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Scaling Hermetic Storage in Tanzania - Making Progress

By Dieudonne Baributsa, Director, PICS Program, Purdue University

This year brought significant progress in scaling the adoption of hermetic storage bags, driven by the USAID-funded initiative "**Expanding Credit Access to Scale-up the Use of Hermetic Storage in Tanzania (CASH-Tz)"**, launched in 2021. The program aimed to enhance the use of hermetic bags by enabling farmers to access financing through partnerships with banks and grain buyers.

Despite challenges such as low maize production, the program achieved remarkable milestones. Training sessions reached 20,000 cooperative members and farmers in 200 villages across the Ruvuma and Rukwa regions, focusing on credit access and hermetic bag usage. Additionally, we engaged development partners, shared key lessons, and highlighted the need to scale hermetic storage to address food safety issues related to chemical use and aflatoxins.

The CASH-Tz initiative led to a 7% increase in hermetic bag adoption since 2021 and a fourfold rise in PICS bag sales in these regions. These results were driven by training programs and efforts to improve PICS bag availability in rural markets and shops. Results about the adoption and impacts of hermetic storage technologies in the region can be found in this publication.

Interestingly, during travels in Tanzania, we observed women traders selling maize stored in PICS bags at a 20% premium over chemically treated maize, reflecting growing consumer demand for safe, chemical-free grains. The program also uncovered innovative uses for PICS bags, including **silage storage** and **fingerling transportation**. Storing silage in PICS bags maintains quality and facilitates transport, while using PICS bags for fingerlings reduced mortality rates from 50–70% to zero. These breakthroughs open new avenues for research and scaling hermetic storage in Tanzania and beyond.

We extend warm wishes to you and your loved ones for a joyful close to 2024 and a prosperous 2025!

Left: Bucket with a PICS liner containing water and fingerlings ready to be shipped to a fish farm.

Right: Silage stored in PICS bags. Check out our YouTube video!

Enhancing Coffee Quality and Farmer Income with PICS Technology in Colombia

By Ken Foster, Department of Agricultural Economics, Purdue University

In the highlands of Colombia, where arabica coffee thrives, a study has unveiled the potential of PICS (Purdue Improved Crop Storage) bags to revolutionize coffee storage practices. This research, conducted at the Universidad de Caldes in Manizales, offers promising solutions for smallholder farmers seeking to maintain coffee quality and maximize their income.

The Coffee Storage Challenge

Coffee, a crucial cash crop for many tropical regions, faces unique storage challenges. As a seasonal crop, coffee prices fluctuate with harvest cycles, often leaving farmers at the mercy of market dynamics. Traditional storage methods, while common, often fall short in preserving the delicate qualities that make Colombian coffee world-renowned.

Water activity (the amount of chemically free water) is highly correlated with moisture content and thus indicates potential for spoilage during storage, and also aids in important browning reactions during roasting that give coffee its unique aromas and flavors. Too high and spoilage occurs but too low and aroma and flavor are adversely impacted.

PICS Technology: A Game-Changer for Coffee Storage

The study, led by a team of researchers from Purdue University and Universidad de Caldes, Manizales, Colombia, has been published in the Journal of Stored Products Research. This study compared the performance of original PICS bags (two liners in one woven bag), modified PICS bags (a single liner in one woven bag), and traditional jute bags over a six-month period.

Key findings include:

1. Both the original and modified PICS bags excelled in maintaining the moisture content and water activity of green coffee beans. These factors are crucial for preserving coffee's sensory qualities and preventing spoilage.

2. Coffee stored in PICS bags maintained its sensory attributes, including sweetness and cleanness, for up to six months. This preservation of quality is vital for farmers aiming to access premium markets.

3. Coffee stored in PICS bags consistently received higher price premiums compared to traditional storage methods. The economic analysis revealed positive net returns from using PICS technology, with the modified PICS bags showing particular promise due to lower manufacturing costs.

4. While quality was best preserved for six months, the study suggests that PICS technology could allow farmers to store coffee for extended periods, enabling them to capitalize on seasonal price fluctuations.

5. The success of modified PICS bags, which use fewer materials, points to a more sustainable storage solution with a reduced environmental footprint.

Implications for Farmers and Cooperatives

The adoption of PICS technology for coffee storage offers multiple benefits:

- By maintaining coffee quality over time, farmers may be able to access better markets and negotiate higher prices.

- Extended storage capabilities allow farmers to sell when prices are most favorable, rather than immediately after harvest.

- Cooperatives can use PICS bags to maintain the quality of their coffee stocks, ensuring consistent supply to buyers.

- The use of PICS bags aligns with growing consumer demand for sustainably produced coffee.

Looking Ahead

As the coffee industry continues to evolve, with increasing emphasis on quality and sustainability, PICS technology stands out as a valuable tool for smallholder farmers. By addressing crucial storage challenges, they not only preserve the renowned quality of Colombian coffee but also empower farmers to take greater control of their product and their income.

The success of PICS bags in coffee storage also has broader implications. In Colombia's post-conflict era, where there's a push to transition farmers away from illicit crops, technologies that enhance the profitability of legitimate crops like coffee play a crucial role in sustainable development.

Enhancing the Adoption of Post-Harvest Technologies in Zambia Using an Innovative Business Model

By Pumulo Nakweba, iDE Zambia

Mulenga Chiimbwe at his shop with Richard Chakota, one of the farmers in Mobe Camp trained in the use of hermetic bags.

Post Harvest Losses (PHL) are one of the major problems faced by smallholder farmers in Zambia resulting in food insecurity and loss of income. These losses are usually caused by poor post-harvest handling techniques and limited access to adequate and improved storage technologies.

To address these challenges, iDE Zambia has been implementing the Post-Harvest Loss Management venture project using an innovative approach. For purposes of sustainability, this involved developing a business model that ensures availability and accessibility of the identified technology to smallholder farmers at the last mile.

To achieve this, iDE leveraged the network of last mile service providers called Farmer Business Advisors (FBA) whom it has supported to create and develop within rural communities as private business minded providers of services at community level. FBAs were trained and linked to the suppliers of the technology to effectively promote the same, leading to sales and adoption among the communities.

Being the link between the suppliers of the technology and smallholder farmers, FBAs have played a pivotal role in ensuring that they stock and provide easy access of the technology to smallholder farmers that are mostly excluded from the market.

Mulenga Chiimbwe (above with his wife in front of their home-based agro shop) is one of the FBAs based in Kapiri Mposhi District who has been making progressive milestones in driving the adoption of the hermetic technology in Mobe Agriculture Camp located about 55 kilometers from the Central Business District. As a farmer, he has been using the technology to store his grain since 2022.

“I have been using the hermetic storage bags for two seasons now. Before I was introduced to the bags, I used to lose over 150 kg of maize from weevils. To get rid of them, I would use chemicals which would compromise the quality of the maize. Despite using different brands of chemicals, weevils would still attack the maize stored for home consumption. Ever since I started using the hermetic storage bags, the losses have reduced and I have also been keeping maize to sell when the prices are better.” Mulenga Chiimbwe said.

As an entrepreneur, Chiimbwe also has been using the technology to create an income source for his family. He runs an agro shop at his farm where he has added the hermetic bags and sells to smallholder farmers in his camp. From the last farming season, he sold over 500 hermetic bags realizing ZMW 25000 ($961.50).

“When smallholder farmers were first trained in post-harvest management which included the use of the hermetic storage bags, they faced challenges on accessing them as the closest point they could buy them was in Kapiri Mposhi town, which is about 55 km away. That challenge presented an opportunity for me as an entrepreneur to start stocking and selling the hermetic storage bags within the area and earn an extra income. iDE linked me to the suppliers of the technology and trained me on how to

effectively present the value proposition to customers and make sales; it also supported in creating an enabling environment by supporting to create awareness in the communities and therefore generate interest and that is how I started ordering the hermetic storage bags," he said.

The model has been tested and has proved to be an effective and sustainable way to respond to challenges posed by postharvest losses to farmers. Through this model, over 100 FBAs were linked to the national supply chain for the hermetic storage technologies to actualize availability of the technology at the last mile. We then saw an increase in sales of the technologies by 118% to 10,913. We are determined to scale up our model and be able to reach out to more farmers and accelerate adoption of the hermetic storage bags.

Improved Post-harvest Storage for Resilient Livelihoods Among Farmers and Refugees (Uganda)

By Richard Businge, Yield Harvest Uganda

Left: Training in refuge camps. *Right: Women sorting grain for storage.*

Small-scale farmers have difficulties comprehending the impacts of poor post-harvest management on their incomes, thus paying less attention to addressing them. About 30% of the food produced is lost at the post-harvest stage, reducing food availability for home consumption and sale for income. Poor storage methods are one of the primary sources of post-harvest loss. Poor grain quality affects the availability and marketability of the grains.

Yield Harvest Uganda, a company involved in grain aggregation and processing to produce maize flour, seized the opportunity to address these challenges. Looking at the challenges, Yield Harvest Uganda explored appropriate storage technologies to improve the quality of grains used in producing flour. After research, PICS bags were identified as the most suitable, cost-effective, and easy-to-use technology for maize storage for flour processing.

To address post-harvest challenges and improve food security among small-scale farmers who supply grain to Yield Harvest Uganda, the company introduced PICS Bags to local farmers' groups. Given that these small-scale farmers are located in the districts of Kasese, Kabarole, Kagadi, Kyenjojo, Kamwenge, Kikuube, and Kyegegwa,

the company found itself in contact with refugees who had grain storage challenges as well. As a result, Yield Harvest Uganda was compelled to seek permission from the Refugee Office, under the Prime Minister, to engage them in production activities by offering a market for their grains. After receiving clearance, Yield Harvest Uganda also provided training to refugees on proper grain handling and storage.

The introduction of the PICS technology has allowed small-scale farmers and refugees to store grains for home consumption for at least 12 months. This has significantly improved the quality of grain that farmers and refugees sell to Yield Harvest Uganda. In addition, the use of PICS bags has enabled households to eat healthy foods free of chemicals, weevils, and aflatoxins. To date, Yield Harvest Uganda has sold more than 10,000 bags to local small-scale farmers, including refugees from Kyaka II and Kyangwali, who bought at least 2,000 bags. Local farmers and refugees say they are using PICS bags given that weevils are never found in grain stored using this technology, even after a long time of storage. In addition, using PICS bags at Yield Harvest Uganda has created job opportunities for women and young men who are involved in sorting, cleaning, packing, and processing grain stored for milling.

Purdue Improved Crop Storage Bags in Cowpea Storage Over the Years (Nigeria)

By Yusuf Idrisa, University of Maiduguri, Nigeria

I came to know about the Purdue Improved Crop Storage (PICS) bags as a hermetic storage technique for crop storage when it was Purdue Improved Cowpea Storage (PICS) bags in the year 2009. Since that time, I have been promoting the technology, encouraging farmers, consumers, and marketers to store agricultural produce in PICS bags. I have also used PICS bags to store cowpea, maize, and Bambara nuts.

I have used PICS bags for the storage of farm produce for about 15 years and the technology has helped me in many ways. In the 2023 farming season, for instance, I got six bags of cowpea (each bag measuring 100 kg), which is 0.6 tons. One bag of cowpea was selling for N43,000 at the time of harvest (November/December). Seven months later, the price rose to between N190,000 - 220,000 (equivalent to $114-132, depending on quality. That is to say, for every 100 kg of cowpea I used or shared with my relatives, I saved between N147,000 - 177,000. That is far more than 300% profit if I were to sell the cowpea.

Storing my cowpea in PICS bags also enabled my family and my relatives to consume healthy food devoid of possibly non-biodegradable storage chemicals. So many cases arise from consumption of agricultural produce stored with chemicals that are not safe. Courtesy of storing my farm produce (largely cowpea) in PICS bags, my family and my relatives, with whom I share my farm produce, have not experienced any case of food poisoning arising from the consumption of contaminated food.

Again, using PICS bags for storage has strengthened me to store my farm produce. This, by extension, has empowered me to help my relatives who, in most situations, are in dire need of help. If I had no farm produce in storage, perhaps it would be difficult for me to source money and buy the produce for them, given the harsh economic conditions we are facing. But it is always easier to pick food items from the store and share them.

I sincerely thank all the stakeholders in the PICS project, notably Purdue University, the International Institute of Tropical Agriculture and the PICS field workers for bringing this technology to farming communities. I also want to use this medium to call on people (farmers, marketers and consumers) to continue to use PICS bags for storage of farm produce.

Dr. Idrisa demonstrating the use of PICS bags in Nigeria

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