

## RESEARCH ARTICLE

# Farmers' adoption and willingness to pay for post-harvest technologies in Tanzania: policy implication for enhancing food security

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## ABSTRACT

This study was conducted in Morogoro, Iringa, Njombe, Mbeya and Songwe regions in Tanzania. The main objective of the study was to establish post-harvest technology (PHTs) adoption and willingness to pay for PHTs. It was found that farmer 'awareness on post-harvest technologies is increasing, especially on hermetic PICS Bags. However the adoption to PHTs is limited by price and availability close to their localities. Most farmers are willing to pay at an average of 4,000 but some sellers are selling more than that price. On preference, many end users prefer PICS for the reason that it is mostly available and mostly popularized. Preference is also determined by price affordability, availability and proximity to suppliers. The study concludes that PHTs have received high acceptance by farmers who have awareness and knowledge. However, the technology uptake is limited mainly by price affordability, availability and proximity. The present study recommends for subsidizing PHT products with manufacturers to reduce the current market price and increase more awareness campaigns through agrodealers, physical visits to farmers and farmers associations to increase demand for PHTs among farmers / farm associations as well as timely distribution of PHTs (hermetic bags) before the harvesting season in May-June in the Southern Highland regions.

**Keywords:** Farmers, postharvest technology, determinants, adoption, willingness

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## INTRODUCTION

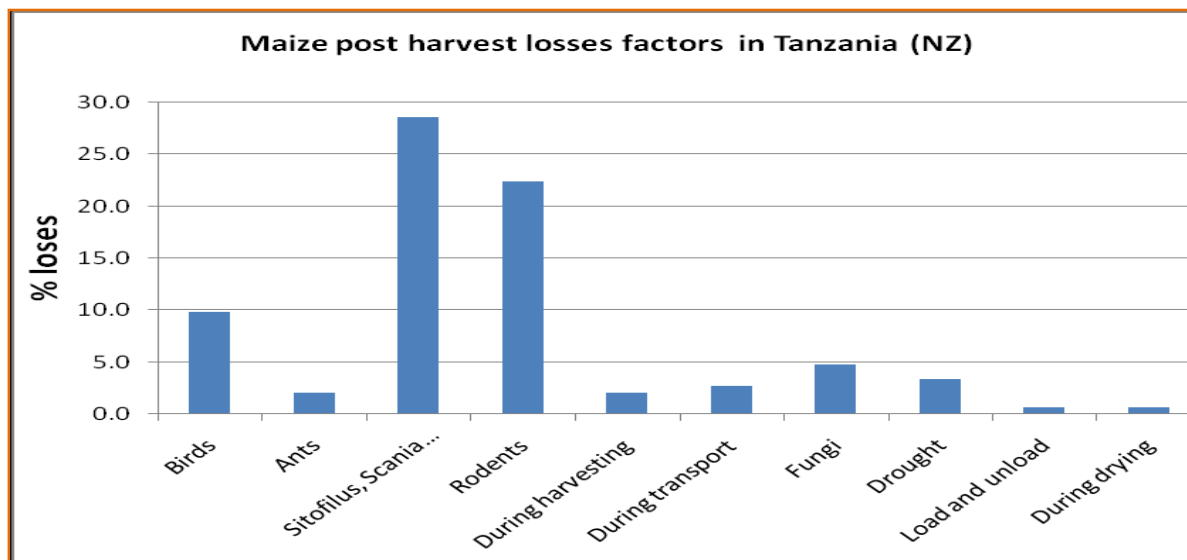
Postharvest Loss (PHL) of grains and pulses is expressed as the loss in dry weight and quality, happens during various stages such as at harvesting (4-8%), transportation from farm to home drying process, shelling, winnowing, farm storage (Hodges et al., 2014). It was estimated that farmers loose between 20-30 percent of their annual harvest due to weevils (Teferre, 2012). In any form, postharvest loss has an impact on farmers' income as farmers' loose quantity and quality of the stored food, which cannot fetch a good market price, and in longer run affect food security. Fig 1 shows the main causes of postharvest loss for maize in Tanzania whereby pests like weevils (*Sitophilus*), Lesser Grain Borer (*Ryzopertha dominica*) and Larger Grain Borer (*Prostephanus truncatus*) have been found to contribute high food loss (Tefera and Abass, 2012; Hodges et al., 2014).

Food insecurity is aggravated by postharvest losses. The postharvest loss is defined as the degradation in both quality and quantity of produced foods (Siddiqui et al., 2016). The quality loss involves the effect on the nutrient caloric composition, the acceptability, and the edibility of grains and pulses; whereas, quantity loss refers to loss of the amount of a product (Kiaya, 2014; Ahmad and Siddiqui, 2015). Postharvest losses can be minimized through postharvest management

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(Makalle, 2012) and adoption to postharvest technologies. Research on postharvest technologies has resulted the improved grain storage techniques including hermetic bags, hermetic cocoons, metal and plastic silos (Tefera and Abass, 2012; Helvetas and Ansaf, 2016). The adoption of postharvest technologies (PHTs) in Tanzania is emerging. The hermetic cocoons, Hermetic bags have been introduced in Tanzania with the support of AGRA/Rockefeller Foundation to reduce postharvest loss and it is slowly getting some acceptance by farmers.

Fig. 1: Causes of Postharvest loss in Maize (Tefere, 2012)



Although hermetic bags, metal silos and hermetic cocoons have been introduced in Tanzania, there are few manufacturers and promoters of PHTs including Intermech Engineering, A to Z, Pee Pee, and GrainPro, Inc., the adoption of technology is limited due to different customers' preference, knowledge and awareness, accessibility, and price.

Adoption of proper postharvest technologies (PHTs) is very important to enhance end users' willingness to pay and adopt. The present study was conducted to gather information on small holder farmers' willingness to adopt and pay for postharvest technologies. Different agro-dealers, farmer associations and individual traders were surveyed for uptake of hermetic bags, metal silos and hermetic cocoons as postharvest technologies (PHTs) considering the following questions.

1. What are the determinants of postharvest technology adoption in Tanzania?
2. How willing are farmers to adopt Postharvest Technologies in Tanzania?
3. What are the farmers' preferences for reducing postharvest technologies?

## MATERIALS AND METHODS

### Area of study and procedures

The study was conducted in the southern highlands projects in Morogoro, Iringa, Njombe, Mbeya, and Songwe regions which grow many types of cereals mainly maize and pulses.

A mixed method of quantitative and qualitative data collection was used. A cross-sectional survey questionnaire was conducted to determine demand by categories of PHTs; preference of PHTs, and willingness to pay for PHTs. Whereas; the qualitative methods used an in-depth interview and Focus Group Discussion (FGDs) for understanding end-users' preference of the PHTs. Survey: A survey was conducted for collecting quantitative data on demand for PHTs, preference and distribution network using digital hand held instruments loaded with CSPro 6.2, this was backed up with a paper survey questionnaire.

### **Key informant interviews**

Face-to-face interviews, telephone, and Skype interviews were conducted with PHT manufacturers. Only face-to face interviews were conducted to distributors, farmers' organizations and farmers. An interview guide was used to capture information on PHTs from the respondents. Focus Group Discussion (FGD) was conducted with groups of farmers to get varied experiences and preferences.

### **Sampling**

Gay and Dieh (1992) opined that a sample of representatives depends on a type of research, such as the descriptive research requires 10%, correlational studies require 30%, and experimental research requires 30%. Generally, the minimum acceptable sample is 30%. This study adopted 40 respondents as the adequate sample size. Random selection of PHT manufacturers, distributors, stockiest/ agro-dealers, farmers' organizations and farmers in Morogoro, Iringa, Njombe, Songwe, and Mbeya regions were selected

## **RESULTS AND DISCUSSION**

The study finds out that Knowledge, Attitude and Practice (KAP) on new postharvest technology among farmers, agrodealers and traders is increasing. Most respondents either were using or heard from fellow farmers or through media (watching television or listening to the radio) are willing to use it. Findings show 70.9 percent of the sampled respondents were aware of the postharvest technologies; however, the awareness was limited to Purdue Improved Crop Storage (PICS), being promoted by the local based Tanga, Pee Pee Tanzania Limited.

The collected information from agrodealers, traders and end users on the demand of the PHTs, found high preference on PICS compared to Agro Z, and Metal silos which are not popular in demand. Interviews with agrodealers depicted that they had more inquiries from farmers on PICS as knowledge on the usefulness of PICS keeps on spreading to end users. For example, Unyiha Associates, a local agrodealer in the Southern highlands forecasted to stock over 400,000 PICS bags during the 2017 harvest season because they have gained confidence from farmers using the product.

### **Determinant for farmers' choice of PHTs**

When farmers were asked as whether price determines their choice of postharvest technologies; 79.8% of respondents strongly agree that price determines their choices. Most of the interviewed farmers when asked which technology they use for crop storage, they responded that "I use the PICS or Agro Z Bags for storing grains for food use and seeds, but for selling I use regular Viroba bags and chemicals". This implies that farmers use chemicals to store food because it is cheaper for them as one bottle of actellic gold powder costs Tsh 5,000 (\$2.26), which can be used in 3-4bags of 300-400 Kgs of maize while the price of hermetic PICS could have costed Tsh 15,000 (\$6.8) to 20,000 (\$9.0) for the same volume.

## Findings on user preference on PHTs

The findings on users' preference on postharvest technologies shows that 34.5% of end-users prefer PICS followed by Agro Z. PICS have become the main farmers' preference simply because that is what they know and aware of. The tone of agrodealers reflected that PICS is most accepted by farmers and for them, they are very much willing to stock as long as educational services to farmers increase to promote the technology. The interview with agrodealers in the sampled districts show an increasing demand for PICS

## Willingness to pay for PHTs

Farmers' willingness to pay for the PHTs was determined by affordability and how much the technology can accommodate their harvests. Many would use 100 bags each with 100kg as their unit measure. When asked on the willingness to pay Tsh. 4000-5000 for PHTs given that the market price for PHTs is higher than the conventional bags, the results showed 74% of responding farmers would be willing to adopt the technology at Tsh4000 (\$1.8) for a PICS bag with carrying capacity of 100kg. However, the mean score for a PICS price in the surveyed areas was found to be Tsh. 4,483 (\$2.02) with a price range from 3,600 to 6,000 by various traders/agrodealers. The willingness to adopt the PHTs for farmers who have used PICS before was higher as they testified about the positive results of their adoption. These were noted in the Focus Group Discussion (FGD) and interviews. A focus group discussion (FGD) with members of Isansa agricultural cooperative society, in Momba region, Mbozi district testified with high confidence of willingness to continue using PHTs. They testified that a group of experts from NAFKA, a USAID project had given them knowledge on the use and benefits of using PICS. One community member said;

"I used last year, my maize cobs were clean as if it came from the harvest", it means that 8 months after storage, his maize had not been destroyed. This signified the ability of PICS as the solution to postharvest loss.

Another farmer and member of the cooperative society said I did not use Actellick, I opened PICS my maize was good to go for flour milling. This implied that the new technology assures health safety as they do not use chemicals to preserve grains.

## FGD at Isansa- Mbozi

Interviews conducted with some end-users at Tunduma, Isansa, and Mlowo on PICS known as "*Kinga njaa*" in Kiswahili, few farmers were aware of it; however, for those who had an opportunity to attend the demonstrations by NAFKA-USAID project acknowledges the effectiveness and efficiency of PICS. One female trader cum farmer narrated that; "*these PICS are good, even myself I use. The maize I put in two years ago, till today (i.e. 2017) are good. I eat clean. Since all of our kids are in school, we still have maize from two years ago harvest*".

Another male farmer who had heard about PICS but had never used said, "I hear it is good; my neighbor still has clean maize from last year's harvest; I would like, but the price"! The interpretation from end users for the PICS is that the technology is highly accepted by those who have knowledge and used it before, but it is not widely applied for low awareness and price barrier.

An interview with Agrodealer at SIDO Market in Mbeya: PICs technology is accepted very well by farmers who have used it. They come back to us to say that their maize is very clean. We have been getting many users only during the season. As we are now getting to the harvest season, we need reliable supply.

## CONCLUSION

The results of the survey and interviews show an increasing demand for the new Postharvest Technologies in Tanzania. The interviewed farmers echoed the quality of maize (grains) 6 or more months after when stored in hermetic bags. This signifies their continued use of the improved PHTs, given that the price of PICs for example remains below Tsh five thousand. On the other hand, testimonies for increased demand of PHTs came from distributors/ agrodealers/ traders who indicated more plans and desire to increase stocks during the 2017 crop harvest. They also described the increasing sales and demand for hermetic bags from their clients.

With the new innovations on postharvest losses, one can affirmatively say the solution to the problem has been found by using Postharvest Technologies in Tanzania. Farmers are widely accepting the use of hermetic bags as the solution to their problem of losing crops. The demand for PICS for example, is high during harvesting season beginning May. As farmers are expecting harvests the demand gets high. The demand for PHTs is increasing as there is testimony to the effectiveness of PHTs. However the technology uptake is still low. The most barriers for the technology adoption were found to be on price, availability, proximity as well as preference to some technologies by end-users.

Since price was found to be a critical limiting factor for the technology uptake by farmers, policy actions such as subsidizing the products with manufacturers could help to reduce the current market price and increase farmers' adoption to PHTs. On the other hand, postharvest technologies such as hermetic cocoons should be promoted to large National Food Reserve Agency (NFRA) as they occupy bigger space and have more food in stock.

## RECOMMENDATIONS

1. Promote Postharvest technologies to smallholder farmers that has proved acceptance and willingness to adopt
2. Create more awareness campaigns through agrodealers, physical visits to farmers and farmers associations to increase demand for PHTs among farmers / farm associations.
3. Make prices affordable to small scale farmers. Tsh. 3600 -4000 as it was found to be affordable and acceptable by many farmers by subsidizing prices to manufacturers and or agrodealers.
4. Distribute timely PHTs (hermetic bags) before the harvesting season in May-June (in Southern Highland regions)

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