PRELIMINARY STUDIES ON THE PERSPECTIVE OF GARDEN BROAD BEAN CULTIVATION IN ROMANIA

STUDII PRELIMINARE PRIVIND PERSPECTIVA CULTIVĂRII BOBULUI DE GRĂDINĂ ÎN ROMÂNIA

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Abstract*. Broad bean crop presents great nutritional, agrotechnical, economic and social value worldwide, along with other legume crops such as soybean, bean and pea. In Romania, the interest for this crop is very low, although there are favorable conditions to acquire successful crops, in the last 30-50 there being a well-known crop.*

The study presents the most important achievements regarding the cultivation technology, with special emphasis on the assortment, crop density and fertilization regime, as important factors for the promotion of this culture in our country.

The scientific paper is elaborated on the bases of the scientific literature regarding the most important cultivation factors and the correlation between them to meet the ecological needs of the plant.

Key words: cultivation technology, cultivar assortment, crop density, fertilization regime.

Rezumat. *Cultura bobului de grădină prezintă o mare valoare alimentară, agrotehnică, economică și socială la nivel mondial, alături de alte culturi leguminoase precum soia, fasolea și mazărea. În România, interesul pentru această cultură este unul foarte redus, deși sunt condiții favorabile pentru realizarea unor culturi de succes, în ultimii 30-50 de ani această cultură fiind bine cunoscută.*

Lucrarea prezintă cele mai importante realizări privind tehnologia de cultivare, accent deosebit fiind pus asupra sortimentului, densității și regimului de fertilizare, ca factori importanți pentru promovarea culturii în țara noastră.

Lucrarea științifică fost elaborată pe baza literaturii de specialitate privind cei mai importanți factori și corelația dintre aceștia pentru a satisface cerințele ecologice ale plantei.

Cuvinte cheie: tehnologia de cultivare, sortiment de cultivare, densitate, regim de fertilizare.

INTRODUCTION

The broad bean (*Vicia faba* L.) is one of the oldest cultivated plant by man, archaeological evidence proving the use of this species since the Neolithic period (5000-6000 BC.). The species is known for its rusticity, ecological plasticity and

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nutritional value, especially for its high protein content (20-40%), fats (0.2%) and mineral salts (2.5-4%). Also, the garden broad bean is of particular importance, due to its ability to fix atmospheric nitrogen with the help of nitrogen-fixing bacteria, leaving in the soil about 130-160 Kg/ha N fixed biologically.

The broad bean has three botanical varieties according to seed size: *Vicia faba major* (garden broad bean), with large seeds, *Vicia faba minor* (field bean or pigeon bean), with small seeds and *Vicia faba equine* (horse bean) with medium seeds

The garden broad bean can currently be part of all three varieties, with the condition to provide culinary qualities preferred by consumers: the color of the seeds to be light (white, greenish white, beige, beige-brown), the color of the hilum white (especially for canned) and pleasant taste (with low tannin content or other anti-nutritive substances) (Munteanu, 1992).

Thus, cultivation technologies are known for temperate areas (including Europe), tropical areas (including the Middle East), for southern areas (New Zealand, Australia). Under the conditions from our country, some elements of the cultivation technology are known, but they are mostly taken over by specialized literature (including books) from abroad.

The present paper aims to review the knowledge on the main technological links regarding the following factors: cultivar assortment, density and fertilization regime.

THE SITUATION OF GARDEN BROAD BEAN CULTIVATION

The broad bean was used in human consumption, prepared in various forms, by the Chinese about 5,000 years ago. The broad bean was used by the ancient Jews by grinding and mixed with wheat, barley or millet to make bread. In Egypt, it was consumed by preparing germinated seeds. For the Greeks, the broad bean was a very well-known plant, even the word "bean" used to name the plant is of Greek origin and means "food". The Romans consumed the broad bean on the occasion of religious holidays, distributing it as food to the needy (Mlești, 1986).

According to The Food and Agriculture Organization (FAO) of the United Nations, broad bean is currently grown in more than 58 countries. Worldwide, according to FAOSTAT (2013), the garden broad bean is the seventh most cultivated vegetable, with a production of 1,168,000 t (Veloso, 2016). The highest broad bean production in the world is obtain in China with about 35.9%. The largest broad bean seed-producing countries are China, Ethiopia, England, Australia, France and Egypt. Currently, the broad bean is cultivated on an area of 2.57 million ha, with a total production of 5.43 million t. The highest producing country in Europe is England, followed in order by: France, Italy, Spain and Germany (Veloso, 2016).

It is worth mentioning that the annual production of dried garden broad bean seeds decreased from 5 million tons on an area of 5 million ha, in the 60's,

to a production of 4 million tons on an area of 2,7 million ha, in the 2000's. The largest reduction in area was recorded in China, from 3,5 million ha, in the 1960's to 1,25 million ha, in the 2000's. In contrast, annual production in sub-Saharan Africa increased over the same period from 23,000 t from an area of 250,000 ha to 540,000 t, from an area of 45,000 ha (Singh and Bhatt, 2012).

Green seeds production in the period 1998-2003 was estimated at 940000 t / year, on an area of 2.6 million ha. The main producing countries are: Algeria (118000 t / ha), China (114000 t / ha) and Morocco (112000 t / ha) (Singh *et al*., 2013).

In our country, it is not known exactly the cultivated area or the production obtained per hectare in recent years for garden broad beans.

According to FAO, however, in 2018, Romania cultivated an area of 12,800 ha with broad bean, obtaining a production of 17,300 t, and next year the surface decreases to 11,890 ha, obtaining a production of 14,100 t.

THE BIOLOGICAL CHARACTERISTICS OF THE GARDEN BEAN

The garden broad bean is an annual, herbaceous plant that is propagated by seeds.

Root. The garden broad bean has a fairly developed root system, but which does not provide good drought resistance, consisting of a main pivoting root that can penetrate into the soil to a depth of about 50-60 cm and secondary roots that have nodules with nitrogen-fixing bacteria *Rhizobium leguminosarum*.

Stem. The stem is erect, edged, fistulous, and glabrous, having a height that can varies from 80 cm to 180 cm. The plant can have a single stem or more (3-4 in number), giving the plant a bush appearance (Stan *et al*., 2003).

Leaf. The leaves are large, about 10-25 cm long each, bluish-green or gray-green, feathery composed of 2-4 pairs of ovate-elliptical leaflets, glabrous, 4-8 cm long and 2-4 cm wide.

Flowers. The flowers are hermaphroditic, typical for the *Papilionaceae* family, 2-4 in racemes located at the ascils of the leaves (Ciofu *et al*., 2003). The flowers have a length of 2.5-4.0 cm, their calyx being tubular, the color of the corolla is white, with a white, pink or black hull and the wings can be completely white or can have a black macula spot (Munteanu, 1992).

Flower pollination is partially autogamous, but the percentage of allogamy can reach up to 40-60% depending on environmental conditions of variety or insect activity (Singh and Bhatt, 2012).

Seeds. The seeds in the pod are 2-6 in number. Their color can be light green, white-green, green-purple, cream, brown, dark brown, black. The size of the seeds varies greatly, depending on the variety. The length of the seeds varies from 0.6 cm to 2-3 cm, the width from 0.5 to 1.5 cm, and the thickness from 0.3-0.6 cm to 2-3 cm. The mass of 1000 seeds varies from 400g to 1200g (Stan *et al*., 2003).

THE REQUIREMENTS OF THE GARDEN BROAD BEAN CONCERNING ENVIRONMENTAL FACTORS

The garden broad bean is a plant known for its hardiness, with higher demands on moisture. In order to obtain high quality and quantity harvest, however, the requirements of the garden broad bean regarding environmental factors must be ensured at optimal levels.

Both in Europe and in our country, a Mediterranean breed adapted to a wetter climate and a temperate one with higher soil requirements is known.

Temperature requirements. Broad bean plants germinate and rise at temperatures starting at 3-4^{0}C. The optimum temperature for growth and development is 16-20^{0}C (Stan *et al.*, 2003). Temperatures above 27°C can cause abortion of flowers, while temperatures above 30°C can completely stop flowering.

Water requirements. Water is the factor that ensures the success of the crop. Higher water requirements are recorded during germination, the seeds requiring a larger amount of water to germinate, due to their size, during emergence and especially during the flowering, fruiting and growth phase.

Soil requirements. Soil is the second most important factor for garden broad bean cultivation. It requires soils with a good water retention capacity but with a permeable structure, which allows water to penetrate deep to avoid puddles of water on the soil surface. The soils suitable for garden bean cultivation are clayey, loamy-clayey or leosoid soils that have a medium fertility, medium content of organic substances, and a neutral or slightly acidic pH.

Nutrients. The garden broad bean has a high consumption of nutrients. During only 3-4 months of vegetation, it manages to accumulate 30-40 tons of biomass per hectare, consuming 180-250 Kg N, 100 Kg P_2O_5, and 130-160 Kg K_2O.

Light. Originally the garden broad bean is a short-day plant type, but its evolution in different ecological conditions has led to the emergence of types specific to the cultivation area or even indifferent to light.

CULTIVATION TECHNOLOGY OF GARDEN BROAD BEAN

The garden broad bean, in our country, is cultivated in field conditions. Garden broad bean is cultivated in order to obtain green seeds that are immediately sold on the market, frozen or preserved like peas.

Assortment. The assortment of garden beans with free pollination is quite rich. Below are some of the most cultivated varieties in different countries:

- in America: Aquadulce, D'Aquadulce, Early Violletto, Sweet Lorane, Delle Cascine, Early White, Windsor, Bell Bean;

- in England: Stereo, The Sutton, Witkeim Manita, Crimson Flowered, Red Epicture, Optica, Aqadulce Claudia;

- in Spain: Muchamiel, Cuarentena, Aguadulce, Ramillete, Claro de luna, Loreta, Mahon blanca y morada, Granadina, Agua dulce o sevillana;

Other cultivated varieties in Europe are: Green Windsor, White Windsor, Bonny Lad., Imperial Green Longpod, Relon, Hylon, Imperial White Longpod, Masterpiece Longpod, Express, Sussex Wonder Longpod.

Studies regarding the garden broad bean in our country were carried out in the 80's at The Institute for Vegetable and Flower Research (ICLF Vidra) and Vegetable Research Station (SCL Bacău) and the varietes obtained were: Cosmin, Fin de Vidra (ICLF Vidra) and Productiv 31 (SCL Bacău).

Density. The density of plants used in practice is varied, being between 15-60 plants/m^2. These densities are determined by the cultivar (their vigor), climatic conditions (temperature, humidity), certain ecological properties (sowing season, care work and their mechanization, purpose and quality of the harvest).

Numerous studies have been carried out on the density of garden beans, using densities between 10 and 100 plants per m^2:

- Aguilera-Diaz and Recalme-Manrique (1995), Spain, studied densities between 10 and 30 plants per m^2 and established the optimal density is 10 plants per m^2.

- Pilbeam *et al*. (1991), England, studied densities between 10 and 80 plants per m^2 and established the optimal density is 20 plants per m^2.

- Marcellos and Consable (1986), Australia, studied densities between 10 and 60 plants per m^2 and established the optimal density of 35 plants per m^2.

- Coelho (1987), Portugal, studied densities between 10 and 50 plants per m^2 and established the optimal density is 40 plants per m^2.

- Salih (1989), Sudan, studied densities between 15 and 50 plants per m^2 and established the optimal density is 50 plants per m^2.

Fertilization. Can be done with organic or mineral fertilizers. Outstanding results were gotten from the application of organic fertilizers were reported by Walled *et al*., (2019); Husain *et al*., (2016) and other authors.

Chemical fertilizers are the most commonly used, being applied especially for the contribution of macroelements such as N, P and K.

The best results by application of nitrogen fertilizers have been reported by Palha *et al*., (1993); Mohamed and Babiker, (2012) and other authors.

Significant results by application of phosphorus fertilizers have been reported by Bolland *et al*., (2000); Adak and Kibritci, (2016) and other authors.

Good results from the application of potassium fertilizers were reported by Mona *et al*., (2011); Barłóg *et al*., (2019) and other authors.

Most reports were made using so-called fertilization recipes with fertilizers (organo-minerals or macro-elements), the best results being obtained by Kawochar *et al*., (2011) and Abou-Amer (2014).

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