STUDIES ON THE POTENTIAL CULTURE OF SPECIES *PHASEOLUS AUREUS*

STUDII PRIVIND POȚENTIALUL DE CULTIVARE AL SPECIEI *PHASEOLUS AUREUS*

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Abstract. *Phaseolus aureus is practically unknown in Romania. This paper proposes a bibliographic study of the suitability of cultivation in our country, comparatively analyzing popular culture, technology and patented worldwide and biological requirements of species. In this regard, we presented issues like: special requirements for the environment, cultural practices, production and performance, market challenges to growing and improving in Phaseolus aureus growing and consuming countries. Adjacent to the area's climatic conditions are Moldova and thus can be cultivated species in this habitat.*

Key words: suitability, rusticity, genetic resources

Rezumat. *Specia Phaseolus aureus este practic necunoscută în România. Lucrarea de fața își propune un studiu bibliografic al pretabilității cultivării în țara noastră, analizând, în mod comparativ, tehnologia de cultura cunoscuta și brevetată la nivel mondial și cerințele biologice ale speciei. În acest sens, vom prezenta aspecte privind: cerințele speciei față de mediu, practicile culturale, producția și performanțele, piața, provocări pentru ameliorare în țări cultivatoare și consumatoare de Phaseolus aureus. Adiacent, vor fi prezentate condițiile pedoclimatice ale zonei Moldovei și implicit posibilitatea speciei de a fi cultivată în acest habitat.*

Cuvinte cheie: pretabilitate, rusticitate, resurse genetice

INTRODUCTION

Phaseolus aureus, also known as *Vigna radiata* it is known worldwide and cultivated especially in the United States, Australia, India, Pakistan where is it appreciated for human consumption, which creates prerequisites researchers to study different aspects species: adaptability, resistance pathogen attack, the quantity and quality of the harvest.

MATERIAL AND METHOD

The study was carried out in Bacau at the VRDS Bacau. The biological material: *Phaseolus aureus* species. The paper presents a literature review on that species, as a documentation of this species regarding the possibilities for cultivation in North East part of Moldova. The main items analyzed are special requirements for the environment, cultural practices, production and performance.

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RESULTS AND DISCUSSIONS

Temperature. Mungbeans are a warm season crop requiring 90–120 days of frost-free conditions from planting to maturity, depends on variety (Oplinger 1990).

Water. High humidity and excess rainfall late in the season can result in disease problems and harvesting losses due to delayed maturity. Adequate rainfall is required from flowering to late pod fill in order to ensure good yield.

Soil. Mungbeans do best on fertile sandy, loam soils with good internal drainage. They do poorly on heavy clay soils with poor drainage. Performance is best on soils with a pH between 6.2 and 7.2 and plants can show severe iron chlorosis symptoms and certain micronutrient deficiencies on soils that are more alkaline. Mungbean has phosphorus, potassium, calcium, magnesium and sulfur requirements similar to other legumes, which must be meet by fertilizer additions if the soil is deficient in these elements. Mungbean is cultivated on relatively light soils, which are considered marginal for cultivation of other crops.

Light. Mungbeans are responsive to length of daylight so short days hasten flowering and long days delay it (Khattak G, 2006). Varieties differ in their photoperiod response. The photoperiod sensitive: "Desi moong" varieties were low yielding (250-500 kg/ha), asynchronous, and late maturing (95-115 days). They had spreading growth, small pods (5-6 cm) and small seed size (20-25 g/1000 seeds). The color of seed was usually green, either dull or shiny. Strong response of these varieties to length day forced farmers to postpone their sowing, which delayed the sowing of the following wheat crop. They were susceptible to both mungbean yellow mosaic virus (MYMV) and cercospora leaf spot (CLS) disease. The photoperiod insensitive: Desi varieties gave relatively better yield (400-600 kg/ha). They had erect growth habit and took 90-95 days to mature in summer (kharif) and about 80 days when sown in spring. They had comparatively bigger pods (7-8 cm) and medium size seed (25-30 g 1000 seeds) with a green, but dull seed coat. They were, for the most part, also susceptible to *MYMV* and CLS. Long-duration and unsynchronized maturity created strong competition with other crops for land and labor. Susceptibility to diseases made a risky crop, and its dull color made it unattractive to consumers.

Available material: All over of the world the varieties of *Phaseolus aureus* are grouped and cultivated after different criteria. Mungbeans (if proper varieties are used) are adapted to the same climatic areas as soybean, drybean and cowpea. Using criteria of variety G.M Popova established three varieties of *Phaseolus aureus* (Olaru, 1982). *Indicus* variety – very common in India, the plants are erect, rarely lying port. The pods are thin 0.25-0.4 cm width and short 4-6 cm length. Seeds are small, with late maturity. *Chinensis* variety - common in China - plants of this variety are lying bush. The pods are 0.5-0.8 cm width and 8-15 cm length. The seeds are bigger than seeds of indicus variety and the maturity is early. *Iranicus* variety – common in Iran, plants of this variety shows peak wrapped. The pods are middle 7-8 cm length, 0.5-0.8 cm width. The maturity is middle. Analyzing these varieties we observed significant differences regarding port of the plant, color and size of pods and seeds, maturity. Using criteria of responsive to length of daylight: the photoperiod sensitive varieties and the photoperiod insensitive varieties. All over the world, thousands of experimental lines of mungbean

have been tested. Much of this testing and research has been coordinated with the Asian Vegetable Research and Development Center in Taiwan, which is the international center responsible for mungbean research worldwide. According Official Catalogue of Varieties of Crop Plants in Romania – full edition 2011 in Romania there are any varieties of *Phaseoulus aureus* cultivated in Romania. This was the reason for what at Vegetable Research and Development Station we started a collection process of *Phaseolus aureus* varieties. All collected material was analyzed, described, coded, labeled, and placed in our gene bank (VRDS Bacau). The collection process represent a starting point in a project aimed to establish the suitability of the species for cultivation in North East of Moldova area, and also the right moment for planting, the most appropriate density and to establish some physiological index of *Phaseolus aureus.*

Features cultivation In order to establish the most conducive method of cultivation in climatic conditions of Romania, Moldova area, we analyzed different ways successfully applied in countries with a tradition of cultivating the species *Phaseolus aureus*. Because the seed is small, careful handling and attention to planting machinery adjustments is necessary to ensure planting with little damage to the seed. The production is negatively affected by use of mixing seed of different varieties. If mungbean is being planted in a field for the first time the proper nitrogen fixing bacteria must be provided. The inoculants can be applied to the seed just before planting or applied in the furrow in peat or granular form. Care must be taken to distribute inoculants uniformly in the field. It is recommended to use the bacteria that are specific for mungbean or closely related species. Only certified seed should be use so that quality and variety purity are guarantee. The soil should be tile to remove weeds and to prepare a seedbed, which will provide good seed-soil contact. The final seedbed needs to firm with a surface free of clods and debris to allow a good distribution of seeds.

According with **climate condition**:

In USA in Wisconsin and Minnesota climate conditions mungbean should be planted between May 15 and June 6 like the other legumes (field bean, adzuki, cowpea) which are being grown as the major crop on the field. Too late a planting date results in bloom and pod fill during the hottest, driest period of the summer. In some areas, mungbean is planted as a second crop after the small grain is harvested. If this is done, planting should occur immediately after the grain harvest with a minimal disturbance of the seedbed. It is doubtful that the growing season would be long enough to plant after small grain harvest. There are two main planting windows for mungbean in Australian climate condition:

-Spring planted mungbean can produce reasonable yields if specific attention is paid to: stored soil moisture levels at planting, management of trips on seedling plants, special care at flowering moment, desiccation prior to harvest, increased weed pressure. The most consistent results with spring plantings have been achieved with late September/early October plantings in situations with at least 90 cm of stored soil water. Late October/November plantings are considered a riskier proposition in western areas because of the increased risk of experiencing dry, heat wave conditions on the emerging seedlings and on plants at flowering.

-Late planting varieties are preferred for late plantings because they have a degree of resistance to powdery mildew. Late planting can result in lower yields, as the crop often flowers around 35 days after planting, and the small plants fail to achieve canopy closure. If planting on narrower rows, increase the seeding rate by 5 kg/ha for plantings made after mid-January. This helps compensate for smaller plant size.

In Pakistan *Phaseolus aureus* is cultivated in two cropping seasons (Mubarik Ali 2009): The summer season from May to October is called kharif season and crops grown in this season are named kharif crops. The dry winter season from November to April is called rabi season and the crops cultivated in this season are called rabi crops. The proportion of mungbean in the total cropped (kharif and rabi season) area in the major growing districts ranged from 24% to 33%.

The American technologies recommends: planting equipment for soybean, field bean, adzuki and cowpea can be used to plant mungbean but careful adjustments must be made to properly deliver and distribute the very small seed (2700–5500 seeds/kg). In 30" rows, the recommended planting rate is 9 seeds/30.5 cm; in 20" rows 6 seeds/30.5 cm; and in 6"–10" rows 2–3 seeds/30.5 cm. Populations of 300.000–400.000 plants per ha will be achieved with these rates. Because of possible weed outbreaks with early season planting and the need for cultivation to control them, row spacing of 20"–30" are recommended. In later plantings or planting as a second crop the narrow rows will produce higher yields.

The Australian technology recommends two type of system culture: dry land - target population of 200.000–300.000 plants/ha and irrigated - target population of 300.000–400.000 plants/ha. Mungbeans require phosphorus, potassium and certain micronutrients at levels similar to other field beans. Like the other legumes most of the nutrient uptake occurs later in the season so starter fertilizers have not been very helpful. (Jayne Gentry, 2010)

Weed Control: Broadleaf weed control options are very limited in mungbeans, and growers should plan a weed strategy prior to planting. Mungbean seed lots containing weed seeds can be difficult to sell, and can incur substantial discounts. The weed control can be realized mechanical and chemical.

Diseases and control: Proper rotation, tillage practices, and water management (if under irrigation) can be effective in reducing the impact of these diseases. Mungbeans are susceptible to the usual array of pathogens, which attack other legumes.

Predators and their control: In US mungbeans do not generally require insecticide sprays to control problems in the field. Seed corn maggot and wireworms could attack seeds in the early germination period and reduce stand under certain conditions. Occasional grasshopper or caterpillar infestation could occur and result in defoliation. Mungbeans are no more affected by insect problems than the other legumes. Weevils can attack the seed in storage. In Australia insects can significantly affect the overall profitability of a mungbean crop, reducing both yield and seed quality. Accordingly, insect damage is one of the main reasons for downgrading mungbeans. Crops should be inspected regularly (weekly) from the vegetative stage through to budding, and twice weekly from the start of budding-flowering through to the completion of pod fill. Crops that are producing buds, but not flowers, may contain

damaging levels of sucking insects, causing the buds to abort before the flowers open. Mungbeans can compensate for early damage by setting new buds and pods but this may result in uneven maturity. Excessive early damage can delay harvest.

Harvesting: Mungbeans has indeterminate flowering habit. This means that they do not have a defined flowering period and will continue to flower as long as they have adequate soil moisture. Consequently, they can have flowers, green pods and black pods present on the plant at the same time. This growth habit can make the harvesting decision difficult. The ideal stage for harvest to maximize yield and quality is when the majority of pods are physiologically mature, and 90% of the pods have turned either yellow or black. At this stage, the crop should be considered ready for desiccation and harvest. The key point when desiccating mungbeans is the use of a robust rate of glyphosate and allowing sufficient time for the crop to dry down before commencing harvest. There is a tendency to harvest too soon after desiccation. The rate of dry-down of the crop will depend on: choice of desiccant, rate used, temperature and moisture conditions. Depending on used product for desiccation as it can be seen in table 1 the waiting time for maximum dry down of leaf and stem moisture, vary from 5 – 6 days to 7 – 16 days. Mungbeans at about 12% moisture can then be stored in regular grain bins previously fumigated to control bean weevils. If mungbeans are higher in moisture then 12% they can be dried slightly by moving unheated air though thin layers until they are near the 12% value. Because they will be sprouted and eaten direct, care should be taken to keep all possible contaminants away from the storage area.

Table 1

Products for desiccating mungbeans

(processing after - Mung bean management guide – 2 nd edition)

Active ingrdient	Example trade name	Rate (L/ha)	Days to maximum dessication	Withholding period (WHP)
Diquat	Reglone	2.0-3.0	5-6	0
Gliphosate	Roundop Power Max	various	7-16	7

Production and performance - Mungbean production in Australia varies between 30.000 and 60.000 tons per year. Nearly all (95%) of the Australian mungbean crop is bagged, containerized and exported. All stages of crop production and processing have to comply with strict hygiene practices to ensure the crop meets the highest standards for food safety and hygiene. Yield potential in Australia depending on system culture is dry land double crop 0.25–1.25 t/ha, dry land winter fallow 0.75–2.0 t/ha, in condition of irrigation 1.25–2.75 t/ha. Grading losses will usually reduce marketable yields by 5–20%.

CONCLUSIONS

Our bibliographical study relives the high potential of *Phaseolus aureus* species for cultivation in North East part of Moldova area. The placement of our experimental lands assures the mungbeans requirements for:

Temperature - mungbeans are a warm season crop requiring 90–120 days of frost-free conditions from planting to maturity. If we choose the planting time to be May, we obtain a proper period for mungbean cultivation. The period is similar with the one for *Phaseolus vulgaris* traditionally cultivated species in our area.

Soil - we can assure relatively light soils for *Phaseolus aureus* culture.

Studying the climate condition regarding rainfall, the adequate rainfall can be assured from flowering to late pod fill in order to obtain a good yield. If the possibility of drought appears, the lack of the water can be substituted by our irrigation system.

Comparing with other culture practices, we should use the same cultural practices as for green bush beans, except the harvest moment and technologies.

Culture of the species *Phaseolus aureus* may contribute to the development and diversification of agricultural production, the range of foodstuffs in general and the development of sustainable agriculture, for which to aim and the Romanian agriculture in the context of European and world agriculture.

For obtaining a proper yield there are some recommendations ask to be respected:

-Use of approved seed or, if using grower-retained seed, test before planting and replace every three years – (it is practically impossible to find the certified material in Romania from autochthon production since there are not any varieties cultivated).

-Avoid paddocks with major variations in soil type or unevenness. Assess weed status of the paddock (broadleaf weed control options are limited). Fertilize according to paddock history (especially after a long fallow) and soil test analysis.

-Be aware of any residual herbicide risks.

-Stay within recommended planting windows.

-Use effective inoculation.

-Monitor disease status in crop and timely insect control, check crops every week during vegetative stages and at least twice weekly from budding through to pod fill.

-Use effective desiccation before harvest.

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