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INFLUENCE OF DIFFERENT STORAGE CONTAINERS ON PHYSIOLOGICAL OBSERVATION OF INDIAN MUSTARD (*Brassica juncia L.*)

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ABSTRACT: An experiment was conducted during the period from 1 Jan 2022 to 30 June, 2023 to evaluate the mustard seed quality under different storage conditions. Indian mustard (*Brassica juncia* L.) variety TAM-108-1 seed stored for eighteen months in tin container, aluminium foil, polythene bag and cloth bag at room temperature. The initial cold test germination percentage of seed was 90.23% but after eighteen months (540 days) in tin container, aluminium foil, polythene bag, cloth bag it was decreased with time period to 42.00%, 34.00%, 30.00%, 27.00%. The initial brick gravel test germination percentage in seed was 89.00% however, after storage for eighteen months in tin container, aluminium foil, polythene bag and cloth bag it was declined to 40.23%, 29.00%, 24.00%, 21.00%. The initial speed of germination index percentage in seed was 55.23% however, after storage for eighteen months in tin container, aluminium foil, polythene bag and cloth bag it was declined to 21.23%, 15.23%, 13.77% and 12.23% respectively. Storage condition affects the moisture content and normal germination. The study revealed that for seed storage tin container was better significant than aluminium foil, polythene bag, cloth bag for mustard seeds.

Keywords: Cold test, Germination, Mustard, Seed quality, Storage container

INTRODUCTION:

Indian mustard (*Brassica juncea* L.) is important Rabi oilseed crop which belongs to family "Cruciferae". India is the first position in area and second position in production after China. In India, it is cultivated in state of Assam, Bihar, Rajasthan, Haryana, Uttar Pradesh, Orissa, Punjab and West Bengal are majorly growing of mustard in India (Sharma *et al*., 2020). Mustard is the important oilseed plant. In any agriculture field seed quality and the natural seed deterioration of stored seeds poses a significant scientific challenge of global concern. Various biotic and abiotic factors, including crop genotype, initial seed quality, storage containers, and storage conditions, contribute to seed deterioration under improper storage conditions. Among these factors, storage temperature and moisture content are pivotal, with moisture content usually exerting a more pronounced influence than temperature (Ray and Bordolui, 2022). The oilseed plant of Brassica species commonly called as rapeseed-mustard, which is the most important Rabi oilseed crop in agriculture. Seed quality is a complex trait that is determined by the genetics, physical, physiological and health properties of a seed (Neves *et al.,* 2016). The quality of seed is comprised genetic and mechanical purity,seed germination, vigour and

seed health (Prasad *et al.,* 2017). Any agriculture field seed performance is depended on its quality. Two attributes of seed quality that are often measured are seed viability and vigour (Šimic *et al.,* 2007). The ability of seed to germinate and produce a normal seedling is called viability of seeds. Seed is metabolically active and contains enzymes capable of catalyzing the reactions needed for germination and seedling growth commonly called viability. Thus, a seed lot usually made up of a mixture of dead and live seeds with the live seeds containing both dead and live tissues (Moreano *et al., 2013*). Seed is an important component of agricultural production in India. In any agriculture the seed quality is the foundation of a successful crop production programme. The seed quality plays an important role in the agricultural production as well as in national economy. Therefore, the good seed quality is necessary to enhance the production and productivity. These properties are inturn influenced by the agro-ecological conditions in the seed production field, seed handling and processing, storage conditions and storage period (Shelar *et al., 2008*). *Carvalho et. al., (2016)* revealed that the use of packages with larger number of seeds (big bag and polyethylene container) did not favour the maintenance of the pre- packing cooling temperature. The types of packages did not show significant differences in the seeds viability during storage, up to eight months, regardless the pre-packing cooling. Types of containers also regulate temperature, relative humidity and seed moisture contents. High temperature, relative humidity and moisture in the storage environment appear to be key factors involved in deterioration of seed quality. Loss of germination capacity is the final manifestation of seed deterioration. So, the present study was undertaken to identify the best container for storing mustard seed (*Brassica juncia* L.) variety TAM-108-1.

MATERIAL AND METHODS:

The experiment was conducted at the laboratories of Department of Botany, RTMNU, Nagpur and Govt. seed testing lab, Nagpur. This experiment was conducted during the period from 1 Jan 2022 to 30 June, 2023 to evaluate the mustard seed quality under different storage conditions. The seed of Indian mustard (*Brassica juncia* L.*)* variety TAM-108-1. which was stored in four different storage condition i.e. tin container, aluminium foil, polythene bag, and cloth bag and period of storage T1 (0 day), T2 (90 days), T3 (180 days), T4 (270 days), T5 (360 days), T6 (450 days) and T7 (540 days) at the room temperature for 18 months (540 days) at room temperature. Seeds were collected from P.K.V, Nagpur. Seeds were used for the determination of germination in cold test, brick gravel test and speed of germination. The experiment was statistically analyzed by using factorial design CRD (Completely Randomized Design). During the storage period, seed samples were taken after three months (90 days) from each container for physiological observation of three parameters determination germination in cold test, brick gravel test and speed of germination.

Determination of Germination in Cold Test:

The *phythium* infected soil was obtained from the upper six-inch layer of thefield. The soil was then mixed with unsterilized sand in 1:2 ratio (three replications of 100 seeds of each variety were used the cold test was carried out by following *Gill, (1970)*. About 600 gm of soil mixture was placed evenly in 7x7x1 inch plastic rectangular trays. 100 seeds were placed in rows over it and 570 gm of sand soil mixture was used to cover the seeds. Measured quantity of water was added to attain 70 % water holding capacity in trays. The tray was then covered with moist towel paper and placed in refrigerator at 8 ± 2 °C for five days particularly during this period, care was taken to see that the medium in the tray did not become dry. Whenever towel paper on the top becomes slight dry, it was sprinkled with water. On 5^{th} day, the trays were transferred to the growing racks for emergence. The media was watered to facilitated seedling emergence. Seedling generally emerged on 8^{th} day and they were counted. The

number of normal seedlings that emerged out of 100 seeds was considered the germination percentage of cold test.

Determination of Brick Gravel Test (Hiltner Test):

Brick Gravel test was performed on crushed stone with maximum particle size 2 to 3 mm. It was moisture with 250 ml water per 1100 gm. It was then mixed and allowedto stand for about an hour to absorb water. A layer of wet brick gravel (3 cm deep) was placed in the base of tray. The seeds were kept on the gravel without touching each other to avoid cross infection. It was covered with a layer of 3 to 4 cm brick gravel. The trays were covered with lid and kept in the dark germination chamber for 10 to 14 days. The lid was removed after the seedlings have emerged. At the end of the test the trays were emptied and the seedlings were removed from the medium for examination. Evaluation of seedling was done as per prescription for normal and abnormal seedlings given in the rules for seed testing (Anonymous., 1985). The total of normal emerged seedlings is reported aspercent brick gravel value. This test was conducted as per the procedure recommended by Fuchs, (1981).

Speed of Germination (Vigour index):

The speed of germination was calculated as per the procedure laid down in standard germination test on 1st, 2nd, 3rd, 4th and 5th day. The result of Seedling count was taken from second day onwards until completion of the test. Seeds with radicle and plumule protruding were counted and removed from the towel paper before the latter were returned to the seed germination. This practice of removing the germinated seedlings from towel papers was continued up to the end of that particular test. At the end of the test, the germination index was calculated. The number of germinated seedlings counted each day was divided by number of days to that count. The values obtained at each count are summed up to obtaine the germination index (Maguire, 1962).

$$\frac{n_1}{1} + \frac{n_2}{2} + \frac{n_3}{3} - - - - = N\ (GI)$$

n_1, n_2, n_3, ---------- are number of seeds germinated in 1st, 2nd and 3rd days

N-Germination Index

RESULT AND DISCUSSION:

In the present study of cold test germination of mustard seed stored in different containers have presented in table 1. In mustard variety TAM-108-1, the cold test germination significantly decreased with increase in storage period. The rate of loss in germination varied with the type of container used. The initial cold test germination of the seed was (90.23%) but after the storage 18 months (540 days) in tin container, aluminium foil, polythene bag, cloth bag it was declined. Seeds stored in Tin showed significantly higher cold test germination (42.00%) as compared to those stored in Aluminium foil (34.00%), Polythene bag (30.00%) and Cloth bag (27.00%) up to 540 days (T7) days of the storage. Among the containers Tin showed significantly higher mean of standard germination (69.64%) as compared to Aluminium foil (64.67%), Polythene bag (60.49%) and Cloth bag (55.10%) throughout the storage period. Similar findings were reported by Guha *et. al*., (2012) in okra seeds. Saisantosh and Patil (2018) also observed a continuous decrease in the germination percentage in onion seeds with a progressive extension in storage duration. The brick gravel test germination of mustard seed stored in different containers have presented in table 2. In mustard variety TAM-108-1, the brick gravel test germination significantly decreased with increase in storage period. The rate of loss in brick gravel test germination varied with the type of container used. The initial brick

gravel test germination of the seed was (89.00%) but after the storage 18 months (540 days) in tin container, aluminium foil, polythene bag, cloth bag it was declined. Seeds stored in Tin showed significantly higher brick gravel test germination (40.23%) as compared to those stored in Aluminium foil (29.00%), Polythene bag (24.00%) and Cloth bag (21.00%) up to 540 days (T7) days of the storage. Among the containers Tin showed significantly higher mean of brick gravel test germination (68.25%) as compared to Aluminium foil (58.65%), Polythene bag (54.11%) and Cloth bag (51.32%) throughout the storage period. Lambat *et. al*., (2017) studied the effect of seed size on germination and seedling vigour by the brick gravel test conducted on safflower and showed that large grade seeds were superior with respect to germination as compared to small, medium and ungraded seeds. The speed of germination index percentage of mustard seed stored in different containers have presented in table 3. In mustard variety TAM-108-1, the speed of germination index significantly decreased with increase in storage period. The rate of loss in speed of germination index varied with the type of container used. The initial speed of germination index test of the seed was (55.23%) but after the storage 18 months (540 days) in tin container, aluminium foil, polythene bag, cloth bag it was declined. Seeds stored in Tin showed significantly higher speed of germination index (21.23%) as compared to those stored in Aluminium foil (15.23%), Polythene bag (13.77%) and Cloth bag (12.23%) up to 540 days (T7) days of the storage. Among the containers Tin showed significantly higher mean of speed of germination index (43.70%) as compared to Aluminium foil (38.16%), Polythene bag (35.43%) and Cloth bag (33.42%) throughout the storage period. Basavegowda *et al*., (2013) reported that, commercial storage at 5-7 °C and 65% relative humidity exhibited the highest seed vigour, while working on chickpea. So, the present study was revealed that tin container better for storing seeds as compared to aluminium foil, polythene bag and cloth bag.

Table 1. Cold test Germination (%) of mustard seeds stored in different containers:

Storage Period	Different Containers			
	Tin container	**Aluminium foil**	**Polythene bag**	**Cloth bag**
T1	90.23	90.23	90.23	90.23
T2	86.77	80.23	75.23	70.23
T3	78.23	75.00	70.23	65.77
T4	75.00	70.00	66.00	49.23
T5	65.23	58.23	51.00	45.00
T6	50.00	45.00	40.77	38.23
T7	42.00	34.00	30.00	27.00
Mean	69.64	64.67	60.49	55.10
SE (m)	1.114	1.078	1.065	1.126
CD (P=5%)	3.379	3.272	3.233	3.416

Table 2. Brick Gravel Test (Hiltner Test) Germination (%) of mustard seeds stored in different containers.

Storage Period	Different Containers			
	Tin container	Aluminium foil	Polythene bag	Cloth bag
T1	89.00	89.00	89.00	89.00
T2	85.23	80.77	74.77	72.00
T3	78.77	63.77	58.77	55.77
T4	73.77	60.00	51.00	47.23
T5	63.00	48.23	45.23	42.00
T6	47.77	39.77	36.00	32.23
T7	40.23	29.00	24.00	21.00
Mean	68.25	58.65	54.11	51.32
SE (m)	1.116	1.217	1.139	1.059
CD (P=5%)	3.865	3.690	3.454	3.206

Table 3. Speed of germination Index % of mustard seeds stored in different containers.

Storage Period	Different Containers			
	Tin container	Aluminium foil	Polythene bag	Cloth bag
T1	55.23	55.23	55.23	55.23
T2	55.00	48.23	46.77	43.77
T3	52.23	46.23	42.23	40.77
T4	47.23	41.23	38.23	36.77
T5	42.00	37.23	34.00	29.00
T6	33.00	23.77	17.77	16.23
T7	21.23	15.23	13.77	12.23
Mean	43.70	38.16	35.43	33.42
SE (m)	1.115	1.136	1.289	1.123
CD (P=5%)	3.383	3.445	3.910	3.407

CONCLUSION:

The present study was concluded the cold test germination, brick gravel test germination and speed of germination index were better significant in seeds stored in air tight tin container as compared to aluminium foil, polythene bag and cloth bag. Storage condition affects the production of normal germination and dead seedlings, and the study revealed that seed storage in air tin container was better than aluminium foil, polythene bag, cloth bag for mustard seed.

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