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Review Article

STORAGE LOSSES IN FEED INGREDIENTS BY INSECTS AND ITS CONTROL

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Introduction

In feed mill godown loss in raw material in terms of quantity is due to moisture shrinkage losses, losses due to pest and rodent and improper bagging materials. Control of losses is very important to improve the profitability of feed production. In feed mill godown the biological factors responsible for storage losses in feed ingredient are: Insects, Rodents, Birds and Microorganisms.

Biological Factors:

Losses in foodgrains may fluctuate under different sets of ecological conditions. Post harvest losses in food grains has estimated the total loss about 9.33 per cent owing to unscientific storage wherein rodents, insects and micro organisms destroy food grains (Government of India, 1971). It is estimated that roughly 6.6 per cent of foodgrains is lost in storage. Of this amount, 2.25 per cent is attributed to insects, 2.50 per cent to rodents and the remainder to birds and moisture (Moore *et al*., 1973). Biological losses of foodgrains are due to insects, rodents, mites, birds and properties of grains (Girish and Nayer, 1979).

Insects:

Among all the biotic factors, insects are most important and causes huge losses in the grains (Abass, 2014). Insects do not breed successfully in an environment where the relative humidity is maintained at less than 40 per cent and the temperature below 10ºC (Hall, 1980). The most suitable moisture content and temperature of grains for their growth are about 11-15 per cent and 28º - 36º C respectively. At the temperature of about 32ºC, the rate of multiplication is such that a monthly compound increase of 50 times the present number. Thus, 50 insects at the harvest could multiply to become more than 312 million after 4 months (FAO, 1973).

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Insects feed on most feed ingredients and contaminate them with faeces, webbing, body parts, foul odours and micro organisms. Feeds are attractive places for insects, which include various species of moths, weevils and beetles, which consume the feed. They grow well at normal temperature in stored feed and at 26-37ºC they can reach epidemic proportions. Insects thrive better on ground materials. Whole cereals or oil cakes can therefore be stored longer than meals made from them.

Nearly one thousand species have been found associated with stored products in various parts of the world. The majority of insects and pests belong to the order of Coleoptera and Lepidoptera, which account for about 60 per cent and 8-9 per cent respectively of the total number of species of stored product insects and pests (Girish, 1977).

Factors Affecting Insect Infestation:

- Factors like relative humidity, grain moisture, temperature, light, types of storage containers, storage practices, storage period and fungi are associated with storage losses due to the presence of insects in foodgrains.
- Insects damage grains by eating it, by producing larvae that eat it, by their excreta and by bacteria they carry inside them (Christensen, 1969).

Table 1: Important storage Insects and Pests of Cereals and Pulses

Order	Family	Common Name	Scientific Name	Commodities Infested
Coleoptera	Curulionidae	Rice Weevil	Sitophilus oryzea	Cereals
	Bostrichidae	Borer Beetle	Rhyzopertha dominica	Cereals, pulses and dried roots
	Dermestidae	Khapra or Cabinet Beetle	Trogoderma granarium Everts	Cereals and cereal by-products, oilseed cakes and meals, finished feed, pulses
	Bruchidae	Pulse or Seed Beetle, Bean Weevil	Callosobruchus maculatus	Pulses
	Tenebrionidae	Rust Red Flour Beetle	Tribolium castaneum	Cereals and cereal by-products, oilseed cakes and meals, finished feed
		Long Headed Flour Beetle	Latheticus oryzae	Cereals
	Silvanidae	Saw Toothed Grain Beetle	Oryzaephilus surinamensis	Cereals and cereal by-products, oilseed cakes and meals, finished feed
Lepidoptera	Gelenchiidae	Grain Moth	Sitotroga cerealella	Cereals
		Rice Moth	Corcyra cephalonica	Cereals
		Fig or Almond Moth	Ephestia cantella	Cereals
		Meal Worm Moth	Plodia interpunetella	Cereals

- The direct damage caused by insects and pests includes the loss of weight and nutrients, reduced germination and contamination of grains with eggs, larvae-pupae and odour.
- The indirect damage caused by insects and pests is hidden infestation, moisture migration, heating, distribution of parasites to man and presence of uric acid.

Losses due to insect attack:

- Weight loss: weight loss of sacked grain is easily identified by the appearance on the sack surface of frass resulting from feeding activity of the insects.
- Quality loss: Secretion of enzyme lipase by the insects themselves will enhance deteriorative chemical processes. Many feedstuffs contain a high percentage of fat which tends to break down during storage. This breakdown is accelerated by insect attack, especially when the insects break off small particles, introduce microorganisms, or raise the temperature or moisture content. The breakdown of fat causes an increase in free fatty acids which cause off-flavours and rancidity.
- Insufficient storage methods tend to reduce the amounts of fat, vitamins, proteins and carbohydrates due to the attack of molds, rodents and insects (Lamboni and Hell, 2009). Deterioration of nutritional and rheological properties of the stored wheat mainly occurs due to insect infestation after six months of storage (Bashir *et al*., 2013).
- Scavenging insects such as cockroaches may cause contamination with pathogenic bacteria such as Salmonella.

Control:

- Cooling stored grain through aeration. Climate is the most important factor determining the effectiveness of a storage system for feed ingredients because of the close relationship between insect growth and ambient climatic conditions.
- Hygienic management: Cracks and crevices provide harborage's for the insects. Hence storage godown should be soundly constructed to ensure maintenance of correct storage conditions and allow for easy cleaning. They should be insulated, well-ventilated and damp-proof.
- Insecticide: Chemical contact insecticide such as Malathion, Fenitrothion and Carbamates are used preferably when the godown is empty and applied to floor and internal walls of the godown. It is also applied minimum 15 feet surrounding the feed mill. Spraying the contact insecticide on bag stacks is not recommended.

- Fumigation: Methyl bromide and phosphine are the most commonly used chemicals for fumigation (Shaaya *et al*., 1997). At the time of storage fumigation is the best method to control insects than netting and treated bags (Dowell and Dowell, 2017).
- Modifying the atmosphere by reducing O2 levels or raising CO2 levels also provided good control in stored-grain pests (Dowell and Dowell, 2017).

Conclusion

Total eradication of insect population in feed mill godown in tropical condition is not possible. The degree of infestation can be reduced through effective control measures. Heavily infested ingredients should not be brought into the godown. If infested material enter the godown, it should be kept separate until fumigate to totally eradicate the pests.

References

[1] Abass, A.B., G. Ndunguru, P. Mamiro, B. Alenkhe, N. Mlingi and M. Bekunda, 2014. Post-harvest food losses in a maize-based farming system of semi-arid savannah area of Tanzania. J. Stored Prod. Res., 57: 49-57.

[2] Bashir, M.H., S.U. Mahmood, M.A. Khan, M. Afzal and K. Zia, 2013. Estimation of nutritional losses caused by Rhizoglyphus Tritici (acari: acaridae) in stored wheat. Pakistan Jl. of Agricultural Sciences, 50: 631-635.

[3] Christensen, C., 1969. Grain Storage: The role of fungi in quality loss. Menneopolis, University of Minnesota Press. p.124.

[4] Dowell, F.E. and C.N.Dowell, 2017. Reducing grain storage losses in developing countries. Quality Assurance and Safety of Crops & Foods, 9: 93-100.

[5] Food and Agriculture Organisation of the United Nations (1973). Analysis of an FAO survey of Post-Harvest food losses in developing countries. FAO, Rome, pp.52-53.

[6] Girish, G.K. and Nayer, J.J., 1979. Training and Demonstration Programmes to Minimize Post-Harvest Losses at Gross Root Level. Bull. Grain Tech., 17(2): 109.

[7] Girish, G.K., 1977. Insect problems in storage and control techniques under Indian conditions, In: N.S. Agarwal and G.K. Girish, An Introduction to Action Programme to reduce on-Farm Level storage in India, New Delhi, p.17.

[8] Government of India, 1971. Report of the committee on Post-Harvest losses of foodgrains in India. Ministry of Food and Agriculture, New Delhi.

[9] Hall, W.C., 1980. Drying and Storage of Agricultural Crop Connection, AVI, Publishing Company.

[10] Lamboni, Y. and K. Hell, 2009. Propagation of Mycotoxigenic fungi in Maize Stores by Postharvest Insects. Int. Jl. of Tropical Insect Sci., 29: 31- 39.

[11] Moore, J.R., S.S. Johl and A.M. Khusro, 1973. Indian Foodgrain Marketing, Prentice Hall of India Pvt. Ltd., New Delhi.

[12] Shaaya, E., M. Kostijukovski, J. Eilberg and C. Sukprakarn, 1997. Plant oils as fumigants and contact insecticides for the control of stored-product insects. J. Stored Prod. Res., 33: 7-15.