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STUDIES ON THE MUD-BIN STORAGE OF WHEAT

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Modification of mud bin structures by treating them with coaltar, synthetic enamel, calcium oxide or addition of activated clay resulted in reduction in losses of wheat due to insects during storage at pilot and at farm level. Amongst various treatments applied, calcium oxide coating proved to be the most effective in reducing the losses due to insect infestation.

Key words :Wheat, Mud-bin, Insects infestation

INTRODUCTION

Post harvest losses of agricultural commodities are a serious problem in Pakistan. The magnitude of these losses is reported upto 50% of the total yield depending upon the nature of the crop, means of transportation, marketing and storage [1]. The major factor responsible for these losses is lack of proper storage facilities. An improvement in these can help in reducing the losses and in increasing their availability at a reasonable price.

Post harvest losses, in case of wheat and other non-perishable grains have been reported to range from 10 to 15% [2,3]. These figures are on the basis of large scale storage. The losses are much more at the village level where storage conditions are primitive. It will be a furtile effort to grow more food, if the produce is not preserved properly and is allowed to be damaged by insects, moulds, or rodents during storage. Thus primary concern of the researchers is to develop suitable structures or to modify the existing ones. Birewar *et al.* [4] have suggested various storage structure designs and modifications of the existing traditional old raceptacles.

Chaudhry *et al.* [5] have reported that the primary factors affecting storage of food grains were moisture, aeration and temperature. Hence the present investigations were designed to control these factors. Mud bins ("Bhrollas") commonly used for wheat storage in the rural areas were modified by treating them with coaltar, synthetic enamel, calcium oxide and activated clay.

MATERIALS AND METHODS

Three experiments were run on storage studies of wheat. Two of them were pilot scales (20 kg/container) and one at farm level (3600 kg/container). Mud bins were used as storage containers in all the three experiments. Pilot scale experiments were run at PCSIR Laboratories Complex Lahore and full scale experiment at a nearby farm.

Experiment 1. Wheat purchased from the local market was stored in 20 kg capacity mud bins purchased from the local market. Following treatment were applied:

(i) Container placed on a raised platform, (ii) Polythene sheet of 100 micron thickness was placed inside the bin, (iii) Calcium oxide coated on both inside and outside of the bin, (iv) Synthetic enamel coated outside the bin and (v) Coaltar coated outside the bin.

The bins were sealed by placing a pitcher upside down on the month of the bin and fixed by using plaster of paris and placed in the open atmosphere.

Experiment 2. Treatments applied in the Experiment 1 were supplemented with the addition of activated clay at the rate of 0.5% (w/w). Activated clay was added to the wheat and mixed thoroughly by using a sample splitter.

Experiment 3. Wheat produced at a farm was stored in a 3600 kg capacity mud bin at the site. The bin was coated with calcium oxide and sealed.

Wheat samples were analysed for moisture content and initial insect infestation. Temperature and relative humidity data, were recorded daily using wet and dry bulb thermometer.

Sample analysis. The samples were drawn from the bins after 45 and 72 days storage, and analysed for moisture [6] and insect infestation. The samples were sieved using a 10 mesh standard sieve, and number of live and dead insects and lervae was recorded. Infested grains were taken out from the samples and weighed. After sieving, weight of the dust (flour) was also recorded. Hidden infestation, as egg plugs, was detected by staining method [7].

RESULTS AND DISCUSSION

Experiment 1: Results regarding insect infestation, after 45 days of storage in mud bin are reported in Table 1. Bins treated with calcium oxide showed the lowest insect population followed by those coated with synthetic enamel or coaltar. However, insect population, in case of the bins stored at raised platform and containing internal polyethylene lining, was considerably higher (Table 1). Larval population, egg plugs, weight of dust and infested grains also showed a similar trend.

The increase in relative humidity from 72 to 89% resulted in increased infestation in calcium oxide treated bin (Table 2). It is obvious that the number of live insects de-

Table 1. Effect of different treatments on the mud bin storage* of wheat (45 days storage).

Treatments	Moisture content (%)	Weevils (No./kg) Alive	Dead	Total	Larvae (No./kg)	Egg plugs (No./kg)	Weight of dust (g/kg)	Weight of infested grains (g/kg)
Initial infestation	10.01	36	11	47	4	121	1.3	9.0
Control	10.45	101	84	185	36	521	8.0	162.1
Stored on raised platform	10.49	92	75	167	25	353	7.6	120.0
Polythene sheet (internal)	10.35	84	60	144	13	276	7.0	100.0
Calcium oxide coating	10.21	14	44	58	5	85	2.5	60.0
Synthetic enamel coating	10.25	23	44	67	12	228	4.0	82.0
Coaltar coating	10.24	24	46	70	11	214	3.8	91.1

*Storage conditions: (i) Temperature range: 22 - 47.5°; (ii) Relative humidity: 29 - 88% range.

Table 2. Effect of different treatments on the mud bin storage* of wheat (72 days storage).

Treatments	Moisture content (%)	Weevils (No./kg) Alive	Dead	Total	Larvae (No./kg)	Egg plugs (No./kg)	Weight of dust (g/kg)	Weight of infested grains (g/kg)
Initial infestation	10.01	36	11	47	4	121	1.3	9.00
Control	10.63	196	114	310	68	1142	18.0	268.99
Stored on raised platform	10.60	179	100	279	56	992	16.1	198.76
Polythene sheet (internal)	10.48	170	92	252	55	980	16.0	191.25
Calcium oxide coating	10.24	48	108	159	23	420	8.0	121.25
Synthetic enamel coating	10.27	68	102	170	39	521	12.0	158.39
Coaltar coating	10.29	43	117	160	31	448	9.2	135.01

*Storage conditions: (i) Temperature range: 19 - 45.5°; (ii) Relative humidity: 35 - 94% range.

Table 3. Effect of different treatments on the mud bin storage* of wheat (45 days storage).

Treatments	Moisture content (%)	Weevils (No./kg) Alive	Dead	Total	Larvae (No./kg)	Egg plugs (No./kg)	Weight of dust (g/kg)	Weight of infested grains (g/kg)
Initial infestation	9.74	17	10	27	3	40	0.5	42.00
Control	10.23	55	42	97	6	124	9.0	94.00
Addition of activated clay (A.C.)	10.22	21	35	56	–	70	7.8	46.00
Calcium oxidxe coating	9.89	22	36	58	–	52	5.0	53.17
Calcium oxide coating + A.C.	9.82	12	43	55	–	58	4.7	32.39
Synthetic enamel coating	10.04	36	42	78	4	89	5.2	64.33
Synthetic enamel coating + A.C.	9.86	17	31	48	–	62	6.8	52.33
Coaltar coating + A.C.	10.00	14	38	52	–	49	6.5	35.97

Storage conditions: (i) Temperature range: 5.2 - 31.0; (ii) Relative humidity range: 25-93%.

creased after 45 days of storage, again reached the original level after 72 days. Mud bins have been reported to be poor storage structures [8,9]; however, coating with calcium oxide seems to improve storage conditions.

Experiment 2. Insect infestation of wheat stored in various bins after mixing with activated clay is given in Table 3 and 4. A further decrease in the number of live insects was observed. However, larvae population, egg plugs, weight of dust and number of infested grains was the same as reported in Table 2. It is evident from the results that calcium oxide coating was most effective.

Table 4. Effect of different treatments on the mud bin storage* of wheat (72 days storage).

Treatments	Moisture content (%)	Weevils (No./kg) Alive	Dead	Total	Larvae (No./kg)	Egg plugs (No./kg)	Weight of dust (g/kg)	Weight of infested grains (g/kg)
Initial infestation	9.74	17	10	27	3	40	0.50	42.00
Control	10.81	97	81	178	42	904	16.20	179.62
Addition of activated clay (A.C.)	10.80	35	48	83	21	457	12.45	91.31
Calcium oxide coating	10.12	31	42	73	26	399	10.11	82.96
Calcium oxide coating + A.C.	9.98	22	51	73	12	125	9.87	45.27
Synthetic enamel coating	10.08	45	49	94	37	563	13.25	123.15
Synthetic enamel coating + A.C.	10.00	32	45	77	23	311	11.35	87.99
Coaltar coating + A.C.	10.40	26	55	81	16	389	11.76	46.56

Storage conditions (i) Temperature range: 5.0-31.9°; (ii) Relative humidity range: 25-93%.

Table 5. Weevil population in wheat stored* in calcium oxide coated mud bin (3.6 ton capacity) at an agricultural farm.

Storage time (days)	Moisture content of wheat (%)	Weevils (No./kg) Alive	Dead	Total	Larvae (No./kg)	Egg plugs (No./kg)	Dust (g/kg)	Infested grains (g/kg)
D	8.5	Nil	Nil	Nil	Nil	Nil	Nil	Nil
45	8.6	10	8	18	4	Nil	0.5	2.0
72	8.2	32	20	52	6	32	2.0	20.0

*Storage condition: (i) Temperature range: 12.3-45.2°; (ii) Relative humidity range: 13-92%.

Experiment 3. Activated clay has been reported [9] to absorb waxy material of the cuticle of the insects which resulted in dessication and ultimate death. Results of bulk storage in 3600 kg mud bin treated with calcium oxide are given in Table 5. The results were comparable to those reported in Table 4. Thus storage life of wheat at the farm level can be increased by coating the mud bin with calcium oxide.

Application of various materials to mud bins helped in filling the pores of these structures, thereby checking the free flow of air and moisture. Calcium oxide had additional benefit of having insecticidal properties.

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