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VERTEBRATE PEST CONTROL PROJECT

Food Security Management
Post-Harvest Management Component

VERTEBRATE PEST INFESTATIONS IN SIND
PROVINCIAL FOOD STORAGE FACILITIES

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VERTEBRATE PEST INFESTATIONS IN SIND PROVINCIAL FOOD STORAGE FACILITIES

By Ejaz Ahmad and Joe E. Brooks*

ABSTRACT: Out of 100 food grain storage centres of Sind examined in March and April 1986, wheat was stored only in 29 centres and all of them were physically surveyed. At these sites, 85 godowns (81 house type and 4 bini shells) were inspected for vertebrate pest infestation, structural conditions and defects etc. Infestation by vertebrate pests was noted in 75 (88.2%) godowns. Birds were the major vertebrate pests present in 60 (70.6%) of the structures surveyed, only one of which was severely infested. Rodents were found in 30 (35.3%) godowns out of which 17 were infested with house mice (*Mus musculus*), 10 with roof rats (*Rattus rattus*), 6 with desert gerbils (*Meriones hurrianae*) and one with striped squirrels (*Funambulus pennanti*). Severe rodent damage or infestation was not observed in any of the godowns. Structural condition as judged from outside the godown was good in 52 (61.2%) and poor in 10 (11.7%) godowns. Structural defects were noted in 83 (97.6%) godowns. Despite all these observations the grain losses due to these vertebrate pest infestations are insignificant.

1. INTRODUCTION

Losses of stored grains due to vertebrate pests are poorly documented in most areas of the world. Pakistan is no exception. The production of wheat as the major cereal grain in this country has increased from 7,673,500 mt in 1975 to 12,414,400 mt in 1982 (Agricultural Statistics of Pakistan, 1984). The wheat is procured by the Provincial Food Departments mainly in Punjab and Sind, put in storage and then distributed from wheat surplus areas to wheat deficit areas over a period of 6 to 9 months (Ahmad, 1984). The exact amount of wheat lost in provincial stores to the attack by vertebrate pests (mainly rodents and

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birds) is not known but has been variously estimated as high as 5-6% (Anon., 1953) to a low of 1% by the Vertebrate Pest Control Laboratory, Karachi (Roberts, 1981). The economic losses due to rodents at Landhi, Karachi, having capacity of 246,000 tons (rice godowns), was roughly estimated to be in the range of 1000-8000 US$ per annum (Greaves, 1974).

In a previous survey of wheat storage centres under the control of the Punjab Department of Food (Brooks and Ahmad, 1986), the losses due to rodents and birds in the 66 centres inspected was estimated at not more than 0.1 to 0.2%. The estimate did not account for losses due to contamination by urine, feces, hair and feathers, however, but it was felt that even this would be minimal. This low estimate was somewhat surprising in view of the many structural defects noted in the storage godowns. But when account is taken of the rather rigorous schedule of phosphine fumigation as practiced by the Punjab Food Department the low estimate is not unexpected.

This survey of vertebrate pest infestations and causative structural and management conditions in provincial storage centres in Sind is a continuation of surveys to be conducted in food storage centres in all the four provinces in Pakistan.

2. METHODS

The Deputy Directors, Food were contacted in each of the 3 regions of Sind; Hyderabad, Sukkur and Karachi. They provided a listing of all the storage centres, construction types and

capacities (Appendix I). The selection of a random sample of all centres as was done in Punjab was not applicable in Sind. The Deputy Directors, Food reported that only certain centres still contained wheat, due to the start of the procurement program for the next season. So it was decided to survey all centres with remaining wheat stocks.

The interview/inspection survey form used in Sind was the same as used in the previous survey in Punjab Provincial Food Storage facilities (Appendix II). The interview/inspection procedure used was as previously described (Brooks and Ahmad, 1986).

3. RESULTS

In Sind, 29 public sector storage centres out of 100 were surveyed for vertebrate pest infestation. At these 29 sites physical inspections of 85 godowns, containing 81 housetype and 4 bini shells, were made. In Sind inspection of bins was not done. The rated capacity of these 85 structures was 93,500 mt which is 12.9% of the total storage capacity in Sind. The total quantity of wheat stored in these godowns at the time of survey was 67,563 mt which equals to 9.4% of the total storage capacity of Sind. The quality of grain was judged as good in 72.9%, fair in 16.5% and poor in 5.9%, while it was not recorded in 4.7% of the samples. In all the godowns visited, the wheat was stored in bags, each containing approximately 100 kg. Duration of storage averaged 8.4 months and ranged from one week to 11 months. In

these 29 centres, 103 technical and 561 non-technical (chowkidars and sweepers) employees were working.

Storage Capacity and Sample Size

Most of the sites with storage capacity of 2,000 mt or less, were empty due to start of the wheat procurement for the next year. Only 1 out of 49 centres with 2,000 mt or less storage capacity was surveyed. On the other hand, there were 7 centres having storage capacity of 25,000 mt or more and all of them were surveyed (Table 1).

Table 1: STORAGE CAPACITIES AND NUMBER OF SITES VISITED

Capacity (mt)	No. of Sites	Sites Visited	%
18 - 2000	49	1	2.04
2001 - 4000	15	4	26.66
4001 - 6000	11	6	54.54
6001 - 8000	6	4	66.66
8001 - 10000	6	4	66.66
10001 - 25000	6	3	50.00
25001 or above	7	7	100.00

Age and Structural Condition

The age of the structures ranged from 1 to 34 years with mean age 12 years. Thirty six percent of these godowns were 5 years or less in age and 25.9% were more than 20 years old (Table 2).

The structural condition as judged from outside of the godowns was good in 52 structures (61.2%), fair in 23 godowns (27.1%) and poor in 10 godowns (11.7%).

Table 2: AGE VS STRUCTURAL CONDITION

Age (Yrs)	No. of Godowns Surveyed	Structural Condition		
		Good	Fair	Poor
0 - 5	31	21	6	4
6 - 10	17	12	3	2
11 - 15	11	8	3	0
16 - 20	4	3	1	0
21 - 25	11	5	5	1
26 - 30	7	3	4	0
31 - 34	4	0	1	3
Total	85	52	23	10

Structural Defects

Out of 85 godowns containing 81 housetype and 4 bini shells, structural defects were noted in 83 godowns (97.6%). The most frequently observed defect was defective walls (75), followed by doors (67), floor (65), and windows (29). Leaking roofs were noted only in 6 structures. Only one structural defect was present in 12 godowns, two defects in 15, three in 30, four in 21 and all five structural defects were present in 5 godowns (Table 3). There was a positive correlation ($r = .7939$, $p = <.05$, $y = 2.496 + .038x$) between structure age and number of types of defects noted.

Table 3: AGE VS STRUCTURAL DEFECTS

Age (Yrs)	Sample Size	Mean No. of Structural Defects
0 - 5	31	2.10
6 - 10	17	3.04
11 - 15	11	3.09
16 - 20	4	3.00
21 - 25	11	3.09
26 - 30	7	3.57
31 - 34	4	4.00

Vertebrate Pest Infestation

Vertebrate pest infestations were noted in 75 (88.2%) of the godowns visited (Table 4). Rodents were found in 30 (35.3%) godowns. In these godowns 19 were infested with house mice, 10 with roof rats and 7 with other rodents. In Sind no severe rodent infestation was observed, whereas, infestation was medium at 4 godowns and few at 26 godowns. Among other rodents desert gerbils (*Meriones hurrianae*) were the major species and was noted at 6 structures and striped squirrels were found in one godown only.

Birds were found in 60 (70.6%) godowns as vertebrate pests. Only one godown structure was severely infested with birds, 11 godowns were judged as medium and in 48 godowns infestation was few.

Table 4: VERTEBRATE PEST INFESTATION

No. of godowns surveyed		85
No. of godowns infested with vertebrate pests		75
No. of godowns infested with rodents		30
House mice infestation		19
Roof rat	"	10
Desert gerbil	"	6
Striped Squirrel	"	1
Other vertebrate infestations (all rats)		8
No. of godowns infested with birds		60
Severity of infestation:		
Rodents:		
Few	26	
Medium	4	
Severe	0	
Birds:		
Few	48	
Medium	11	
Severe	1	

Cats were the only other vertebrate noted in 8 (9.4%) godown structures. It was observed that there were no rats or mice at the centres where cats were present, which shows a positive correlation between the presence of cats and the absence of rats or mice. This positive correlation between cats and absence of rats or mice was not seen in the Punjab survey (Brooks and Ahmad, 1986).

4. DISCUSSION

In Sind, structural defects were noted in 97.6% of the godowns surveyed. Most of these defects were minor and could be repaired by the in-charge of the centre. But maintenance procedures are the same in Sind as it is in Punjab (Brooks and Ahmad, 1986). Structural maintenance and repair is the responsibility of the Provincial Public Works Department (P.W.D) and funds are provided by the Provincial Food Department but they rarely received responses from the P.W.D. at proper time, as it is a lengthy process. Suppose a pane glass of a window ventilator is broken at some centre and they want to repair it. The in-charge of the centre will report to the District Food Controller and through him this letter will go to the Deputy Director of the region. The Deputy Director will send that letter to Executive Engineer, P.W.D. and he will send a person to check and estimate the expenses. When the estimate is made, budget funds will be allocated. After which they will repair only one glass of window ventilator and in the mean time some other defects will appear and again the same routine will start.

Pest control measures include cleaning, white washing and then spraying malathion as it is done in Punjab (Brooks and Ahmad, 1986). At least weekly inspection for insect infestation is done by the in-charge of the centre after the wheat goes into storage and if insects appear then godowns are fumigated. Otherwise the Food Department staff fumigate the wheat once a year before the start of the monsoons. Normally 2-3 tablets of fumigant (aluminum phosphide) per metric ton are applied but the rate is variable depending on the severity of infestation. Same fumigants which are applied in the Punjab, i.e. Cellphos, Detia or Phostoxin are used in Sind (for details see Brooks and Ahmad, 1986). At some centres the in-charges were found to be applying the expired fumigants without checking the expiry date.

Training in fumigation is not given by the Food Department to the in-charge or other workers of the center at any level. Sind is second in wheat production in Pakistan. Wheat is procured in Hyderabad and Sukkur regions and numerous shipments of imported wheat are received at Karachi port from where they are distributed to NWFP and Baluchistan Province. Being such an important province, the Food Department should train at least the in-charge of the centre on provincial or divisional level. Such training could be done in collaboration with Agricultural Universities or Agricultural Extension Services.

As far as vertebrate pest infestation is concerned it is not so severe as observed in Punjab by Brooks and Ahmad (1986) on the basis of their assumption. Losses due to rodents are not more

than 0.02% whereas the losses due to birds are between 0.05 - 0.06%. So the total losses observed in the grain storage centres of Sind due to vertebrate pests are not more than 0.1%. Existing storage capacity of provincial food storage is 721,665 mt and losses due to vertebrate pests are 721.665 mt, amounting to Rs. 1,443,330 for storage of nine months. Although there are losses due to contamination of grain by urine, hair, droppings, etc. but still these are insignificant.

5. RECOMMENDATIONS

In addition to recommendations given by Brooks and Ahmad (1986), it is further recommended that:

1. The Sind Food Department should arrange some training programs for in-charge or other staff at storage centres. In these training programs they should be taught how to make the godowns air tight, the proper application of fumigants, how and when to apply different precautionary measures to take during fumigation, grain quality control tests, etc. This training should be not less than a week. With this kind of training, the Food Department staff should learn how to store the stock for a longer period without any problem of infestation.

2. The procurement of better quality grain should be improved because if the quality is poor the insect infestation and attack by fungus will be more. During procurement the Food Department should prefer excellent varieties and advise the farmers to use the better seed.

3. Expired fumigants were noted at some of the Centres. The Food Department should not supply these expired fumigants because most are useless. The in-charge of the godown centre should check the expiry date while receiving the fumigants. If stock of fumigants become expired in the store, it should be discarded.

4. Storage capacity of the godown structure should not be more than 2000 metric tons because it is very difficult to air-tight and fumigate the godowns having capacities exceeding this size.

5. Walls should be plastered on the inside. It was observed in some centres that godowns were constructed by stones and the inside walls were not plastered, so they have small holes which allow the fumigant gas to leak out and allows the passage of insects into the structure.

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6. REFERENCES

Agricultural Statistics of Pakistan. 1984. Ministry of Food, Agriculture and Cooperatives, Islamabad, Pakistan.

Ahmad, Hafiz. 1984. Storage of Wheat in Pakistan. Prog. Farm., 4(4):36-44.

Anonymous. 1953. Food Storage. Past, Present and Future Activities of the Department of Plant Protection. Central Department of Plant Protection, Karachi. pp. 35-38.

Brooks, J.E. and E. Ahmad. 1986. Vertebrate Pest Infestations in Punjab Provincial Food Storage Facilities. Technical Report No. 2. Vertebrate Pest Control Project/USAID, National Agricultural Research Centre, Islamabad, Pakistan. 19 pp.

Greaves, J. 1974. Interim Report on Rodent Control in Landhi Godowns. Unpublished Working Paper. Project PAK/71/554. 4 pp.

Roberts, T.J. (Ed.) 1981. Handbook of Vertebrate Pest Control in Pakistan. Pakistan Agricultural Research Council and Food and Agricultural Organization, Karachi, Pakistan. 216 pp.

List of Food Storage Centres under Sind Department of Food

District	Centre	House Type		Bins	Bini Shells	Totals
		Prov.Govt	Hired			
Nawabshah	Nawabshah	24977	27500	4480	–	56957
	Gabar Dahri	6600	–	–	–	6600
	Majid Kerio	15400	–	–	–	15400
	Moro	3500	–	–	–	3500
	N.S. Feroze	2500	–	–	–	2500
	Mehrabpur	3000	–	–	–	3000
	Padidan	2500	–	–	–	2500
	Sakrand	5500	–	–	–	5500
	Ali Abad	6600	–	–	–	6600
	Doulatpur	2000	–	–	–	2000
	Kandiaro	5000	–	–	–	5000
	Darbelo	4400	–	–	–	4400
	Bucheri	–	10000	–	–	10000
					Total	123957
Sukkur	Sukkur	6100	–	–	–	6100
	Arian Road	10500	–	–	–	10500
	S.I.T.E.	16500	–	–	–	16500
	Rohri	500	–	–	–	500
	Ali Wahan	1000	–	–	–	1000
	Pano Akil	1500	–	–	–	1500
	Ghotki	1500	–	–	–	1500
	M. Mathelo	2000	–	–	–	2000
	Deharki	500	–	–	–	500
					Total	40100
Khairpur	Khairpur	12000	–	1000	–	13000
	Tando Masti	1000	–	1000	–	2000
	Gambat	3000	–	–	–	3000
	D.Mehar Shah	11000	–	–	–	11000
	Ranipur	1000	–	1000	–	2000
	Kotdiji	7100	–	–	–	7100
	Setharja	5000	–	2000	–	7000
	Pacca Chang	2500	–	–	–	2500
	Thari Mirwah	1500	–	–	–	1500
					Total	49100
Shikarpur	Shikarpur	5000	–	–	–	5000
	Madeji	1000	–	–	–	1000
	Garhi Yaseen	–	90	–	–	90
					Total	6090

Larkana	Larkana	6000	–	–	–	6000
	K.A. Khan	1500	–	–	–	1500
	Shahdadkot	7000	–	–	–	7000
	Dokri	1500	–	–	–	1500
	Bakrani	1000	–	–	–	1000
	Badah	5000	–	–	–	5000
	Nasirabad	2000	–	–	–	2000
	Warah	500	–	–	–	500
					Total	24500
Jacobabad	Jacobabad	6000	–	–	–	6000
	Kashmore	500	–	–	–	500
	Thul	1500	–	–	–	1500
	Garhi Khairo	1500	–	–	–	1500
	Kandhkot	3500	–	–	–	3500
	Mouladad	1000	–	–	–	1000
	Ghousepur	–	18	–	–	18
					Total	14018
Hyderabad	Hyderabad	40000	1400	–	–	41400
	T.A.Yar	5000	–	–	–	5000
	T.M.Khan	1500	–	–	–	1500
	Hala	1500	–	–	–	1500
	B.D.Kaka	1000	–	–	–	1000
					Total	50400
Thatta	Thatta	6000	–	–	–	6000
	Sujawal	3500	–	–	–	3500
	Sakro	500	–	–	–	500
	Bathoro	500	–	–	–	500
	Jati	500	–	–	–	500
					Total	11000
Badin	Badin	500	–	–	–	500
	Talhar	500	–	–	–	500
	Matli	500	–	–	–	500
	T.G.Ali	1500	–	–	–	1500
					Total	3000
Mirpurkhas	Mirpurkhas	9500	10160	6720	–	26380
	Digri	6500	–	6720	–	13220
	Jhudo	2500	–	6720	–	9220
	Naukot	3000	–	–	–	3000
	Kunri	4500	–	–	–	4500
	Umerkot	500	–	–	–	500
	T.J.Mohd	1500	–	–	–	1500

	Pithoro	1500	–	–	–	1500
	Dhoronaro	500	–	–	–	500
	N. Road	500	–	–	–	500
	Samaro City	4400	–	–	–	4400
	Mithi	500	–	–	–	500
	Diplo	500	–	–	–	500
						=========
					Total	66220
						=========
Sanghar	Sanghar	8500	–	–	–	8500
	Shahdadpur	2000	3000	4480	–	9480
	Serhari	1000	–	–	–	1000
	Jhol	2500	–	–	–	2500
	Khipro	1000	–	–	–	1000
	Hingorno	8800	–	–	–	8800
	Tando Adam	10000	–	–	–	10000
	Nauabad	2000	–	–	–	2000
	Singhorno	3000	–	–	–	3000
						=========
					Total	46280
						=========
Dadu	Dadu	4000	–	–	–	4000
	Bhan	4000	–	–	–	4000
	Sehwan	2000	–	–	–	2000
	Johi	2000	–	–	–	2000
	Khudabad	1000	–	–	–	1000
	Phulji	1500	–	–	–	1500
	K.N.Shah	3500	–	–	–	3500
	Radhan	4000	–	–	–	4000
	Kotri	1000	–	–	–	1000
	T.B.Khan	500	–	–	–	500
	Sita Road	1500	–	–	–	1500
	Bolhari	–	–	–	100000	100000
						=========
					Total	125000
						=========
Karachi	SGG-I	28500	–	–	–	28500
	SGG-II	25500	–	–	–	25500
	SGG-III	108000	–	–	–	108000
						=========
					Total	162000
						=========
					GRAND TOTAL	721665

Appendix-II

VERTEBRATE PEST SURVEY
OF FOOD STORAGE FACILITIES

District _____ Town _____ Date _____

Name and Address of Facility _____

_____ Govt. [] Private [] Other []

Manager's Name/Person Contacted _____

Number of Employees/Titles _____

Pesticide Application: fumigant Used _____

Schedule of Treatments _____ Frequency of Inspection _____

Any Other Control Methods: Traps [] Predators [] Barriers [] Other []

Training Needs: Present Refresher Training Given: Yes [] No []

Schedule of Training _____ Duration of Training _____

Godown No. _____ Stored Food _____ Quantity _____ mt. Duration _____ mo.

Quality: Excellent [] Good [] Fair [] Poor [] Bagged [] Bulk []

Bulk under tarps outdoors [] Bagged under tarps outdoors [] Bagged outdoor uncovered []

Structural: Type of structure _____ Age _____ Capacity _____

Structural condition: Good [] Fair [] Poor []

Structural Defects: Yes [] No [] Doors not fitting [] Floor cracked/broken []

Wall cracked [] Windows unscreened/broken [] Leaking Roof [] Grilled doors []

Vertebrate Pest Problems: Yes [] No [] House mice [] Roof rats [] Other rodents []

Pest Birds [] Other vertebrates [] (Cats, dogs, bats, etc.)

Severity of infestation: Rodents: Few [] Med [] Severe [] Birds: Few [] Med [] Severe []

Evidence: Droppings [] Live or dead animals [] Burrows outside [] Burrows inside []

Kinds of damage: Food consumption [] Contamination [] Bag damage [] Structural []

Remarks: _____

Godown No. _____ Stored Food _____ Quantity _____ mt. Duration _____ mo.

Quality: Excellent [] Good [] Fair [] Poor [] Bagged [] Bulk []

Bulk under tarps outdoors [] Bagged under tarps outdoors [] Bagged outdoor uncovered []

Structural: Type of structure _____ Age _____ Capacity _____

Structural condition: Good [] Fair [] Poor []

Structural Defects: Yes [] No [] Doors not fitting [] Floor cracked/broken []

Wall cracked [] Windows unscreened/broken [] Leaking Roof [] Grilled doors []

Vertebrate Pest Problems: Yes [] No [] House mice [] Roof rats [] Other rodents []

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Kinds of damage: Food consumption [] Contamination [] Bag damage [] Structural []

Remarks: _____