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Selection of Initial Material Based on Phenological Observation Results of Mung Bean Varieties Chosen from the Collection Nursery Rice Research Institute

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Abstract: This article provides information on the selection of initial materials from a mung bean collection comprising varieties from the Philippines, India, Vietnam, and China. Based on phenological observations, varieties with high yield potential, early maturity, and resistance to diseases and pests were identified for further use in breeding programs.

Keywords: Phenological observation, mung bean collection, yield indicators, early maturity, initial source.

Introduction

It is well known that obtaining high-quality and abundant yields from agricultural crops and fully meeting the population's demand for agricultural products are among the main responsibilities of specialists in this field. There are essentially two main approaches to achieving this goal. The first is to develop the necessary agrotechnical measures for each crop variety; the second is to create new high-yielding and adaptable varieties using breeding methods. This complex task is carried out by the science of plant breeding. The primary objective of breeding is to create new varieties (hybrids) of crops. To date, scientists at the Rice Research Institute have developed several new varieties of mung bean—a leguminous crop—many of which have already been widely introduced into production.

Currently, great attention is being paid in our country to the cultivation of leguminous, grain, and oilseed crops, with their planting areas expanding year by year. Significant opportunities are being created to develop agriculture and use land resources efficiently. One of the most pressing global issues today is the protein problem—that is, meeting humanity's demand for protein. This issue can primarily be addressed through protein-rich leguminous crops among agricultural plants. Mung bean is one such crop, and it plays an important role in solving this problem.

As the population of our country continues to grow, so does the demand for leguminous products. Therefore, the production of agricultural and food products is becoming increasingly important. In order to increase the production of livestock and poultry by providing essential and high-value feed, it is necessary to develop technologies for obtaining high and abundant yields of mung bean. This, in turn, supports the advancement of breeding and seed production efforts.

In accordance with the Decree of the President of the Republic of Uzbekistan No. PF-5853 dated October 23, 2020, "On the Approval of the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020–2030," as well as other relevant regulatory and legal

documents, tasks have been defined for ensuring food security, developing high-yielding and high-quality crop varieties, organizing primary seed production, and improving cultivation agro-technologies. This research serves, to a certain extent, in the implementation of those strategic goals.

The promising mung bean variety "Zamin" was developed at the Rice Research Institute. **General characteristics:** The variety is early-maturing and yields 3.2 centners per hectare more than the control variety. It has an upright stem structure. The position of the lowest pod is 7–10 cm above the ground. Each plant forms 55–65 pods. The pods are slightly curved and contain an average of 8–10 seeds. The seeds are shiny, green, and round in shape.

Sowing period: Seeds are sown as a main crop during the first to third ten-day periods of May, and as a secondary crop during the first to third ten-day periods of June.

Seeding Rate: 14–16 kg/ha at a depth of 3–4 cm.

Irrigation Norms: When sown in early April, the seeds germinate well in moist soil. In case of drought, the field should be irrigated before sowing. During the growing period, irrigation is applied 1–2 times.

Inter-row Cultivation: During the growing season, the field is hoed 2–3 times and cultivated twice.
The variety was developed in 2024.

Mung bean (*Phaseolus aureus*) is mainly used as a food product in Central Asia and the Transcaucasian countries. Both the green stems and dried stalks of mung bean are considered nutritious fodder for animals. Mung bean can be intercropped with maize to produce protein-rich green fodder and silage. The seeds contain 25–27% protein. Until 1989, mung bean cultivation in our country was limited to household gardens, but since 1989, it has been grown on a planned basis as a secondary crop. In 2022, a total of 257,196 hectares were planted with mung bean in our country, including 19,351 hectares as secondary crops and 9,307 hectares planted in orchard and vineyard inter-rows.

Materials and Methods:

In this study, mung bean varieties from the collection available at the Rice Research Institute were selected and planted in a collection nursery, where phenological observations were conducted. Phenological observations, field and laboratory analyses were carried out using the methodology of the All-Russian Research Institute of Plant Industry (1984). Research results and variance statistical analyses were performed based on the methods of O. Rebrova and B. Dospekhov.

It is advisable to involve forms with complex traits to develop high-yielding mung bean varieties and to develop their intensive agro-technology. In Uzbekistan, a pressing issue in mung bean breeding is to select and create varieties suitable for intensive technology and adapted to the soil and climatic conditions of all regions of the republic, and to introduce them into production. The most important tasks in mung bean breeding include identifying disease- and pest-resistant initial sources and using them in hybridization, selecting high-yielding, disease- and pest-resistant varieties introduced from abroad and adapting them to local climatic conditions, and based on these, creating soybean varieties with valuable biological and economic traits that are suitable for both primary and secondary cropping. These tasks are among the key responsibilities of breeder scientists.

Increasing the yield of mung bean is mainly carried out by introducing new high-yielding promising varieties along with the local climate-adapted ones. The selection of the variety depends on the biology of the variety at each growth stage. The above challenges are addressed by creating early, medium, and late maturing varieties with different growth periods.

In mung bean cultivation, along with agrotechnical measures, it is possible to create new promising varieties by applying breeding and seed production achievements.

Analysis and Results:

Research on mung bean varieties was conducted on a total of 170 local and foreign varieties in the collection nursery. The "Radost" variety was planted as a control after every 10 samples to compare and study the planted varieties. During the plant growth period, all phenological observations were carried out by the variety testing commission based on the developed guidelines. This included recording the stages of emergence, branching, flowering, pod formation, and ripening. For biometric analysis during the ripening phase, 5 plants from each variety sample were taken and analyzed. This analysis determined the growth period, plant height, lower pod placement, number of branches, number of pods per plant, seed weight per plant, and 1000-seed weight of each variety.

Based on valuable economic traits, 9 varieties with the highest performance were selected and their economic indicators were identified. Their full description is presented in Table 1.

The growth period of the selected varieties in the collection nursery was as follows: the control variety “Radost” ripened in 100 days. The selected samples had a shorter growth period compared to the control, ripening between 75 and 86 days. Regarding plant height, the control variety averaged 65.6 cm, while the selected samples ranged from 15 cm to 58 cm higher, with one sample 5 cm shorter. For lower pod placement, the control variety was at 10.0 cm, with six samples having placement 1.2–12.4 cm higher, two samples 2–2.6 cm lower, and one sample equal to the control.

The number of pods per plant was 50 in the control variety, while the selected samples ranged from 40 to 57.2 pods, indicating higher productivity. In terms of seed weight per plant (yield), the control variety produced 8.2 grams, while the selected samples had 0.4–2 grams more, indicating higher yield potential compared to the control. The 1000-seed weight of the control variety was 43.9 grams; one sample was 8.2 grams lower, while all other samples were 0.8–15.4 grams higher. The highest value was found in sample K-863 with 59.3 grams.

These selected samples will serve as a basis for creating new varieties in the future.

Table 1 Description of selected samples from the collection nursery of mash. 2024

№	Catalog number	Origin	Growing season, days	Plant height, cm	Lower leg position	Quantity, pcs.		Weight, g		Stem shape
						bough	Number of pods per plant	Grain weight per plant	1000 grain weight	
St	Radost	Uzbekiston	100	65,6	10,0	3,6	50,0	8,2	43,9	Prostrate
1	567960	Filippin	75	82,0	14,2	3,2	107,2	8,8	46,8	Prostrate
2	522773	Hindiston	79	81,6	8,8	5,6	100,0	8,7	50,5	Prostrate
3	567940	Vetnam	80	60,6	10,0	4,0	105,0	9,3	35,7	Prostrate
4	VIR K-386	Vetnam	81	150,0	21,0	5,4	103,2	9,8	54,2	Upright
5	264	Uzbekiston	81	120,2	22,4	4,2	97,8	9,1	54,3	Upright
6	103	Xitoy	83	102,0	7,4	3,8	97,5	10,0	44,7	Upright
7	K-863	Tojigiston	84	101,0	12,4	4,2	95,6	10,2	59,3	Prostrate
8	K-790	Uzbekiston	85	80,6	11,2	3,4	95,0	8,6	44,8	Prostrate
9	12400	Vetnam	86	123,6	13,0	5,6	90,0	9,8	45,2	Prostrate

Conclusion. Almost all samples of the varieties studied in the collection nursery showed a higher indicator in terms of early maturity than the control. As the earliest, two samples, namely 567960 Philippine sample 75 days and 522773 Indian sample 79 days, can be selected as the starting material for selection work aimed at early maturity.

If we recommend four samples for selection work aimed at yield, namely, in terms of the number of pods per plant, 567960 Philippine sample 107 pieces, 522773 Indian sample 100 pieces, 567940 Vietnamese sample 105 pieces, and VIR K-386 Vietnamese sample 103 pieces showed an equally high indicator in terms of the control.

In terms of grain weight per plant, the Chinese sample No. 103 showed 10 g, the Tajik sample K-863 showed 10.2 g, the VIR K-386 sample showed 9.8 g, and the Vietnamese sample 12400 also showed 9.8 g.

The highest 1000-seed weight was shown by the K-863 Tajik sample with 59.3 g, the VIR K-386 Vietnamese sample with 54.2 g, and the Indian sample with 522773 with 50.5 g.

These studied collections were selected for planting and cross-breeding in hybrid and selection nurseries next year.

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