STUDY ON CHARACTERISTICS OF STORED MAIZE GRAIN IN HERMETIC BAGS AND TRADITIONAL METHODS

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ABSTRACT

This study was performed in ADMI Village Dih sarsauna, Tajpur, Samastipur Bihar, to observe the effect of a type of storage structure on additive characteristics of stored Maize (Variety- 9081) was stored in hermetic bag and two conventional grain storage structures, viz. Steel/metal bin and Mud bin. Two hermetic bags, one metallic bins, and one Mud bin in each containing 1 quintals of wheat stored at 10-15 farmers household in the village were observed by without any treatment. Physical property like grain moisture content, germination %, 1000 grain weight, insect infestation and storage loss. Representative samples from three type storage mode were collected every month and tests for all parameters of stored grains were performed. After Nine months, wheat stored in hermetic bags had higher germination (90.35%), slowly increased moisture content (0.02), slightly increase 1000 grain weight (0.08) and no insect-damaged or storage loss. Hermetic bags with deliberately introduced Rhyzopertha dominica successfully eliminated the pests. Mud bin stored had infestations; metallic bins also were infested. Maize grain moisture content in all storage mode varied depending upon ambient conditions; moisture, 1000 grain weight variation was largest in mud bin; Infestation of insect was found in all kind of bags except Hermetic Super Grain Bag. Only Storage loss in mud bin lower than Metallic bin. Hermetic bags can be an effective and environmentally better performed for reducing storage losses of wheat. It was concluded that it is safe to store quality Maize with 12% m. c. or less in hermetic plastic bags for Nine months.

Keywords: Maize, Hermetic bags, Storage loss, Germination, Moisture Content, Insect infestation.

Introduction

Maize is considered as a potential aquatic cash crop in India particularly in Bihar. Maize is grown particularly in Begusarai, Samastipur and Khagaria etc. where it is grown commercially.

Agricultural development has two major aspects – production and post harvest processing. Technology of post harvest processing refers to the processes and treatments carried out on agricultural produce after harvest for its protection, conservation, processing, packaging, distribution, marketing and utilization to meet the food and nutritional requirements of the people in relation to their needs. Hence, the scope of post harvest processing activity encompasses all operations from the stage of harvest till the material reaches the end users in the desired form, place, packaging, quantity, quality and price. It has to develop in consonance with the needs of each society to stimulate agricultural production, prevent post harvest losses, improve nutrition and add value to the products. Presently, more attention is needed on primary processing aspects, which include cleaning and grading, drying, storage and packaging. Bihar is yet to make a sound beginning on these aspects.

With 2.85 % of India's geographical area and 8.07 % of population**,** Bihar is the third most populous state in the country (2001 census). About 80% of Bihar's population is dependent for its livelihood on agriculture. Bihar is the eighth largest producer of grains in India. On one front, state of Bihar is being talked of as the next big hope for the agriculture sector, on the other this sector remains the most crucial factor for the state economy. Degree of dependence on agriculture in terms of employment as well as income is high. In spite of high volume of production and a good range of crops, the earnings from farming are poor. The value-addition in agricultural products is negligible. Owing to low literacy, small land holdings and poor infrastructure, the production practices and input usage is either less or more than recommended practices. Needless to say, if the recommended practices are followed the potential for sustainable increase in production and productivity is huge.

A hermetic bag was tested for its effectiveness by storing the wheat. Also a comparative performance of Hermetic bag was evaluated with reference to traditionally used techniques such as Mud bin and Metal bins, based on various parameters, e.g. grain Moisture content, 1000 grain weight, germination percentage etc.

Hermetic storage bags is a safe, cost-effective storage method that controls insect infestations in addition to preserving the quality of grains, allowing pesticide-free, short-term and long-term qualitative and quantitative seed preservation without refrigeration, maintaining seed vigor and pest control. Storage at low temperature (4°C) ensures greater safety margins between insect development time and break of dormancy, in case of hermetic storage even at ambient temperature, insect development gets naturally eliminate. Also Hermetic storage is capable of maintaining relative humidity that preserves seed moisture and prevents mold growth.

Materials and Methods

1.1 Sample Preparation

Experiment trial was carried out at ADMI village Dih-Sarsauna, Bihar (India). Total 10-15 farmers household were selected for the purpose. For perpetration of storage sample, the Cleaning and grading of Maize grain was done in seed grader machine.

1.2 Treatment

The experiment comprised three different storage modes – namely Hermetic grain bag, Mud bin and Metal bin without chemical fumigant. In any of the case were counted as treatments. The Hermetic bag-end was closed by tightly twisting the free portion and then tying it by ropes or some suitable means. The bags were placed in a room made of concrete roofed and wall with suitable ventilation. All the treatments were kept under ambient conditions. The different storage modes were arranged in a row on a dunnage so as to protect the grains bags from the direct contact with ground. The temperature and relative humidity were recorded on a daily basis while the other dependent parameters were recorded on monthly basis.

1.3 Observations Recorded

The Maize grain samples of about 25.27 gm per slot were obtained with a compartmentalized grain sampling spear (Seed Buro Equipment Company, Chicago, USA) at one month intervals. The sampling spear was 1 m long, with five slots, 15 cm long, evenly-spaced, and separated from each other by a 2.5 cm-long wooden plug.

1.4.1 Moisture Content

Moisture content, 1000 grain weight, germination percentage, insect-pest infestation etc were derived by the help of collected grain samples from each treatment.

The Initial and sampling data were moisture content of the Maize grain was determined for finding the dry matter as well as moisture content of the raw sample. The moisture was determined by standard H A O method in which samples were dried at 105 ^{o}C for 24 hours duration. The total dry content of grain sample was determined in accordance with AOAC method (Anonymous, 1990) and moisture content (MC) was calculated using following formula:

$$MC = \frac{W_m}{W_m + W_d} \times 100 \quad (1)$$

The data on in where, W_m = Initial moisture content and

W_d = Final dried moisture content

1.4.2 1000 Grain Weight

Randomly 1000 seeds from each treatment of Maize samples were taken and weighed using electronic balance of 0.01 g sensitivity.

1.4.3 Germination percentage

The germination percentage was determined by taking 100 grains of Maize from each treatment in 3 different Petri-dishes. The disc was fully filled with sand and water. Water spraying was done regularly to keep the grain moist. After 72 hrs the number of grain of grain was counted carefully and germination percentage of 1 respective samples germinated was determined as under :

$$\text{Germination Percentage} = \frac{\text{number of seeds sprouted}}{\text{total number of seeds taken}} * 100\% \quad (2)$$

1.4.4 Insect -pest Damage

At the end of every month of storage period random samples were taken and each sample was visually rated for damage by insect and pests. The extent of insect-pest damage in stored grains under each three treatment was determined with the help of collected grain samples.

1.4.5 Storage Loss

Quality and quality loss of stored like other parameters. The extent of storage loss all treatments was also determined for each sample collected data-wise, to evaluate comparative performance of different storage modes, followed in study.

1.4.6 Temperature humidity profile during storage

The temperature and relative humidity were recorded by portable relative humidity
Meter on Monthly basis for entire storage period.

RESULTS AND DISCUSSION

The results obtained and discussion from the characteristics of stored Maize grain in Hermetic bags and traditional methods of food grain. It deals with the tabulation of the data and the presentation of the results by graphs based on experimental data. The merits and demerits of the results have been discussed to facilitate the generation of information on these aspects which would help in developing suitable storage structure. The derived result on storage performance of different technique followed, are presented as under.

2.1 Relative Humidity (RH) and Ambient Temperature

The ambient relative humidity and temperature was high during winter season. In winter season the ambient relative humidity and temperature was lower as compared to the monsoon.

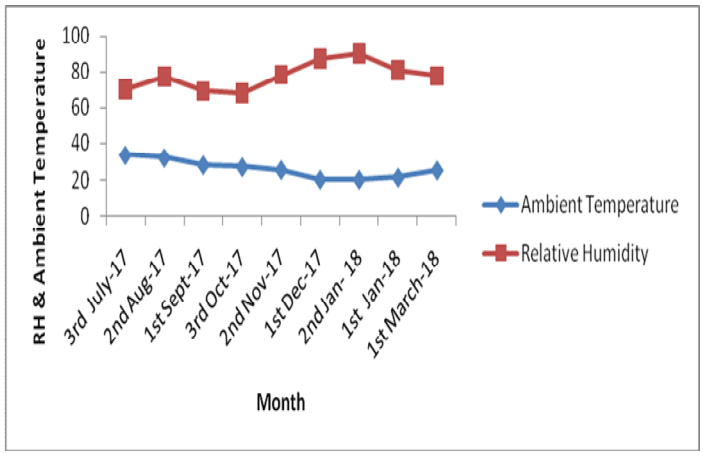

Fig 2.1. Variation in Relative humidity & ambient temperature during storage period

2.2 Variation in Grain Moisture Content

The variation in grain moisture content during storage period under different storage modes stored in Hermetic bag was a treatment is shown in Figure 2.2. The initial moisture content of Maize stored in Hermetic bag was 12.40 % (w. b.), Mud bin 12.45 % (w. b.) and Metal bin 12.44 % (w. b.). On perusal of fig, it is noticed that in the treatments of Mud bin storage and Metal bin storage the moisture content of Maize is in increasing trend. Which may be due increase in ambient relative humidity and dampness created by the heat of respiration of the grain.

Comparatively, the variation in moisture content of maize in hermetic grain bag was least which ranging between 12.40 to 12.42%. on the other hand, in Mud bin storage these is increase in moisture content from 12.45 % to 13.48% while in Metal bin the moisture content was increased from 12.44% to 13.40%.

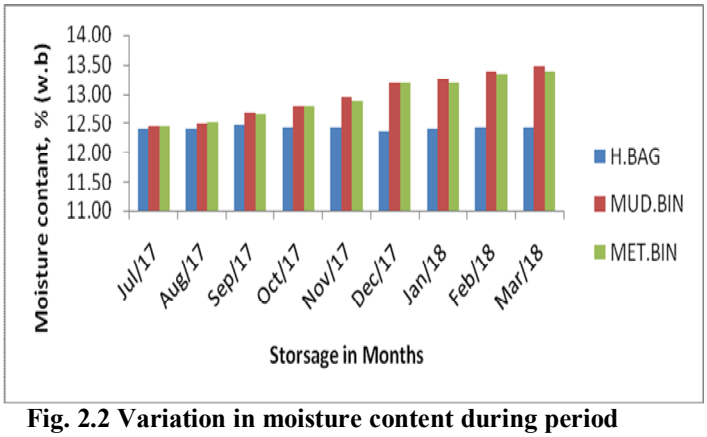

Fig. 2.2 Variation in moisture content during period

Comparatively, the increase in moisture content in Mud bin and Metal bin was mainly due to respiration of grain and increased relative humidity. It was also seen that the moisture increased initially slowly up to Nine months of storage period and then it increased rapidly might be due to variation in relative humidity.

The least variation in moisture content in hermetic storage bag is due to generation-of aerobic metabolism of insect

pests and micro-organisms of oxygen-depleted and carbon dioxide-enriched inter-granular atmosphere of the storage ecosystem.

2.3 Variation in 1000 Grain Weight

The variation in 1000 grain weight in hermetic bag, Mud bin and Metal bin storage during storage period is shown in Figure 2.3. This parameter behaves in same manner as the change in moisture content with storage period.

The variation in 1000 grain weight of Maize in the hermetic grain bag was to about negligible (276.42 g to 276.47 g.) while in the Mud bin storage it was from 276.25 g to 240.35 g in Metal bin from 276.34 g to 250.30 g. the variation was mainly because of humidity and temperature variation during storage period.

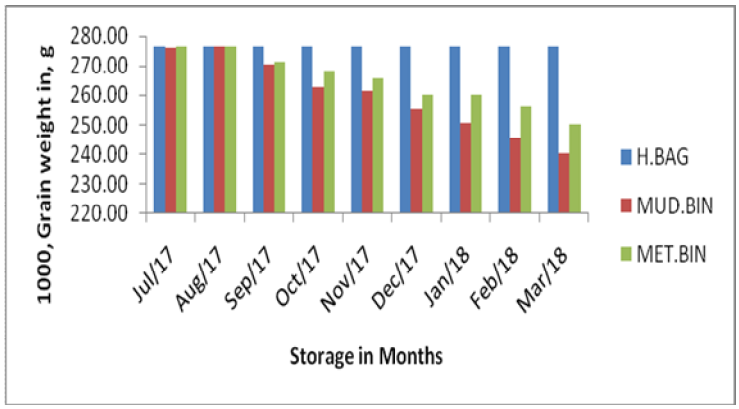

Fig. 2.3 Variation in 1000 grain weight

2.4 Germination Percentage

The status of germination percentage during storage of Maize in different storage modes are shown in Fig 2.4. As per table value the percentage germination of Maize was quite high (more then 90%) and about to at uniform rate throughout storage period in case of Hermetic bag storage. In contrast, it was lower and at varying trend both in Mud bin and Metal bin storage.

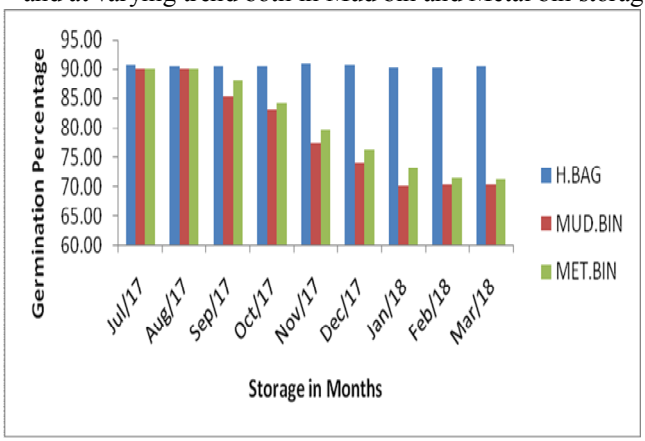

Fig. 2.4 Variation germination percentage

Overall the germination percentage was good during the initial days. In the end, the germination was decreased in Mud bin and Metal bin. The germination percentage of maize seed in the Mud bin decreased from 90% to 70.32%, germination percentage in the Metal bin decreased from 90.00 % to 71.30%. The best germination percentage was found storage in hermetic bag up to Nine months.

2.5 Insect Pest Damage in Stored Grain

Graphical presentation of level-cum-variation in insect-pest damage caused in stored Maize grain under different storage modes is shown in Figure-2.5, which advocates that increase of Hermetic bag no during storage period.

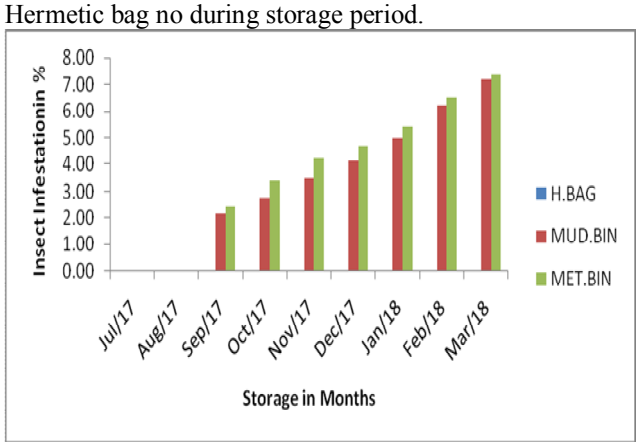

Fig. 2.5 Variation insect infestation

The storage was found not insect –pest in all type of storage mode in maize stored until two months from the time, but was found to be extended until storage time in Mud bin or Metal bin after two months. Hermetic bag not been found in the bag to be some sort of worm in maize stored up to Nine months.

On the other hand in case of mud bin and Metal bin storage it was at significant level. The insect -pest damage in stored grain of Maize grain in Mud bin increased after two months from 2.15 to 6.23 %, and in the Metal bin it was to the increased of 2.42 to 6.50%. the incidence of insect-pest depends mainly on the ambient humidity, which was comparatively greater in Mud bin and Metal bin storage. Because of the fact the level of grain damage due to insect-pest was at greater level in both of these two. In Hermetic storage there was no variation in relative humidity, but remain at optimum level throughout storage period.

2.6 Storage Loss

The variation in storage loss in stored Maize grain during storage in different storage modes are shown in Fig 2.6. No visible loss was observed in hermetic bag storage during storage period of Nine months. In contrast the disembarkation of the storage loss in mud bin and metal bin storage was observed to a significant level in increasing trend from the beginning of storage to the end

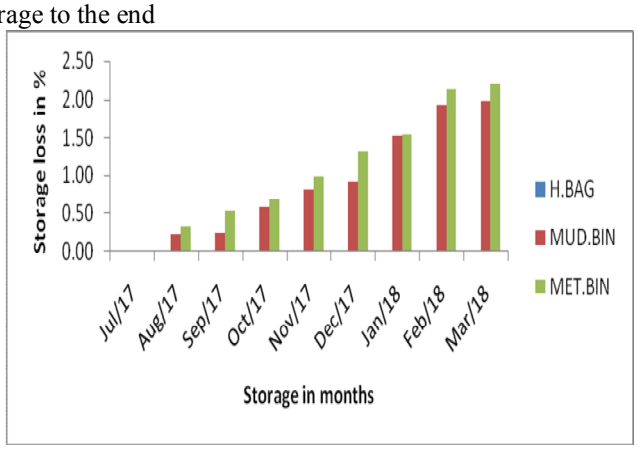

Fig. 2.5 Variation Storage loss

Overall, the Storage loss percentage was enhanced from one month after storage. The Storage loss of Maize grain in the Mud bin after one month from storage was noticed 0.24 to 1.98 %, while in Metal bin it was from 0.33 to 2.19 %. In hermetic bag storage, the storage loss was about to negligible.

CONCLUSIONS

In the study "Study on characteristics of stored maize grains in hermetic bags and traditional methods" based on observations and after analysis of the same, it was found that the Hermetic bag (Super grain bag) was better in all respect regarding storage of Maize grain. The percentage germination grain loss, incidence of insect-pest, 1000 grain weight etc was in favorable limit, which is mainly because of airtight features of bag.

In contest, in other modes of storage, i.e. Mud bin and Metal bin, the storage loss percentage germination, 1000 grain weight increasing of insect-pest etc was quit high over hermetic bag storage. The season may be because of high humidity moisture content etc. in grain storage environment.

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