Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 04 (JULY-AUG, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Economic Impact of Stored Grain Pests on Global Food Security

(*Miranda Thaimei[1], Pooja Kashyap[2], Muskan Sneha[3], Ramnivas[4] and Shivraj Singh Dhakad[5])
[1]Dept. of Agricultural Economics, College of Agriculture, Pasighat (CAU, Imphal)
[2]Division of Food Science and Nutrition, Banasthali Vidyapith, Newai, Rajasthan, 304022
[3]Department of Entomology, CPGS-AS, Umiam, Meghalaya (CAU, Imphal)
[4]Department of Entomology, Maharaj Surajmal Agriculture College, Bharatpur
[5]Dept. of Agricultural Economics, MBDDSMKM, Siswali, (AU, Kota), Rajasthan
*Corresponding Author's email: miranda.thaimei@gmail.com

Stored grain pests represent a critical challenge to global food security, impacting both the quantity and quality of food supplies. These pests include various species of insects, rodents, and microorganisms that infest stored grains, leading to significant economic losses. The impact of these pests is particularly pronounced in developing countries, where inadequate storage facilities and limited access to pest control technologies exacerbate the problem. This article explores the types of stored grain pests, their economic impact, and strategies for mitigating these losses to ensure sustainable food systems.

Types of Stored Grain Pests

Insect Pests: Insects such as the rice weevil (*Sitophilus oryzae*), maize weevil (*Sitophilus zeamais*), and red flour beetle (*Tribolium castaneum*) are among the most common pests found in stored grains. These pests can cause direct damage by feeding on grains and indirect damage by creating conditions conducive to mold growth.

- **Rice Weevil**: This pest is notorious for infesting rice and other grains, boring into kernels and reducing both weight and nutritional value.
- **Maize Weevil**: Similar to the rice weevil, this insect targets maize and other cereals, causing extensive damage during storage.
- **Red Flour Beetle**: This pest is often found in processed grain products and can cause significant contamination and spoilage.

Rodent Pests: Rodents, including rats and mice, not only consume stored grains but also contaminate them with their urine, feces, and hair. This contamination can lead to severe health risks for consumers and additional economic losses.

- **Rats**: Capable of consuming large quantities of grain and contaminating much more, rats are a major threat to stored food supplies.
- **Mice**: Although smaller, mice are equally problematic due to their rapid reproduction and ability to contaminate grains.

Microbial Pests: Fungi and bacteria can infest stored grains, leading to spoilage and production of mycotoxins, which are harmful to human and animal health. Fungal infestations, particularly by *Aspergillus* and *Penicillium* species, are common in improperly stored grains.

- **Aspergillus**: Known for producing aflatoxins, which are highly toxic and carcinogenic.
- **Penicillium**: Can cause spoilage and mycotoxin production, affecting the quality and safety of stored grains.

Economic Impact

Quantitative Losses: Quantitative losses refer to the reduction in the actual weight or volume of stored grains due to pest activity. According to the Food and Agriculture Organization (FAO), post-harvest losses, including those caused by pests, can reach up to 30% in some developing countries (FAO, 2011). This loss translates to millions of tons of grain annually, representing a significant economic burden.

- **Global Statistics**: An estimated 1.3 billion tons of food is lost or wasted annually, with a significant portion attributable to post-harvest losses caused by pests (FAO, 2011).

Qualitative Losses: Qualitative losses include reductions in grain quality due to pest contamination, leading to lower market value. Grain quality deterioration can result from insect damage, rodent contamination, and microbial spoilage, making the grains unsuitable for consumption or processing.

- **Market Impact**: Contaminated grains often fetch lower prices in the market, reducing the income of farmers and traders (Boxall, 2001).

Increased Storage Costs: Managing stored grain pests often requires investment in pest control measures, such as fumigation, aeration, and use of insecticides. These measures can be costly, especially for small-scale farmers and storage facilities in developing countries.

- **Pest Control Costs**: The expenses associated with chemical treatments, monitoring, and improved storage infrastructure can be substantial (Hodges & Farrow, 2004).

Health Risks and Food Safety: Stored grain pests can introduce health risks through contamination with pathogens and mycotoxins. Consumption of contaminated grains can lead to foodborne illnesses and long-term health issues, further exacerbating economic losses due to healthcare costs and loss of productivity.

- **Mycotoxins**: Produced by fungi, mycotoxins such as aflatoxins and ochratoxins can cause severe health problems, including cancer and liver damage (Bryden, 2012).

Strategies for Mitigation

Integrated Pest Management (IPM): IPM involves a combination of biological, chemical, and cultural practices to manage pest populations effectively. By reducing reliance on chemical pesticides, IPM promotes sustainable and cost-effective pest management.

- **Biological Control**: Use of natural predators and parasitoids to control pest populations.
- **Cultural Practices**: Crop rotation, sanitation, and proper storage techniques to minimize pest infestations (Kumar & Kalita, 2017).

Improved Storage Practices: Adopting improved storage practices, such as hermetic storage and proper sanitation, can significantly reduce pest infestations. Hermetic storage, which involves sealing grains in airtight containers, prevents pest entry and inhibits microbial growth.

- **Hermetic Storage**: This method creates an oxygen-deprived environment that is inhospitable to pests (Murdock et al., 2012).
- **Sanitation**: Regular cleaning and maintenance of storage facilities to prevent pest infestation (Hodges & Farrow, 2004).

Technological Innovations: Advances in detection and monitoring technologies, such as pheromone traps and electronic sensors, can help in early detection and timely intervention. These technologies can minimize losses and reduce the economic impact of stored grain pests.

- **Pheromone Traps**: Used for monitoring and controlling insect pest populations (Fields & White, 2002).
- **Electronic Sensors**: Detect changes in temperature and humidity that may indicate pest activity (Subramanyam & Hagstrum, 1996).

Conclusion

The economic impact of stored grain pests on global food security is profound, affecting both the quantity and quality of food supplies. Understanding the extent of these losses and implementing effective management strategies are crucial for ensuring sustainable food systems. Continued research and investment in pest management technologies and practices will be essential in mitigating these impacts and safeguarding global food security.

References

1. Affognon, H., Mutungi, C., Sanginga, P., & Borgemeister, C. (2015). Unpacking postharvest losses in sub-Saharan Africa: A meta-analysis. *World Development***,** 66, 49-68.
2. Boxall, R. A. (2001). Post-harvest losses to insects—a world overview. *International Biodeterioration & Biodegradation***,** 48(1-4), 137-152.
3. Bryden, W. L. (2012). Mycotoxin contamination of the feed supply chain: Implications for animal productivity and feed security. *Animal Feed Science and Technology,* **173**(1-2), 134-158.
4. FAO. (2011). Global food losses and food waste – Extent, causes and prevention. *Food and Agriculture Organization of the United Nations.*
5. Fields, P. G., & White, N. D. G. (2002). Alternatives to methyl bromide treatments for stored-product and quarantine insects. *Annual Review of Entomology, 47,* 331-359. Link
6. Hodges, R. J., & Farrow, R. A. (2004). Grain storage practices: Causes of losses and prevention. *Encyclopedia of Grain Science,* 218-225.
7. Kumar, D., & Kalita, P. (2017). Reducing postharvest losses during storage of grain crops to strengthen food security in developing countries. *Foods,* 6(1), 8. Link
8. Murdock, L. L., Margam, V., Baoua, I., Balfe, S., & Shade, R. E. (2012). Death by desiccation: Effects of hermetic storage on cowpea bruchids. *Journal of Stored Products Research, 49,* 166-170.
9. Subramanyam, B., & Hagstrum, D. W. (1996). Integrated management of insects in stored products.