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Breaking down Silos: on Post-Harvest Loss Interventions in Tanzania

Joachim Vandercasteelen and Luc Christiaensen

RESEARCH OVERVIEW

This research examines the effects of an intervention aimed at reducing Post-Harvest Losses (PHL) of maize growing farmers during their maize storage in Tanzania. Farmers were invited to attend a training on best practices in post-harvest maize management, and a randomized subset of trainees received the opportunity to buy an improved storage facility (silos) at a substantially discounted price. Data collected at 30 days and 90 days after harvest, however, do not point to significant impacts of the treatments offered to the farmers. Receiving training on best practices improved stated knowledge but training nor the opportunity to purchase an improved storage had a significant effect on maize storage and sales behavior, physical PHL during storage, or the quality of the stored maize. The research explores potential explanations and provides some policy recommendations for future learning and decision-making on how to address PHL issues in developing countries.

INTRODUCTION

Post-Harvest Losses (PHL) are considered to pose important economic losses for farmers in developing countries. Because farmers lose some of their harvested crops along the process to supply food from field to farm, less food is available for household consumption and commercial sales.

There are two ways through which policy makers have tried to address the PHL in crop production. First, training on the best practices in harvest and post-harvest management of crops should improve farmers' knowledge on how to properly handle and prepare the harvested crops for storage. Second, once the crop is properly prepared for storage, access to improved storage technologies is expected to reduce PHL during the on-farm storage of crops.

As there is limited evidence on the effectiveness of innovations aiming to reduce PHL during storage, this research assesses the impacts of an intervention providing farmers access to both training and improved storage facilities on the farm level PHL outcomes of adopters.

DATA

Financed by the World Food Programme (WFP), the NGO Norwegian Church Aid (NCA) implemented an intervention with the aim to reduce PHL in maize production in the districts of Kilosa, located in central Tanzania. Every farmer within the targeted villages was invited by NCA to a training covering topics on the best practices regarding grain quality; PHL problems in maize; and improved harvest and post-harvest management techniques. The training also taught farmers about the benefits and application of improved

storage facilities. At the end of the training, a (randomly) selected subset of trainees was offered the opportunity to buy a silo at a discounted rate of 70%.

To assess how this intervention has affected the PHL outcomes of the trained farmers in these villages, data was collected from farmers attending the training, as well as from farmers in the same villages not receiving the training. Moreover, the research uses the random assignment of the opportunity to buy the silo to distinguish two groups of trainees, i.e., those that got the (random) opportunity to buy a silo and those that did not get the opportunity. Data was collected at – on average – 30 and 90 days after harvest to see the effects of the intervention immediately and a bit later after harvest.

This research evaluates two aspects of the PHL intervention implemented by the WFP in central Tanzania. It first looks at farmers' participation (selection) in the training on best practices in maize post-harvest management and the (stated) decision to adopt the PHL reducing technologies (when offered). After understanding farmers' decision to participate in training and silo adoption, the research quantifies the short-run impact of the intervention on different PHL outcomes of farmers in central Tanzania. It first looks at the effect of the training offered by NCA on post-harvest practices, and then at how the combination of training with access to improved storage facilities affected PHL outcomes of maize farmers.

Access to training was not randomized, so PHL training was provided to all farmers that showed up and were interested in receiving training. However, as not all maize growing farmers showed up to attend the training sessions, the subset of the non-trainees in the NCA villages is used as comparison group. This control group allows to analyze selection into training and will be used as counterfactual to measure impacts. However, selection bias into training will confound the impacts measured, and the research applies different econometric techniques to control for the bias.

FINDINGS

The section summarizes the most important findings of Vandercasteelen and Christiaensen (2020) on the outcome of the PHL intervention in Tanzania. First, descriptive analysis of the size of the PHL problem in the sample of farmers surveyed shows that between 9 to 14 percent of the households reported to have experienced maize losses during storage, which results in a loss of maize during storage of 1 percent of the total quantity of maize harvest. While the sample is not country representative, this finding might question the magnitude of PHL in maize storage in central Tanzania, and more generally the level of food waste in smallholder production and at what stage it occurs (pre- or post-storage), an issue that is well documented in the existing literature (e.g., Kaminski and Christiaensen 2014). Moreover, qualitative responses from farmers indicate that they store maize mainly for consumption purpose.

Second, the research analyses farmers' decision to participate in the PHL training. Results summarized in Table 1 show that farmers with access to mobile money and those with household heads more active or experienced in (modern) maize production are more likely to participate in the training, while those heads active outside agriculture are less likely to attend. This is surprising, as households with larger maize area are also more likely to harvest substantial amounts of maize, making it more profitable to know about good PHL handling. Whether farmers are more or less risk averse, are credit constrained, or expect higher levels of PHL in traditional facilities does not appear to affect participation in PHL training.

Table 1: determinants of participation in PHL training, ordering of the silo (when randomly offered), and ultimate purchase of the silo.

VARIABLES	Participation in training (%)	Order of silo (%)	Purchase of silo (%)
Head is male (%)	no	neg**	no
Age of the head (years)	pos***	pos***	pos**
Head has primary education (%)	no	pos**	no
Head has secondary education (%)	no	pos*	pos***
Household size (persons)	pos*	pos**	pos***
Maize area size (hectare)	neg***	no	no
Household used seasonal credit for agricultural inputs (%)	pos**	no	no
Household has a money account (%)	pos**	no	no
PCA index of housing assets (.)	pos***	no	neg*
PCA index of livestock assets (.)	pos***	no	no
Expectations of PHL (%)	no	no	no
Household is considered as very credit constrained (%)	no	no	no
Household is considered as temporarily credit constrained (%)	no	neg**	no
Household is considered as risk liking (%)	no	no	no
Household is considered as very risk averse (%)	no	no	no

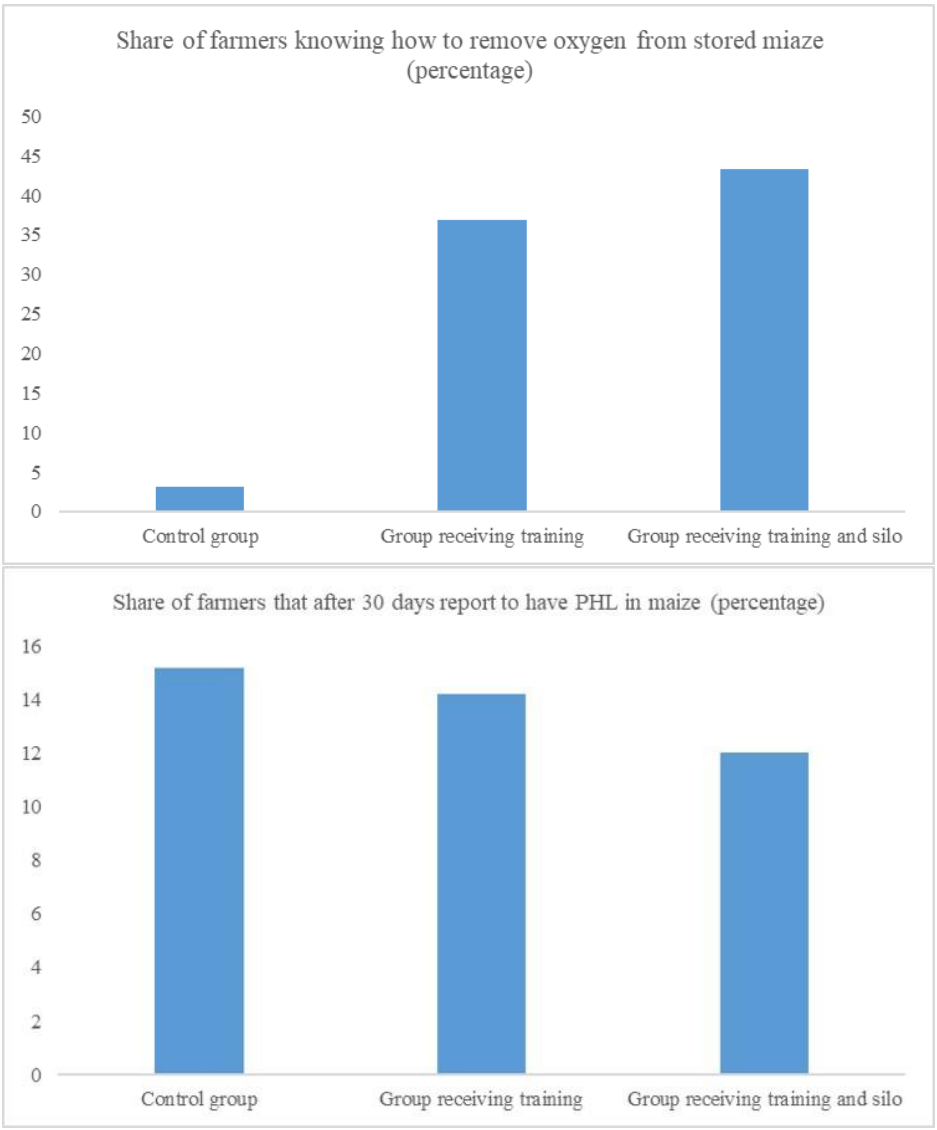
Note: 'no' refers to no effect, 'pos' to a positive effect, and 'neg' to a negative effect. The asterisk indicates the level of statistical significance.

The research also looked at the uptake of the silo and the determinants thereof. While training was offered to every farmer in the village, and hence farmers self-selected into training, the offer of discounted silos was not, due to a limited number of silos that could be manufactured. However, even when offered at subsidized prices (of 70%) at the end of the training, and despite farmers showing interest in ordering silos when offered (randomly), only 28% of the surveyed farmers were willing or able to pay for silo delivery.

Table 1 shows that male household heads are less likely to order the silo, while older and more educated households, and larger households, are more likely to do so. Households that are considered as temporary credit constrained are significantly less likely to order the silo than those that are considered not risk constrained. This confirms the qualitative response of farmers that indicated that they could not come up with the required credit needed to finance the silo. Finally, looking at the actual purchase decision, older household heads, those with secondary education and wealthier households are more likely to purchase the silo.

Third, the research examines the effectiveness of the training given and technology used on different PHL outcomes in maize production. The findings reported in Figure 1 find little short-run impacts of the intervention. Training did increase farmers' knowledge on best practices in post-harvest maize management, but the extent to which this improved knowledge was effectively applied is limited. Moreover, neither training, nor the opportunity to buy a silo did (significantly) reduce the likelihood, of PHL, quantity of maize lost during storage, increase the quality of the stored maize, or induce a change in (more) storage or sales behavior.

Figure 1: Effect of intervention on farmers' stated knowledge of PHL management and share of stored maize lost.



CONCLUSIONS AND POLICY RECOMMENCATIONS

This research explores the determinants of farmers' uptake of training on best practices in post-harvest maize handing and improved storage facilities (silos); and the impact of both technologies on different PHL outcomes measured at the farm level.

The research illustrates that promoting the use of silos by maize farmers is far from straightforward. Even when farmers get the opportunity to buy a silo at discounted prices, the majority of farmers decided (or could) not purchase the silo. The decision to order the silo when offered is positively affected by human capital indicators, access to financial means, and household's wealth.

The latter finding confirms the qualitative response from farmers who got the opportunity to order a silo but did not purchase them because they lacked the financial means to do so. It might also be related to the fact that farmers do not consider improved storage facilities a profitable investment, even if offered

at reduced prices. This might be linked with the small gain in reducing PHL from silo adoption suggested by the finding of low storage losses to begin with. Or even if silos are profitable, it requires complementary interventions to address liquidity and capital constraints for potential adopters. Profitability of silo adoption at the farm level therefore remains uncertain and more research is needed to understand farmers' willingness to pay for silos, and the cost effectiveness of silos in real farm conditions.

There are several potential explanations for the limited short-term impact of silos. The intervention might be trying to address a problem that appears to be less problematic for farmers in central Tanzania – as assumed by WFP – and more generally in SSA – as assumed by many development practitioners. This is in line with the academic literature (e.g. Sheahan and Barrett 2018) and calls for a wider dissemination of these findings. Also, the maize harvest of farmers in the sample was quite low, so there are not much maize storage losses to begin with. The benefit of improved storage facilities (and PHL knowledge) is likely to occur when maize can be stored for a longer period. It seems with this low level of maize output, mainly produced for auto consumption, there is little use of having a plastic silo.

There were also operational issues in the distribution of the silos. Most of the silos were manufactured in Uganda as they could not be manufactured in Tanzania during the project time period. This of course makes the silo more expensive for Tanzanian farmers and last mile transport issues resulted in only a limited number of farmers receiving the silo. These operational constrains further reduced the number of farmers that received training and bought the silo, and hence further dilute the impacts measured. Operational feasibility and smoothness are thus not only important for the effectiveness of an agricultural intervention but could also jeopardize farmers' expectation and willingness to adopt new technologies.

Some important policy recommendations can be drawn from the study. First, on-farm PHL during storage seem to be a (relative) smaller concern to farmers in Tanzania, at least smaller than is commonly expected. Second, farmers that store maize in improved storage facilities do this mainly to obtain more and better-quality maize for household consumption. Economic motives to sell more maize or later in the season at higher price appear less important. Yet, most interventions are motivated (and accounted) on the premise that farmers will sell the stored maize at a later point in the season, when prices are higher.

Third, the uptake of silos is limited and significantly related to the financial and wealth status of households. This suggests that the promotion of improved but costly storage facilities – such as silos – should be complemented with improved access to capital or liquidity for households that relax their financial constraints in the purchase of silos (Sheahan and Barrett 2018). This can be done by explicitly linking saving schemes or loans with the silo, as is recently being tested by Aggarwal, Francis and Robinson (2018). Finally, the current (first year) implementation of the training and equipment distribution to reduce PHL did not bring about much behavioral change. This calls for a better understanding of what PHL issues farmers are confronted with, and how farmers understand and apply the information received during PHL trainings, and how they can apply them once they get access to improved storage facilities.

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1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: CRP-PIM@cgiar.org | **www.pim.cgiar.org**

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