les dossiers
d'**AGROPOLIS**
INTERNATIONAL
Expertise of the scientific community
Special Partnership Issue

Agroecological transformation for sustainable food systems

Insight on France-CGIAR research

Number 26
September 2021

Minimizing insecticide use during grain storage in smallholder farming systems

Reducing food losses is important to make more nutritious food available and achieve Sustainable Development Goal 2 – Zero Hunger. In a smallholder farming system, from on-field predrying and harvest onward, grain undergoes processes during which improper handling associated with abiotic (ambient temperature, relative humidity) and biotic factors (insects, fungi, rodents) may lead to losses. To reduce losses, farmers may opt to treat their grain with insecticides during storage, frequently at inappropriate doses and without adequate practices, and little is known about the associated health risks. Insecticide use by smallholders is a public health concern as intoxication cases in Mexico and Latin America are frequently reported. Hermetic storage technologies (hermetic metal silo, hermetic bags, recycled hermetic plastic containers) represent a viable alternative for smallholders as these airtight technologies—by stopping the exchange of oxygen and moisture between the stored grain and its environment—are effective in controlling pest activity inside the storage containers, without the use of insecticides. Research has shown that, regardless of agroecological conditions, **hermetic storage technologies reduced postharvest losses from, on average, 39% (with conventional farmers' practices) to 3% in lowlands (< 500 m above sea level) in Mexico, where insect pressure is greater than in highlands. Hermetic technologies also limit fungal infestation and the associated risk of mycotoxin production**[1], **maintain the percentage of seed germination, and minimize quality loss during storage.** CIMMYT is promoting the use hermetic technologies with smallholders along with good handling practices, including low-cost shelling and drying solutions and moisture checking using simple methods. Building the postharvest technology market is also a key aspect as it facilitates farmers' physical and economic access to high-quality technologies that have the potential of minimizing losses and strengthening their food security.

Contacts

Sylvanus Odjo (CIMMYT, CGIAR, Mexico), sylvanus.odjo@cgiar.org

Bram Govaerts (CIMMYT, CGIAR, Mexico), b.govaerts@cgiar.org

Nele Verhulst (CIMMYT, CGIAR, Mexico), n.verhulst@cgiar.org

For further information

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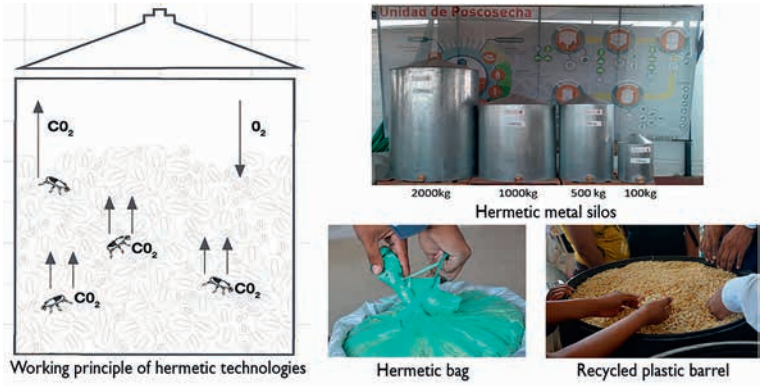
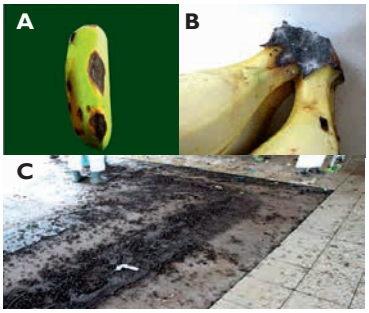
▶ *Working principle of hermetic technologies and hermetic technologies promoted by CIMMYT in Mexico.* © *CIMMYT*



Redesigning postharvest banana practices integrating agroecological constraints

Consumer demand has been steadily growing over the last decade for residue-free fruit and vegetables produced without chemical treatments. New marketing labels have thereby been developed to reassure consumers on the safety and high quality of such untreated produce. How can the high level of quality required by all banana stakeholders be reconciled with the barrier-breaking adoption of a field-to-fork agroecological approach? Addressing this future challenge has been a key research focus of the joint QualiSud research team (France). Indeed, banana is highly susceptible to postharvest diseases, particularly fungus attacks causing diseases like anthracnose (Photo A) and crown rot (Photo B).

It is now essential to implement an integrated approach to address this challenge while reconsidering postharvest practices through an agroecological lens[1]. This will be the best way to meet consumer demand for top quality bananas produced under environment-friendly conditions. Indeed, sanitary conditions in banana orchards as well as in packing stations (Photo C) must be optimized to curb the fungus contamination risk as early as possible. These prophylactic measures—although essential—would however not be sufficiently effective to compete the chemical fungus control. **As the harvest stage is the result of a trade-off between the banana yield, green life**[2] **and fungal disease susceptibility, it is a key parameter to take into account in the design of integrated solutions throughout the food chain. Moreover, the shipping stage needs to be streamlined by implementing new technologies and innovative approaches, e.g. combining controlled atmosphere conditions with the use of oxidative molecules like ozone.** Abandonment of the chemical treatment option poses many complex challenges yet it also opens new opportunities for the research community and consumers. Total elimination of chemical antifungal treatments will create a virtuous circle by restoring consumer confidence while fostering innovative research and development strategies.



▲ ***Photo A.*** *Anthracnose disease on a Cavendish banana.*
Photo B. *Crown rot on Cavendish bananas.*
Photo C. *Pistil accumulation, a source of* Colletotrichum musae *contamination at the packing station.*
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Contact

Pierre Brat (QualiSud, CIRAD, France), pierre.brat@cirad.fr

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