Trans-SEC
Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer

UPS 7: Optimized storage for earning better prices and for improved grain quality

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Key Objective **Smoothen temporal food availability, enhance stored grain quality, and increase poor farmers' income through grain selling over an extended period of up to six months or even more.**

Key constraint addressed

Optimized market oriented storage addresses the post-harvest grain losses in storage, the poor quality of stored grains, and stress selling often encountered immediately after harvest when prices are overly low.

Description

In most countries, grains are among the most important staple foods. However, they are seasonally produced and in many places there is only one harvest a year, which itself may be subject to failure (de Graaff et al., 2011). This means that in order to feed the world's population, most of the global production of maize, wheat, rice, sorghum and millet must be stored for periods varying from one month up to more than a year (Ezezika and Oh, 2012). Thus, grain storage occupies a vital place in the economy of individual households, especially in rural areas.

The main function of storage in the economy is to even out fluctuations in market supply, both from one season to the next and from one year to the next, by taking a product off the market during surplus seasons and releasing it back during lean seasons. This, in turn, smooths out fluctuations in market prices (Guidi, 2011). The desire to stabilize the prices of basic foods is a major reason why governments try to influence the amount of available storage, if not directly undertaking storage themselves (MAFAP, 2013). This UPS aimed at building the capacity of individual farmers regarding market-oriented storage practices in order to engage them in profitable and sustainable storage. The improved, proper, storage facilities will help increase the volume of supply and quality of grains, thus enabling farmers to obtain competitive prices during the lean season.

PROVEN SUCCESS IN TZ AND BEYOND

According to Jones et al. (2011), the superior profitability of the Purdue Improved Cowpeas Storage (PICS) technology has high potential for adoption in Malawi, Mozambique, Tanzania and Ghana. The largest potential income gains resulting from using PICS and super grain bags (IRRI) could occur in regions with Larger Grain Borer (LGB) infestations, although rigorous verification of these bags efficacy with LGB is still underway. In long-term storage, analysis shows that improved storage bags, such as PICS and IRRI, are more cost-effective than either of the leading chemical grain protectants. Hermetic storage technologies, including triple layer (PICS), IRRI bags, cocoons, and others, are being promoted as cheap and effective ways to control insect pests in Asia and Africa (Quezada et al., 2006).

TYPE OF FOOD CROPS APPLICABLE:

Grains, particularly those that are easily infected by pests and insects, such as maize, rice, cowpeas, and pigeon peas, among others.

TECHNICAL SPECIFICS, DIMENSIONS:

The experiments targeted two villages in sub-humid regions, Ilakala and Changarawe. The aim was to combine with other best storage practices e.g. appropriate structural designs, simple moisture management (simple moisture testing technologies when farmers dry their produce since most farmers do not know whether they have reached the right moisture content that will ensure quality storage of grains). The storage treatments were done in four types of bags, namely super bag (IRRI bag), PICS, polypropylene bag with and without insecticides treatment. The table below shows storage treatments results of these bags, emanating from three different durations in Changarawe i.e. 0 months, 3 months, and 6 months.

The IRRI bag has the capacity to store grains for five (5) consecutive production seasons, while PICS can store for less than three (3) seasons, as it needs special handling during storage and grains interchange. Polypropylene is a popular method for the majority of farmers, but can only effectively store grains for one (1) season. Both IRRI and PICS bags are air tight with one and three layers, respectively.

The parameters interesting for this UPS are moisture content, dry matter loss, germination, and proximate analysis. The storage periods were for three and six months. The frequency of opening was once per week. Furthermore, the aflatoxin test was conducted at the Tanzania Food and Drug Agency (TFDA) in Dar es Salaam.

TRANS-SEC FINDINGS

The result and findings noted from the treatment experiments at the household level can be summarized as follows:
The market price of maize at the beginning of the storage was 45,000 Tsh per bag and at the end of storage it was 75,000 Tsh per bag. However, it is important to note that maize prices fluctuate between seasons and years; in good years maize prices are low while in bad years it is high.
For the amount stored in super bags, inspection after 2.5 months indicated that the grain quality was good compared to other storage bags; during this period the price changed from 50,000 Tsh to 75,000 Tsh per bag.
Despite its relatively higher prices, IRRI bags can provide an additional profit margin of more than 28,000 Tsh per bag of maize due gains associated to price patterns and storage quality. Around 10% or 9% of post-harvest loss is prevented with use of IRRI or PICS bags, respectively, and more than 25,000 Tsh extra can be earned due to storage.
Generally, during the storage period (both 3 and 6 months) IRRI and PICS bags show better performance in terms of weight loss, germination rate, mold growth, and insect damage than either of the traditional methods. Using traditional methods, including mixing grains with insecticides performs better than just the traditional method. The results reveal that as awareness increaseses, farmers will most likely need more super bags or PICS.

	Storage Duration (0 months)			Storage Duration (3 months)			Storage Duration (6 months)		
Treatment	Grain weight (kg)	Germination rate (%)	Insect damage (%)	Grain weight (kg)	Germination rate (%)	Insect damage (%)	Grain weight (kg)	Germination rate (%)	Insect damage (%)
IRRI bags	38	91.8	8	37.33	91.67	4.45	36.58	91.67	3.17
PICS bags	38	91.8	8	36.25	90.00	7.22	36.42	92.50	3.83
Polypropylene bags (with insecticide)	38	91.8	8	35.67	91.67	7.78	33.00	80.17	12.58
Polypropylene bags (without insecticide)	38	91.8	8	34.92	88.33	30.00	29.67	26.67	49.67

IMPLEMENTATION CONSTRAINTS

The main challenge reported by the farmers is the prices of the improved bags, whereby, high purchase prices of 10,000 Tsh and 4,000 Tsh for IRRI bag and PICS bag respectively were noted, compared to 1000 Tsh for polypropylene bags. However, some farmers are willing to buy them at a price not more than 3,000 Tsh per bag. Second, availability of these bags in rural areas is also a problem, PICS bags were somehow more available to nearby agro-dealers than the IRRI bags. Third, the size of the bags are uniform, which were reported to be challenging to farmers, particularly women. Availability of 50kg and 25kg bags can be useful for household level use and the storage of small quantities of produce for future use. Lastly, the bags do not seem to be in as great demand by farmers in semi-arid areas, as some of their crops, such as millet, sorghum and wheat, are not severely affected by pests and insects.

LINKAGE TO OTHER FVC COMPONENTS

Improved grain storage provides a form of savings for future household use, to cover future cash need through sale, for barter exchange, or gift-giving and food. Grain can also be stored to be used as quality seed and for inputs into household enterprises such as local beer brewing, or the preparation of cooked food. The improved grain storage enables the households to be food secure and to increase household income if better prices are realized.

Considerations & criteria for UPS outscaling

The availability of bags in rural areas and awareness of storage techniques, if increased through promotion and campaigns, can greatly influence this UPS outscaling. With higher production of grains a successful storage is needed. Willingness and ability to pay for the bags is crucial, whereby farmers need education regarding simple storage economics to recognize the benefits of the storage to secure food and markets.

Key lessons learned

Proper post-harvest handling measures, particularly grain storage, in the improved bags can offer a wide range of benefits to pro-poor farmers. Quality produce can be available for household food, potential markets, and farm seeds. Moreover, most farmers have objectives of meeting household food requirements and therefor are willing to invest in storage technology, regardless of its economic returns.

References

de Graaff, J., Kessler, A., & Nibbering, J. W. (2011). Agriculture and food security in selected countries in Sub-Sharan Africa: diversity in trends and opportunities. Food Security, 3, 195-213. DOI 10.1007/s12571-011-0125-4

Ezezika, O. C., & Oh, J. (2012). What is trust?: perspectives from farmers and other experts in the field of agriculture in Africa. Agriculture & Food Security, 1 (Suppl 1), S1.

Guidi, D. (2011). Sustainable Agriculture Enterprise: Framing Strategies to Support Smallholder Inclusive Value Chains for Rural Poverty Alleviation. CID Research Fellow and Graduate Student Working Paper No. 53. Center for International Development at Harvard University.

Jones, M., Alexander, C., & Lowenberg-DeBoer, J. (2011). An initial investigation of the potential for Hermetic purdue improved crop storage (PICS) bags to improve incomes for maize producers In Sub-saharan Africa. Purdue University West Lafayette, Indiana 47907-Working Paper #11

MAFAP (2013). Review of food and agricultural policies in the united republic of tanzania 2005-2011, (July). MAFAP Country Report Series, FAO, Rome, Italy.

Quezada, M.Y., Moreno, J., Varqueze, M.E., Mondoza, M., Mendeze-Albores, A., Moreno-Martineze, E. (2006). Hermetic storage system preventing the proliferation of Prostephanus truncatus Horn and storage fungi in maize with different moisture contents. Post harvest Biology and Technology 39, 321-326.