

## GERMINATION OF BLACK GRAM (*VIGNA MUNGO* L.) SEED IS INFLUENCED BY DIFFERENT STORAGE CONTAINERS AND STORAGE PERIODS

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**ABSTRACT.** A laboratory test was carried out to examine the influence of various storage containers and periods on the germination percentage of black gram seed. In this research, three seed containers, *viz.* sealed tin container, poly bag and gunny bag were used to store the seeds, as well as seeds were stored for three different storage periods, *viz.* 15, 30 and 45 days and thereby conducted germination tests. The results revealed that storage and storage periods considerably influenced the germination percentage (GP) of black gram seed. The highest GP of 87.73% was found in the seeds stored at sealed tin container, while the lowest GP (71.08%) was observed in the seeds stored in gunny bag. Among the three

storage containers, the GP reduced rapidly in the seeds stored in gunny bags (6.52%), followed by poly bag (18.98%). The maximum values of GP (85.43%) of black gram seed were recorded when 15 days after storage (DAS), whereas the lowest GP (68.33%) was at 45 DAS, and the GP decreased noticeably with the increase of storage periods from 15 to 30 and to 45 DAS. In combination influence of storage containers and storage periods, the maximum GP (85.90%) was recorded at when seeds kept in sealed tin container with stored for the shortest duration (15 DAS), while the minimum (58.11%) was recorded in the seeds stored in gunny bag for the longest period with 45 DAS. Seeds stored in

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the sealed tin containers exhibited an excellent performance regarding GP with the shortest storage periods and, thereby, black gram should be kept in sealed tin containers or like this air tight containers for storage, as well as seeds should be sun dried after a short period for maintaining seed quality.

**Keywords:** *Vigna mungo*; seed storing pots; seed storage duration; germinability.

## INTRODUCTION

Pulse crops (Legumes) belonging to the family *Leguminosae* and the legumes are the second in agricultural importance based on area harvested and total production in Bangladesh. Pulses are considered as poor man's meat due to their easy and cheapest source of protein in the South Asian countries. It is easily digestible, good for all age groups and does not have any adverse effect on known diseases. The soup is widely known as *Dal* in south Asian countries, including Bangladesh. At present, the agricultural land is decreasing day by day with increasing population of Bangladesh, so it is necessary to provide more food from our limited or confined land (Islam *et al.*, 2017a).

Black gram (*Vigna mungo* L.) is one of the most important pulse crops next to chickpea, lentil and mungbean both in area and production (AIS, 2017). Black gram is important legume crop characterized by a relative high content of protein (25.67%), carbohydrates (5.4%), fat (1-3%), fibers (3.5-4.5%) and ash (4.5-5.5%), while calcium and

phosphorus are 132 and 367 mg per 100 g of seed, respectively (Ahmad *et al.*, 2008). The area under black gram has gone down due to its lower yield, which is responsible to scarcity of quality seed among the many factors. In order to maintain increased productivity, seed quality should be maintained properly. Seed storage is an important factor on which the seed qualities greatly depend. Without proper storage seed quality degraded rapidly with absorbing moisture from the surrounding environment, which invites different diseases. Different phytopathogenic seed borne diseases are responsible for disease development, which attacks the plants during seedling stage to maturity.

Black gram is grown the *Rabi* season in Bangladesh and harvested seeds are stored for at least 8-9 months before planting in the next season. Through this period, seeds tend to lose their viability due to the impact high and low temperature, relative humidity (moisture), pathogens, insects etc. All crops contain higher moisture at the harvesting stage. The amount of moisture they contain is of little consequence if the crop is to be consumed immediately after harvest. But, if the crop is to be stored for long time, it is essential to reduce its moisture rate, so that it does not exceed certain well determined limits.

The proper storage of seed is a very important factor to the proper production of seed or crop. Maintenance of high seed germination and vigour of seed from harvesting to

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sowing is the purpose of good storage of seed. Adequate provisions and facilities for storage are, therefore, important components of seed production programme in all climatic regions.

Storage is a part of food production system consisting of two subsystems crop production and post-harvest operations. The reduction in post-harvest losses depends on the proper threshing, cleaning, drying and storage of the crops. A reduction in crop loss at one stage may have a far-reaching effect on the overall reduction of the loss. This suggests that a system approach is essential for increasing the efficiency of food production system. This implies that considerable emphasis should be given not only on crop production, but also on drying and storage process. The current experiment was aim to find out the influence of different types of storage containers and duration of storage on germination of black gram seed.

### MATERIALS AND METHODS

#### Experimental cite

An experiment was conducted at Department of Agronomy, Hajee Mohammad Danesh Science and Technology University (HSTU) Dinajpur, Bangladesh, during 25 March to 10 June, 2016.

#### Treatments

The following treatments consisting two factorial experiments are used in the experiment:

Factor A: Three storage container: *viz.* i) Sealed tin container, ii) Polythelene bag, and iii) Gunny bags; Factor B: Three storage periods: *viz.* i) 15 DAS (days after storage), ii) 30 DAS, and iii) 45 DAS.

#### Experimental design

The experiment was arranged with completely randomized design (CRD) with five replications.

#### Experimentation

The sand was collected from the Agronomy Lab. 2, HSTU, Dinajpur, and sun dried. The tray was then filled up with the dried sand @ 3 kg/tray. A total of 45 trays were filled with the soil. Four hundred seeds at every sampling time in five replications were implemented for three storage containers to manage this germination test. Seeds per tray were sown in equal distances and 1.5 cm depth in the sand, which was moistened whenever necessary. Careful consideration was manage for normal seedlings at each replicate of 80 seeds and removed, counted and documented. Before storing the initial germination percentages of seeds were recorded.

#### Data collection

Germination was counted at daily interval and continued up to 10<sup>th</sup> day (240 h). About 2 mm long plumule and radicle size can be considered as germinated seed. Normal seedlings were totaled at each replicate. The replicate results were averaged to give the mean percentage of normal germination. Finally, germination percentage was described according the following formulae:

$$\text{Germination percentage} = \frac{\text{No. of seeds germinated at final count}}{\text{No. of seeds placed for germination}} \times 100$$

**Storage conditions during experimentation (temperature and relative humidity)**

Temperature and relative humidity during the study was recorded regularly by the HOBO U12 Family of Data Loggers (MicroDAQ.com) at the meteorological station, at HSTU,

Dinajpur, Bangladesh. Temperature fluctuated from 25.0 to 30.0°C, but the range was minimum, whereas relative humidity varied more from 54 to 86% during the experimentation. The daily weather data on temperature and relative humidity (weekly average) during the investigation, are showed in Fig. 1.

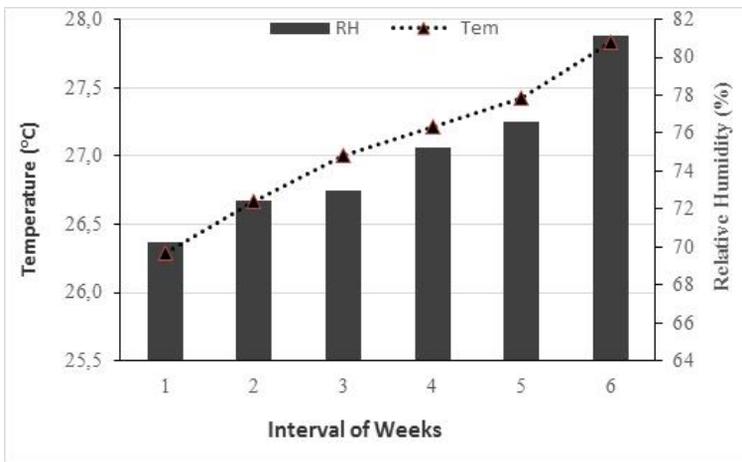


Figure 1 - The average temperature and relative humidity during investigation (Weekly)

**Statistical analysis**

The recorded and calculated data were statistically analyzed using a MSTAT-C Package Program (Gomez & Gomez, 1984). Duncan’s Multiple Range test (DMRT) was performed to compare variations among treatments.

**RESULTS AND DISCUSSION**

**Effect of storage containers on the germination percentage**

Seed germination is an important seed testing method by which the suitability of a seed lot as

sowing/planting materials is evaluated and it offers to the ability of seeds to emerge out healthy/normal seedling and thereby to build up onto a healthy vigorous plant in later. The germination percentage (GP) varied significantly under the different storage containers and it declined remarkably from sealed tin containers to poly bag and to gunny bag (Table 1). The results exposed that the seeds stored in tin container achieved the optimum GP (87.73%), whereas the lowest GP (71.08%) was observed in the seeds contained in gunny bag.

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Intermediate GP (82.01%) was observed from the seeds stored in poly bag. The present findings are in conformity with the findings of Islam *et al.* (2017b) in mungbean seed, who depicted that seeds stored in sealed tin container achieved the highest germination percentage, as compared to polythene bag and gunny bags, and seeds in gunny bag showed the worst result of GP. The influence of storage containers on the GP has been mentioned by several researchers and they reported that the GP of seeds greatly decreased during storage when seeds of rice (Haque, 1982; Kaur *et*

*al.*, 1990), durum wheat (Islam, 2008), bean (Nahar *et al.*, 2009), lentil (Hasan *et al.*, 2016; Hasan *et al.*, 2017b), soybean (Majid and Nahar, 1981; Umarani & Selvaraj, 1996) are not stored properly in air tight containers. Agrawal (2003) also declared that the deterioration of seed quality through reduced germination percentages increased with increasing moisture content of the seed. In our study, the GP of the seeds stored in gunny bag reduced 18.98%, whereas the reduction in the air proof polybag was only 6.52% (*Table 1*).

**Table 1 - Impact of storage containers on germination percentage of black gram seed**

Storage containers	Germination (%)	Reduction (%)
Tin	87.73 a	-
Poly bag	82.01 b	6.52
Gunny bag	71.08 c	18.98
Level of significance	3.91	-
Sx	1.621	-

### Effect of storage periods on the germination percentage

The storage periods exhibited significant influence on the GP of black gram seed (*Table 2*). The initial GP of 86.32% was observed before storing the seeds. Throughout the storage periods, the highest GP (85.43%) was recorded from 15 DAS, while the lowest one (68.33%) from 45 DAS, and the intermediate GP was recorded at 30 DAS. The GP decreased considerably with the advancement of storage periods from 0 to 45 DAS and the rate of reduction was opined 1.03, 8.64 and 20.84% at

15, 30 and 45 DAS, respectively. Kaur *et al.* (1990) witnessed the presence of pathogenic inoculum in the soybean seed due to increased moisture content for long time storage resulting reduced seed germination. It is well established in earlier that seeds absorbed moisture from the surrounding environment due to its hygroscopic nature (James, 1967; Harrington, 1972; Agrawal, 2003). The results in our study are in corroborated with the findings of Umarani & Selvaraj (1996) in soybean, Islam (2008) in durum wheat, Hasan *et al.* (2017a) in lentil,

Islam *et al.* (2017b) in mungbean, who reported that the GP decreased progressively with increasing storage periods due to absorption moisture

from the surrounding environment, which prominently depend on the nature of the storage containers.

**Table 2 - Impact of storage periods on the germination percentage of black gram seed**

Storage periods (DAS)	Germination (%)	Reduction (%)
0	86.32a	-
15	85.43 a	1.03
30	78.86 b	8.64
45	68.33 c	20.84
Level of significance	5.10	-
Sx	1.21	-

**Table 3 - Interaction effects of storage containers and storage periods on the germination percentage of black gram seed**

Interaction (Storage periods x containers)	Germination (%)	Reduction (%) over15 DAS x tin containers
0 DAS	86.32 a	-
15 DAS x Tin container	85.90 a	0.49
15 DAS x Poly bag	81.98 b	5.03
15 DAS x Gunny bag	75.09 c	13.01
30 DAS x Tin containers	83.98 a	2.71
30 DAS x Poly bag	76.20 c	11.72
30 DAS x Gunny bag	69.10 d	19.95
45 DAS x Tin containers	75.22 c	12.86
45 DAS x Poly bag	65.51 e	24.11
45 DAS x Gunny bag	58.11 f	32.68
Level of significance	0.81	-
Sx	1.05	-

**Interaction impact of storage containers and storage periods**

Storage container and storage period interaction showed a significant effect on the GP black gram seed (*Table 3*). The initial GP of 86.32 was recorded before storage of seeds. However, the highest germination (85.90%) was found at the treatment combination of 15 DAS x tin container, which was statistically

similar (83.98%) to 30 DAS x tin container treatment conferring during storage periods. The lowest germination percentage (58.11%) was observed at 45 DAS x gunny bag treatment combination. There was no significant variation among the treatment combinations of 15 DAS x gunny bag, 30 DAS x poly bag, and 45 DAS x sealed tin container regarding the GP of black gram seed.

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The rate of reduction of GP due to storage containers and periods are 0.4, 2.71 and 12.86% for tin container, 5.03, 11.72 and 24.11% for poly bag and 13.01, 19.95 and 32.68% for gunny bag at 15, 30 and 45 DAS, respectively. Branderburg *et al.* (1961) reported that higher moisture content in the seed stored in air leaked container, over a longer storage period, accelerated the respiration rate and infestation of microorganisms, consequently the GP of seeds inhibited. The decrease in GP could be due to high rate of absorption of moisture by gunny bag (Kaur *et al.*, 1990; Hasan *et al.*, 2017b).

### CONCLUSIONS

Black gram seeds stored in sealed tin container recorded considerably the highest GP, as compared to poly bag and gunny bag. Different storage periods also significantly influenced the GP, and the values of GP progressively reduced with the advancement of storage periods (15 to 45 DAS). From the study it may be concluded that sealed tin container (air tight) is the significant successful one for long period of storage and could be endorsed for general implementation in maintaining seed quality.

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