Review on: Impact of Seed Storage Container on Seed Quality

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Abstract

Seed is the fundamental and essential input for any crop production. Especially high quality seed is a serious input on which all other inputs will depend for their full value. Seed deterioration starts directly after acrop has attained the physiological maturity stage. The process of seed deterioration could be connected with some physiological changes, such as a progressive decrease in germinability, increase mean time of germination and increase in the number of abnormal seedlings and lower tolerance to adverse environmental conditions. Seed is a living entry and is subjected to various stresses which affect the quality. In storage, the viability and vigor of the seeds not only vary from genera to genera and variety to variety, but it is also regulated by many physic chemical factors like moisture content, atmospheric relative humidity, temperature, preliminary seed quality, physical and chemical composition of seed, gaseous exchange, storage structure, storage materials, etc. In order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, several methods are adopted, such as seed treatment with appropriate chemicals or plant products and storing in safe containers, in addition sanitation of the storage place. Therefore it is concluded that seeds stored in polythene bag or plastic container showed the germination in good performance so that selecting the appropriate seed storing material is very important.

Keywords: *Seed storage container and Seed quality*

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Introduction

Background of the review

Seed deterioration starts directly after a crop has attained the physiological maturity stage. The process of seed deterioration could be linked with some physiological changes, such as a progressive drop off in germinability, increase mean time of germination and increase in the number of abnormal seedlings and lower tolerance to adverse envirionmental conditions [1]. Storage containers or packaging materials are considered as one of the most important factors influencing longevity of seeds in storage. Many factors determine the longevity of seeds during storage. These includes seed moisture content, temperature, relative humidity, initial viability, stage of maturity at harvest, storage gas and initial moisture content of seed entering into storage. The farmers depend on their previous harvest for seeds and accordingly they preserve some portion of their harvest by indigenous methods. Generally low cost and easily available materials like earthen jar, coalter coated earthen jar, biscuit tin, kerosene tin, metal dram, gunny bag, polythene bag, dole, cow dung coated dole etc. are used as storage containers. The farmers have different types of storage containers in order to protect the seed from moisture absorption and insect infestation. Storage container had significant effect on moisture content of wheat seed at different observation date of storing. Seeds packed in polythene maintained high viability with time due to minimized moisture fluctuation and consequently produced more vigorous seedlings compared with those from seeds stored in jute or cloth bags which had little defense against moisture fluctuation [2]. Quality characters of crop seeds, such as seed germination, moisture content, seed discoloration and seed-borne fungal prevalence have long been known to be influenced by various factors due to storage containers [3].

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Consequence of storage containers on the germination of tossa jute seed of jute seed at different storage periods was verified. Initial germination was 82.0% for all storage containers. Storage containers significantly influenced germination. For 15 DAS, the highest germination (80.0%) was recorded in Tin container, which was statistically similar to Polythene bag, and the lowest germination (75.0%) was recorded in Gunny bag, which was statistically similar to Polythene bag. The *highest (78.0%) germination was recorded in Tin container and the lowest (70.0%) germination was recorded in Gunny bag at 30 DAS. For 45 DAS, the maximum (77.0) germination was obtained from Tin container and the lowest (66.0%) was obtained from Gunny bag. For 60 DAS, the highest germination (75.0%) was recorded in Tin container, which was statistically similar to Polythene bag, and the lowest germination (62.0%) was recorded in Gunny bag [4]. The tropical climate with high temperature and high relative humidity along with unscientific storage conditions adversely affect the preservation of cereal grains, oilseeds, etc., which lead to the total loss of seed quality [5]. The plastic bottle package presented the highest values for the 1st germination count (%) and germination (%) characters in all environments and storage periods. On the other hand, trifoliate paper and polyethylene bag stored in the cold and humid chamber at 180 days had the lowest values. the storage of rice, maize and beans seeds, with different packages, concluded that, regardless of the species, the plastic bottle package presented better values of 1st count (%) and germination (%), this was due to the seed moisture content that were stored in the permeable packages, in which they suffered a greater influence of the atmospheric conditions of the storage site, since this type of packaging does not offer any resistance to the water vapor exchanges of the seeds with the medium in which they are stored different than the impermeable, and this is revealed in the values of moisture degree of the seeds [6]. Therefore reviewing and gathering information based on the previous research finding, as well as identifying the knowledge and research gaps under the impact of Seed storage container on seed quality is very important.*

Objective of the review

to review the impact of seed storage container on seed quality

Review of Literature and Discussions

Definition of terms

Seed: It is defined as a complex biological structure consisting of a plant in miniature and food reserves protected by covering coats. A miniature plant possessing a remarkable capacity to ensure that the new individual starts life in the right place at the right time [7].

Seed quality: Seed quality is judged by different end users such as farmers and industries. For instance, farmers expect to obtain high quality seeds that are able to germinate and produce normal seedlings under field conditions [8] .

Impact of seed storage container on seed quality parameters

[9] seeds stored in porous containers give better performance than the seeds stored in air tight containers. From the results it may be concluded that the tin container was found the most effective for two months period of storage than polythene and gunny bag and may be recommended for general practice. Moreover if moisture percent of seed increase in storage condition germination percentage will decrease [10]. The initial moisture content of seeds in tin container, polythene bag and cloth bag were 13.3%, 13.1% and 12.2% but it was increased with increasing storage period. The increasing rate was higher in seeds of cloth bag. The initial germination percentage of seeds in tin container, polythene bag and cloth bag seeds were 91.32%, 89.15% and 88.40% but after storage it was declined. The decline rate is higher in seeds of cloth bag. The initial abnormal seedling of seeds in tin container, polythene bag and cloth bag seeds were 5.32%, 5.45% and 6.63% but it was increased with increasing storage period [11]. The increasing rate was higher in seeds of cloth bag. The initial dead seed of seeds in tin container, polythene bag and cloth bag seeds were 3.56%, 5.40% 4.97% but it was increased with increasing storage period. The increasing rate was higher in seeds of cloth bag. The initial root and shoot length of seeds in tin container, polythene bag and cloth bag were 15.04 cm and 13.3 cm, 10.95 cm and 12.60 cm and 8.24 cm and 11.15 cm but it was decreased with increasing storage time. The decreasing rate was higher in seeds of cloth bag. The initial root and shoot dry matter of seeds in tin container, polythene bag and cloth bag were 11.84 mg, 10.56mg, and 9.59mg but it was decreased with increasing storage period. The decreasing rate was higher in seeds of cloth bag. Germination index is lower in cloth bag. During setting of experiment on germination, several fungus like Fusarium,Alternaria, Colletotrichum, and Rhizopus were found higher no. of fungus was observed in seeds of cloth bag. From the above discussion, we may conclude that cloth bag is not safe for soybean seed storage for long time than tin container and polythene bag. Because the rate of moisture absorbance was higher inx cloth bag than tin container and polythene bag [11] .

According to [3] Seeds of rice were stored in five types of containers viz.,'dole (bamboo made), earthen pitcher, tin container, polyethylene bag and refrigerator (100C) for ten months at room temperature and finally the occurrence of black point and percentages of germination, moisture content and different fungi associated with wheat seeds during storage in different types of container was detected. Variations were observed in seed moisture content, insect population and germination percentage and seedling parameters due to storage devices and storage duration. At the time of storage, the moisture content and the germination percentage of BRRI dhan47 were 12.6% and 98.33%, respectively. The insect population at the time of storage was 0. Germination percentage decreased with increase in storage duration compared to its initial values before storage. The highest germination in BRRI dhan47 was 76.57% at 2 months of storage [9]. The lowest germination (8.75%) was found at 6 months of storage. Reduction on germination percentage may be due to dormancy of seed and it was 0.0% after 6 months of storage. Root length (RL), shoot length (SL), root dry mass (RDM) and shoot dry mass (SDM) decreased due to storage containers. The higher values were in 2 months of storage; while the lower values were in 6 months of storage. The highest germination (51.50%) was found in gunny bag and the lowest germination (27.33%) was found in tin container. Root length (RL), shoot length (SL), root dry mass (RDM) and shoot dry mass (SDM) were varied due to storage device. Higher values for all the parameters were observed in seeds stored in gunny bag. In case of interaction, seed germination percentage varied from 90.30% to 5.0% where the highest value was found in the seeds stored in plastic container for 2 months and the lowest value was found in tin container for 4 months. All the seedling parameters were found zero for the seeds stored *in all the four containers after 6 months of storage with few exceptions in gunny bag [9].*

[3] reported that the seed moisture content and black point severity were found highest in dole resulting in the lowest percentage of seed germination. The highest germination percentage was observed under storage in refrigerator followed by polyethylene bag, tin container and earthen pitcher. The moisture content and black point infection increased and seed germination decreased with the increase of storage period. The seed germination was 95%, which decreased to about 75% at the end often months of storage. Various fungal flora associated with wheat seeds differed in their prevalence depending on the length of storage period and types of container used for storage. The population of field fungi viz.Alternaria alternata, Aiternaria triticina, sorokiniana, Cladosporium cladosporioides, Curvularia lunata, Epicoccum purpurascens and Fusarium spp. Decreased while that of storage fungi viz. Aspergillus, Chaetomium, Nigrospora, Penicillium and Rhizopus increased with the progress of storage period. Seeds treated with Cyperus rotundus L. stored in all containers showed reduced seed mycoflora and enhanced seed germination, shoot and root length. The untreated seeds showed increased seed mycoflora than the treated seeds in all containers. In untreated seeds maximum seed mycoflora was recorded in glass bottle (48%) and minimum was in gunny bag (32%). Treated seeds showed maximum seed mycoflora in glass bottle (30%) and minimum in gunny bag (20%). Seed germination was minimum in untreated seeds compared to treated ones in all the containers. In case of untreated seeds more seed germination was found in the seeds stored in gunny bag (80%) followed by tin box (77%). In case of treated seeds more seed germination was in the seeds stored gunny bag (100%) followed by tin box (79%) and minimum in glass bottle (67%). Regarding shoot and root lengths, untreated seeds showed least lengths than treated ones in all containers. Shoot and root lengths were more or less similar in all seeds stored in different containers [12].

[10] found zero germination in rice seeds stored in earthen, tin and plastic containers after six months of storage with minimum germination in gunny bag. 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. Seed moisture content is the most important factor that regulates the longevity of the seeds. Observed that seeds stored in a high relative humidity lost their viability and vigor more quickly than those stored in dry air. Higher moisture in seeds enhances seed deterioration, which ultimately reduces the planting value of seeds in the field. In this study the initial moisture content of the seeds were 12.17% and the relative humidity was 70% or above through the storage period. For this reason, seeds absorbed moisture from the ambient air and tended to equilibrium with relative humidity. Container type is one of the factors that affect moisture absorbance and seed quality during storing of seeds. In this study, the rate of absorbance was higher in gunny bag. The gunny bag is not air tight container but tin and polythene bag are moisture proof. So, moisture increasing rate was lower in air tight polythene bag [1] .

[12] reported that seeds treated with leaf powder of Azadirachta indica A.Juss showed reduced seed mycoflora and enhanced seed germination, shoot and root length in all the containers. Increased seed mycoflora was recorded in all the containers in untreated seeds than the treated ones. In untreated seeds more seeds mycoflora was recorded in gunny bag and plastic bag (50% each), whereas least seed mycoflora was recorded in tin box. In treated seeds least seed mycoflora was recorded in gunny bag (17%) and maximum in plastic bag (20%). Seed germination was found to be more in all the containers in treated seeds than in the untreated ones. In treated seeds more seed germination was recorded in the seeds stored in gunny bag (93%) followed by plastic bag (90%), tin box and glass bottle (80%). In untreated seeds seed germination was maximum in seeds stored in gunny bag (77%) followed by glass bottle (71%), tin box (70%) and plastic bag (68%). Rosario et al. (2017) also reported that seedling vigor index of paddy was significantly different in the different storage materials on the fourth month of storage. Under cold storage, although seedling vigor index I of seeds stored in woven polypropylene bag increased with storage duration and attained highest value in eight month, super bag maintained the seedling vigor index I until four month, whereas metal bin showed the stable value until six month after storage. Woven polypropylene bag resulted higher seedling vigor index I than super bag and metal bin in all storage durations. The highest seedling vigor index I of sesame seeds was resulted from seeds stored in woven polypropylene bag for eight month under cold storage although rapidly increase of seedling vigor index I was occurred in the same packaging material under ambient condition. Seeds lose their viability and vigor very fast under ambient conditions as the changes in environmental conditions like temperature and humidity. Seed deterioration is a natural phenomena and life span of seeds decrease with the passing of time. Seed deterioration processes, however depend on a large number of genetic and environmental factors. This higher moisture in the seed may be the main reason of quick quality deterioration in the seeds of gunny bag. The polyethylene bags are effective in maintaining high viability at 5°C and could be used for seed storage, while aluminum foil pouches are suitable for the long-term storage of seeds especially at sub-zero temperatures [13]

[2] concluded that seeds stored in polythene bag or plastic container showed the germination performance similar to those in glass jar. Thus, the study revealed that soybean seed can be stored in polythene bag or plastic pot after drying to 6 to 8% moisture content for retaining high viability. The black sesame was tested in a woven polypropylene bag, IRRI super bag and a metal bin under ambient and dry cold conditions for eight month. During storage, seed moisture content was influenced by storage duration, but not by packaging types and storage environments. All packaging materials showed the same trend for moisture content by sustaining until six monththen increasing in eight-month storage. It can be suggested that all packaging materials can maintain moisture content only for six months. Thus, the re drying and packaging of sesame may be required for more than six-month storage to avoid increasing moisture content. Germination increased with the advancement of storage durations, and germination index, seedling vigor index

I and II were observed in the same trend of germination percent. The fully dormancy release of seeds under ambient condition was earlier than cold storage. The germination percent of seed under cold storage has not reached highest level until eight-month of storage. Therefore, cold storage is not necessary for eight month storage of black sesame seed. Among packaging materials, woven polypropylene bag showed the early dormancy break than other airtight containers, super bag and metal bin, under both storage environments. The effect of CO influenced on the dormancy release of sesame. So, to achieve fully dormancy release early, farmers and seed companies should keep the seeds under the non-airtight condition with storage pest control measure [14] . The environment with temperature control is efficient in storing rice seeds for 180 days using a plastic bottle package. During storage, the greatest changes in the physiological quality of rice seeds are verified in the cold and humid chamber environment and in the polyethylene bag package [6].

[15]were studied the effect of seed storage containers on four genotypes of cowpea seed samples (Hewale, Vidiza, Asomdwoe and Asenetapa all unpigmented seed coat. Seed samples were initially stored in a cold room for after harvesting before it was sampled for the experiment. Seed samples were stored in polythene bag (black), Cotton bag (cloth), and Air-tight glass-bottle (Kilner jar) and kept under ambient storage conditions for storage and the results showed that irrespective of the cowpea genotypes and storage material used, percentage vigour and germination were significantly affected with time in storage. Seeds stored in cotton bags had the least percentage vigour (57%) and germination (65%) while the highest was recorded for seeds stored in air-tight glass containers. Among all the cowpea genotypes studied, Hewale was found to have poor storage abilities. For better storage of cowpea seeds for a period exceeding 3 months, it is preferable to use glass containers or black polyethylene bags even under ambient condition to maintain seed vigour and germinability. [16] suggested that seeds in paper bag, aluminium foil pouches, PETE bottle, tetrapack packing, vacuum packing and cloth bags for different periods i.e. 150 and 250 days under dry cold room, refrigerator and ambient conditions. Seedling parameters i.e. germination percentage, seedling length, seedling dry weight and seedling vigor index were calculated and observed that they decreased with the period of ageing. Sesame seeds cultivars are stored in different packaging materials were affected due to storage but the effects were more pronounced in the cloth bag compared to the other packaging materials. Vacuum packing had maintained the seed quality with least deterioration. Storage under refrigerator conditions at low temperatures had superior quality maintained compared to storage under dry cold room and ambient conditions in all the seedling parameters.

[17] studied on effect of seed moisture content, packaging and storage period on mitochondria inner membrane of soybean seed; here there are three factors moisture content, i.e. 8. 10 and 12 percent, storage materials, i.e. polyethylene, wheat and aluminium foil; storage period i.e. 0, 1, 2, 3, 4, 5, and 6 months. Changes in seed moisture content, phospholipids and protein content of mitochondria inner membrane, germination and coefficient velocity of germination were monthly determined. It was found that seed moisture content was increase and showed positive correlation with electrolyte leakage and showed negative correlation with phospholipids and protein content of mitochondria inner membrane, germination and coefficient velocity of germination. From this experiment, soybean seeds were stored in aluminium foil bags observed highly phospholipids and protein content of mitochondria inner membrane, germination, coefficient velocity of germination and keep moisture content in low level could delay seed deterioration followed by polyethylene and wheat bags

Conclusion and Recommendation

Conclusion

Seed is the basic and essential input for any crop production. Especially high quality seed is a critical input on which all other inputs will depend for their full value. Seed deterioration starts directly after a crop has attained the physiological maturity stage.The process of seed deterioration could be connected with some physiological changes, such as a progressive decrease in germinability,increase mean time of germination and increase in the number of abnormal seedlings and lower tolerance to adverse environmental conditions.Seeds stored in polythene bag or plastic container showed the germination in good performance so that selecting the appropriate seed packaging or storing material is very important.

Recommendation

Seed is one of the vital inputs for crop production. It has been shown experimentally that only by using good quality seed yield of a certain crop type is could be increased by 15% to 20%. So that for preventing the high quality of a certain crop seed from deterioration or loss we shoud have to be select the best packaging material.

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