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Packaging materials for seed storage in Indian bean – Genotypic response

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ABSTRACT

Seeds of six locally cultivated distinct types of Indian bean bean were harvested at field maturity, sundried at about 8 per cent moisture content and stored in different containers viz., metal container, aluminium foil, polythene packet, cloth bag and earthen pot having almost no air space within the containers, and such containers were kept in ambient condition. Pre-storage seed quality parameters were assessed for harvest fresh seeds along with its moisture content (about 8%). Destructive sampling was made after 3, 6, 9 and 12 months of storage. Consideration of performance of individual genotypes indicated the existence of variation in its response for all the parameters studied. Germination (%) of seeds was maximum for all the genotypes when stored in aluminium foil and metal containers. Lowest germination was noted for seeds stored in earthen pot irrespective of the genotypes. Vigour index with significantly highest magnitude was determined when seeds were stored in both metal container and aluminium foil for 12 months, with the exception in genotype 3, for which safe storage of the seed upto 12 months was noted for aluminium foil and polythene packets. Reduction in both the parameters was consistent with the advancement of storage period irrespective of the containers. Therefore, both aluminium foil and metal container can be recommended in general for better seed storage in Indian bean bean, though some genotype specific preference could be recognized for polythene packet.

Keywords: Indian bean, *Lablab purpureus*,seed packaging materials, seed storage, seed quality

Indian bean [*Lablab purpureus* (L.)] is a leguminous multipurpose crop, grown for vegetable, forage and pulse, cultivated throughout the country. Seeds of this leguminous crop are mostly sensitive to storage period and conditions, especially from harvest of crop till the next planting season. So, proper seed packaging and ideal storage conditions are required to maintain seed quality. According to Rao *et al*. (2006) seed packaging container, storage environment and duration affects seed quality i.e., viability and vigour. This quality does not decrease immediately but it declines during the increment of time (Harrington, 1972). High temperature and moisture plays an important role in the process of seed deterioration (Justice and Bass, 1978). The seed deterioration significantly reduces the germination (Khajeh Hosseini *et al*., 2003), seedling emergence (Basra *et al*., 2003) and growth. So, it is essential to preserve them in suitable containers for enhancing its longevity. The present experiment was formulated with view to identify the ideal storage container so that the farmers can safely store the seed materials of Indian bean [*Lablab purpureus* (L.) Sweet] in order to maintain its highest norms of quality, especially in relation to its vigour status.

MATERIALS AND METHODS

The experiment was conducted at the Department of Seed Science and Technology laboratory, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. Harvested fresh seeds of Indian bean were sun dried thoroughly till 8 per cent moisture content was achieved. Pre-storage seed quality parameters were assessed for harvest fresh seeds (C_0d_0). Sufficient quantity of seeds of six genotypes were stored in various seed storage containers *viz*., metal container (C1), aluminium foil (C2), polythene packet of 700 gauge thickness (C3), cloth bag (C4) and earthen pot (C5) for a maximum period of 12 months in such a way that no vacant space is left with free air within the containers. Number of each type of storage containers were five to allow destructive sampling at different periods of storage *i.e*., at 3 (d_1), 6 (d_2), 9 (d_3) and 12 (d_4) months of storage each and one was kept as insurance lot. During this period, regular seed quality parameters were recorded at 3 months' interval to record the rate of deterioration in germination and vigour. The experiment was set up in one factor completely randomized block design (CRD) and statistical analysis was done accordingly. One hundred fifty seeds of each genotype for each container in three replications of fifty each were taken for the experiment. Germination test was carried out using germination papers by between papers (BP) method (ISTA, 1985) and calculated as Germination (%) = No. of normal seedlings germinated × 100/ Total no. of seeds placed for germination. Vigour Index was also calculated after Abdul-Baki and Anderson (1973) as: Vigour index = Germination (%) × root and shoot length (cm).

RESULTS AND DISCUSSION

Pre-storage seed quality parameters were assessed for harvest fresh seeds along with its moisture content

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Table 1: Germination (%) of seeds as influenced by storage containers and duration

Treatment	Genotype						Mean
	V1	V2	V3	V4	V5	V6	
Pre-storage C_0d_0	92.67 (74.32)	94.67 (76.70)	93.33 (75.07)	92.00 (73.65)	94.67 (76.70)	92.67 (74.32)	93.34 (75.13)
C_1d_1	90.67 (72.23)	91.33 (72.90)	89.33 (70.95)	90.00 (71.62)	91.33 (72.90)	90.67 (72.23)	90.56 (72.14)
C_1d_2	86.00 (68.06)	88.67 (70.34)	84.00 (66.45)	87.33 (69.16)	87.67 (68.60)	87.33 (69.16)	86.67 (68.63)
C_1d_3	80.67 (63.92)	83.33 (65.91)	79.33 (62.97)	81.33 (64.41)	80.00 (63.45)	80.67 (63.92)	80.89 (64.10)
C_1d_4	73.33 (58.91)	76.67 (61.12)	72.67 (58.48)	74.00 (59.35)	71.33 (57.63)	74.67 (59.78)	73.78 (59.21)
C_2d_1	90.00 (71.62)	92.67 (74.32)	90.67 (72.23)	88.00 (69.78)	92.00 (73.65)	91.33 (72.90)	90.78 (72.42)
C_2d_2	87.33 (69.16)	88.00 (69.78)	86.00 (68.06)	85.35 (67.49)	87.33 (69.16)	88.00 (69.78)	87.00 (68.91)
C_2d_3	81.33 (64.41)	82.67 (65.41)	81.33 (64.41)	82.00 (64.92)	82.67 (65.40)	81.33 (64.41)	81.89 (64.83)
C_2d_4	75.33 (60.23)	75.33 (60.23)	74.67 (59.78)	76.67 (61.12)	74.00 (59.35)	75.33 (60.27)	75.22 (60.16)
C_3d_1	88.67 (70.34)	90.33 (72.90)	89.33 (70.96)	88.67 (70.34)	90.00 (71.62)	90.67 (72.23)	89.78 (71.40)
C_3d_2	84.67 (66.96)	87.33 (69.16)	84.00 (66.45)	84.00 (66.45)	85.33 (67.49)	86.00 (68.06)	85.22 (67.43)
C_3d_3	79.33 (62.97)	82.00 (64.92)	78.67 (62.50)	79.33 (62.97)	78.00 (62.04)	80.00 (63.45)	79.56 (63.14)
C_3d_4	72.67 (58.48)	74.00 (59.35)	71.33 (57.63)	72.00 (58.06)	73.33 (58.91)	72.00 (58.06)	72.56 (58.42)
C_4d_1	87.33 (69.16)	89.33 (70.96)	87.33 (69.16)	88.00 (69.78)	88.67 (70.34)	88.67 (70.34)	88.22 (69.96)
C_4d_2	81.33 (64.41)	82.00 (64.92)	80.67 (63.92)	83.33 (65.91)	81.33 (64.41)	83.33 (65.91)	82.00 (64.92)
C_4d_3	74.67 (59.78)	76.00 (60.68)	73.33 (58.91)	77.35 (61.57)	75.33 (60.23)	77.33 (61.57)	75.67 (60.46)
C_4d_4	66.00 (54.34)	69.33 (56.38)	64.67 (53.52)	68.67 (55.96)	67.33 (55.14)	71.33 (57.63)	67.89 (55.50)
C_5d_1	86.00 (68.06)	88.00 (69.78)	86.67 (68.60)	87.33 (69.16)	85.33 (67.49)	85.33 (67.49)	86.44 (68.43)
C_5d_2	80.67 (63.92)	81.33 (64.41)	79.33 (62.97)	80.00 (63.45)	78.00 (62.04)	79.33 (62.97)	79.78 (63.29)
C_5d_3	69.33 (56.38)	72.67 (58.48)	69.33 (56.38)	73.33 (58.91)	69.33 (56.38)	71.33 (57.63)	70.89 (57.36)
C_5d_4	53.33 (46.91)	62.00 (51.95)	58.67 (49.99)	57.33 (42.22)	52.67 (46.53)	61.33 (51.55)	57.66 (49.36)
Mean	80.06 (64.03)	82.32 (65.74)	79.75 (63.78)	80.76 (64.44)	80.22 (64.26)	81.37 (64.94)	
		V		**Cd**		**V× Cd**	
SEm (±)		**0.20**		**0.38**		**0.93**	
LSD(0.05)		**0.40**		**0.75**		**1.83**	
LSD(0.01)		**0.53**		**0.98**		**2.41**	

Note: Figures in the parenthesis are the arc-sin transformation values, V1-V6 =Genotype 1-6; C_1 –C_5=Containers; d_1-d_4=Duration of storage (3, 6, 9 and 12months); C_0d_0= Control

Table 2: Vigour index of seeds as influenced by storage containers and duration

Treatment	Genotype						Mean
	V1	V2	V3	V4	V5	V6	
Pre-storage C_0d_0	4283.62	4437.70	3973.62	4625.79	4792.88	4318.09	4405.28
C_1d_1	4109.66	4071.41	3116.24	4072.45	4458.64	3886.32	3952.45
C_1d_2	3692.74	3694.74	2806.71	3685.99	3960.75	3549.70	3565.10
C_1d_3	3286.42	3150.66	2361.76	3256.84	3400.81	2967.82	3070.22
C_1d_4	2667.01	2646.80	1923.90	2689.74	2529.86	2495.33	2492.11
C_2d_1	4058.48	3950.70	3575.53	3985.62	4275.95	4120.43	3994.45
C_2d_2	3720.80	3560.04	3156.38	3689.86	3672.73	3679.73	3579.92
C_2d_3	3235.50	3235.12	2758.20	3196.32	3227.35	3096.89	3124.90
C_2d_4	2653.65	2732.16	2395.58	2791.99	2513.96	2644.56	2621.98
C_3d_1	3728.98	3742.98	3652.52	4218.36	3896.17	3977.93	3869.49
C_3d_2	3335.25	3311.82	3060.54	3605.93	3345.68	3594.74	3375.67
C_3d_3	2945.25	2928.64	2689.05	2944.28	2910.04	3122.58	2923.30
C_3d_4	2404.80	2503.00	2296.32	2475.74	2432.14	2525.32	2439.55
C_4d_1	3405.79	3409.34	3261.91	3824.48	3417.96	3446.10	3460.93
C_4d_2	2910.15	2676.44	2632.12	3241.82	2927.67	2941.15	2888.22
C_4d_3	2374.28	2188.69	2178.08	2833.73	2316.16	2534.94	2404.31
C_4d_4	1771.15	1738.27	1557.70	1980.06	1787.44	1842.85	1779.58
C_5d_1	3276.62	3184.42	2916.44	3794.70	3338.99	3270.86	3297.01
C_5d_2	2834.94	2621.40	2405.31	3056.88	2802.29	2730.94	2741.96
C_5d_3	2049.91	2043.12	1923.82	2489.68	2221.68	2172.72	2150.15
C_5d_4	1263.95	1578.44	1410.81	1712.38	1369.34	1639.22	1495.69
Mean	3048.04	3019.33	2669.17	3246.32	3123.74	3074.20	

	V	Cd	V× Cd
SEm (±)	**17.09**	**31.97**	**78.30**
LSD (0.05)	**33.65**	**62.96**	**154.21**
LSD (0.01)	**44.35**	**82.97**	**203.25**

Note: V1-V6=Genotype 1-6; C_1-C_5=Containers; d_1-d_4=Duration of storage (3, 6, 9 and 12 months); C_0d_0= Control

(about 8%). The findings on different parameters revealed that genotypes along with other treatment combinations were able to create significant variation for each and every parameter. Prior to storage in different containers, maximum germination (94.67%) was noted for seeds of genotypes 2 and 5 followed by genotypes 3, 1 and 6, and 4 (Table 1). It was reduced due to storage irrespective of the container and consistently enhancement in reduction was noted with the enhancement in duration of storage.

On an average, potentiality of both metal container and aluminium foil was superior over other containers up to 9 months of storage and aluminium foil was superior over the metal container for 12 months of storage indicating that aluminium foil could be utilized for long term storage. On the other hand, earthen pot could be identified with poor storage potentiality irrespective of the storage duration preceded by cloth bag and polythene packet. While considering the response of individual genotypes towards storage container and duration, highest germination (92.67%) could be noted for genotype 2 when seeds were stored in aluminium foil for 3 months (C2d1). Variation in response of the genotypes was noted for germinability of seeds when stored in different containers for varying durations. It could apparently be noted through the magnitude of germination of seeds, aluminium foil was preferred by maximum genotypes, though significantly similar performance of the genotypes was noted when storage was made in both aluminium and metal containers irrespective of the storage duration, excepting nine (9) months storage for genotype 5 for which aluminium foil could be identified as significantly better than metal container. Earthen pot was noted as poor performer for utilizing seed storage irrespective of the genotypes. Significantly lowest germination was noted for genotypes 1, 2 and 3 when seeds were stored in both earthen pot and cloth bag upto 6 months; it was similar for genotype 4 for 3 months' storage only and cloth bag was superior to earthen pot for 6 months' storage, and cloth bag storage upto 6 months was superior to earthen pot for both genotypes 5 and 6. For both 9 and 12 months' storage, earthen pot could be identified as the inferior most storage container irrespective of the genotypes.

When average over genotypes was considered, the highest magnitude of vigour index was noted for C2d1 *i.e*., storage of seeds in aluminium foil for 3 months followed by C1d1 (metal container for 3 months) and C3d1 (polythene packet for 3 months), though the first two were statistically *at par* (Table 2). Consideration of interaction effects indicate that pre-storage condition produced seedlings with maximum vigour for all the genotypes, consequent of which it was reduced due to storage periods irrespective of the containers. Both germination and vigour of Indian bean seeds deteriorate with progress in storage duration in ambient condition (Simpson *et al.*, 2001). The trend in change varied with the containers and genotypes. For categorical clarification of storage containers and its influence with varied storage periods, it is clear that both metal container and aluminium foil were best suited for 3 months' seeds storage of genotypes 1 and 2, both aluminium and polythene packet for genotypes 3 and 6, both metal container and polythene packet for genotype 4 and only metal container for genotype-5. When storage for 12 months was considered, significantly highest magnitude of vigour index was determined for all the genotypes when stored in both metal container and aluminium foil excepting genotype-3, for which aluminium foil and polythene packets were identified for the same, storage in polythene packets may also be considered for genotypes 5 and 6. Variation in trend of this parameter can also be recognized for all the genotypes when stored for 6 and 9 months. Performance of individual genotypes for vigour index was noted to be decreased consistently with the advancement of storage period irrespective of the containers. This result is in accordance with the findings of Janmohammadi *et al.* (2008) and Sheidaei *et al.* (2014) observed the seedling vigour index declined by increase of storage period.

If critical consideration is made for all the parameters especially for germination (%), and vigour index, genotype specific preference will become evident for both storage containers and periods, though aluminium foil could be recognized as the best longest storer irrespective of the genotypes. This result is in line with Balesevic Tubic *et al*. (2010) reported that seed germination of soybean declines more in storage due to variability in temperature and relative humidity; and Tripathy and Lawande (2014) reported that significant differences exist in seed germination and seedling vigour among various packaging materials. Seed stored in aluminium foil has been recorded as the best storage material by Chuansin *et al.* (2006) in Soybean when storage was made for 4months and by Selvraj (1988) in Brinjal when storing was made up to 24months, which principally corroborate the present findings. Varietal differences for storability of Barley and Linseed have also been reported by Sharma and Singh (1997).

Reduction in both the parameters like germination (%) and seedling vigour index was consistent with the advancement of storage period irrespective of the containers. Both aluminium foil and metal container can be recommended in general for better seed storage in Indian bean, though some genotypic specific performance could be recognized for polythene packet.

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