

Use of plant products for safe and economic storage of food grains

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ABSTRACT : Keeping in mind the importance and high demand of cereals for consumption, their proper storage must not be neglected. The post – harvest losses of food grains and oilseeds are estimated to be 10 to 20 per cent in India. The post-harvest damage caused during storage is mainly due to infestation by storage pest causes huge quality losses in food grains combined with economic losses. This damage may be due to direct feeding of grains by insects and pests or by microbiological agents like fungi and bacteria. Some of the methods practiced by rural house-holds from ancient times and use of some plant products for safe and economic storage of food grains along with detailed procedure are being discussed here in this article.

Key Words : Products for safe, Economic storage, Food grains

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Keeping in mind the importance and high demand of cereals for consumption, their proper storage must not be neglected. The post-harvest damage caused during storage is mainly due to infestation by storage pest causes huge quality losses in food grains combined with economic losses. This damage may be due to direct feeding of grains by insects and pests or by microbiological agents like fungi and bacteria.

The post-harvest losses of food grains and oilseeds are estimated to be 10 to 20 per cent in India (Chahal, 2011). India experiences severe losses in storage of food grains, as per the official records economic loss to the tune of 11, 700 tons of food grains was reported to have occurred in the government godowns during 2010 alone (Chahal, 2011). Through use of proper pest management practices the above storage losses can be minimized effectively. Different causative agents are moulds and insects which cause economic and quality losses during storage, some of the methods practiced by rural house-holds from ancient times and use of some plant products for safe and economic storage of food grains along with detailed procedure are being discussed here in this article.

Types of pest causing infestation:

Fungi:

Fungi are plant like organisms and spores are single cell

bodies through which they reproduce themselves and it almost impossible to keep the spores away from environment. It is very difficult to identify the stage of fungal infection in stored grains. Infection spread through the spores, which are present in the atmosphere everywhere and move by wind and insects. Blackening of grains and pungent smell are some of the obvious indicators of fungi infestation. Grain quality, texture, and taste completely altered and also food items acquire bad taste and decreased nutritious quality. Humidity and non-aerated storage space are main reasons of fungal infection. Proper drying of the stored product is the only solution to avoid the infection because even at high temperature at the place of storage do not completely kill the spores due to their strong viability.

Insects:

Insect's demands for the survival are food, water and air which all are furnished properly in the environment where stored grains are generally kept. Beetles and moths are two main types of insects which generally infest pulses and stored grains. The larvae of both groups insects are totally un like, they look like little worms even its difficult to identify them because some of them infest with in the kernel. Store only undamaged whole seed as much as possible because broken kernel invites secondary and tertiary insects for damage and

Important insect pests of stored food grains	
Common name	Storage grains attacked
Flour mite	Cereals, cereal products, dried fruits, tobacco
Pulse weevil	Many pulses including kidney bean
Cowpea weevil	Pulses
Southern cowpea beetle	Many pulses including soybean
Pulse beetle	Many pulses except soybean and kidney bean
Rice moth	Rice, maize, soybean, groundnut, cacao, dried fruits, copra, flour
Rusty grain beetle	Maize, wheat
Tropical ware house moth	Rice, maize, mungbean, soybean, groundnut, flour, dried fruits, copra
Indian meal moth	Rice, wheat, maize, sorghum
Australian wheat borer	Paddy, rice, maize, sorghum, root crops
Rice weevil, black weevil	Rice, maize, wheat, sorghum, pulses
Angoumois grain moth	Paddy, wheat, maize
Red flour beetle	All cereals, starch, pulses, oilseeds, spices
Red weevil	All cereals, starch, pulses, oilseeds, spices

possibility of larvae development of primary insect inside the kernel may be also there so even a hole in the grain lead to total loss of grains.

Rodents are another agents which cause much damage to the stored grains through consuming it directly as food, causing hole in the jute bags lead to big losses of seeds, by spoiling the quality of food grains through their droppings, rodents are also carriers of some harmful diseases which spread among the humankind through eating and handling and contaminated grain. Infesters of this category are also not restricted by temperature and moisture conditions. Their control is possible only through mechanical barriers and by using chemical treatment.

House hold measures to control losses during storage:

House hold practices using locally available plant products are efficiently used for protection of food grains as they have advantage over scientific methods because of their low cost or easy availability. It comes from the combination of skills and knowledge of local peoples which they acquire through their interaction with environment and experiences. By using house hold products quality of the grain for feeding purposes will not be compromised. Nature best owed human beings with such plants which possess so many medicinal and herbal properties like neem (*Azadirachta indica*), turmeric, Tulsi etc. Drying the storage space is a not the main alternative. Here are the some home strategies adopted for the protection of food grains.

Traditional practices:

Since ancient times the use of natural resources for safe storage of food grains is adopted by rural peoples. The basis behind the use of these resources is very simple like they are

user friendly, easily available and directly associated with scientific reasoning. These practices are generally based on locally accessible and available natural resources. An effort is made here on the collection of traditional methods used by rural peoples.

Neem leaves as pest control agent:

Neem leaves are widely used to repel the pest from stored food grains. Collect fresh leaves from plant and dry the min shade, directly mix in food grains and sealed the container in which grains are stored. It is safe, cheap and effective method. Neem leaves used as pest protectant abundantly by south Indian farmers for storage of Ragi food grain.

Turmeric (Haldi):

Turmeric powder is another good alternative which can be used at the rate of 40 g per kg of grains. Rub the grains gently with turmeric powder and shade dried for half an hour before storage. Turmeric can be used in raw form for protection. Its strong smell and insecticidal properties keep the insects away from food grains. This treatment give along lasting protection from the pest attack and equally safe for consumption.

Use of spices:

Some times local practices used by women also provide protection of food grains like to place two red chilies in the stored items. Insecticidal properties of garlic stops the multiplication rate of insects hence, control the infestation. Cloves of garlic placed in layers in rice and tightly close the containers where stored food items are kept. Bitterness of cloves kept the insects out of reach, put them on top of the

storage item and sealed the container properly.

Sweet flag rhizomes use as pest control agent:

Take 1 kg of sweet rhizomes for 50 kg of grains. Make it powdered and put in a cloth pouch which should be placed in the container where grains are stored.

Salt used as preservative as well as pest protectant:

Since ancient times salt was used as preservative in various food items to avoid fungal and bacterial infections. Salt act as abrasive for insect skin and prevent its entry into stored grains. 200 g of salt is mixed with 1 kg of red gram grain manually and then grains are stored in jute gunny bags and stitched properly. However, it is found that this method is very effective and affordable but only for short duration like 4 or 5 months only. Storage of tamarind was being followed from such along time by Indian farmers. After harvest, tamarind was removed from the pods and stored in pots in layers. 10 g of salt is used for a 1 kg of tamarind and spread between the layers uniformly. It's stops the infestation of pest attack like beetles, Indian meal moth etc. And also help in loosening of tamarind flesh.

Lime treatment:

Farmers use another cheap and easily available source

lime (calcium carbonate) for pest control. Powder the lime and mix it uniformly with rice grains and stored them in gunny bags at dry place. Its irritating smell keeps insects away and prevents them to multiply. Generally 10 g of lime is used to treat 1kg of grains. This treatment provides long lasting protection against pest attack.

Ash treatment for pest control:

Routinely used since old time by farmers. They pour the pulses in earthen mud pots and filled its $\frac{3}{4}$ volume and then remaining $\frac{1}{4}$ is covered with ash (wood/cowdung). Through this treatment grains will be protected for 6 months. After six month again drying the grains under sunlight and place them in pots with same treatment. Wheat grains are also stored by mixing with cow dung ash which is desiccative and insecticidal in nature.

Match box use as repellent against pest in festation:

Its almost oldest method used by ladies at houses for storage of food grains and still use effectively. They keep match boxes in layers. Generally 6-8 match boxes kept at the middle, bottom and top of the container and tightly close the lid of the container. Phosphorus in the match sticks have strong repellent proper ties which help to avoid the in

Other popularly used plant products for safe storage of food grains		
Common name	Used against	References
Greater galangal	<i>S. zeamais</i> and <i>T. castaneum</i>	Visetson, 1994
Black pepper	<i>C. chinensis</i>	Morallo-Rejesus <i>et al.</i> ,1990
Ginger	<i>C. chinensis</i> and <i>T. castaneum</i>	Ho,1990
Sugar apple, custard apple	Leaf extract inhibits growth of <i>S. cerealella</i>	Grainge and Ahmed,1988
Himalayan cedar (wood)	Wood oil as grain protectant against rice weevil	Singh <i>et al.</i> ,1989
Indian privet	Leaves used against stored grain pests	Ahmed and Koppel,1987
Inert materials		
Ash (wood)	Rice weevil	Kanta <i>et al.</i> ,1991
Charcoal (wooden coal)	Place in rice container to protect against rice weevil	Kanta <i>et al.</i> ,1989
Salt (NaCl)	Safe storage of basmati rice	Jilani <i>et al.</i> , 1988
Magnesium carbonate	Protectant of wheat seed against <i>Trogoderma granarium</i>	Samma and Verma,1993
Ash (burnt rice husk)	Mix with rice to protect against weevil	Kanta <i>et al.</i> ,1989

List of essential oils effective against storage fungi			
Plant	Vernacular name	Activity level	References
Neem (<i>Azadiracta indica</i>)	Neem	Allarequiteactive	Kher and Chaurasia1978
<i>Apiumgraveolens</i>	Celery		
<i>Curcumaaromatica</i>	Wildturmeric		
<i>Myristica</i> sp.	Nutmeg		
<i>Citrusmedica</i>	Badanimbu	Inhibit all fungal in festations	Pandey <i>et al.</i> ,1982
<i>Caesuliaaxillaris</i>	Gathlia	Fungicidal	
<i>Ocimumcanum</i>	Kalitulsi	Fungicidal	

festation.

Plant products used in processed form:

Neem seed kernel extract (NSKE):

- For 10% NSKE solution one need 1kg neem kernel powder in 10 litres of water.
- Take 1 kg neem kernel and make into powder, collect powder in a clothpouch and soak the pouch in 10 litres of water over night.
- Next morning squeeze the pouch into the water to get the extract.
- Dip gunny bags into this solution for half an hour, dry in shade and use for grain storage.
- Never dry the gunny bags in direct sunlight.

Neem oil:

One of the familiar and traditional practices followed by farmers for pest control is use of neem oil for seeds to

storage treatment. For 1 kg of pulses seeds 20 ml neem oil is used, applied manually to cover seed completely. It prevents infestation of weevils, red flour beetles, long headed flour beetle and fig moth etc. The peculiar properties of neem oil like repellence, strong odour keep the insects away and it almost kills the insect even a titts egg stage, so that infestation stops early. Neem oil mixed with coconut oil / castor oil (1/1) show more effective results. Soybean oil, ground nut oil and corn oil can be used as protectant. Citronella leaves extract shows more effective results in the eradication of pest infestation.

Conclusion:

Continuous availability of food grains through out the year is only possible through safe storage practices at house hold level. The safe storage practices discussed above have advantages over chemical treatments due to their low cost, easy availability, safe to use and eco-friendly nature.

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