	6240	130	1446	x
3.	$a_1b_3$	8250	172	3456	xxx
4.	$a_2b_1$	1651	34	-3143	000
5.	$a_2b_2$	3684	77	-1110	-
6.	$a_2b_3$	3468	72	-1326	0
7.	$a_3b_1$	5514	115	720	-
8.	$a_3b_2$	8177	171	3383	xxx
9.	$a_3b_3$	6683	139	1889	xx
10.	$a_4b_1$	875	18	-3919	000

11.	a <sub>4</sub> b <sub>2</sub>	2654	55	-2140	00
12.	a <sub>4</sub> b <sub>3</sub>	3069	64	-1725	0
Average ( $\bar{x}$ )		4794	100	0	

LSD5% = 1290,36 kg/ha

LSD1% = 1757,88 kg/ha

LSD0,1% = 2362,55 kg/ha

## CONCLUSIONS

1. The highest production increase (12%), compared to the average, was recorded for the 50 cm distance between the nests, while a second gradation of factor B (distance of 40 cm) resulted in a production increase of 8%, both variants being statistically assured at a significant level compared to the average.

2. The Lady Di variety recorded the highest production values for two of the three gradations of factor B (D1 = 30 cm, D2 = 50 cm), respectively 7264 kg/ha and 8250 kg/ha, resulting in production increase statistically assured compared to the average.

3. In the experiment for the distance of 40 cm the Polestar variety was noticed, with a production of 8177 kg /ha, value provided at a very significant level from the average.

4. Through the variation of the distance in 2014, the White Apollo variety has determined the lowest productions, with negative differences compared to the average.

5. In case of the combination cultivar x distance between nests/rows the best results were recorded by the varieties: Lady Di x 50 cm (8250 kg/ha), Polestar x 40 cm (8177 kg/ha) and Lady Di x 30 cm (7264 kg/ha). Also, statistically assured high productions were obtained for the combinations Polestar x 50 cm (6683 kg/ha) and Lady Di x 40 cm (6240 kg/ha).

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