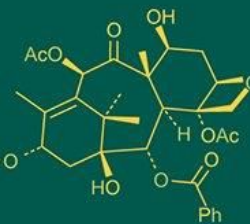
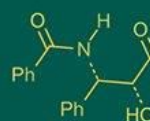


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Effect of different storage containers on moisture content and standard germination of mustard seed

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Abstract

The study was conducted to evaluate the quality of mustard, *Brassica juncea* variety TAM-108-1 seed stored for eighteen months in tin container, aluminium foil, polythene bag and cloth bag at room temperature. The initial moisture content of the seed was 10.00% but after eighteen months (540 days) it was increased with moisture and humidity with time period in tin container, aluminium foil, polythene bag, cloth bag 14.74%, 16.23%, 16.46%, 16.75%. The initial standard germination percentage in seed was 98.77% however, after storage for eighteen months in tin container, aluminium foil, polythene bag and cloth bag it was declined to 49.77%, 44.23%, 39.00%, 35.00% respectively. Storage condition affects the moisture content and normal germination. The study revealed that seed storage in tin container was better significant than aluminium foil, polythene bag, cloth bag for mustard seed.

Keywords: Tin storage, TAM 108-1, moisture content, seed quality

Introduction

India is a land of agriculture. Indian mustard (*Brassica juncea*) belongs to the family of Cruciferae (Brassicaceae). The family Brassicaceae are containing about 350 genera and 3500 species. It is one of the ten most economically important plant families with a wide range in agriculture production. Basically Brassica is the important oilseed plant. The oilseed plant of Brassica species is also called as rapeseed-mustard, which is the most important Rabi oilseed crop in agriculture. In India Brassica species have been cultivated since Vedic times. This seeds are being used for many purposes, that is, edible oil, vegetable, condiments, medicine, fodder preparation and seasoning of food articles, and so forth. They have also been used as medicine and condiments (Suma A. *et al.* 2013) ^[14]. All over the world Brassica species is the third most important oilseed crops after soybean and palm. The major rapeseed-mustard growing countries are China, India, Canada, Japan and Germany. Mustard is the second most important oilseed crops of India, next to soybean. India is one of the largest rapeseed mustard growing country occupying first position with 20.23% area and second position with 11.7% share to the global production (USDA, 2012) ^[17]. The quality of seed is mainly determined by its genetic, physical purity, germination and vigour. Therefore, germination and purity decide its planting value. The seed quality is determined by different factors including seed viability and vigour which imparts inherent capacity to grow under favourable and unfavourable conditions (Ahmad, 2001) ^[2]. Usberti *et al.*, 1998 ^[16] was reported that seed longevity decreased with increasing storage temperature and moisture content and the deterioration rate depends on storage condition so the temperature, relative humidity, seed moisture contents, storage container are important parameters for storage of seeds. 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. The good seed quality is necessary to enhance the production and productivity. These properties are in turn influenced by the agriculture ecological conditions in the seed production field, seed handling and processing, storage conditions and storage period (Shelar *et al.*, 2008) ^[13]. Seed quality is a complex trait that is determined by the genetics, physical, physiological and health properties of a seed (Neves *et al.*, 2016) ^[10]. The quality of seed is comprised genetic and mechanical purity, seed germination, vigour and seed health

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(Prasad *et al.*, 2017) ^[12]. Escandon, *et al.*, (2013) ^[4] revealed that the rate of loss of germination with various containers like the germination of seeds stored in poly lined gunny bags declined at very slow rate. Malaker *et al.*, (2008) ^[8] observed that wheat seed stored in aluminium and polyester bags showed high seed germination, seed vigour and kept nutrient contents, and therefore they could delay seed quality deterioration compared with plastic and cloth bag. Afrakhteh *et al.*, (2013) ^[18] revealed that seeds packed in cloth bag which maintained higher germination and vigour index after six months of storage. Guha *et al.*, (2012) ^[6] stated that seed stored in plastic container showed the maximum germination (95%), at 6 months of storage, whereas seeds stored in gunny bag showed lowest seed germination (54 %) at 6 months of storage. Thus plastic bags results in good germination for storage of okra seeds. The quality of mustard (*Brassica juncea*) seeds stored for two months in air tight container, poly bag and gunny bag at room temperature and also studied the RH. There was storage condition affects the production of normal and dead seedlings as well as they concluded that seed storage in air tight container was better than gunny and poly bag for mustard seeds. They have used four kinds of container to regulate temperature, relative humidity and seed moisture contents. They found that the seed in the air tight container was better as compared to gunny and poly bag for mustard seeds (Tithi *et al.*; 2010) ^[15]. The seeds are highly hygroscopic living materials so it absorbs moisture from air if it is stored in an environment where relative humidity is higher than seed moisture content. The seed moisture content is the most important factor that regulates quality of seeds as well as longevity of the seeds. Gorechi (1982) ^[5] studied that seeds stored in a high relative humidity lost the seed viability as well as vigor more quickly than those stored in dry air. The higher moisture in seeds enhances seed deterioration which is declined the planting value of seeds in the field. In this study the initial moisture content of the seeds were 10.00% and it was increases during the storage because seeds absorbed moisture from the ambient air and tended to equilibrium with relative humidity. Paricha *et al.*, (1977) ^[11] found that viability of seed decreased with increasing relative humidity and storage time. The maintenance of seed quality during storage period is important not only or crop production in throughout the year but also for the maintenance integrity of the seeds because of their constant threat and of genetic erosion. In agriculture farmers face many problems regarding to storing seed. So, the present study was undertaken to identify the best container for storing mustard seed, *Brassica juncea* variety TAM-108-1.

Materials and Methods

The experiment was conducted at the laboratories of Department of Botany, RTMNU, Nagpur and Govt. seed testing lab, Nagpur. The seed of all the four Indian mustard 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 180 months (540 days) at room temperature. Seeds were collected from PKV, Nagpur. Seeds were used for the standard germination and cold test. 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 two parameters determination of moisture content and determination standard germination test percentage.

1. Determination moisture percentage

The standard method for determining moisture in seed was followed using a hot air oven. The soybean seeds were finely ground was used for moisture determination. 5 gm of sample was weighed directly into the container. After weighing, the container with seeds (lid kept separately) was placed in the oven which has already been heated to the drying temperature. In this experiment the “low constant temperature method” was followed involving drying at 103 °C for 17 hours. The oven drops in temperature when the sample is placed in it and hence the drying period was counted from the moment only when oven regained the required temperature. At the end of drying period the container along with the lid was allowed to cool 30 to 45 minutes in desiccator and then it was weighed again. The moisture content (M) in percentage was calculated as follows.

$$\text{M.C. \%} = \frac{M_2 - M_3}{M_2 - M_1} \times 100 \quad (\text{Nema, 1986})^{[9]}$$

Where,

M₁= Weight of empty container with lid

M₂= Weight of container with lid and seed before drying

M₃= Weight of container with lid and seed after drying and cooling.

2. Determination of germination percentage

Standard germination procedure as described in the International Seed Testing Association Rules (Anon, 1985) ^[3], were followed seeds varieties. Four replications of 100 seeds of respective kinds were kept between the folded moist towel papers. These were then placed in a tray positioned at a 45° inclination at constant temperature of 25 ± 0.5 °C and 85 ± 3 % relative humidity in germination chamber. The first count was noted on 5th day and final on 8th day of germination. Only normal seedlings having characteristics laid down in I.S.T.A. (International Seed Testing Association) rules for testing seeds were taken in to account and abnormal and dead seeds were excluded. The percentage of germination was calculated by counting the number of normal seedlings to the total number of seeds put for germination.

Statistical analysis

The experimental data was statistically analyzed by using factorial CRD (Complete Randomized Design). The standard errors and critical differences between the parameters like mustard seed variety container and storage period were worked out at five per cent significance.

Results and Discussion

In the present study moisture contents of mustard seed stored in different containers have presented in figure 1 and table 1. The result showed that moisture percentage increased with increase in time period and seed moisture appeared significant difference after 540 days of storage. The initial moisture content of the seed was 10.00% but after 18 months (540 days) it was increased with time

period. In mustard variety (TAM-108-1), Tin container, Aluminium foil, Polythene bag and Cloth bag showed fluctuations in moisture content of seeds during storage according to temperature and relative humidity of the atmosphere. A significant minimum fluctuation of moisture content was observed in Tin container. Seed stored in Tin container showed significantly lower moisture content (14.74%) as compared to those stored in Aluminium foil (16.23%), Polythene bag (16.46%) and Cloth bag (16.75%) up to 540 days (T_7) days of the storage. Among the containers Tin container showed significantly lower mean moisture content (12.89%) as compared to Aluminium foil (13.85%), Polythene bag (14.04%) and Cloth bag (14.31%) throughout the storage period. Similar findings were reported by Tithi *et al.*; (2010) ^[15] in mustard seeds. Similarly, standard germination percentage of mustard seed stored in different containers have presented in figure 2 and table 2. In mustard variety TAM-108-1, the standard

germination significantly decreased with increase in storage period. The rate of loss in standard germination varied with the type of container used. The initial standard germination test of the seed was 98.77% 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 standard germination (49.77%) as compared to those stored in Aluminium foil (44.23%), Polythene bag (39.00%) and Cloth bag (35.00%) up to 540 days (T_7) days of the storage. Among the containers Tin showed significantly higher standard germination (77.47%) as compared to Aluminium foil (73.71%), Polythene bag (69.21%) and Cloth bag (65.36%) throughout the storage period. Similar findings were reported by Guha *et al.*, (2012) ^[6] in okra seeds. 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: Moisture content (%) of mustard seeds stored in different containers.

Storage Period	Different Containers			
	Tin container	Aluminium foil	Polythene bag	Cloth bag
T_1	10.00	10.00	10.00	10.00
T_2	11.32	11.56	12.36	12.74
T_3	12.56	13.56	13.82	13.86
T_4	13.42	14.59	14.55	14.72
T_5	13.75	15.32	14.86	15.56
T_6	14.47	15.71	16.23	16.52
T_7	14.74	16.23	16.46	16.75
Mean	12.89	13.85	14.04	14.31
SE (m)	0.716	0.683	0.420	0.370
CD (P=5%)	2.171	2.072	1.274	1.122

Table 2: Standard Germination (%) of mustard seeds stored in different containers.

Storage Period	Different Containers			
	Tin container	Aluminium foil	Polythene bag	Cloth bag
T_1	98.77	98.77	98.77	98.77
T_2	94.77	91.23	90.23	82.00
T_3	85.77	80.77	75.23	72.77
T_4	82.23	80.00	70.00	63.00
T_5	70.77	66.23	63.23	60.23
T_6	60.23	54.77	48.00	45.77
T_7	49.77	44.23	39.00	35.00
Mean	77.47	73.71	69.21	65.36
SE (m)	1.078	1.162	1.181	1.134
CD (P=5%)	3.268	3.524	3.582	3.438

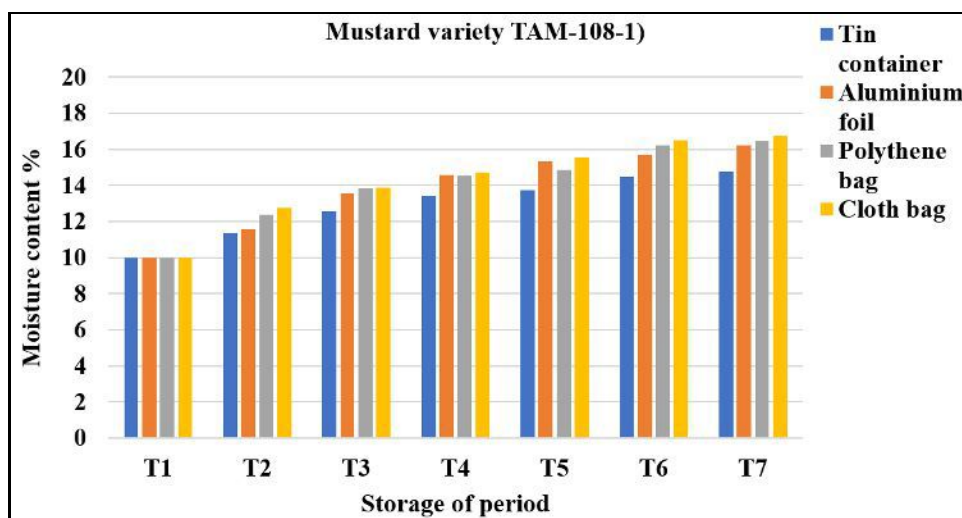


Fig 1: Effect of storage containers moisture content (%) in mustard TAM-108-1

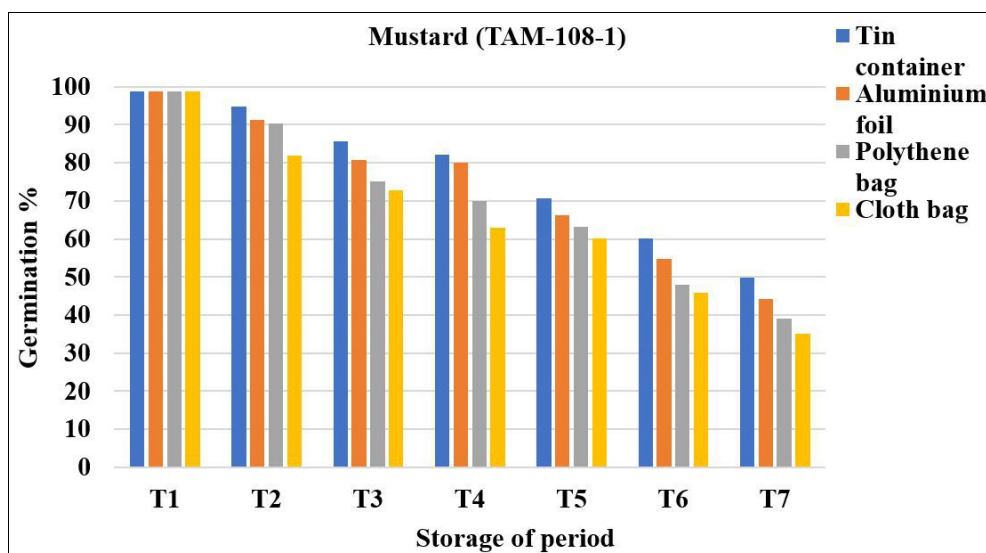


Fig 2: Effect of storage containers standard germination (%) in mustard TAM-108-1

Conclusion

The present study is concluded that moisture content and standard germination rates 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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