International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; SP6: 769-772

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(Special Issue -6)
3rd National Conference
On
PROMOTING & REINVIGORATING AGRI-HORTI, TECHNOLOGICAL INNOVATIONS [PRAGATI-2019]
(14-15 December, 2019)

Comparative study of traditional storage and hermetic bag storage methods of wheat

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Abstract
Comparative 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 in hermetic storage of wheat (Veriety-HD-2733) with traditional storage modes - metal bin and mud bin, was performed at ambient conditions. Representative samples from three type storage mode were collected every month and tests for all parameters of stored grains were performed for eleven month. Physical property is like grain moisture content, germination%, 1000 grain weight, insect infestation and storage loss were analysed. From study it was found the storage in hermetic bags was superior over other methods. Wheat stored in hermetic bags showed higher germination (90.23%), slow increase in moisture content (0.11), slightly decreased 1000 grain weight (1.13) and no insect-damage or storage loss. Hermetic bags deliberately introduced with Rhyzopertha Dominica were successfully eliminated during storage. Infestation of insect and storage loss was in mud bin and metal bin was to a greater extent as compared to hermetic bags. In nutshell the Hermetic bag proved to be an effective and environmentally friendly storage option for reducing storage loss of wheat.

Keywords: traditional storage, hermetic bag, storage loos, germination, moisture content, insect infestation, grain weight

1. Introduction
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.
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 vigour 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 mould

growth.
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.

2. Materials and Methods

Sample Preparation

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

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.

Observations Recorded

The Wheat 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.

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 Wheat 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 105ºC 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

1000 Grain Weight

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

Germination percentage

The germination percentage was determined by taking 100 grains of Wheat 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:

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

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.

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.

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 Wheat 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.

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.

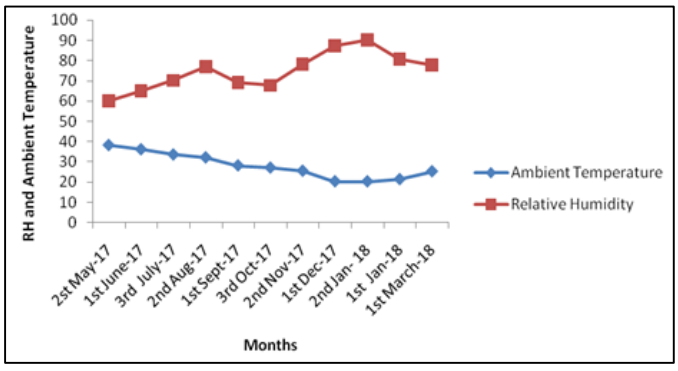

Fig 2.1: Variation in Relative humidity & ambient temperature during storage period

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 Wheat stored in Hermetic bag was 11.35% (w. b.), Mud bin 11.39% (w. b.) and Metal bin 11.30% (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 Wheat is in

increasing trend. Which may be due increase in ambient relative humidity and dampness created by the wheat of respiration of the grain.

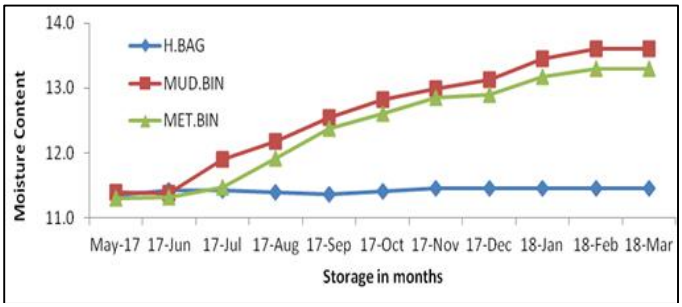

Fig 2.2: Variation in moisture content with storage

Comparatively, the variation in moisture content of maize in hermetic grain bag was least which ranging between 11.35 to 11.46%. on the other hand, in Mud bin storage these is increase in moisture content from 11.39 to 13.60% while in Metal bin the moisture content was increased from 10.90% to 11.21%.

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 Eleven 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.

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.

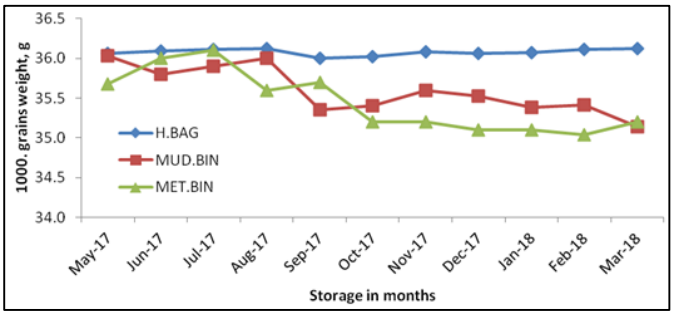

Fig 2.3: Variation in 1000 grain weight

(36.06 g to 36.12 g.). While in the Mud bin storage it was from 36.30 g to 35.14 g in Metal bin from 35.68 g to 35.20 g. the variation was mainly because of humidity and temperature variation during storage period.

Germination Percentage

The status of germination percentage during storage of Wheat in different storage modes are shown in Fig 2.4.

As per table value the percentage germination of Wheat 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.

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 Wheat grain in the Mud bin decreased from 90% to 59%, germination percentage in the Metal bin decreased from 91.10% to 60.32%. The best germination percentage was found storage in hermetic bag up to Eleven months.

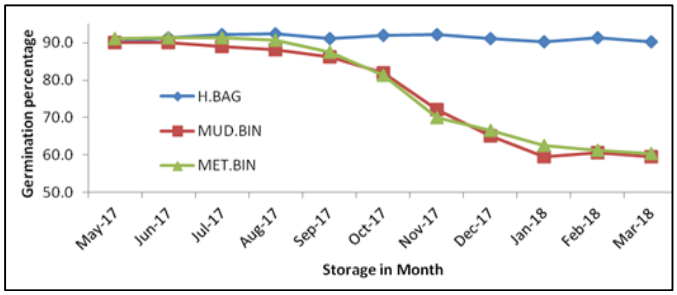

Fig 2.4: Variation germination percentage

Insect Pest Damage in Stored Grain

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

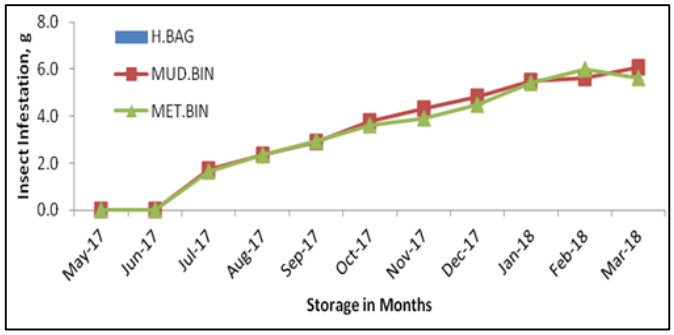

Fig 2.5: Variation Insect-Infestation percentage with storage

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 Wheat grain in Mud bin increased after two months from 1.72% to 6.10%, and in the Metal bin it was to the increased of 1.65% to 5.64%. 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.

Storage Loss

The variation in storage loss in stored Wheat 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 Eleven 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

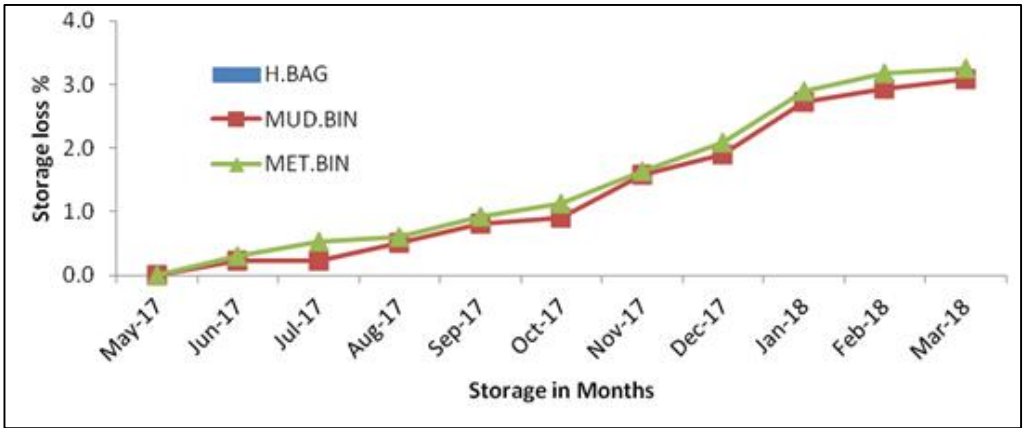

Fig 2.6: Variation Storage loss

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 0.23 to 3.09% while in Metal bin it was from 0.31 to 3.26%. In hermetic bag storage, the storage loss was about to negligible.

Conclusions

In the study "comparative study of hermetic bag storage of wheat with traditional storage 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 Wheat 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.

References

1. Agrawal NS. Desing on storage structure. Seminar on post-harvest technology of cereals and pulses. I.N.S.A., I.C.A.R., C.S.I.R. and F.C.X., 21-23 December, New Delhi, 1972.
2. Basavaraja H, Mahajanashetti SB, Udagatti NC. Economic Analysis of post harvest losses in food grains in india: A case study of Karnatka. Agricultural Economics Research Review. 2007; 20(6):117-126.
3. Debashri M, Tamal M. A Review on Efficacy of Azadirachta Indica A. juss Based Biopesticides: An Indian Perspective. Research Journal of Resent Sciences. 2012; 1(3):94-99
4. Gough MC. Physical changes in Large-scale Hermetic Grain Storage. Journal of Agricultural Engineering Research. 1985; 31(1):55-65.
5. Groote HD, Kimenju SC, Likhayo P, Kanampiu F, Tefera T, Hellin J. Effectiveness of hermetic systems in controlling maize storage pests in Kenya J. Stored prod. Res., 2013; 53:(27-36).
6. Grover DK, Singh, Jasdev, Singh, Satwinder. Assessment of marketable and marketed surplus of major food grains in punjab. AERC study no. 32. Agro-economic Research centre, Department of Economic and sociology, Punjab Agricultural University, Ludhiyana, 2012.
7. Krishnamurthy K. Post harvest losses in food grains. Bulletin of Grain Technology. 1975; 13(1):33-49.
8. Kumar V, Kumari A, Rajak D, Sharma PD, Shrivastava M. Qualitative Loss of Maize Under Different Bag Storage Modes. The First International Congress on Postharvest Loss Prevention, Rome, Italy. 2015, 96-97.
9. Kumari A, Kumar V, Rajak D, Shrivastava M. Comparative Study on Storage Behavior of Food Grain in Different Storage Bag. A project report submitted to college of agricultural engineering, RAU, PUSA, 2015.
10. Majumdar SK, Natarajan CP. Some aspects of the problems of bulk storage of food grains in India. World. Rev. Pest Control. 1963; 2(2):25-35.
11. Mookherjee PB *et al*. Studies on incidence and extent of damage due to insect pests in stored seeds-I. Cereal seeds. Indian J Ent., 1968; 30:61-65.
12. Mukherjee PB, Jotwani MG, Sircar P, Yadav TD. Studies on the incidence and extent of damage due to insect pests in stored seeds. Indian Journal of Entomology. 1968; 30(1):61-65.
13. Murdock LL, Baributsa D, DeBoer JL. Hermetic Storage of Grain in Developing Nations. Journal of stored products research. 2014; 58:1-2.
14. Nanda SK, Vishwakarma RK, Bathla HVL, Rai Anil, Chandra P. Harvest and post harvest losses of major crops and live stock produce in India. A report published by All India Coordinated Research Project on Post Harvest Technology (ICAR), 2012.
15. Sawant SD. Modern grain storage for reducing storage losses. Agricultural Engineering Today. 1994; 4(1):12-20.