

Tanzania | 2014-16 | PICS Storage Bag Scale-Up

Farmers First

PHASE:	Research Station	50 – 500 Farmers	1,000 – 20,000 Farmers	Full Scale
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Introduction and Objectives

Maize is one of the main staple food crops in Tanzania. On average, farmers in Tanzania cultivate around 1 hectare of maize, which under optimal yield conditions should result in a grain surplus (for an average household of 4.84 people). However, maize cobs left to dry in the field often become infested with weevils before they are stored, resulting in significant grain losses. Further, only 64% of One Acre Fund farmers report shelling their maize, with the rest storing it on the cob, often in a home storage unit made of mud and covered by a thatched roof (called a kihenge). In addition to reduced quantities of maize available for consumption, post-harvest loss due to pests and moisture makes it difficult for farmers to take advantage of price fluctuations by storing their grain for later sale.



Purdue Improved Crop Storage (PICS) bags were identified as a potentially impactful intervention in terms of reducing post-harvest loss from pests and moisture. Designed by Purdue University, PICS bags were initially created to stop post-harvest loss in legumes in West Africa, and their use has now spread across the continent. PICS bags are made up of three nested plastic bags; the inner two hermetically seal when closed properly. The outer bag resembles more commonly available storage bags with tightly woven plastic strips. In addition to preventing post-harvest loss, PICS bags offer economic impact by facilitating storage and sale later in the season when maize prices are higher. By offering a chemical-free storage option, One Acre Fund Tanzania sought to encourage farmers to shell and store their maize early.

One Acre Fund Tanzania performed several phases of trials with PICS bags, beginning with an assessment of impact and then moving on to adoption/feasibility. In a Phase 2 Impact Trial, we measured a \$4.96 impact over the three-year lifespan of the PICS bag package (containing three bags) through prevention of loss due to pests and rot. In Phase 3, adoption rose to 17%, and in Phase 4 it reached 22.2%. Through farmer feedback and focus groups, One Acre Fund Tanzania shifted our marketing to focus less on increased sales opportunities and more on the ability to feed families maize stored without chemicals. At scale in 2016-17, PICS bags were adopted by 19% of One Acre Fund clients, over 4,000 farm families. We see potential for increased adoption as the innovation diffuses.

19% One Acre Fund customers purchasing PICS bags in 2016-2017 season

\$ 4.96 Impact of PICS bags over three years of use

0% Pest damage observed among PICS adopters, compared to 8% for controls

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Research Objectives 2014-16

- 2013-14: Phase 2 Impact Trial
 - To compare adoption of a full-storage bundle including a storage chemical + standard storage bags to PICS bags
 - To assess if PICS usage was associated with lower rot and pest damage compared with the maize storage bundle or control storage practices
- 2014-15: Phase 3 Adoption Trial
 - To assess farmer willingness to purchase PICS bags from One Acre Fund
- 2015-16: Phase 4 Trial
 - To assess the feasibility of One Acre Fund selling PICS bags at scale (mid-season)
 - To confirm farmer willingness to purchase PICS bags from One Acre Fund
- 2016-17: Full Scale Roll Out

Phase 2 Impact Measurement

Hypotheses

- PICS will be associated with at least 2% lower rates of pest and rot loss in stored maize when compared with losses from maize stored in common bags with or without storage chemicals
- PICS will be adopted at a rate of at least 10% throughout all first season offerings and trials

Methodology

One Acre Fund District: Iringa

Sites: Kihanga, Kiponzelo, Sadani

Agro-ecological zone: Iringa 2 High Elevation

Altitude: 1600-1811m

Average annual rainfall: 1500mm

Number of Farmers: 37

Treatments

Two One Acre Fund sites were selected for a Phase 2 PICS Trial.

- In the test site (Kihanga), farmers were given the opportunity to buy three PICS bags for \$5.75 (11,500 Tanzanian shillings (Tsh)) in cash.
- In the neighboring control site (Kiponzelo), farmers were given the opportunity to purchase a maize storage bundle, containing three typical storage bags (widely available, made from tightly woven plastic strips) and a 200g bottle of Shumba Super, a storage chemical. The cost of the bundle was \$3 (6,000 Tsh), also paid in cash.
- For impact calculations regarding stored maize, One Acre Fund farmers in a third neighboring village (Sadani) who were not offered PICS bags were also surveyed.

Experimental Design

Three sites located in the same region received separate treatments and results were compared by average post-harvest storage loss figures across sites as treatment units.

Variables Measured

6 months after distribution (February 2014)

- Pest damage percentage

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- Number of damaged kernels per randomly selected sample
- Rot damage percentage
 - Number of damaged kernels per randomly selected sample

Analysis

Farmers were visited by M&E agents for follow up three times over six months after receiving their storage intervention. In addition to performing visual checks on how maize was stored (away from other food, off the floor), three samples were taken from intervention bags (PICS bags for PICS farmers, maize storage bags for control farmers). Agents had a sampling tool and checked for signs of pest or rot damage in three samples of 100 kernels. Damage protection was used as the main indicator of impact with an expected three year usage per PICS bag as compared to a recurring expense for storage chemicals and a likely 1-2 year lifespan for storage bags. Annual impact was calculated as the difference between the loss from control and loss from other interventions (either PICS or storage package). Then, the cost of the intervention was subtracted from this difference. *Impact = (Loss from Control - Loss from PICS) - Cost of Intervention.*

Results

Table 1: Stored Maize Damage Assessment (February 2015)

PICS Farmers		Storage Bundle Farmers		Control Farmers	
Pest Damage	Rot Damage	Pest Damage	Rot Damage	Pest Damage	Rot Damage
0%	1%	3%	1%	8%	1%

Table 2: February 2015 Stored Maize Damage Assessment

Treatment	Cost of Intervention	Total Kgs Stored <i>Assumed 3 bags</i>	Percent of Maize Damaged by Pests	Percent of Maize Damaged by Rot	Total Kgs Lost to Pest and Rot	Value of Lost Kgs
PICS	\$5.50	330	0.0%	0.7%	2.388	\$0.60
Storage Bundle	\$3.00	390	2.7%	1.0%	14.44	\$3.61
Control	0	390	7.9%	0.6%	33.344	\$8.34

Typical maize bags contain approximately 130kg.

PICS bags store between 100-110kg.

Maize Price: 500 Tsh/kg; \$1 USD = 1820 Tsh

The difference in loss value between farmers using PICS bags and those who did not use any improved storage method was \$7.47. Applying an annual impact depreciation rate of 10% and a discount rate of 19%, we project a three-year impact of \$4.96. While this may seem relatively trivial, it reflects more than 10% of the value of a bag of maize.

Phase 3 Marketing and Adoption

Methodology

One Acre Fund District: Kilolo South

Sites: Utengule A, Utengule B, Ihimbo A, Ihimbo B, Mtitu A, Mtitu B, Kilolo, Pomerini, Mawambala

Agro-ecological zone: Kilolo South Mid-Elevation

Altitude: ~1800m

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Average annual rainfall: 1500-1800mm

Number of Farmers: 256

Treatments

PICS bags were sold through a mid-season purchase option (paid by cash) to farmers who had qualified by reaching 70% loan repayment by June (more than ¾ of the way through the season); 70% was agreed upon with the field operations team as a “safe” repayment level from which a farmer could afford to consider taking additional products.

Results

With 27% adoption (among qualified farmers) as a result of this Phase 3 trial in South Kilolo, strong farmer interest was confirmed. Tanzania’s most adopted top up product, the SunKing Pro 2 solar lamp, had 34% adoption during the same season (the second season it was offered).

Focus: Marketing Dynamics

In Phases 2 and 3, marketing for PICS bags focused on the benefits of improved storage and decreased loss in the context of a volatile maize market (Appendix 1). Midway through Phase 3, farmers were asked what they had done with maize stored in PICS bags. 100% said they used it for home consumption. Digging into this finding further through qualitative focus groups, we found that what farmers liked most about PICS was the ability to store maize without chemicals. This made them feel safer feeding maize to their children and allowed the flavor-rich (and slightly more nutrient-rich) seed coats to be integrated into ground maize flour rather than separated during milling (Appendix 2).

Phase 4 Support before Sale at Scale in Full Program

Methodology

One Acre Fund Districts: Iringa, Kilolo South, Kilolo North, Mbeya

Sites: All

Agro-ecological zone: Southern Highlands

Number of Farmers: 4,000

Treatments

PICS bags were sold through a mid-season top up (on credit) to farmers who had qualified by reaching 50% loan repayment in May. The sale was slightly earlier in the season than the prior Phase 3 Trial, therefore the field team felt more confident that PICS bags would not significantly affect repayment.

Results

With 22.2% adoption, strong farmer interest was confirmed. The product was approved for sale in subsequent seasons. Given the decreased adoption of the SunKing Pro 2 lamp (22% in 2016 down from 34% in 2015), we expect PICS adoption to ebb and flow. PICS bags are significantly cheaper than solar lamps. Tanzania’s adoption strategy is focused on converting a larger percentage of home storage into PICS (i.e., shifting 1 bundle [3 bag] families into 2-3 bundle [6-9 bag] families). Through this strategy, we think adoption could reach 30% by 2020.

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Next Steps

- Assess whether delivery at the beginning of the season reduces correct usage of bags
- Continue to assess farmer interest and use of PICS to assure proper marketing, package size, and delivery timing
- Understand long-term adoption, and eventually work to convert all home storage to PICS (rather than traditional storage methods)
- Understand usage patterns over time, including determining how long farmers continue PICS usage
- Better understand the diffusion of innovation curve for PICS bags, to estimate if adoption could increase in future years for both early adopters (by ordering more) and late adopters