International Journal of Agriculture and Plant Science
www.agriculturejournal.in
Online ISSN: 2664-7664, Print ISSN: 2664-7656
Received: 24-07-2024, Accepted: 23-08-2024, Published: 07-09-2024
Volume 6, Issue 3, 2024, Page No. 46-48

Seed quality of stored rice (*Oryza sativa*) as influenced by storage containers and storage periods

Marju Alam[1], Lazia Rahman[1*], Tasnima Husna[2]
[1] Department of Horticulture, Bangladesh Agricultural University, Mymensingh, Bangladesh
[2] Department of Crop Botany, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh

Abstract
An experiment was conducted at Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during April to June 2024 to study the effect of two storage containers (plastic jar and cloth bag); and four storage periods (0, 10, 20 and 30 days) on the seed quality of rice. The experiment was laid out in Completely Randomized Design (CRD) with three replications. The rice seeds stored in plastic jar showed maximum germination capacity with high germination index, highest seedling growth and vigour index. The seeds stored in cloth bag had the lowest seed quality during the testing period. The highest 1000-seed weight, moisture content was recorded in cloth bag; where the equivalent lowest values were recorded in plastic jar. The moisture content, 1000-seed weight, were increased with the longer period of storage. In addition, germination index, seedling growth of rice seedling and vigour index decreased with the increase in storage period. Among the two containers, plastic jar was the best storage container for rice seed storage for long period.

Keywords: Rice, seed quality, storage container, storage period

Introduction

Rice, as one of the three major food crops in the world and is the largest grain consumed, especially in low-income and middle-low-income countries. Rice (*Oryza sativa* L.) is the most important staple food crop for more than half of the world's population (Kumar *et al*. 2019) [3] and the agro climatic condition of Bangladesh is very much favourable for rice production. Moreover, rice cultivation is cultural heritage of the country. Farmers grow Aus, Aman & Boro rice as a common crop in all the year round. Factors such as varieties, climatic conditions, pre-harvest operations and technical managements affect grain quality. Because of the seasonality of the rice crop, it is necessary to ensure the preservation and availability of the product for a long period (Elert, 2014) [1].

Storage is one of the most critical post-harvest operations, it deserves special attention in order to estimate the economic magnitude of its negative impact. It may be interred that total post-harvest losses around 14%, while the average losses in storage alone 4.5%. In fact, poor storage practices are one of the main causes of losses in the various stages of the post-harvest system. The estimated total postharvest loss of rice paddy in Bangladesh was about 14%, of which drying and storage losses are 2.3% and 3.8%, respectively (World Grain, 2017).

At farm household level, storage is essential for food security or as a commodity bank for consumption into cash when required. Unfortunately, small scale or marginal farmers often lack of the resources to store large amounts of grain and do not have a large storage structure, they therefore are bound to sell their paddy to traders or buyers immediately after harvest. They carry out no further processing (drying, cleaning, grading) because of the immediate need for cash, and there is a lack of incentive to dry, as there is no significant difference in price between wet and dried paddy. The paddy is only dried for safe storage, and only the amount of necessary for consumption or a little more foe cash conversion or to sell at a better price. The losses were likely to be higher in Bangladesh in comparison with developed countries where better storage systems were employed. Germination capacity of rice ranged from 96 to 94% in steel drum, 96 to 84% in Dole, 96 to 70% in gunny bag, while no change in germination was observed in plastic drum (96%).

In most of the areas of Bangladesh, the farmers and remote areas living people store food grains in most of their household traditional storage structures like Dole, Berh, Gola, Gunny bags, steel drum and Plastic Drum etc. These structures are not so durable and poor in providing optimum storage conditions. The grains stored in these structures are susceptible to damage by natural calamities like heavy rainfall, flood, cyclone and attack of micro-organisms, insects and rodents which cause a considerable damage and loss every year. Storage loss in our country is relatively high due to improper storage structure, lack of knowledge about storage to the farmers and traders and improper management during storage period. The net availability of rice is considerably less than its gross production due to all these factors.

Therefore, an attempt was carried out to identify existing storage technologies at farm level and determine efficacy of those for rice storage.

Materials and methods

Experimental site

This experiment was carried out at the Seed Technology laboratory of Agronomy Department, BSMRAU from April to June 2024. Geographically, the station is located at 24° 2′ 10.32″ N, 90° 23′ 45.24″ E.

Design of the experiment

The experiment was carried out in a completely randomized design (CRD) consisting of two different types of storage materials as treatments (plastic jar, cloth bag) with three replications.

Weather parameters at seed laboratory during experimental period

The meteorological data such as temperature and relative humidity during the entire experimental period (April to June 2024) was recorded at seed laboratory. The mean maximum and minimum temperatures were 36 °C in June and 28 °C in April. The relative humidity ranged from 61.38 % in April to 78.72 % in June.

Storage materials

Plastic Jar

Plastic bin was a cylinder with a narrow opening at the top. The jar was placed inside the room. After having filled with rice seed, the top opening was made air tight by a lid. Its capacity ranges from 2-4 kg.

Cloth Bag

Cloth bag is the most popular and environment friendly packaging solution for agricultural industries. They are made from cotton fiber and bio-degradable.

Experimental procedure

The laboratory, storage materials and seeds were cleaned before the setup of the experiment. One kilograms of clean rice seed of BU Dhan-1 variety was stored in two different storage materials for a period of two and half months. Before storage, laboratory tests were carried out for recording the initial seed quality parameters like moisture content and germination percentage. Seed moisture content (%) was determined directly with the oven dry method. In this method, 300 rice seeds i.e., 100 seeds per replication were put on moistened germination paper and incubated at 30°C for two weeks. Normal seedlings were counted from each replication and average germination percent was calculated by the following formula (Krishnasamy and Seshu 1990) [2].

Germination % = (No. of seed germinated/No. of seed tested)*100

Moisture content

Moisture content was determined at every 15 days during experimental period by using low constant temperature oven method (103^0C, 18 hr) following International Rules for Seed Testing in the seed Technology Laboratory of BSMRAU. The moisture content of seed (wet basis) was determined using the following formula:

$$\text{MC \%} = \frac{(M2-M3)}{(M2-M1)} \times 100$$

Where,

M1 = wt. of container + cover

M2= wt. of container + cover + rice seed before drying

M3= wt. of container + cover + rice seed after drying

Germination Index

The germination index (GI) was calculated as described in the Association of Official Seed Analysts.

$$\text{Germination index (GI)} = \frac{\textit{Number of germinated seed}}{\textit{Days to first count}} + \ldots\ldots\ldots + \frac{\textit{Number of germinated seed}}{\textit{Days to final count}}$$

Seed Vigour Index

This was calculated by determining the germination percentage and seedling length of the same seed lot. For seed vigour index data were recorded on germination up to 15 days. Then root length and shoot length were measured from seedlings of pots for calculating seed vigour index. Seed vigour index was calculated using the following formula:

Seed vigour index = Germination (%) X (Mean shoot length + Mean root length)

Results and discussion

The moisture content in plastic jar initially 10.8% and finally after 30 days 13.8%. Difference between initial and final moisture content 3% in plastic jar. On another hand, the moisture content in cloth bag initially 10.8% and finally after 30 days 15.4%. Difference between initial and final moisture content 4.6% in cloth bag (Table 1).

The germination % in plastic jar initially 91.33 % and finally after 30 days 87.00 %. Difference between initial and final germination percentage 4.33% in plastic jar. On another hand, the germination % in cloth bag initially 91.33% and finally after 30 days 83.33%. Difference between initial and final germination percentage 8.33% in cloth bag (Table 1).

The germination index in plastic jar initially 14.94 and finally after 30 days 12.9. Difference between initial and final germination percentage 2.04 in plastic jar. On another hand, the germination index in cloth bag initially 14.94 and finally after 30 days 10.55. Difference between initial and final germination percentage 4.4 in cloth bag (Table 1).

The thousand seed weight in plastic jar initially 26.62g and finally after 30 days 27.94g. Difference between initial and final thousand seed weight 1.32g in plastic jar. On another hand, the thousand seed weight in cloth bag initially 26.62g and finally after 30 days 29.47g. Difference between initial and final thousand seed weight 2.85g in cloth bag (Table 1).

The seedling length in plastic jar initially 6.65cm and finally after 30 days 8.25cm. Difference between initial and final seedling length 1.6cm in plastic jar. On another hand, seedling length in cloth bag initially 6.65cm and finally after 30 days 7.83cm. Difference between initial and final seedling length 1.18cm in cloth bag (Table 1).

The seed vigour index in plastic jar initially 607.34 and finally after 30 days 717.75. Difference between initial and final seed vigour index 110.41 in plastic jar. On another hand, the seed vigour index in cloth bag initially 6.7.34 and finally after 30 days 652.47. Difference between initial and final seed vigour index 45.13 in cloth bag (Table 1).

Table 1: Stored rice influencing factor such as moisture %, germination%, germination index, thousand seed weight (g), seedling length (cm) and seed vigour index

Storage container	**Moisture content (%)**			
	Initial	10	20	30
Plastic Jar	10.8	11.3	12.8	13.8
Cloth Bag	10.8	12.6	14.2	15.4
Storage container	Germination (%)			
	Initial	10	20	30
Plastic Jar	91.33	90.33	88.67	87.00
Cloth Bag	91.33	89.67	86.00	83.33
Storage container	Germination Index			
	Initial	10	20	30
Plastic Jar	14.94	14.38	13.76	12.9
Cloth Bag	14.94	13.11	11.80	10.55
Storage container	Thousand Seed Weight (g)			
	Initial	10	20	30
Plastic Jar	26.62	27.12	27.61	27.94
Cloth Bag	26.62	27.86	28.90	29.47
Storage container	Seedling Length (cm)			
	Initial	10	20	30
Plastic Jar	6.65	7.21	7.50	8.25
Cloth Bag	6.65	6.96	7.34	7.83
Storage container	Seed Vigour Index			
	Initial	10	20	30
Plastic Jar	607.34	642.24	664.5	717.75
Cloth Bag	607.34	624.10	639.84	652.47

Conclusion

The rice grains generally deteriorated with storage and deterioration was particularly strong for grains stored in cloth bag. High temperature, high relative humidity, and moisture in the storage environment are the principal factors involved in deterioration of rice seed quality during storage. Loss of germination capacity was the final manifestation of seed deterioration. When seed moisture content was increasing the rate of germination percentage was decreased. The deterioration rate was also the highest in seeds of cloth bag. The shoot and root length of seedling and seedling vigour was the lowest in cloth bag at the end of storage period. From the results, it may be concluded that the conventional practices of rice seed storage in cloth bags are not suitable because there is a possibility of moisture gain and pests attack, which play important role in deterioration of rice seed quality and viability during storage. Air tight tin plastic jar will be the best means for rice seed storage for long time.

Author's contribution

Md. Marju Alam developed the idea and designed the experiment. Md. Marju Alam, Lazia Rahman and Tasnima Husna collected the data. Lazia Rahman wrote the manuscript. Lazia Rahman and Tasnima Husna revised the final version of the manuscript.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

1. Elert E. Rice bt the numbers: Agood grain. *Nature*,2014:514:50-51.
2. Krishnasamy V, DV Seshu. Germination after accelerated ageing and associated characters in rice varieties. Seed Sci. Technol,1990:18(1):147-156.
3. Kumar R, Mishra J S, Kumar S, Hans H, Bhatt B P, Srivastava A K. *et al*. Production potential, economics and energetic of rice (*Oryza sativa*) genotypes as influenced by varying levels of nitrogen. Indian Journal of Agricultural Sciences,2019:89(11):1846–1849.