

Short Communication

Effect of pod maturity on seed quality parameters of green gram (*Vigna radiata*) seeds

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ABSTRACT

The study was conducted on two mungbean varieties MH 1142 and MH 421 during Kharif 2023 to assess the effect of pod maturity on seed quality parameters of green gram (*Vigna radiata*) seeds. The results revealed that 42.88 g and 32.76 g test weight was observed in the MH 421 variety in the seeds extracted from mature and green (immature) pods respectively. In Variety MH 1142, the test weight was 40.51 g in seeds of matured pods and 20.83 in seeds of green pods. The germination of seeds extracted from mature pods was less (80.50%) than the seeds of green pods (88.00%) in MH 421 but germination of seeds extracted from matured pods was (88.00%) found at par with seeds of green pods (87.50%) in variety MH 1142. Seedling length was 38.93 cm and 31.67 cm in variety MH 421 while it was 40.03 and 33.60 cm in variety MH 1142 in seeds of matured pods and green (immature) pods respectively. Similarly, seedling dry weight was 0.241 mg and 0.172 mg in variety MH 421 and 0.223 mg and 0.122 mg in variety MH 1142 in seeds of mature pods and green pods respectively. It is concluded from the study that there is no difference in germination of seeds extracted from mature pods and green seeds, hence harvesting can be done when the plant bears the maximum number of mature pods.

Key words: Green gram, Indeterminate growth, Immature pods, Germination

Mungbean (*Vigna radiata* L.), a member of the Fabaceae or Leguminosae family and commonly referred to as green gram, is an age-old and widely recognized leguminous crop in Asia. It has a particularly prominent status in the Indian subcontinent and plays a substantial role in India's pulse crop production, accounting for 45 percent of the global output. It is primarily cultivated in states such as Rajasthan, Maharashtra, Andhra Pradesh, Orissa, Karnataka, Bihar, Madhya Pradesh, and Uttar Pradesh. The cultivation takes place during both the Kharif and spring seasons due to its short growth cycle and insensitivity to photoperiod. Mungbean exhibits indeterminate plant growth, resulting in multiple rounds of flowering and uneven pod maturation. Consequently, the necessity for additional rounds of picking becomes imperative to achieve a standard yield. This characteristic, which is negatively correlated, imposes an economic burden on farmers due to the increased production costs associated with mungbean cultivation. Furthermore, apart from reducing the yield, the lack of synchronization in pod maturation presents a significant challenge, requiring labour-intensive

and costly hand-picking practices. Notably, statistics indicate that approximately 65% of pods can be harvested during the initial picking at 70-75 days after sowing (DAS), followed by 18% during the second picking at 75-80 DAS, and 17% during the third picking at 90-95 DAS (Rahman, 1991). The maturity of pods at the time of harvesting can significantly impact the quality of green gram seeds and subsequent germination and seedling growth. Seeds from mature pods generally exhibit better germination rates, higher viability, greater vigour, and improved uniformity of germination. Due to the frequently excessive moisture content of seeds at physiological maturity, additional desiccation is required before direct harvesting and threshing by mechanical means can take place. Harvest maturity is determined as the initial point at which the moisture content of the seeds decreases to a level suitable for harvest, particularly in crops collected as dry seeds and/or fruits (TeKrony and Egli, 1997). If possible, it's advisable to prioritize harvesting mature pods to obtain high-quality seeds with the best chances of successful germination and healthy plant establishment. Attaining the highest seed

viability and vigour is contingent upon harvesting seeds at the precise stage of maturity. Delayed harvesting may result in declining seed quality, influenced by unfavorable environmental conditions such as elevated temperatures, increased humidity, rainfall, excessive drying, susceptibility to diseases and pests, as well as potential damage caused by birds and animals (Copeland and McDonald, 1995). The maturity of pods can influence the rate at which seeds within them germinate. Generally, mature pods contain fully developed and viable seeds with a higher germination potential compared to seeds from immature pods. The germination, survival, and growth of seedlings are predominantly influenced by the seed's food reserve, which correlates with its test weight (Tripathi and Khan, 1990; Khan and Shankar, 2001). However, conflicting findings exist regarding interspecific variation in seed weight and germination behavior. The harvest time's maturity stage stands out as a crucial factors affecting seed quality. Recent research has confirmed that both seed vigour and longevity exhibit ongoing improvement beyond physiological maturity. This underscores the significance of the late maturation phase in optimizing seed quality. Farmers often grapple with uncertainty regarding the optimal time to harvest their crops due to uneven maturity. While a significant number of pods reach maturity, some remain green. The dilemma arises as to whether farmers should await the ripening of the green pods or if harvesting them in their current state is a viable option. This study aims to evaluate the impact of pod maturity on seed quality parameters and determine the economically optimal stage for harvesting, providing valuable insights for farmers.

The present study was conducted on two mungbean varieties MH 1142 and MH 421 seeds produced during *Kharif* 2023 at the breeder seed farm of the Department of Seed Science and Technology, CCS Haryana Agricultural University, Hisar. Fully matured pods (Dark brown/black colour) and green immature pods of both varieties were harvested separately from the same plants and seeds were extracted from the pods after drying (Figure 1). The green pods were at the physiological maturity stage having a moisture content 20 ± 2 %, which was estimated through hot air oven method (ISTA, 2019). The seeds were evaluated for following seed quality parameters- germination (%), seedling length (cm), seedling dry weight (mg), vigour index-I, vigour index-II, test weight (g). The germination test was conducted using a total of 400 seeds, which were divided into four

sets and each set had 100 seeds. These seeds were placed on germination papers (BP), appropriately moistened, and placed inside a seed germinator set at a temperature of 25 °C, maintaining a relative humidity of 90-95% (ISTA, 2019). The seeds which did not absorb water and were found as such at the end of the test were considered as hard seeds. After eight days, the seedlings were assessed. The length of ten randomly chosen seedlings was measured to determine the average seedling length in centimeters. The same ten seedlings from each treatment (which were used for measuring seedling length), replicated four times were dried in a hot air oven at a temperature of 80 ± 1 °C for 24 hours. Once dried, the seedlings from each replication were weighed, and the average dry weight of seedlings for each genotype was calculated. Seedling vigour indices were calculated according to the method suggested by Abdul-Baki and Anderson (1973):

$$\text{Vigour index-I} = \text{Standard Germination (\%)} \times \text{Average seedling length (cm)}$$

$$\text{Vigour index-II} = \text{Standard Germination (\%)} \times \text{Average seedling dry weight (mg)}$$

Test weight was calculated by counting one thousand seeds in four replications, weighed and average seed weight of each variety and each lot was calculated (Figure 1). The experiment followed a factorial completely randomized design for laboratory parameters, in line with the standard method recommended by Panse and Sukhatme (1985). The collected data were then analyzed using an online statistical tool (Sheoran, 2010).

The results revealed no significant difference in the germination percentage of seeds extracted from mature pods and seeds extracted from green (immature) pods in both varieties. However, other seed quality parameters such as test weight, seedling

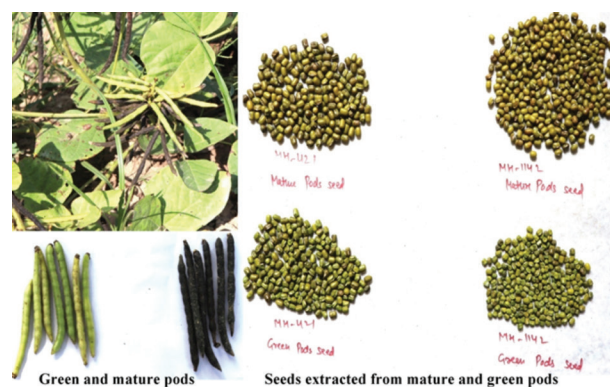


Figure 1: Green gram plant having mature and green pods and extracted seeds

Table 1. Effect of pod maturity on seed quality parameters of mungbean crop

Variety	Test weight (g)		Germination (%)		Seedling length (cm)		Seedling dry weight (mg)		Vigour Index-I		Vigour Index-II	
	Mature pods	Green pods	Mature pods	Green pods	Mature pods	Green pods	Mature pods	Green pods	Mature pods	Green pods	Mature pods	Green pods
M H 421	42.88	32.76	80.50	88.00	38.93	31.67	0.241	0.172	3125	2788	19.37	15.10
MH 1142	40.51	20.83	88.00	87.50	40.03	33.60	0.223	0.122	3873	2938	19.62	10.65
SE ±(m)	V=0.62, M=0.62, VxM=0.88		V=0.63, M=0.63, VxM=0.89		V=0.77, M=0.77, VxM=1.09		V=0.01, M=0.01, VxM=0.008		V=45.3, M=45.3, VxM=64.1		V=0.45, M=0.45, VxM=0.63	
CD (P = 0.05)	V=1.94, M=1.94, VxM=2.74		V=196, M=1.96, VxM=2.77		V=2.40, M=2.40, VxM=N.S.		V=0.02, M=0.02, VxM=N.S.		V=141, M=141, VxM=199		V=1.39, M=1.39, VxM=1.96	

Where V=Varieties, M= Maturity stages (Mature and Green pods)

length, and seedling dry weight and vigour indices were found superior in the seeds extracted from mature pods. The test weight of the seeds extracted from matured pods was observed 42.88 g while it was 32.76 g in the seeds extracted from green (immature pods) in the MH 421 variety. In variety MH 1142, the test weight was 40.51 g in seeds of matured pods and 20.83 in seeds of green pods. Although the test weight of the MH 421 variety was more as compared with MH 1142 as MH 421 is a large-seeded variety. However, seedling length was higher in MH 1142 which indicated that seed size does not affect seed germination and seedling length. Both supportive and opposite results have been reported by different scientists for test weight and germination. Some studies suggest that large seeds may exhibit higher germination percentages compared to small seeds (Tripathi and Khan, 1990; Bhuyan *et al.*, 2000; Khan and Shanker, 2001), while others proposed higher germination percentages in small seeds. Alternatively, germination may be independent of seed size (Gross and Kromer, 1986; Perez-Garcia *et al.*, 1995). Within a species, there are also contrasting observations, with heavier seeds potentially germinating more quickly than lighter ones (Barik *et al.*, 1996), seeds with less test weight germinating earlier than their heavier counterparts (Murali, 1997; Khan *et al.*, 1999), or germination time remaining unrelated to seed weight (Perez-Garcia *et al.*, 1995). The germination of seeds extracted from mature pods was less (80.50%) than the seeds of green pods (88.00%) but germination of seeds extracted from matured pods was (88.00%) found at par with seeds of green pods (87.50%) in variety MH 1142. The result is supported by Meena *et al.* (1994) who reported that seeds exhibit maximum vigour and viability at the time of physiological maturity. Subsequently, they undergo a gradual aging process, leading to a decline in both viability and vigour. Prasath *et al.* (2021) also reported similar results in horse gram and reported that the seeds reached

their peak in germination at 94% dry weight at 0.859 g/25 seeds, and vigour parameters, including root length (17.7 cm), shoot length (8.8 cm), dry matter production (0.161 g/10 seedlings), vigour index I (2491), and vigour index II (15). Yadav *et al.* (2020) also supported the results and reported that seeds achieved their maximum weight, germination rate, seedling length, vigour index, and field emergence either when harvested at approximately 20 % seed moisture content or 19 days after flowering in mung bean. The seedling length was 38.93 cm and 31.67 cm in variety MH 421 while it was 40.03 and 33.60 cm in variety MH 1142 when studying the seeds of matured pods and green (immature) pods, respectively. Similarly, seedling dry weight was 0.241 mg and 0.172 mg in variety MH 421 and 0.223 mg and 0.122 mg in variety MH 1142 when studying seeds of mature pods and green pods, respectively. Vigour index-I was recorded at 3125 and 2788 in the MH 421 variety and 3873 and 2938 in the MH 1142 variety when studying the seeds of mature and green pods, respectively. Vigour index-II was 19.37 and 15.10 in the MH 421 variety and 19.62 and 10.65 in the MH 1142 variety when studying mature and green pods, respectively.

It is concluded from the present study that variety MH 421 is a more vigorous variety than MH 1142 and hence can be used in further breeding programmes. The best option in mungbean is to harvest the matured pods but it will increase labour resulting in more cost of production, although there is no difference in the germination of seeds extracted from mature pods and green seeds, hence harvesting can be done when the plant bears the maximum number of mature pods.

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