

EXPERIMENTAL RESULTS ON RUNNER BEAN (*Phaseolus coccineus* L.) BEHAVIOUR DEPENDING ON THE TRELLISING SYSTEM

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Abstract

This paper presents the behavior of the runner bean (*Phaseolus coccineus* L.) in three crop trellising systems: with maize plants (intercropping), on individual string on a single row and on trellis with synthetic mesh. Runner bean and maize were sown at the same time, in early May, at a distance of 0.4 m between nests and 1 m between rows. The results were evaluated based on the main morphological and phenological plant features, including those regarding agro-productivity. The results revealed significant differences between the studied variants and highlighted the superiority of trellising system on individual string on a single row.

Key words: agro-productivity, intercropping, trellis, trellising mesh

Runner bean (*Phaseolus coccineus* L.) is a widely known species in Romania, within private gardens or households, being confused with the climbing common bean (*P. vulgaris* L.). Runner bean is a species that is cultivated similarly with the climbing common bean, and the harvest is relatively easily sold. This kind of bean is known as a luxurious food that is valued at higher prices than the common bean. It is a short-day plant, by origin, but most cultivars are neutral. It is a light loving plant, but bears the shadow relatively well, being cultivated interspersed with other species, such as maize (Salinas A.D., 1988).

Runner bean cultivation is profitable if an appropriate technology is used, based on the optimization of major technological factors (cultivar, epoch, density and scheme setting) in close relation to biological and ecological peculiarities (Popa L.D., 2010). In Romania, the entries in the literature are few and incomplete, so it is necessary to conduct systematic research to substantiate cultivation technologies (Munteanu N., 1985a,b, 2005, 2006; Munteanu N. et al., 1989, 2007a, b; Popa L.D. et al., 2008).

The research aim is to assess the behavior of runner bean in three crop trellising systems: with maize plants (intercropping), on individual string on a single row and on trellis with synthetic mesh. Necessity of this research results from the fact that a standard technology for runner bean crop is not elaborated. Thus, there is an attempt to obtain profitable production by using different means of

trellising and establishing the most effective trellising system.

MATERIAL AND METHOD

In accordance with the purpose and objectives of the research, the experiment was placed in the experimental field of vegetable growing department within the "V. Adamachi" farm of UASVM Iași, in 2013-2014.

The available biological material was made of the runner bean seeds (C₃ local population) and maize seeds (Flato hybrid).

The experimental device consisted of randomized blocks with three repetitions type. The studied experimental factor was the trellising system with three degrees:

- V₁- palis on maize plants (*figure 1*);
- V₂ – individual string trellis in a single row (*figure 2*);
- V₃ – synthetic mesh trellis (17 cm mesh) in a single row (*figure 3*).

Each experimental plot had an area of 6 m², 1 m distance between rows and 0.4 m between plants in the row.

The establishment of the culture was held in the first week of May, by direct sowing, three runner bean seeds/nest and two corn seeds/nest. At the time of emergence, in each nest there were two runner bean plants and one maize plant. Thus, in each repetition, in the case of runner bean trellising on maize, there were 30 nests of runner bean plants and 14 plants of corn and in the runner bean mesh and string trellising systems, there were 30 nests of runner bean plants.

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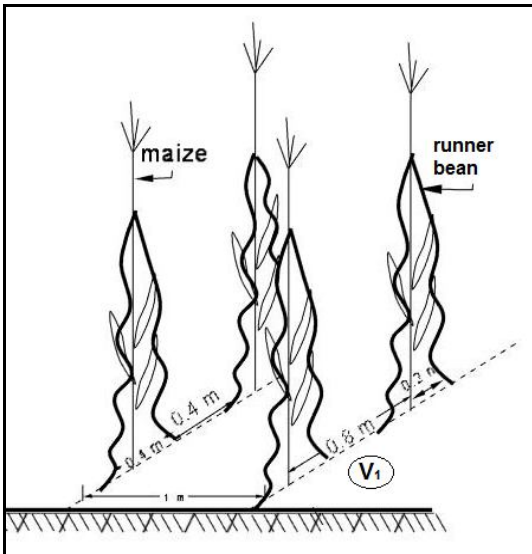


Figure 1. V₁ – palis on maize plants

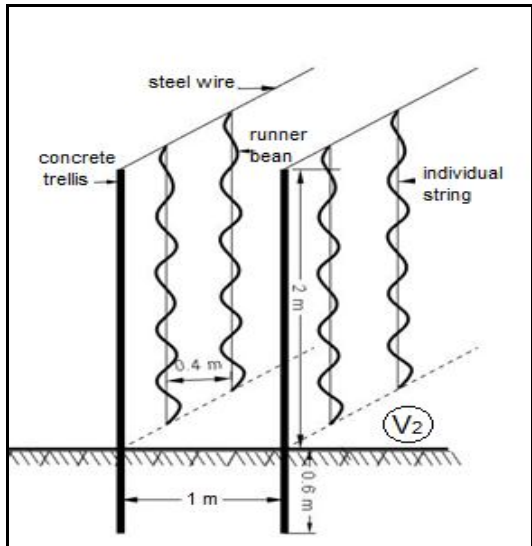


Figure 2 – V₂ - individual string trellis in a single row

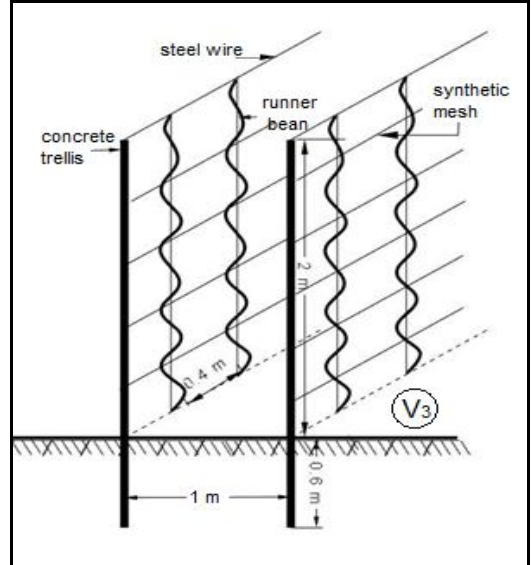


Figure 3. V₃- synthetic mesh trellis in a single row

The experimental culture was conducted according to technical rules arising from the consulted specialized literature (Munteanu N. et al, 1989; Stan N. et al, 2003; Ruști G., 2007; Popa L.D., 2010; Axinte M. et al, 2006). The culture was performed on well leveled ground; the soil is a cambic chernozem, well-stocked in nutrients, with an organic matter content of 3.2 - 3.4% and a pH of 6.5-6.8.

Works were carried out as recommended for common climbing beans (Munteanu N. et al, 1989; Ruști G. and Munteanu N., 2008; Popa L.D., 2010). The culture was not irrigated.

To assess the influence of the experimental factor, biometric observations and measurements were made, on the main morphological and phenological plant features, including agro-productivity. Production results were statistically interpreted according to the specialized literature (Jităreanu G., 1994; Săulescu N.A. and Săulescu N.N., 1967).

RESULTS AND DISCUSSION

Between the studied trellising systems, there were no significant differences in the morphological and phenological characterization of the runner bean plants (fig. 4, fig. 5, fig.6).



Figure 4 – V₁ (original photo)



Figure 5 – V₂ (original photo)



Figure 6 – V₃ (original photo)

Results in terms of morphological characterization: runner bean plant port is voluble; size (height) of the plant is over two meters; plant vigor is high; number of branches per plant is three to four; color is dark green foliage; flower color is white; seed color is white; pods of widely varying size, with length of 8-17 cm and a width of 1.4 to 2 cm; it is important to point out that the pod's length correlates with the number of seeds / pod, longer pods having a higher number of seeds; seed size, measured by the length of the longest axis, varies between 15 and 22 mm; the number of seed per pod ranges from two to four.

Results in the phenological characterization: emergence is hypogeic, meaning it is achieved only by the epicotil growing above ground, the cotyledon leaves remaining in the soil; period from sowing to emergence was about seven to ten days, the period from emergence to appearance of the first real trifoliolate leaves was around five to seven days, the period from emergence to the first flowers was about 32 -35 days, the period from emergence to the first pod was about 67-70 days, the period from emergence to seed maturation was around 115-122 days and the period from emergence to the end of the vegetation period was around 130-140 days (table 1).

Table 1
Phenological characters for runner bean
(number of days)

Sowing - emergence	7-10
Emergence - first real trifoliolate leaf	5-7
Emergence – first flowers	32-35
Emergence – first pods	67-70
Emergence – seed maturation	115-122
Emergence – end of vegetation	130-140

Results in the terms of production

Following investigations, it appears that seed production ranged from 2234 kg/ha and 3610 kg/ha. Highest production was obtained in the variant V₂, on individual string trellis in a single row (3610 kg/ha), which recorded very significant positive differences from the experience average (2907 kg/ha), while the lowest production was in the variant V₁, palis on maize plants (2234 kg/ha), is highlighted very significant negative differences from the control. Third version (palis on synthetic mesh trellis in a single row) achieved productions within the average experimental variation limits (table 2).

Table 2

Variant		Yield		Differences from the mean (kg/ha)	Semnification ^w
no	specification	kg/ha	% of the mean		
1	V ₁	2234	76,84	- 673	ooo
2	V ₂	3610	124,18	+ 703	***
3	V ₃	2878	99,00	- 29	NS
Mean		2907	100	-	-

^wSignificance of differences made by ANOVA (analysis of variance) for experimental factors and interaction of them; NS, *, **, *** - indicate nonsignificant and positive significant at p≤0.05, 0.01, 0.001, respectively; o,oo,ooo - negative significant at p≤0.05, 0.01, 0.001, respectively

DL 5% = 178,693

DL 1% = 295,679

DL0,1% = 553,4339

CONCLUSIONS

The runner bean considered in the study is a vigorous plant with white flower; seed color is white; number of seeds in pods are 2-4.

In terms of phenology, plants arose after 7-10 days from sowing, flowering occurred after 32-35 days from the emergence, from the emergence to seed maturation 115-122 days, and from emergence to end of the growing season 130-140 days.

Seed production ranged between 2234 kg/ha, obtained in the V₁ variant, palis on maize plants, and 3610 kg/ha, in the V₂ variant, on individual string trellis in a single row. In the case of the V₃ variant, on synthetic mesh trellis (17 cm mesh) in a single row, the yield was 2878 kg/ha.

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REFERENCES

- Axinte M., Roman G., V., Borcean I., Muntean L.S., 2006** - *Fitotehnie*. Editura "Ion Ionescu de la Brad" Iași.
- Hamburdă Silvia Brîndușa, Dascălu T., Munteanu N., 2013** - *Preliminary studies for new cultivation systems of runner bean (Phaseolus coccineus L.)*. Lucrări științifice, seria Horticultură, USAMV Iași. 56 (2): 167-172.
- Hamburdă Silvia Brîndușa, Munteanu N., Popa Lorena Diana, 2014** - *Evaluarea unui sortiment de fasole mare (Phaseolus coccineus L.) în condițiile din județul Iași*. Știința Agricolă. Universitatea Agrară de Stat din Moldova, Chișinău. 1: 38-41.
- Jităreanu G., 1994** - *Tehnică experimentală*. Editura "Ion Ionescu de la Brad", Iași, 167 pag.
- Munteanu N., 1985a** - *Phaseolus coccineus L. - o specie legumicolă care merită mai multă atenție*. Producția Vegetală, Horticultura, nr. 4/1985.
- Munteanu N., 1985b** - *Câteva aprecieri asupra unor populații locale de fasole de grădină*. Cercetări Agronomice în Moldova, vol. 4.
- Munteanu N., Timofte Valentina, Timofte E., 1989** - *Aspecte tehnologice ale culturii fasolei de grădină urcătoare*. Cercetări Agronomice în Moldova, vol. 4, Iași.
- Munteanu N., 2005** - *Studii preliminare privind biodiversitatea speciei fasole mare (Phaseolus coccineus L.)*. Lucrări științifice, UȘAMV, Iași, seria Horticultură.
- Munteanu N., 2006** - *Evaluarea biodiversității speciei Phaseolus coccineus L. (fasole mare) în zona de nord-est a României*. Lucrări științifice, seria Horticultură, USAMV Iași.
- Munteanu N., Popa Lorena-Diana, Stoleru V., 2007a** - *On the agrobiological value of some local population of runner bean*. Lucrări științifice, seria Horticultură, anul L (50), USAMV Iași.
- Munteanu N., Popa Lorena-Diana, Teliban G. C., 2007b** - *Suitability of Phaseolus coccineus L. species for cultivation in sustainable agriculture systems*. Lucrări științifice, seria Horticultură, anul L (50), UȘAMV Iași.
- Munteanu N., Hamburdă, Silvia Brîndușa Popa, Lorena Diana, 2013** - *Research on the main productivity features in an assortment of runner bean (Phaseolus coccineus L.) in the environmental conditions from NE Romania*. Lucrări științifice, seria Agronomie, editura Ion Ionescu de la Brad, Iași. 56 (1): 159-162.
- Popa Lorena-Diana, Munteanu N., Teliban G. C., Stoleru V., 2008** - *Yield comparative study on some local populations of runner bean (Phaseolus coccineus L.)*. Lucrări științifice, seria Horticultură, anul LI (vol. 51, pag. 605-612), USAMV Iași.
- Popa Lorena Diana, 2010** - *Cercetări privind agrobiologia speciei Phaseolus coccineus L. în vederea optimizării cultivării*. Teză de doctorat. USAMV Iași. 232 p.
- Ruști G., 2007** - *Cercetări privind îmbunătățirea tehnologiei de cultură a fasolei de grădină urcătoare (Phaseolus vulgaris L. var. communis L.)*. Teză de doctorat. U.Ș.A.M.V. Iași.
- Ruști G., Munteanu N., 2008** - *Cultura fasolei de grădină urcătoare*. Editura „Ion Ionescu de la Brad”, Iași.
- Salinas A. D., 1988** - *Variation, taxonomy domestication and germoplasm potentialities in Phaseolus coccineus*. In „Genetic Resources of Phaseolus Beans” (edited by Gepts, P.), Kluwer Academic Publishers, Dordrecht/Boston/London.
- Stan N., Munteanu N., Stan T., 2003** - *Legumicultură*, vol III. Editura "Ion Ionescu de la Brad", Iași.
- Săulescu N.A., Săulescu N.N., 1967** - *Câmpul de experiență- ediția a II a, Edit. Agro-Silvică de stat, București*.