

PRELIMINARY STUDIES FOR NEW CULTIVATION SYSTEMS OF RUNNER BEAN (*PHASEOLUS COCCINEUS* L.)

STUDII PRELIMINARE PENTRU NOI SISTEME DE CULTIVARE LA FASOLEA MARE (*PHASEOLUS COCCINEUS* L.)

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Abstract. Paper presents a literature synthesis on the new cultivation systems of runner bean (*Phaseolus coccineus* L.), based on a large Romanian and international bibliography. There were pointed different cultivation systems in monoculture and successive crops or intercropping crops. Assessment of these systems is done according to quantity and quality of the yields.

Key words: continuous cropping, successive cropping, intercropping

Rezumat. Lucrarea prezintă o sinteză asupra cunoștințelor referitoare la noi sisteme de cultivare a fasolei mari (*Phaseolus coccineus* L.), pe baza unei ample bibliografii din țară și străinătate. Au fost puse în evidență sisteme de cultivare în ogor și monocultura, sisteme de culturi succesive și duble și sisteme de culturi asociate și intercalate (intercropping). Evaluarea sistemelor se face în funcție de cantitatea și calitatea recoltei.

Cuvinte cheie: monocultură, cultură succesivă, cultură intercalată

INTRODUCTION

The runner bean (*Phaseolus coccineus* L.) is not very studied in our country, because it is cultivated mainly in the gardens of local farmers (Munteanu, 2005). Very often, the crop of this species was confused with that of the climbing garden bean (*P. vulgaris* L. var. *communis*), to which it is actually quite similar.

The agricultural crop is an agronomical category representing an artificial biotope where the growth and development conditions are ensured for a certain species that is useful to humans. Assuring the conditions for the plants' growth and development is conducted through the cropping system, in which technology is the integrating factor of the system. The cropping technology defines a process of agricultural production following specific rules in a certain chronological order. Basically, this contains specific stages: choosing the land, preparing the land, setting up the crop, taking care of the crop, harvesting, and so on (Stan and Stan, 2010). The cropping system is a complex of technical elements, integrating through specific relations and thus creating a unified whole conducting a mutual exchange of energy and substance and creates an output (biomass) which integrates in the environment or is collected by humans as harvest.

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The runner bean is known as a species growing in a cool and humid climate. Under these circumstances the runner bean crop in the forest steppe from the North-East part of the country is subject to excessively high temperatures and especially atmospheric draught as well as soil draught (Munteanu, 2005).

A sure method to obtain high and stable yields of superior quality and favorable economic results is to find a cropping system in which technology, as an integrating factor, will correct the unfavorable environmental conditions. Taking this into consideration, the purpose of this paper is to present existing information from the specialized literature, domestic and foreign, covering new systems of cultivating runner bean that may suggest solutions or hypotheses of work in developing certain cropping system methods.

MATERIAL AND METHOD

In this paper are presented certain cropping systems of the runner bean, based on the information available in the specialized literature. The biological material considered is the runner bean species, represented by the local population in our country (Munteanu, 1985). The runner bean is an annual, herbaceous species, reproducing by seeds in the conditions from our country.

As work methods were used the comparative analysis and the case study of the existing information, according to the nature and volume of this information, as well as the possibilities for their application in the domestic ecological conditions.

RESULTS AND DISCUSSIONS

The runner bean is cultivated in various systems, according to area, technical facilities and traditions etc. These systems are different, depending on some criteria: cultivation technology, place of cultivation, vegetation or life duration, plants habitus, the place in crop rotation, establishment of the crop, plants design in the crop, intercropping etc.

The cropping systems of vegetable plants may be grouped, according to **the applied technology**, into two large categories: *intensive agricultural systems* (conventional ones) and *non-conventional agricultural systems*. The conventional agricultural systems have as an objective the intensive use of the land and of the capital goods, while the non-conventional ones have as a purpose stopping the pollution and erosion of the agricultural ecosystems, even their regeneration and obtaining agricultural products free of pesticides residues or heavy metals thus preserving and improving the consumers' health (Stoleru, 2013). The runner bean lends itself to both cropping systems allowing for an intensive valorization of the land, considering that the space between the rows of supported, plants can be used for growing other vegetables (carrot, salad, cabbage, cauliflower etc.) (Munteanu et al., 2007). The climbing bean varieties are considered to be very appropriate for intensive cropping, considering the costs, the work volume, the quantity and the value of the harvest, because it responds well to fertilizing, including the organic one and to abundant irrigation (Stan et al., 2003).

Depending on **the place of cultivation** one can distinguish between the vegetable systems *in the laylands* and *the vegetable systems from specially designed or built spaces*. Globally, the runner bean is cultivated almost exclusively in the field. In protected areas the crop aims at obtaining garden peas, in such countries as Belgium and the Netherlands (Popa, 2010). In our country its cultivation began in protected areas began after 1973.

During **its lifetime**, the runner bean is cultivated as an *annual* or *perennial plant*. In Mexico, for example, it is cultivated as an annual plant on a field, in a monoculture system, in intercropping with maize but also as a perennial plant (associated with maize, at least in the first year) in a monoculture system every two years, cultivated after maize in the second year, in-between orchard trees and cultivated on fences, balks and side lands (Salinas, 1988).

Depending on **habitus**, one uses *the bushes cropping system* and *the supported cropping system*. In Great Britain the system with climbing plants are very well known as well as those using types of bushes. The bushes system is preferred in the areas with strong wind. In the Netherlands, Belgium, France, Spain the cropping system with climbing varieties in layland are used.

Depending on **the crop rotation system scheme** one uses *monoculture* or *the crop rotation*. Cultivating the runner bean for several years on the same field (monoculture) or other related species contributes to the multiplying and spreading of specific diseases and pests. Monoculture also determines a substantial decrease in the yield, after five years having a fall of 35-36% comparing to the first year (<http://scribd.com/doc/98586506/La-Legumicultura>). The crop rotation ensures a better use of the land, capitalizing the beneficial effect of self-fertilizing with bean plants – produced nitrogen thus avoiding or reducing the attack of diseases and pests (Stan and Stan, 2010).

Depending on **the set up manner** of the runner bean one uses the cropping system of *direct sowing* in the fields (seeds) as well as the system of seeding *material planting* (tuberized roots, seedling) (Kay, 1979).

Depending on **the time of establishment**, the runner bean crop can be done in *one stage* (after reaching a soil temperature higher than 10-12 °C), on a layland, owing to the long period of vegetation. Therefore, it is not appropriate for successive cropping, unlike the bushes. The purpose of the crop is to ensure a higher yield compared to the bushes, 5-10 times more, on a longer period of time, from July until the autumn when the hoar frost falls (Popa & Co., 2008).

According to **the manner of plant design on the land**, the climbing bean crop is conditioned by the type of the plants' support system. The crop is arranged in rows of individual plants or in nests of 3-5 seeds. In Bulgaria it is quoted the example of a crop in groups of four, six or eight nests (fig 1.), with the plants supported in a pyramid. In the Netherlands and Belgium the crop is set up in nests of 2-3 seeds or pod by pod, the supporting being done on espaliers, 1-2 rows of plant nests to a an espalier, with an average distance between rows of 1,5 m, and on the row, between plants, of 40 cm. In Great Britain the sowing is done in nests

of 2 seeds, in double rows at 30 cm and on the row, in-between nests, at 30 cm, the distance between two double rows being of 1.5 m-2 m. The support is done on the espalier in two close rows. The support can also be an individual one on a stake (Rusti and Munteanu, 2008).

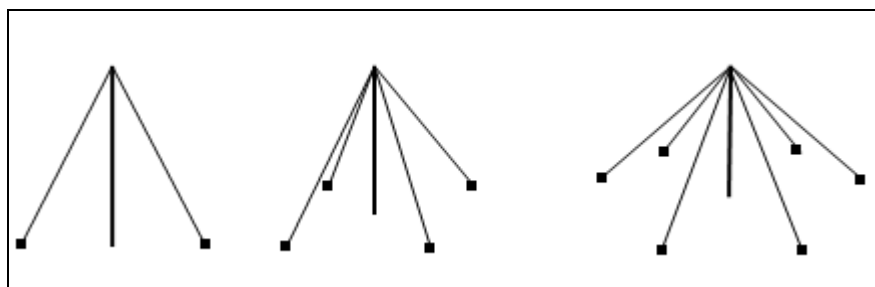


Fig. 1 - Support system of the runner bean plants

In countries from Latin America research has indicated the importance of schemes and densities in setting up the crops as well as the cropping system, recommending distances of 50, 60, 70 and 80 cm in-between the rows and on the rows in-between the plants as well as individual support on the espaliers of 1-2 rows in pyramid shape, with a varying distance between the espaliers from 50 to 220 cm, depending on the support system (Rusti and Munteanu, 2008).

As far as **the use of the land** is concerned, runner bean lends itself very well to *associated cropping* and *intercropping*. Intercropping involves the cultivation of two or more crops at the same time on the same land surface (http://www.oisat.org/control_methods/cultural_practices/intercropping.html). This is an ancient practice of great interest even today owing to its numerous advantages, such as:

- reduces the populations of pest insects owing to the diversity of the crops; when there is an agricultural crop diversity on the field, the pest insects need a longer period of time to identify the plants they want to attack;
- reduces the diseases of the crops; the distance between the plants from the same species is bigger because other plants (belonging to difference botanical families) are sown in-between them;
- reduces the erosion of slopes and protects the soils (eg. Intercropping in strips);
- attracts a larger number of beneficial insects especially when plants with flowers are included in the cropping system;
- uses the farm land more efficiently;
- determines a potential increase in the total yield and the farm profit in comparison to separate cultivation of crops;
- offers a diversity of crops for the farmer families in just one growth season.

The cultivation of runner bean among or in-between the rows of other vegetable varieties (associated crops) or of phyto-technical crops (intercropping) are important for the environment and the producers alike. The simultaneous cropping of vegetables for pods and cereals allows for mixed harvesting and its direct use as forage (vegetable plants make up for the protein and the cereals supply the carbohydrates) and can be separated for individual use.

The runner bean can be very well cultivated with maize, this cropping system being used for hundreds of years. At the same time, the setting up of the runner bean crop is associated with that of Jerusalem artichoke and sunflower, using as a support their stems. The leaves are ripped off so as not to shadow the bean crop, leaving just a few leaves at the top. These cropping systems are extremely efficient especially considering that the support system is very expensive.

The farmers in Central America traditionally use intercropping for maize, beans and Turkish pumpkins. Cultivated together, these three crops optimize the available resources. Maize grows taller than the other crops and the bean climbs up on the maize stems. The pumpkin flowers spread on the ground attracting and reflecting the light, thus shading the earth. The shadow discourages the growth of weeds (http://portal.organicedunet.eu/index.php?option=com_content&view=article&id=11810&catid=1&Itemid=103).

In Romania for the runner bean are used the associated cropping systems or the intercropping with maize supported on stakes, but also monoculture (Popa, 2010).

CONCLUSIONS

1. The runner bean can grow in different systems depending on certain criteria, such as:

- the applied technology;
- the place of cultivation;
- the period of vegetation;
- habitus;
- the crop rotation system scheme;
- the set up;
- the time of establishment;
- the manner of plant design;
- association or succession mode and so on.

2. High perspective, for the conditions in our country, is intercropping system (association with other plants (vegetables or belonging to other groups cultivated)). In this system, the best known is the association with corn, sunflowers and Jerusalem artichokes, which are support plants what replace the support system.

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