HELPING SMALLHOLDERS MAKE THE MOST OF MAIZE THROUGH LOANS AND STORAGE TECHNOLOGY: EVIDENCE FROM TANZANIA

PRESENTATION AUDIO TRANSCRIPT

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Julie MacCartee: So first up will be Julie March who will be providing an introduction to the topic. She is the team leader for Food Security and Livelihoods with the USAID Off of U.S. Foreign Disaster Assistance. Then next up will be Jake Ricker-Gilbert who is an Associate Professor in the Department of Agricultural Economic at Purdue University. He has worked in a variety of capacities to support sustainable, oops sorry I forgot to move it to, there's Julie March in there and here is Jacob. He has worked in a variety of capacities to support sustainable intensification and also to measure cost effectiveness of input subsidies in Sub-Saharan Africa among smallholder farmers. Then we'll also have Hira Channa who is a doctoral student and a graduate research assistant in the Agricultural Economics Department at Purdue. Her dissertation focuses on strategies to solve post-harvest challenges for smallholders in Sub-Saharan Africa. So we're very excited to have them speak to us today.

I'll pass it to Julie March to start.

Julie March: Good morning everybody. I'm so pleased to be here today to welcome our colleagues from Purdue, Jake and Hira and I believe online we have Dieudonne Baributsa, who is instrumental in the work that we as well. He'll be on the chat for those of you online. Hopefully I got that right.

J. Ricker-Gilbert: Yeah.

Julie March: Okay. I really would like to emphasize how the work of Purdue has helped change and model the types of agricultural interventions we do in emergency and disaster response. It's been a collaboration for us for almost a decade now. I know for many other teams and offices within USAID that relationship has gone even longer and I'm sure also been very fruitful.

The journey for OFDA into post-harvest loss really grew out of a friction point for us. We repeatedly had people proposing things like seed banks and grain banks in areas of active conflict. And if you think about a context like South Sudan, Northern Nigeria right now the idea of bringing farmers together to calmly sort and store their seeds with, *[chuckles]* I see heads shaking in the back, with repeated

displacement and other types of chronic issues like repeated droughts it just wasn't a good setup for us. I'm not saying it can't work for other context, but in the emergency and disaster response arena it wasn't appropriate.

So we couldn't just say no we had to think of an alternative. We started looking into post-harvest storage loss reduction and improved handling in the storage practices.

Globally I think when you look at disaster responses the number of responses are increasing every year. They are not quick in-and-out responses, right? You don't go into South Sudan and expect to have it all wrapped it in six months to a year.

So we're looking at these complex responses which last a long time, think about Nigeria, Chad, Malawi. South Sudan. And the types of interventions that were being proposed weren't really appropriate or really sustainable for that context. Surely with decades of response experience we could come up with something better than handing out seeds and tools every year and moving on.

So we started thinking about how do we build potential for greater food security and ultimately for farmers' ability to make choices, right, in terms of the types of crops that they choose and ultimately their storage behavior, because it's all about providing choice not dictating what method we're going to use or making people use a particular technology.

I get really excited talking about post-harvest loss. I can literally count on one hand and maybe one finger the number of effective and low-cost interventions that we have available to us through emergency ag programming globally. That one finger belongs to post-harvest loss activities. You know for something like a $2.00 to $5.00 investment we can reduce post-harvest loss up to 50 percent, maybe beyond. I'm sure they'll give us more specifics.

It's really been a game changer in terms of contributing to increased food security, contributing to increased seed security at the household level for vulnerable farmers.

I think that ultimately that's our game and our goal in humanitarian responses to help build a path toward agricultural development globally.

Purdue has been really instrumental in providing proof of concept. They've developed a system for local uptake through their marketing of PICS. I think their model has been successfully integrated by NGOs all over the world and mostly with their technical support and collaboration.

I think a really interesting thing about this model is that its utility spans emergency response all the way through development programming. I know that within USAID we're often looking for areas where we can work together where emergency feeds into development and we don't find too many of those so this also is a bright spot for post-harvest storage.

So I don't want to take up any more time. I just want to say I'm very much looking forward to this presentation. I think it's going to add one more element to solving the puzzle about why farmers do what they do and how we can help them do that especially in context which are chronically stressful like drought or conflict. So thank you and I will hand it over.

J. Ricker-Gilbert: Thank you Julie very much for the invitation, we really appreciate it and thank you all for coming and listening to us discuss some what we think are exciting findings about this project. I'll give a little bit of an overview of what we're doing on post-harvest in general and then talk more specifically about what we found in this project.

So just to start when we think about the challenges associated with increasing staple crop production and productivity in Africa there are large challenges and we all know that. But post-harvest challenges should not be ignored. When we define the whole post-harvest period it's really the period between when the crop is mature and then when it enters people's mouths, people consume it. We're mostly focused on the drying and storage side and the activities that we're doing on this project and mainly on the storage side, but just to define post-harvest its' that whole period and there are many, many challenges.

The two that we focus on in this project are right here. The first one we could call it an "opportunity and challenge," is the price seasonality that we often exhibit, that we often see exhibited in places especially those that have one harvest per year such as the site that we're focused on in Mbeya in the southern highlands of Tanzania in this project.

This is just showing the price seasonality. For the past couple years you see the difference in price that bottoms out at harvest in June and continues to rise throughout the year and into the next year when it peaks around January and February.

Male: Hey Jacob I'm sorry to interrupt but is it possible that you can try to speak into the microphone as much as possible?

J. Ricker-Gilbert: Yes, sure, sure. Maybe I can use the hand microphone since I'm…

Male: Thank you.

J. Ricker-Gilbert: Thank you. Is this better in the back? Okay, great. So this presents an opportunity and a challenge if you can get your grain from here to here, but there are many threats to that opportunity. One of them being as we see in the other picture the natural threats, the insects, and the mold that can damage your crop and make it difficult to be able to take advantage of that price seasonality and make money through price arbitrage, through storage.

The insects and the mold, those challenges create quantity loss where you physically lose grain and they also create quality loss in the sense that the food may become unsafe if it's infected with mold, if it doesn't look good it's going to get a lower price at market so you're going to lose quality and value there.

The main solution that's on the market for people, the majority of people deal with insect pest they're using chemical insecticide. A popular brand is Actellic that you have to apply over the course of the year two times and you're putting chemicals on your food supply, which isn't ideal.

The issues of price seasonality as I said it creates this potential for arbitrage if you can store and keep your grain until the lean season. But as I'm sure everybody knows many farmers are credit constrained at harvest and need to sell immediately at that low price to payback inputs. When you're making decisions at planting time you have to buy seed and fertilizer you need money and you may need a loan to be able to carry you through the season until you harvest four or five months later and have your product that's harvested and you can sell it and payback your loans. Also many times school fees come due at harvest and there are other expenses that people need to pay so they need cash at harvest and they have to sell at that low price even if that means they have to buyback later in the year at a high price. This is sometimes called the "sell low, buy high phenomenon," although we understand it, you know being in big part due to this credit constraint that people face.

So when we talk about post-harvest loss and how big it is there's studies including those by FAO that cite 30-to-50 percent post-harvest loss which is huge. I think it's important to note that first some of those studies are citing the entire post-harvest chain as I said between the time when the crops mature to when it's consumed. They're also citing it if people do nothing. I think it's important to remember that people do do things to mitigate these losses.

From some of the background work that we've done on the PICS3 Project where we asked people their self-reported quantity loss over quantity stored and this again is just storage loss not total post-harvest loss, we get in the neighborhood of about 4 percent to 7 percent loss. In Tanzania where we're focused in this project from other surveys we get close to 7 percent storage loss I should say. So it's not as high obviously as 30-to-50 and again it's the result of some adaptation strategies that people are taking to deal with the constraints and the problems that they face. Just like people adapt to climate change they adapt to reducing post-harvest loss.

What we see is that the main adaptation strategies given these constraints that people face is to use chemicals like Actellic. In Tanzania we can see that over 50 percent of people in our survey were using chemical on their maize. Ethiopia it's even higher at about 77 percent.

The other thing that they do is not store as long as they might. We see in Tanzania that people especially for sale don't store more; on average they store about 22 weeks, for consumption it's about 35 weeks. And of course there's a range. Some people store longer they can make it the whole year. Some people store much less. Also the same thing with post-harvest loss some people lose a lot, some people just lose very little, so there's quite a range of distribution.

But we see these decisions that people make as a result of the problems they're facing. Given the situation there's no doubt that we can do things to help them improve and store longer, store better quality grain and we're focusing on maize here in this study.

So when we look at these two questions about the need for credit, the need for cash at harvest versus insect problems we did it in our surveys in Uganda we asked people the question: Why don't you sell? You know why don't you store longer? What's the reason you sell at harvest for a low price, rather than selling? The top two reasons were either you need cash to pay expenses because the credit constraint or insects damaging maize.

So we're going to do like a little audience participation. Since I'm a college professor I like to get people involved. So who think it's the credit problem, the need for cash that's the number one reason they sell early? Okay so maybe two-thirds. Who thinks it's insects? A couple of people. Who doesn't know?

By far people say it's the need for cash. That they need to pay their expenses, they need to pay their bills, they need to pay school fees. And insects, avoiding insect damage and mold is a distant second, but it's still there. It doesn't mean that insects in post-harvest loss and these natural challenges are not a problem, they're probably the second problem to this but they're a big challenge too, but at the forefront of

people's mind when they sell early is this credit crunch that they feel. Other answers that came in you know to a less extent, "I don't have storage capacity," I don't store maize, et cetera," I don't think prices are going to rise," that kind of thing. But these are the two biggest and definitely the need to earn cash is the big one.

So we talked about you know how people are dealing with this. The credit crunch, they sell at harvest to get money, even though they're not getting as much money as they might if they stored later in the year. Potentially if they have off-farm income they can use money from that other activity to pay their expenses and store their maize until prices rise, but that's assuming that they have that option which many people of course don't.

To deal with the insect problem we talked about using insecticides like Actellic, which are not ideal from a food safety standpoint and effectiveness standpoint.

Another thing that we see and we've seen evidence of this quite a bit in our surveys is that people really have this belief and it's quite true that local variety store better. So the flint varieties, the local varieties that are common in southern and eastern Africa have a tougher kernel and they have closed husks so they're more resistant to insects than the higher yielding dent varieties that have softer kernels and open husks and are easier for insects to attack. This belief is firmly held locally, therefore, there's this tradeoff that people have to decide, "Do I grow a higher yielding hybrid that doesn't store as well or do I grow a lower yielding local variety that stores better?" To some extent this post-harvest challenge could be limiting hybrid adoption and have sort of knock-on negative affects towards production in the next year.

Other things that people do is they store on cobs in these local structures called "vahingay," in the region where we're operating and it's believed that if you store on the cob it's tougher for insects to get at than if you store shelled maize. They also do things like dry on the roof or hang maize along the wall to try to keep it away from the insects.

So that's sort of what's happening you know at the present time or has been happening for a long time to deal with these problems.

But what we're trying to do is at least test and look at some solutions or potential solutions and options to help relieve these constraints of credit and insects and through that help increase consumption income and ultimately resiliency among smallholders by hoping to reduce the insect problem through getting people to move from using Actellic, using these chemicals to kill insects and putting shelled maize in these sort of generic bags that you see for sale that don't offer any insect protection and last about a year, to an improved bag which I'll talk about here in a second that protects maize or any grain without the need for insecticides and last two to three years.

And on the credit side we provide a loan to smallholders. We work through credit groups and you can see this is a village savings group and they're log books and their safety box where they keep their documents and their information. We provide a loan to smallholders and we'll talk about this in detail here in a second, where they can take a loan against the present value at harvest of their maize, store it safely in these bags for six months, use the cash from the loan to pay their expenses, and then have that maize safely stored for six months until prices rise. They pay it back with interest as here we'll talk about and then they make money. The idea is that they make money on the seasonality and the arbitrage and have good quality maize.

So just a little bit about the technology. We're trying to help them move from a traditional storage structure like this one with the thatched roof that offers little to no insect protection, especially if you put it in a bag, a traditional bag like we saw in the previous slide. After some period of time you'll have this unattractive looking maize that's insect damaged and probably has mold on it.

We want them to move to this improved storage structure. It's called PICS bag, the Purdue Improved Crop Storage bag. I brought one to show you. This is a baby version, 25 kg's. The one that we gave people in the project the more common one is 100 kg's. But this different size provides some flexibility because it's less burdensome to carry 25 kg sack than a 100 kg sack which weighs a lot.

So the way it works is these bags, these PICS bags were developed by Purdue entomologists in the 1980s and '90s and you put your – you make sure your maize or whatever grain you're storing is dried to a safe level so that mold can't grow. You have these two layers of high-density polyethylene that you put the maize in the inner layer, you close the first layer, tie it tight so there's no air on it. Tie the second layer and then tie the third layer so that it looks like this. It creates an airtight or hermetic seal around the grain and insects can't breathe so they basically suffocate.

After some period of time we looked at this maize from Ethiopia after about six months and it looks really nice. If you compare it to the maize up above we'd all much rather eat the maize from the PICS bag than the non-PICS bag.

So these PICS bags and Julie talked about this for a little bit are begin promoted in large part, they're part of a number of other projects, but in large part it's being promoted in the third phase of the PICS project. PICS3 with funding from the Bill & Melinda Gates foundation. We're based in West Lafayette, Indiana and we're promoting the bag in seven countries right now as part of the project that you can see on the map. The idea is to bring the supply side and the demand side together.

On the supply side we're developing local manufacturing, so we have a manufacturer in each of the seven countries that's building these bags locally. It builds local support for the product and provides employment at factories for people to build these bags.

Then from there, from the manufacturer we work to develop distributors and distributor networks who then have a vendor network at the local level who sell directly to farmers. So that's the supply side.

At the same time we work to build the demand side by creating awareness among smallholders about the bags, through doing village-level extension demonstrations. We use mass media and ICT, cell phone, videos, radio broadcasts. We do some films in villages where people hear advertisements in the middle of a local film about

the PICS bags. Then we rely on word-of-mouth, people who have learned about it to share with their friends and neighbors and relatives.

The PICS project really started in 2007 with funding from the Bill & Melinda Gates Foundation and has ramped up quite a bit till now. Some of the initial purchases were made by the government of Niger who bought a bunch of bags and the project bought a bunch of bags. It started in West Africa with cowpea and we've moved onto other crops. But you can see the growth in number of PICS bags fold has been really, really good, especially in a percentage term we've had a lot of good annual growth. This year we've sold almost four million bags worldwide which is great; it's helped a lot of people. But of course when you think about all the bags that people use around the world you know there's many more opportunities for people to benefit from this. So of course the bags are an important part of this project in addition to the loans.

When we think about what we're actually trying to measure in this project and our theory of change and how we're going to you know alleviate some constraints for people and hopefully make them better off we assume that people are constrained by insect damage and mold in the post-harvest and that they're constrained by lack of credit to meet their expenditure needs. So the two treatments or the things we're going to give them are first we're going to give people the two PICS bags that holds up to 200 kg's of shelled maize and the other treatment is the two PICS bags plus the equivalent value of that maize at harvest, so it's about $40.00 that people will use to pay their bills and store.

We hope to see with the PICS treatment insect damage reduced, mold neutralized. Again if you have grain that's in an airtight environment mold can't grow because there's no air. We also relieve the credit constraint when we add in the harvest credit. We hope to see of course ultimately more grain stored at harvest for sale or consumption later in the year.

As I mentioned we want to see if this insect constraint is relived, that we see more hybrid seed adoption, and hopefully more adoption of fertilizer, insect constraint is relived, that we see more hybrid seed adoption, and hopefully more adoption of fertilizer to have some benefits and create resiliency further on. And if PICS bags we

believe to be a substitute for storage, chemicals, hopefully they'll purchase fewer chemicals to protect their maize. Then ultimately we want to see increased income and consumption and better health. We want to compare the incremental benefit to those things by including the PICS bag and then adding credit on to that.

So Hira is going to talk specifically about the project and the intervention. So let me hand it over to you Hira.

Hira Channa: Hello everyone, thank you for being here. Thank you everyone who is listening in and thank you for the opportunity. Okay is this better?

So I'm going to be talking more about the specifics of the intervention. So just a quick look at the area that we're covering. This is southern highlands Tanzania, very specifically in the Mbeya region right here. We covered around seven districts in this region. Our team consists of a lot of great people from different institutions and different disciplines.

There is us at Purdue University. We have a project manager who's based in Tanzania. We have the local NGO, Fearatajo who we're working with who are like a mother-daughter team and I'll be talking more about them in the next slide. Then we have IRTA who is responsibility for the data collection for the baseline and then the end line which we will be going back for in May, this May.

So our credit partner was Fearatajo, they're a local NGO, like I said they're like a mother-daughter team. So their main responsibility is to help these credit groups or VICOBAs you know to register with the local government. If the government comes with any intervention, you know Fearatajo helps facilitate it. They got like special permission from the district government to be a part of this project you know because it involved lending out money.

So these credit groups they consist of like 15 to 30 people. They meet every week or every other week and they buy shares, which is kind of like savings for them. This

creates a pool of money that is sometimes lent out to other members. If the group is really large they also invest it in other businesses.

Just something to note here is that these groups are really hydrogeneous across the board and for a lot of these groups despite the fact that they are a member of these groups they are still credit constrained and a lot of them don't have access to external sources of credit. And the specific loan product that we're talking about here is still new for these group members.

So again the advantaged of working through these savings groups for loan interventions they're well documented. You know our partner, Fearatajo, is familiar with these members. There is a sort of group guarantee. They have like this established network of employees which makes the stakes much easier.

The timeline of the project is so we started off with a baseline survey in May 2017. The actual intervention with the bag and the loan was in June 2017. The loan repayment was scheduled to begin and end in December 2017. There have been some challenges with the repayment, it's still ongoing and we'll be talking more about what those were specifically in the upcoming slides.

The end line survey is scheduled to happen in May 2018. What is ongoing also is journal collection. You know we'll be talking more about that in the next couple of slides what exactly I mean by that too.

So who are we talking about here? We had around 1589 farmers, 131 credit groups and like I said this was spread out across 7 districts in the Mbeya region in Tanzania.

So this is just like how we allocated people. So randomization was done at two levels. The first one was at the group level and then at the individual level. So with projects like these to like cleanly pickup the impact of this intervention, you know the PICS intervention or the PICS-plus credit intervention. That's why you need to randomize who gets what.

So initially we start off with a 131 groups, 44 groups are control, another 86 are in the treatment arm. The treatment arm is split into two, we have 44 PICS and then we have 43 PICS-plus credit groups. We had another layer of randomization after this which was at the individual level. So the main reason for doing that was because financially it was not really possible to give everyone who was in the group you know the loan or the bag. But that one was done, you know we tried to make it as transparent as possible. It was essentially like a bowl with slips of paper that was passed around. So you know everyone knew what was happening and why you got selected or you didn't.

So we ended up with two groups of people here, so you have the exposed group and the treated group. So the exposed group is kind of like they were trained in the use of the bag, but they did not actually receive anything from the project at this time. It's the same in the PICS-plus credit. Like they trained in the use of the bag, but they didn't receive the bag or the loan at this time.

The PICS bag intervention consisted of a training in the use of the bag. The training does involve like a discussion of the benefits of the bag and why it's better health wise and economics wise as compared to traditional storage methods. The actual intervention involved the dispersal of two bags in June, one ____ bag. Like the total bags that were dispersed as part of this intervention was 850.

The PICS bag plus credit intervention it also starts off with a training in the use of the bag. The actual intervention involved the dispersal of the bag and a loan which is approximately worth $40.00. The loan is like it was due back in six months with a 12 percent interest rate.

One of the requirements of Fearatajo, our partner, was that the grain – because the grain that's stored in the PICS bag it was like collateral for the loan, that it should be stored in a collective place and it was with some exceptions. As part of this we had 626 bags that were distributed and Fearatajo lent out $14,800.00.

So the journal collection because you know these groups meet every week or every other week as I said, so everyone was surveyed included the control treatment and exposed, they were give these journals. It basically you know they fill out maize and legume transactions, you know sale, purchase, consumption data every week. You know the advantage of doing this is first of all like statistically it's really nice to have like more observations per person, but also because you know hopefully this is better than relying on recall when we go back like in May 2018, which is like after a year.

There have been some challenges with the journal, because you know the area that we've covered is very spread out. So but what we've done to compensate for that challenge is the team that's based in Tanzania you know they're constantly calling and in touch with people to fill out this information. Then when we go back in the end line we'll be sure to collect all of these journals if we haven't been able to do so so far.

I just now be looking at like initial findings from the baseline survey that was held in May 2017. So we have like an almost equally number of men and women. We have slightly more women. This is kind of like expected maybe credit groups to see more women, but just to note that like in these groups though you know like whether it's the husband or wife who comes to the meeting, generally the decision you know they involve money so people do make them together.

This is so the blue bar is the average maize stored for each of these categories and this is approximately 1,500 kg across all of these categories. This is slightly you know there are larger maize producers as compared to the average Tanzanian farmer. The orange bar is the maize stored. So the thing with this maize stored though is that this even counts in maize that you must, you know like that you've stored for like a few weeks. But if you look at the data like you know a lot of farmers within four, five weeks this becomes really spread, because you know like one-third for example does not have any maize at that point and some do.

This is like the average revenue for each of these categories. So like these bars are like the standard deviation. You know with revenue you expect this kind of variation. Another note is that these are like jointly balanced across these categories which is important when you're doing randomization.

Just a quick look at the uptick of each of these interventions. So for the PICS intervention you know which was like the dispersal of the bags almost everyone took up the bags. For the credit one it was 80 percent, which is still pretty because it shows that people are interested in the loan product. People were free to refuse and this is actually one of the reasons why we did this survey and you know the selection of people in May and then we gave people a few weeks to think about it when we went to actual intervention in June. But we are still serving all of these people. You know we follow-up with them if they still want to be a part of the project.

In December you know we tried to – you know I went back and we tried to get a sense of what people actually did with the loan. So it's really interesting around 40 percent basically used the loan as an opportunity to became maize traders and they bought more maize or sale later on in the later. Another 20 percent they had problems with their own harvest. You know either they lost their entire harvest or it was really small and they needed to buy maize to store in the PICS bag. Another 25 percent used it for household expenses. A lot of this is actually payment of school fees like Jake said which you know is due around that time. Another 8 percent used it to cover harvest-related experiences, you know like paying labor. Another 7 percent used it for investment you know either in small businesses or in some cases livestock purchases.

So I think I'll give it back to Jake who will talk more about the challenges. Thank you.

J. Ricker-Gilbert: Thank you Hira. One of the challenges we experienced in this project was that we saw the graph in the initial slide or the second slide that showed about an 80 percent price increase the past couple of years, but we actually saw a minimal rise initially in this season which was in contrast what we'd seen.

When we went back, I went in October to see what was going on and Hira went December as she said. We found that the people were saying that because prices had been favorably high the past couple of years people decided to plant more maize this year. So what we would say in economics is there was a supply response and people

were trying to you know looking at past prices to try to plant more and maybe make more money this year.

We also learned that the government, the new government in Tanzania had put on an export ban on maize so that it couldn't leave the country. Most of the maize in the southern highland first it goes to Dar es Salaam the capitol, but it also gets exported to the Democratic Republic of Congo and even to Kenya and sometimes into northern Malawi and into Malawi depending on the year. But because of this export ban maize wasn't leaving. The government didn't want to follow a previous pattern of having people sell maize at harvest and then waiting until the government released stocks in January, February, March to buy it, buy back. They didn't want to do that so they put this export ban on so people would keep their maize.

And also neighboring Zambia had a bumper harvest. And as a result as you see in this picture there was a lot of maize around. So that required us to be flexible. Fearatajo, our lending partner, our NGO – I should make clear, the money that was lent to farmers was Fearatajo's money, it wasn't USAID money, it wasn't Purdue money, it was the local partner's money. So they had to make it work for them and that's an important part of this.

They were willing to delay the loan repayment. We had originally planned for everything to be paid back the end of December, end of 2017, but they were flexible with the groups and they allowed it to be delayed and they made arrangements with people. Last time we talked to them which was on Saturday they said 75 percent of the money had been repaid and they had made arrangements to get repayment in the coming weeks. The export ban was lifted in November so prices have risen slowly, but we're confident that we'll get pretty close to full repayment. The impact is of course if prices don't rise that much this year or as much as they have in the past the benefits obviously of the loan won't be as high, but we'll see what happens.

When we talk about what we've learned and I think we've definitely learned a lot so far. For the technology part of this people seem to be quite happy with the PICS bags. When they learn about it and they learned about the benefits of the bag that you know you have to pay a little bit more upfront than you do with the traditional bag. The PICS bag let's say if you translate it into US dollars costs $2.00, $2.50 for

a hundred kg bag. If you buy a traditional bag it costs maybe $.25 or $.50, but if you have to apply chemicals twice a year and you have to pay labor to apply chemicals after a year or so the PICS bag makes a lot of economic sense and you can use the PICS bags for two to three years and then you don't have to use chemicals on your maize.

So once people understood those benefits they liked it, they wanted to buy more. Evidence suggests that people who are in that exposed group who learned about it were interested in buying more that didn't get the bags and even people who got the bags were interested in buying more. Some of the credit groups actually saw it as an opportunity to start selling bags to become vendors, even distributors and make a business out of the bags because they saw potential for growth.

Another interesting thing is that combing these PICS bags with credit seems to have reduced the risk for the lender, Fearatajo. They liked the fact that the grain, the maize that was the collateral for the loan was stored in this safe location. So they knew that if they had to – you know if somebody defaulted they could get this high quality maize back and they would have something physically there to collateralize the loan, so that was good.

It's clear in those results Hira showed you that a lot of people saw this loan as a business opportunity and they took it as an opportunity to buy maize and potentially take advantage of the arbitrage which they were expecting through that price seasonality, which again it didn't happen as much as we thought or they thought.

But one thing that's kind of interesting is this challenge that we have to lend through groups because obviously you're not going to lend to people on the street just random people, you need to lend through these groups for repayment. Any bank of any NGO is going to want to do that. But these people are part of credit groups so they may not be the most credit constrained people in Tanzania for example. But they're still credit constrained but they're part of these groups, but for the purpose of repayment that's kind of the way you need to go, rather than just lending to people that aren't necessarily credit worthy, who may be in greater need.

The challenges with lack of the price rise highlight the general challenge with agricultural credit, that there's a lot of things outside our control that affects loan profitability, weather, planting decisions, government policies, et cetera.

Looking forward and looking back at what we've seen so far it probably makes sense to expand these loans shifted away from maize or try expanding it into other crops like rice and legumes. Rice and legumes are higher value than maize and especially legumes have tremendous post-harvest loss potentially happening to them. So they make a lot of sense and the government at least in Africa is less involved in legumes and rice than it is in maize, so you may not have these export ban problems.

The flexibility in the loan repayment dates was important and that really helped because Fearatajo the NGO had an existing relationship with these groups so they knew the people and were willing to be a bit flexible.

Another thing that we saw was because all the loan repayment couldn't happen at once and Fearatajo the NGO had to go back or continue to follow-up with these people and it's the rainy season in Tanzania right now and many of these groups are inaccessible. The fact that there was a mobile money option lowered the transport costs and the transactions cost and people were able to pay back Fearatajo using mobile money which really helped make it more profitable for the lender.

So the next steps as Hira mentioned the journal collection is ongoing right now. We're going to go back in May for an end line. With the data, the surveys, and the journals we're going to be able to ultimately answer those questions about the impacts on consumption, sales, purchases, input use like fertilizer and hybrid seed planting, et cetera.

Then we received some funding from OFDA to expand the project in Malawi this coming year. It will be nice because we can compare the outcomes of these PICS and PICS-plus credit with a neighboring country. And based on what we learned in Tanzania and also the wishes of the bank that's going to do the lending we're going

to focus on legumes, ground nuts, and soybeans rather than maize, you know in large part because of the way the government in Malawi is involved with maize.

We want to do some more focus trying to understand the labor impacts of moving from pesticide application on maize to storing in PICS bags if you don't have to wash maize, apply pesticides, you know rewash it multiple times there could be some important savings and some important health benefits. So in Malawi we're going to do the baseline and intervention starting next month and then we'll do an end line in 2019, so it will basically be starting this year and ending next year.

So thank you. I've got some takeaway points. So if you forget everything else about this presentation I want you to remember these seven points. Just kidding.

But the first one is you know just this issue that people really seem to like this technology once they learn about it. Even though we gave them two bags to the people who were selected there's still demand for it. We saw this in Uganda too where we gave people one or two bags. When you give them just a little bit of a subsidy for a new product it creates awareness and stimulates interest. So we expect to see more purchases by these groups in the future. Of course you don't to give people all the bags they could ever want, but a little bit of a subsidy for a new product reduces risk and can spark interest and help build the market.

The second point is I made it already just that having this technology to collateralize the loan and protect the grain that was part of the loan made a big difference for the lender, the local partners, the flexibility between the groups and the local partner that was lending the money was very important. With agricultural credit we were dealing with a lot of things outside our control that affected the profitability of the loan like weather and government policies.

It was also really interesting to see how people used this as a business opportunity. Forty percent of people bought more maize to try to sell later in the year. We had to work through groups for repayment, but part of the challenges again if you compare them to people at random these people are probably a bit less needy, but still needy,

but they're more credit worthy. And of course a lender the thing they're worried about is repayment. Mobile money really provided a lot of flexibility for loan repayment and is an important tool moving forward I think in this kind of product.

So thank you and we're happy to answer any questions or comments.

Julie MacCartee: Thank you.