

Novel storage solutions to improve food security for subsistence farmers

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Solutions exist in developed countries to reduce post-harvest grain losses caused by insects to less than 1%. Yet developing countries can experience post-harvest losses of >20% (African Post Harvest Losses Information System (2011)). Most solutions available to developed countries are not appropriate for developing country small farmers, who produce can account for a 50–75% of grain storage in these countries (Baloch, 1999). If these losses can be reduced, then hunger can be reduced and income and food security increased. Varied results have been shown when using commercial and traditional methods of controlling insects that include pyrethroids, diatomaceous earths, ash, and local repellents (Stathers *et al.*, 2008). More recently, methods of creating oxygen-free environments using plastic bags and locally-available metal containers have been used (Murdock *et al.*, 2003). These methods can be effective but can be too expensive for many farmers. Plastic bags also are vulnerable to damage by rodents. Our research group has investigated three innovative storage solutions using readily available materials: insecticide-treated bed nets (ITNs), repellents, and creation of modified atmospheres in storage. ITNs are widely distributed in malaria endemic areas. We have shown in laboratory studies that if grain is stored in these bed nets that have been treated with permethrins, there was almost no insect infestation. However, grain stored in untreated nets became highly infested. We are also working with low-cost, food-safe repellent that has shown to be effective at preventing insect infestations in stored grain. This repellent can be produced locally and is effective at repelling other disease vectors that are common in developing countries. Thus, there could be multiple health benefits resulting from the application of this product. Finally, creating a modified atmosphere that kills insects can be achieved using CO₂ from composting material. As organic material decomposes, it produces CO₂ which can then be used to create an atmosphere unfavorable for insect survival. No special materials are needed for this low cost method of controlling insects, other than common plastic bags or metal contains to contain the grain and capture the CO₂. In summary, ITN's, novel repellents, and modified atmospheres can be low cost and effective solutions to controlling insects for small farmers in developing countries.

Keywords

storage; food security; grain; insects.

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Grain losses in India and government policies

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Food grains form an important part of the vegetarian Indian diet. Grain production has been steadily increasing due to advances in production technology, but improper storage results in high losses in grains. Post-harvest losses in India amount to 12 to 16 million metric tons of food grains each year, an amount that the World Bank estimates could feed one-third of India's poor. The monetary value of these losses amounts to more than Rs. 50,000 crores per year (Singh, 2010). Natural contamination of food grains is greatly influenced by environmental factors such as type of storage structure, temperature, moisture, etc. During storage, quantitative as well as qualitative losses occur due to insects, rodents, and micro-organisms. A large number of insect pests have been reported to be associated with stored grains. At any given time 60–70% of grains is stored on the farm in traditional structures like *Kanaja*, *Kothi*, *Sanduka*, earthen pots, Gummi and *Kacheri*. However, indigenous storage structures are not suitable for storing grains for very long periods. The post-harvest losses in two major food grains, viz. rice and wheat where about 75 per cent of the total post-harvest losses occur at the farm level and about 25 per cent at the market level (Basavaraja *et al.*, 2007). The storage losses at different stages have added up to about 36 per cent of the total post-harvest losses in rice and 33.5 per cent in wheat, while harvesting and threshing operations together account for about 17 per cent of total losses in both the crops. Transit losses at different levels have been an important component of post-harvest losses, contributing to about 20 per cent of the total losses. Educating and training the farmers on post-harvest operations would greatly help in reducing the post-harvest losses in food grains. The establishment of small-size cold storage units in the production centres would help in reducing the storage losses. In this direction, the zero energy cool chambers technology developed by the Indian Council of Agricultural Research needs to be popularized. It is high time that both the Central and state governments should think about the severity of the problem of storage losses. One strategy could be that the Food Corporation of India could keep the stocks with the farmers. An adequate organization needs to be set up at the Centre and in the states to take coordinated action in this direction. We should go in for a systems approach rather than piece meal. Establishment of National Grid of rural godowns as per ecological zones is a must. The 'Save Grain Campaign' programme needs to be strengthened. In villages, from primary school through to high school and intermediate level the subject of grain storage should be taught. The subject should also be included in the job card of extension workers. Arrangement for training in grain storage for the framers should be made all over the country- in the villages at farmers' house where 70–80% grain is stored.

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