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EFFICIENCY OF STORAGE STRUCTURES FOR STORAGE OF WHEAT IN WESTERN RAJASTHAN

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ABSTRACTS

Farmers have been using metal bin, jute bag, earthen pot, bakhari and kothi to store wheat. The mean grain infestation was significantly lowest in metal bin i.e., 2.80, 1.80 and 1.30 per cent in three districts, respectively while it was highest in room in Pali and Jodhpur and in kothi in Jalore. The grain infestation in room and kothi was at par in all three districts under study. The moisture content of the grains stored in metal bin was lowest with a mean of ranging from 8.00 to 8.65 per cent in different districts. While, it was highest in bakhari in Pali and Jodhpur and in kothi in Jalore. The wheat grains stored in metal bin exhibited highest germination with a mean of 91.2, 92.50 and 92.40 per cent in Pali, Jodhpur and Jalore, respectively. The jute bag was found second effective storage structure after the metal bin. The weight loss was significantly lowest in metal bin, followed by earthen pot, jute bag bakhari, kothi and room.

Key words: Wheat, storage structures, extent of damage and losses

Wheat is produced even by the smallest farmer throughout the country and is stored in rural storage structures for domestic use, and also for selling it later at attractive price. It needs to be stored carefully at the lowest level by individual farmers for fulfilling their daily food requirement The food grains, being biological commodities are liable to be attacked by different species of stored grain insect pests. Huge losses in rural storage structures also have been reported from different parts of the country (Gahalawat *et al*., 1993, Ramzan *et al*., 1994, Malik *et al*., 1994 and Singh & Yadav, 1995). Western Rajasthan is an area often facing the problem of drought as such wheat so produced in particular year needs to be stored. Under such situations the use of storage structures is an important component which determines the extent of damage and losses during storage. Therefore, keeping all these facts in view the present studies on the efficiency of storage structure which are being used for the storage of wheat so that losses during storage can be minimized

MATERIAL AND METHODS

Efficiency of six different storage structures, commonly used in western Rajasthan viz; kothi, bakhari, jute bag, room, metal bin and earthen pot was worked out by determining the moisture content of grain, germination per cent, grain infestation and weight loss in each storage structure during September–October when the activity of insect pests was optimum .The studies was conducted in 15 villages spread over three districts viz., Pali, Jodhpur and Jalore and samples were collected from five randomly selected farmers in each village..

A sample of two kg of grains was collected from different places (top, middle, and bottom) in each storage structure with the help of Purkhi/Sampler and mixed thoroughly and then 500 g of grains were taken from each sample by dividing and subdividing it. These samples were packed in polythene bags to avoid loss of moisture and were brought to the laboratory for analysis and further studies. In case a farmer has more than one storage structure then sample was drawn from the storage structure holding maximum grains. The efficiency of storage structure was evaluated by recording grain infestation, moisture content, germination and weight loss in each storage structure as given below:

Grain Infestation : The number of damaged and healthy grains were counted separately in each representative sample consisting of 500 grains. The grain infestation was calculated by the following formula.

$$\text{Per cent infestation} = \frac{\text{Number of infested grains}}{\text{Number of total grains}} \times 100$$

Moisture Content : Moisture content in grains of each sample collected during three surveys from the farmers belonging to different villages of three districts was determined immediately after sample cllectionby OSAW Universal Moisture Meter. (Prakash *et al*., 1987).

Germination : A sample of one hundred grains was taken from the representative samples collected from each

villageand respective storage structure. The samples were placed separately in moist germination paper, covered with another sheet of the paper then rolled and kept in polythene bags to prevent moisture loss. There were three replications for each sample. The observation on germination of seeds was recorded separately for each sample after 5 days (Anonymous, 1976).

Weight Loss : The weight of damaged and undamaged grains in each representative sample was recorded separately and per cent loss in weight was calculated by using the following formula (Adams and Schulten, 1978) :

$$\text{Per cent weight loss} = \frac{(U \times Nd) - (D \times Nu)}{U\,(Nd + Nu)} \times 100$$

Where,

U = Weight of undamaged grains

Nu = No. of undamaged grains

Nd = No. of damaged grains

D = Weight of damaged grains

Mean per cent loss in weight was calculated for each district separately.

RESULT AND DISCUSSION

The mean data on the utilization of different storage structure in Western Rajasthan have been presented in Table 1. The data revealed that kothi is most commonly used in Western Rajasthan followed by bakhari, jute bag, room, metal bin and earthen pot which are being used by 22.63, 20.33, 18.03, 16.33, 12.73 and 9.93 per cent farmers of Western Rajasthan, respectively.

The district wise data revealed that in Pali, different storage structures in their descending order of utilization could be arranged as jute bag (22.40%) > metal bin (20.30%) > bakhari (15.80%) > earthen pot (15.50%) > room (15.00%) and kothi (11.00%). While in Jodhpur and Jalore, kothi (26.70 and 30.20% farmers, respectively) followed by bakhari (23.20 and 22.00%, respectively) jute bag (18.54%) and room (18.30%) are placed at third position in Jodhpur and Jalore respectively. While, rooms and jute bag are utilized by 15.70 and 13.20 per cent farmers in Jodhpur and Jalore, respectively and are placed at fourth position in respective districts. The utilization of metal bin and earthen pot is minimum and are utilized by only 8.40, 9.50 per cent and 7.50 and 6.80 per cent farmers in Jodhpur and Jalore, respectively.

The infestation was lowest in grain stored in metal bin in all three districts. It was 2.80, 1.80 and 1.30 per cent in Pali, Jodhpur and Jalore, respectively (Table 2). Mean grain infestation in metal bin was only 1.96 per cent (Table 20). Jute bag and earthen pots were second in their efficiency in all three districts. No significant difference in grain infestation was recorded in these two storage structures in Pali and Jalore. The highest grain infestation of 17.60 and 18.46 per cent was recorded in room and was at par to grain infestation in bakhari and kothi in Pali. While in Jalore, the grain infestation in room was significantly higher than kothi and bakhari. In Jodhpur, the highest grain infestation of 16.60 per cent was recorded in kothi which was found at par to bakhari. It is interesting to note that in the grain stored in room the infestation was lower than that of bakhari and kothi.

The data on over all mean grain infestation in different storage structures of western Rajasthan have been presented in Table 3. On the basis of mean grain infestation, different storage structure of Western Rajasthan could be arranged in their descending order of efficiency as metal bin > earthen pot > jute bag > bakhari > kothi > room.

The data presented in Table 3 revealed that irrespective of districts the mean grain infestation was lowest i.e. 1.96 per cent in metal bin followed in increasing trends by earthen pot (8.16%), jute bag (8.2%), bakhari (14.86), kothi (15.93%) and highest in room (16.68%). Thus none of the storage structure was found free from infestation. The present finding is in close conformity with the earlier work of Ramasivan *et al*. (1968), Shankar Dass (1977) and Agrawal *et al*. (1981). Metal bin was found most effective with only 1.96 per cent infestation. Ramasivan *et al*. (1968) recorded less infestation in drum than in kothi and kuthla. Zutshi (1966) also observed least damage in metal bin and maximum in room. Srivastava *et al*. (1973), Shankar Dass (1977) and Khound and Borah (1984) also found metal bin better than other structures.

The moisture content of the grain stored in different storage structure of western Rajasthan varied from 8.00 to 13.80 per cent (Table 2) in different districts. Irrespective of different districts, the over all mean moisture content of the grain varied form 8.23 to 12.93 per cent (Table 3). Among the prominent storage structures available in western Rajasthan (Table 20), the minimum moisture content of the grain (8.23%) was recorded in metal bin followed by jute bag (8.76%), earthen pot (10.26%), room (12.00%), kothi (12.80%) and bakhari (12.93%). It is evident from Table 3 that the over all germination per cent of the wheat grain stored in different storage structure varied from 78.91 to 92.03 per cent.

The germination of seed stored in metal bin was (91.20, 92.50 and 92.40% in Pali, Jodhpur and Jalore, respectively) significantly higher than the grains stored in all other storage structures with a mean value of 92.03 per cent followed by jute bag (84.58%), earthen pot (83.63%) bakhari (77.50%), kothi (78.97%) and room (78.91%). In present

investigation, the grain stored in metal bin exhibited highest germination in all three districts. While, it was the lowest incase of grain stored in room . This finding find support from Dhaliwal (1971) who recorded 85.00 per cent germination in metal bin and 77.00 per cent in loose stored wheat Singh and Yadav (1995) also recorded maximum germination (96.00%) in wheat stored in metal bin and minimum (89.00%) in room.

The data presented in Table 2 revealed that the weight loss was lowest in metal bin and highest in room in all three districts of Western Rajasthan. The weight loss was slightly higher than the metal bin in case of earthen pot. The weight loss in jute bag, bakhari, kothi was lower than that recorded in room.

It is evident from the Table 3 that the over all mean loss in grain weight varied from 0.78 to 3.58 per cent. The mean loss in weight was lowest (0.78%) in metal bin, which may be attributed to low–moisture content and minimum infestation. The loss in weight increased with increase in moisture content and grain infestation. The highest loss

Table 1. Adoption of storage structures in different districts of Western Rajasthan

Storage structures	Adoption (%)			
	Pali	Jodhpur	Jalore	Mean
Jute–Bag	22.40	18.50	13.20	18.03
Metal bin/drum	20.30	8.40	9.50	12.73
Room (loose)	15.00	15.70	18.30	16.33
Kothi	11.00	26.70	30.20	22.63
Bakhari	15.80	23.20	22.00	20.33
Earthen pot	15.50	7.50	6.80	9.93

Table 2.Grain infestation, moisture content, germination and weight loss in wheat stored in different storage structures in western Rajasthan

District	Name of storage structures	Infestation	Moisture content	Germination	Weight loss
Pali	Metalbin	2.80 (9.63)	8.05 (16.48)	91.20 (72.74)	0.74 (4.93)
	Room (loose)	17.6 (24.80)	12.40 (20.62)	76.30 (60.86)	3.50 (10.78)
	Kothi (Kachi)	15.8 (23.42)	12.60 (20.79)	78.50 (62.38)	2.80 (9.63)
	Bakhari	16.8 (24.20)	13.80 (21.18)	77.50 (61.68)	2.00 (8.13)
	Earthen pot	9.70 (18.15)	9.80 (18.24)	85.00 (67.21)	1.22 (6.34)
	Jute bags	8.40 (16.85)	8.90 (17.36)	81.00 (64.16)	2.20 (8.53)
Jodhpur	Metalbin	1.80 (7.71)	8.00 (16.43)	92.50 (74.11)	0.82 (5.19)
	Room (loose)	14.00 (21.97)	12.00 (20.27)	80.70 (63.94)	3.70 (11.09)
	Kothi (Kachi)	16.60 (24.04)	11.80 (20.09)	79.40 (63.01)	3.00 (9.97)
	Bakhari	14.20 (22.14)	12.60 (20.79)	80.50 (63.79)	2.30 (8.72)
	Earthen pot	8.00 (16.43)	10.20 (18.63)	82.50 (65.27)	1.30 (6.55)
	Jute bags	7.60 (16.00)	9.00 (17.46)	86.5 (68.44)	2.05 (8.23)
Jalore	Metalbin	1.30 (6.55)	8.65 (17.10)	92.40 (74.00)	0.78 (5.07)
	Room (loose)	18.46 (25.40)	11.60 (19.91)	79.75 (63.26)	3.54 (10.84)
	Kothi (Kachi)	15.40 (23.11)	12.40 (20.62)	79.00 (62.73)	2.90 (9.81)
	Bakhari	13.60 (21.64)	12.00 (20.27)	82.70 (65.42)	2.16 (8.33)
	Jute bags	8.60 (17.05)	8.40 (16.85)	86.25 (68.23)	1.98 (8.09)
	SEm±	0.70	0.724	0.75	0.35
	CD at 5%	2.01	2.084	2.16	1.0

*Values in parenthesis are angular transformed values of percentage.

Table 3.Efficiency of different storage structures in Western Rajasthan

Storage structure	Infestation (%)	Moisture contnet (%)	Germination (%)	Weight loss (%)
Jute–Bag	8.2	8.76	84.58	2.08
Metal bin/drum	1.96	8.23	92.03	0.78
Room (loose)	16.68	12.0	78.91	3.58
Kothi	15.93	12.93	78.97	2.90
Bakhari	14.86	12.80	83.13	2.15
Earthen pot	8.16	10.26	83.63	1.26

in weight was (3.58%) recorded in wheat stored in room. On the basis of loss in weight, different storage structure in their descending order of efficiency could be arranged as metal bin > earthen pot > jute bag > bakhari > kothi and room.

In the present study, the metal bin was found as the most efficient storage structure because the grain stored in metal bin exhibited minimum moisture content, infestation and loss in weight and maximum germination per cent. Earthen pot and jute bugs were next in order of their efficiency followed by bakhari, kothi and room. The room as a storage structure was found least effective as the grain stored in room exhibited maximum loss in weight because of higher grain infestation and moisture content as a result of which grain also lost their power as seed in terms of germination. The present findings get full support from the earlier work conducted by Gahlawat *et al*. (1993), Malik *et al*. (1994) and Singh and Yadav (1995) who reported metal bin as efficient storage structure because grain stored in metal bin carried minimum infestation and resulted in minimum weight loss as compared to traditional storage structure viz., room, bakhari etc.

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