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Helping Smallholders Make the Most of Maize Through Loans and Storage Technology: Evidence from Tanzania

Speakers: Hira Channa, Purdue University
Jacob Ricker-Gilbert, Purdue University

Moderator Julie March, USAID Office of Foreign Disaster Assistance

Facilitator Julie MacCartee, USAID Bureau for Food Security

Date: February 22, 2018

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Julie March



Julie March is the Team Leader for Food Security and Livelihoods for the USAID Office of U.S. Foreign Disaster Assistance (OFDA). With an academic and practical focus on agricultural, ecological and farming systems, Julie has supported the integration of systems thinking into disaster response, recovery and resilience programs. At USAID/OFDA, her work has encouraged research and programming to determine best practices in disasters to support designing interventions that build sustainable systems. One key element of this work has been to support research into post-harvest loss reduction for vulnerable farmers.

Jacob Ricker-Gilbert



Jacob Ricker-Gilbert is an associate professor in the department of Agricultural Economics at Purdue University. Jacob conducts research, teaching and outreach activities that focus on helping smallholder households in sub-Saharan Africa sustainably intensify agricultural production. Jacob works on measuring the cost-effectiveness of input subsidies in SSA, the role of land rental markets in southern Africa and ways to alleviate constraints that smallholder African farmers' face in the post-harvest season. His work on input subsidies has been recognized by the African Association of Agricultural Economists, the American Association of Agricultural Economists and the International association of Agricultural Economists. Ricker-Gilbert received his PhD in Agricultural Economics from Michigan State University in 2011.

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Hira Channa



Hira Channa is a doctoral student and graduate research assistant in the Agricultural Economics department at Purdue University. Her dissertation focuses on finding strategies to solve post-harvest challenges for smallholder farm households in sub-Saharan Africa. Hira has worked in Africa and Asia previously, conducting surveys in Malawi and Pakistan during her time with the International Food Policy Research Institute. She completed her master's degree in Agricultural Economics on a Fulbright Scholarship at Cornell University in 2013.

Helping Smallholders Make the Most of Maize Through Loans and Storage Technology: Evidence from Tanzania

Insights from the
*Increasing Tanzanian Smallholder Farmers' Access to
Improved Storage Technology and Credit Project*

Challenges associated with increasing staple crop productivity for African smallholders are large.

But post-harvest should not be ignored.

Challenges associated with increasing staple crop productivity for African smallholders are large. **But post-harvest** should not be ignored.

Maize price change from harvest (2015 & 2016), Mbeya Tanzania



Moldy and insect damaged maize



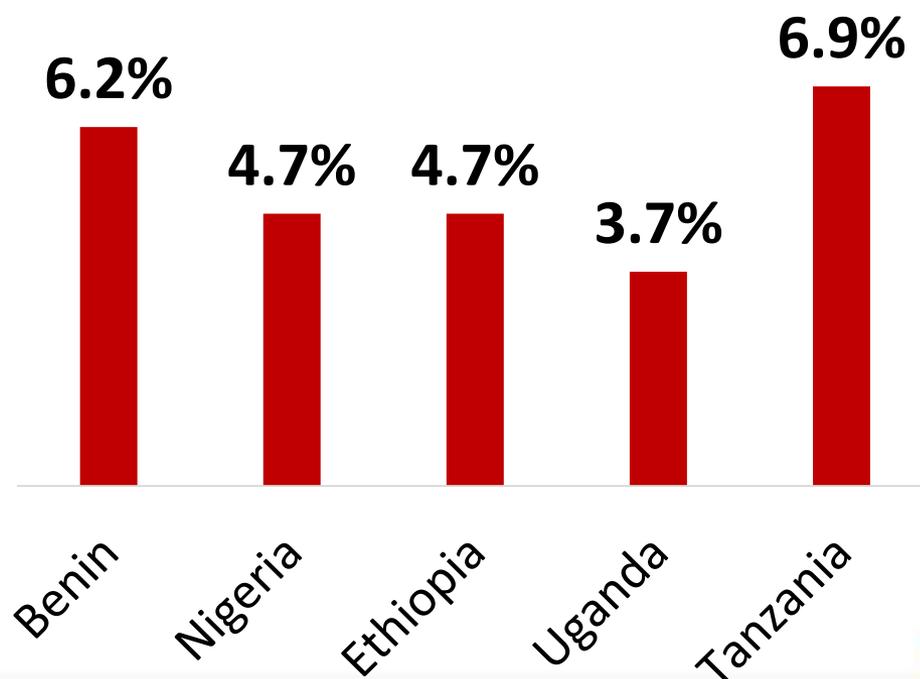
Background to Intervention

- Quantity losses from insects
 - Can be large, caused by multiple storage pests
 - Quality losses as well
 - Existing solution is to **apply chemical pesticides** like Actelic
- Price Seasonality
 - Creates potential arbitrage opportunities to storage
 - But **credit constraints at harvest** prevent farmers from exploiting seasonality
 - Sometimes called “sell-low” / “buy-high” phenomenon



Some studies cite 30-50% post-harvest loss

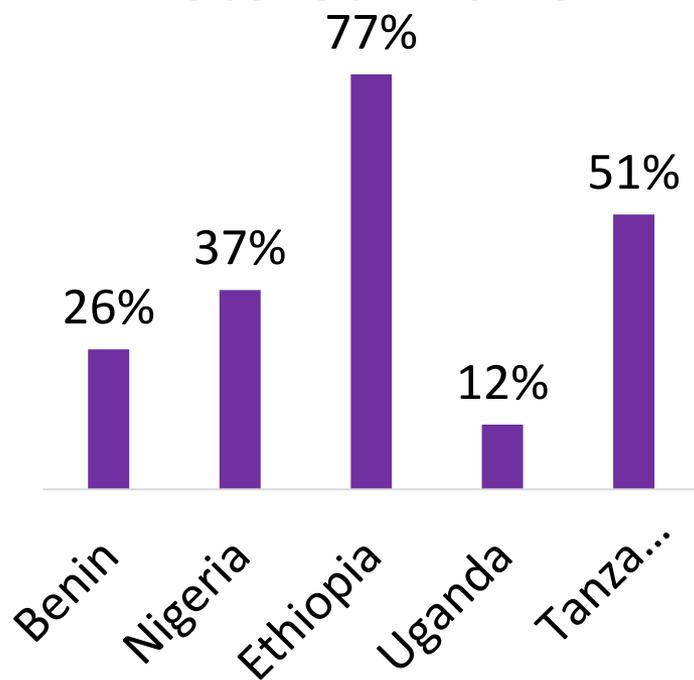
Self-Reported Average Actual PHL for Maize
(Quantity Lost/Quantity Stored)



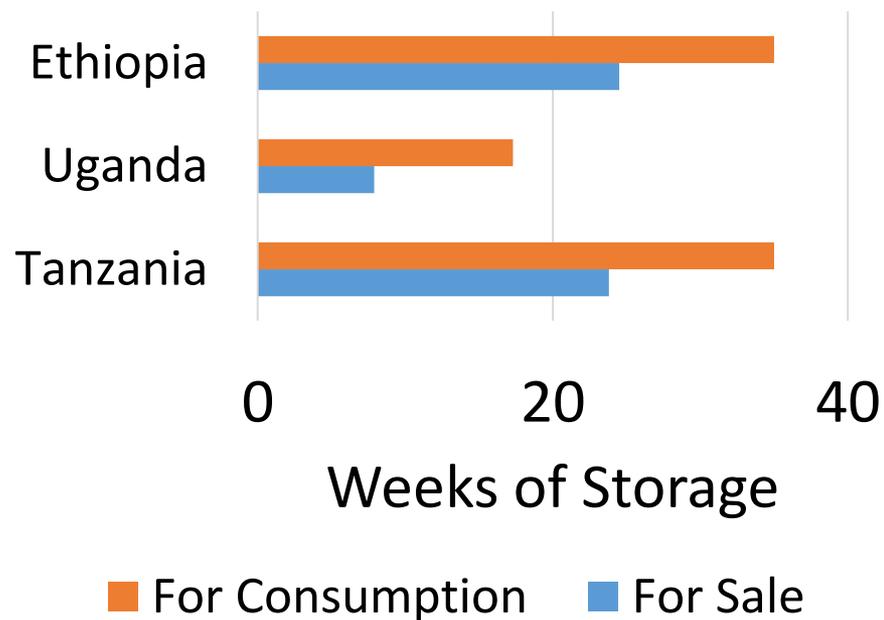
Source: PICS3 baseline studies

But farmers take action to mitigate losses

Apply Chemicals to Stored Maize



Maize storage duration



Situation can be improved!

Source: PICS3 baseline studies

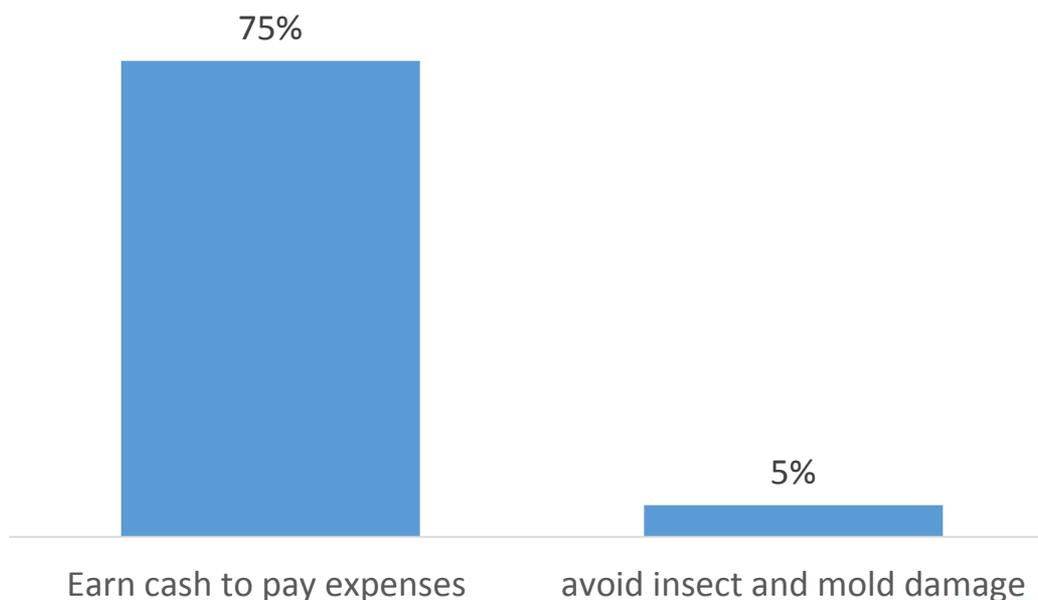
Do smallholders think credit or insects are a bigger problem?

Smallholders in Uganda:

Why do you sell maize at harvest rather than storing for sale later in the year?

Do smallholders think credit or insects are a bigger problem?

Smallholders in Uganda:
Why do you sell maize at harvest rather than storing for sale later in the year?



Existing measures to deal with these issues

Credit

- Sell at harvest
 - Store lower than optimal quantity
- If possible, use off-farm income to fund cash needs

Insects

- Use insecticides
- Grow local maize varieties
 - Some evidence that they are more resistant to storage pests
 - Firm belief locally
- In some areas use local storage methods
 - “Vehenge” stored on cob
 - Drying on roofs/walls



Our project/intervention:

Help relieve these constraints and increase consumption, income and resiliency among smallholders

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- **Insect problem:**

Provide smallholders with an improved storage bag



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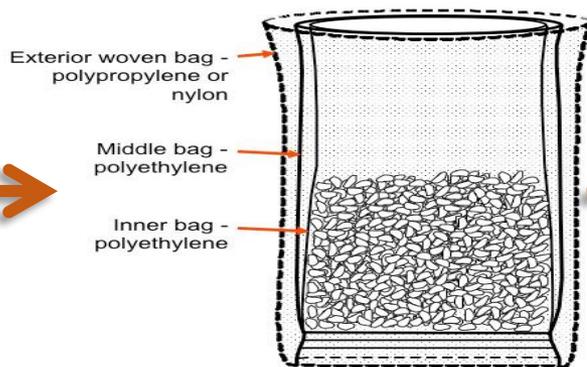
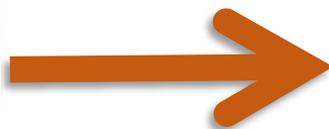
Provide smallholders with an improved storage bag



Credit problem: Provide smallholders with a loan at harvest



Storage intervention – PICS bags vs. traditional technology



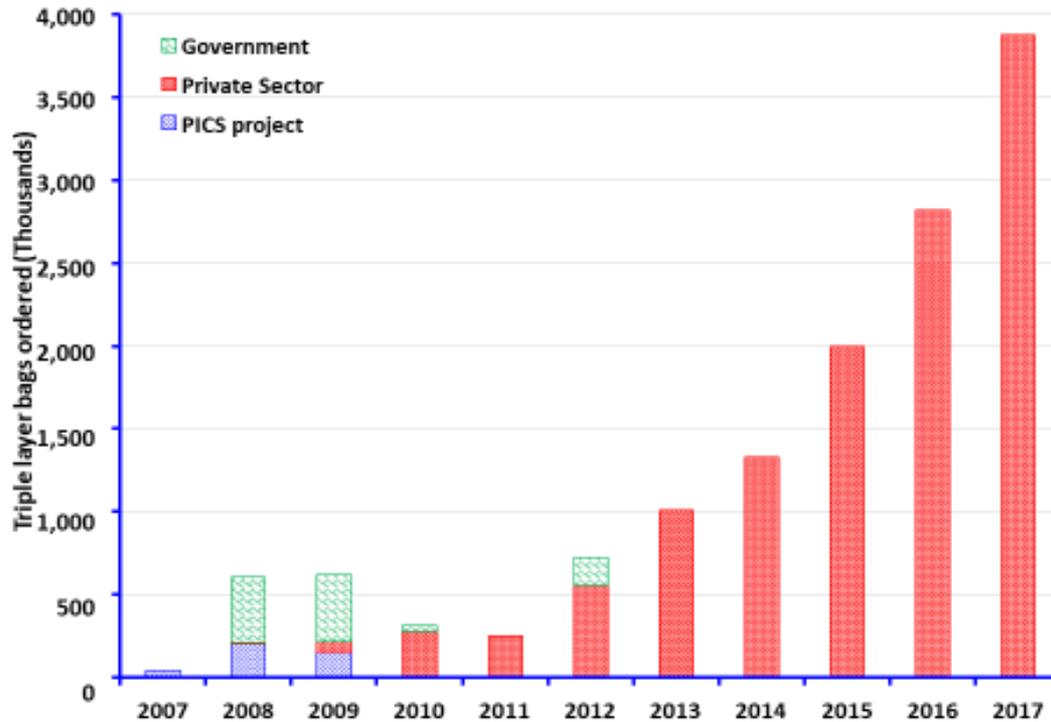
Courtesy: Murdock et al., 2014

Adoption of PICS bags being promoted with funding from Bill and Melinda Gates Foundation under the PICS 3 project

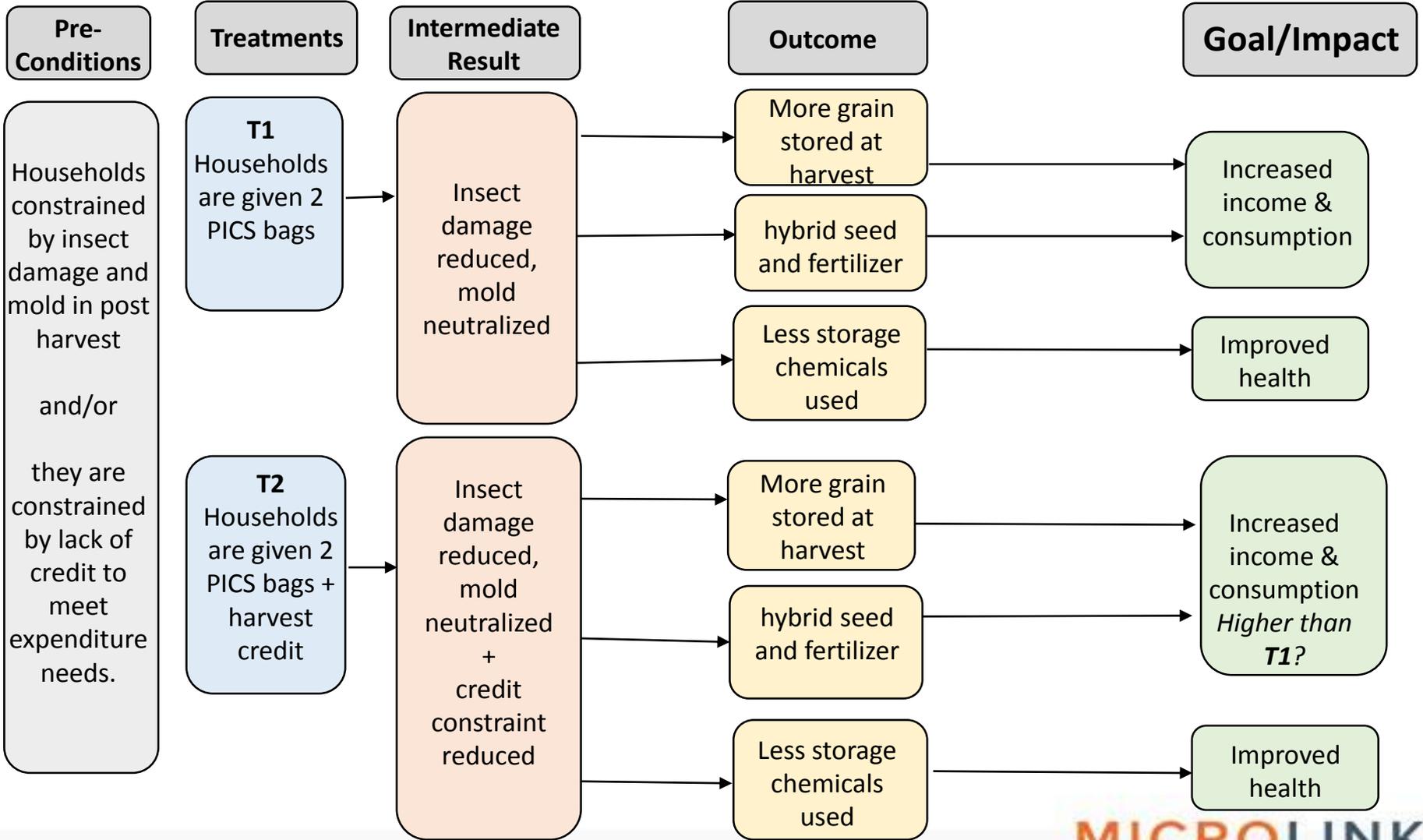
- Develop local manufacturing of the bag
- Develop local supply-chain from manufacturer to distributors to vender
- Create awareness among smallholders about the bags
 - Extension demonstrations
 - ICT
 - Word of mouth



PICS Bag Sales Over Time



THEORY OF CHANGE



Project Area Covered: Southern Tanzania Highlands



Our Team:

Multi-Institutional, Multi-disciplinary

- **Purdue University:** Jacob Ricker-Gilbert, Dieudonne Baributsa, Hira Channa
- **Project Manager:** Bernadette Majabelle
- **PHIRETAJO:** Rebecca Magama, Maria Marisoba
- **IITA** (data collection and management): Tahirou Abdoulaye, Feleke Shiferaw.



Our Credit Partner: PHIRETAJO a local NGO

- Women-run, local NGO
 - Responsible for the registration and training of credit groups in Mbeya region of Tanzania.
- VICOBA (kikundi in Swahili)
 - Groups of 15-30 individuals.
 - Group meets every week and each member buys “shares” in the group.
 - Money is lent to other group members
 - Make investments in small businesses using this pool of money



Credit Intervention:

Work through local village savings groups

- Reduces risk for lender
 - Familiarity with the group members
- Group Guarantee
- Established network of employees in each district



Project - Timeline

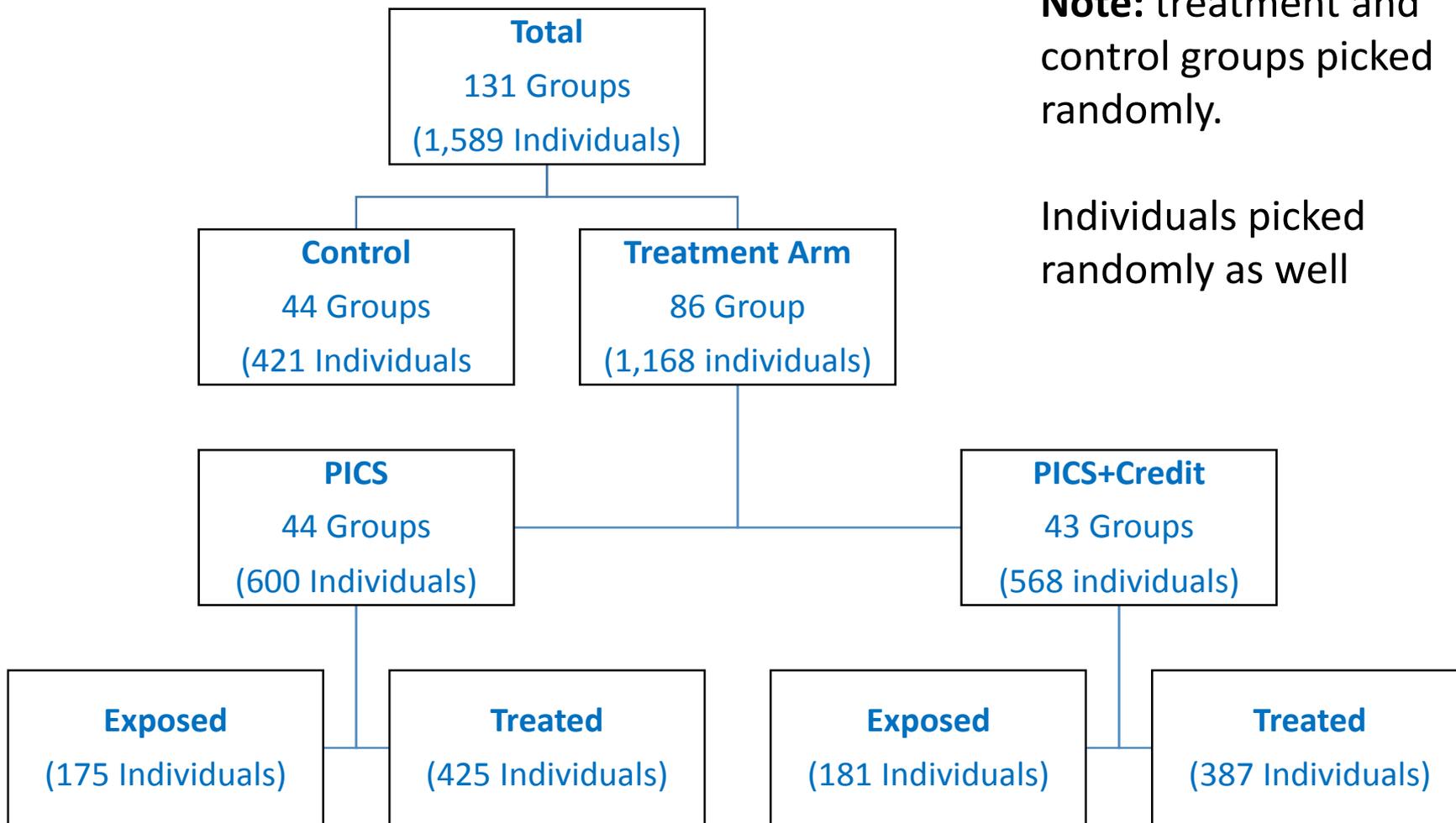
- Baseline: May 2017
- Loan and Bag Disbursal: June 2017
- Loan repayment in **December 2017**
- End line Survey: May 2018
- Ongoing: Filling and collection of weekly journal



Sampling

Who? 1,589 farmers
131 credit groups
7 districts
1 region





Note: treatment and control groups picked randomly.

Individuals picked randomly as well

PICS Bag Intervention

- Training in use of PICS bags
- Explain benefits of storing in quality bag.
- Intervention involved disbursement of 2 bags to each selected participant
- 850 PICS bags distributed



PICS Bag + Credit

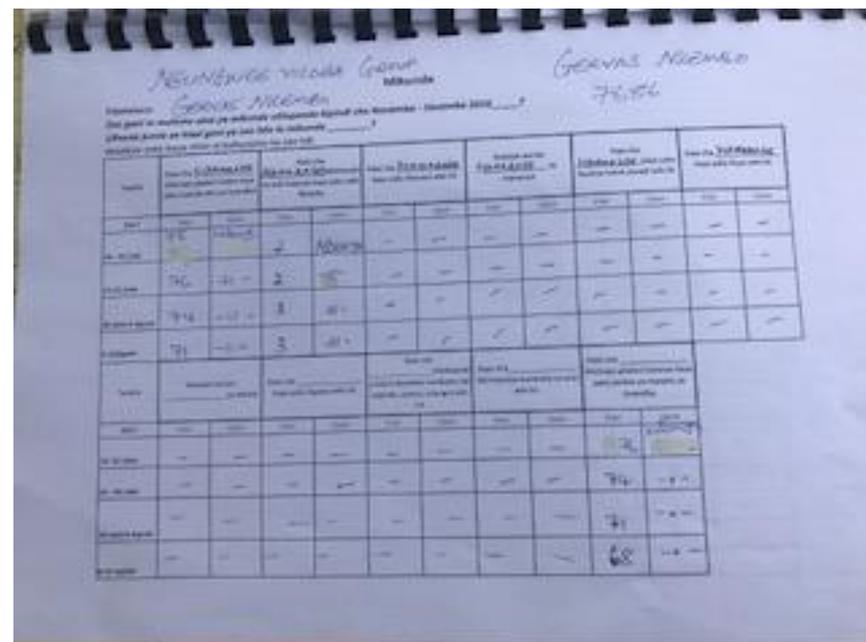
- Training in use of bags
- Intervention involved disbursement of 2 bags and a loan of 40 USD to each selected participant
- 12% interest rate over six months
- Stored collectively in a central location
- 626 PICS bags distributed
- USD 14,800 lent out by Pheretajo



Journal Recording and Data Collection

- High frequency data
 - Maize and legume transactions and consumption
 - Storage pesticide use
 - Capture seasonality more accurately

- Challenge
 - Travel to group locations
 - Constant reminders for filling
 - Collection at end



Neuquén Nueva Group *Geovás Muzmao*

Geovás Muzmao

El grupo de productores está conformado por los siguientes productores: (Nombre del productor)

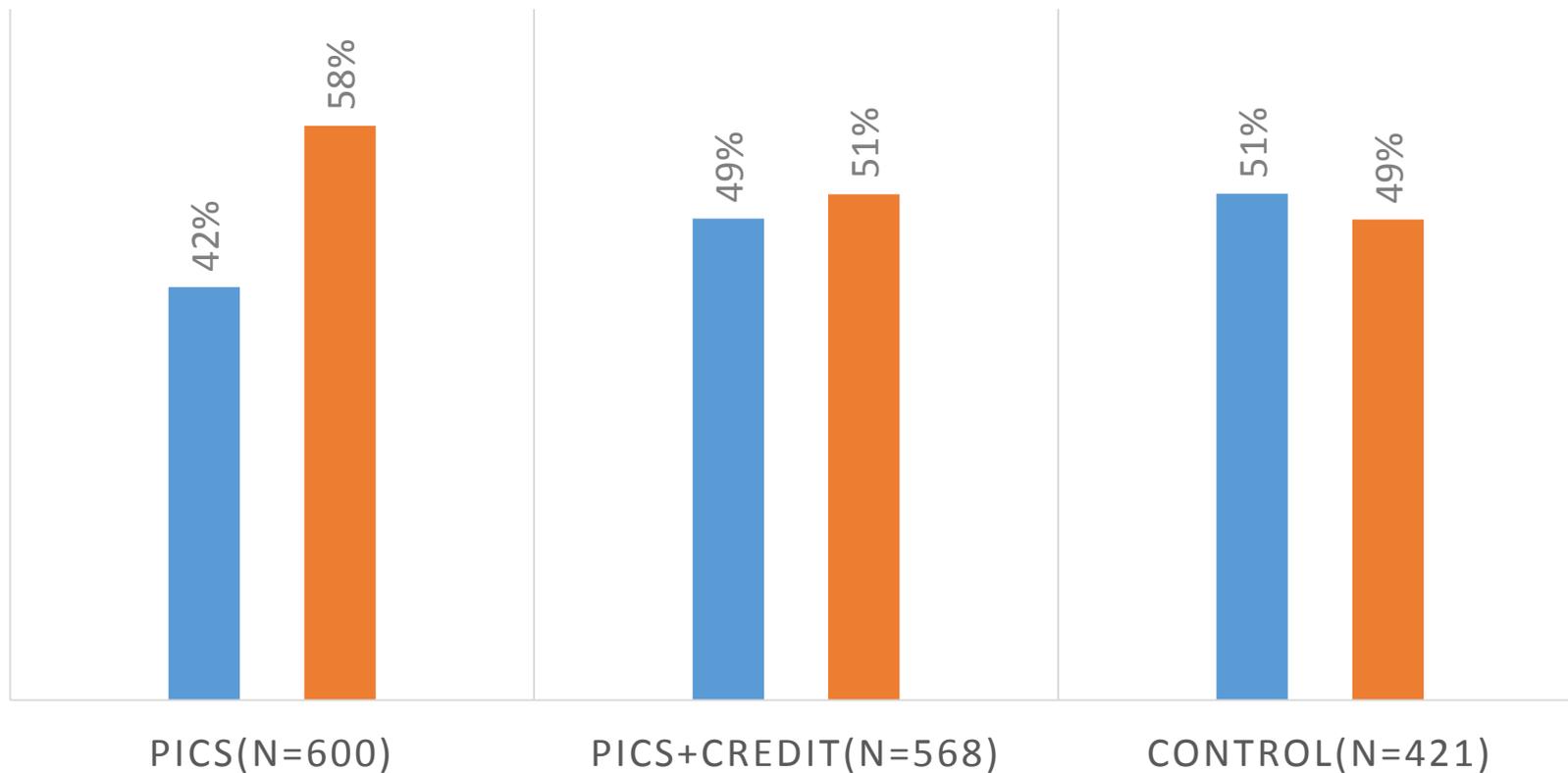
El grupo tiene un total de productores: (Número)

Fecha	Cantidad	Tipo de producto	Precio	Valor	Observaciones	Firma
10/01/2018	100	Maíz	1.50	150.00		
15/01/2018	200	Legumbre	0.80	160.00		
20/01/2018	150	Maíz	1.50	225.00		
25/01/2018	100	Legumbre	0.80	80.00		
30/01/2018	120	Maíz	1.50	180.00		
05/02/2018	80	Legumbre	0.80	64.00		
10/02/2018	110	Maíz	1.50	165.00		
15/02/2018	90	Legumbre	0.80	72.00		
20/02/2018	130	Maíz	1.50	195.00		
25/02/2018	100	Legumbre	0.80	80.00		
30/02/2018	140	Maíz	1.50	210.00		
05/03/2018	110	Legumbre	0.80	88.00		
10/03/2018	120	Maíz	1.50	180.00		
15/03/2018	90	Legumbre	0.80	72.00		
20/03/2018	130	Maíz	1.50	195.00		
25/03/2018	100	Legumbre	0.80	80.00		
30/03/2018	140	Maíz	1.50	210.00		
05/04/2018	110	Legumbre	0.80	88.00		
10/04/2018	120	Maíz	1.50	180.00		
15/04/2018	90	Legumbre	0.80	72.00		
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05/06/2018	110	Legumbre	0.80	88.00		
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30/07/2018	140	Maíz	1.50	210.00		
05/08/2018	110	Legumbre	0.80	88.00		
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Initial Findings

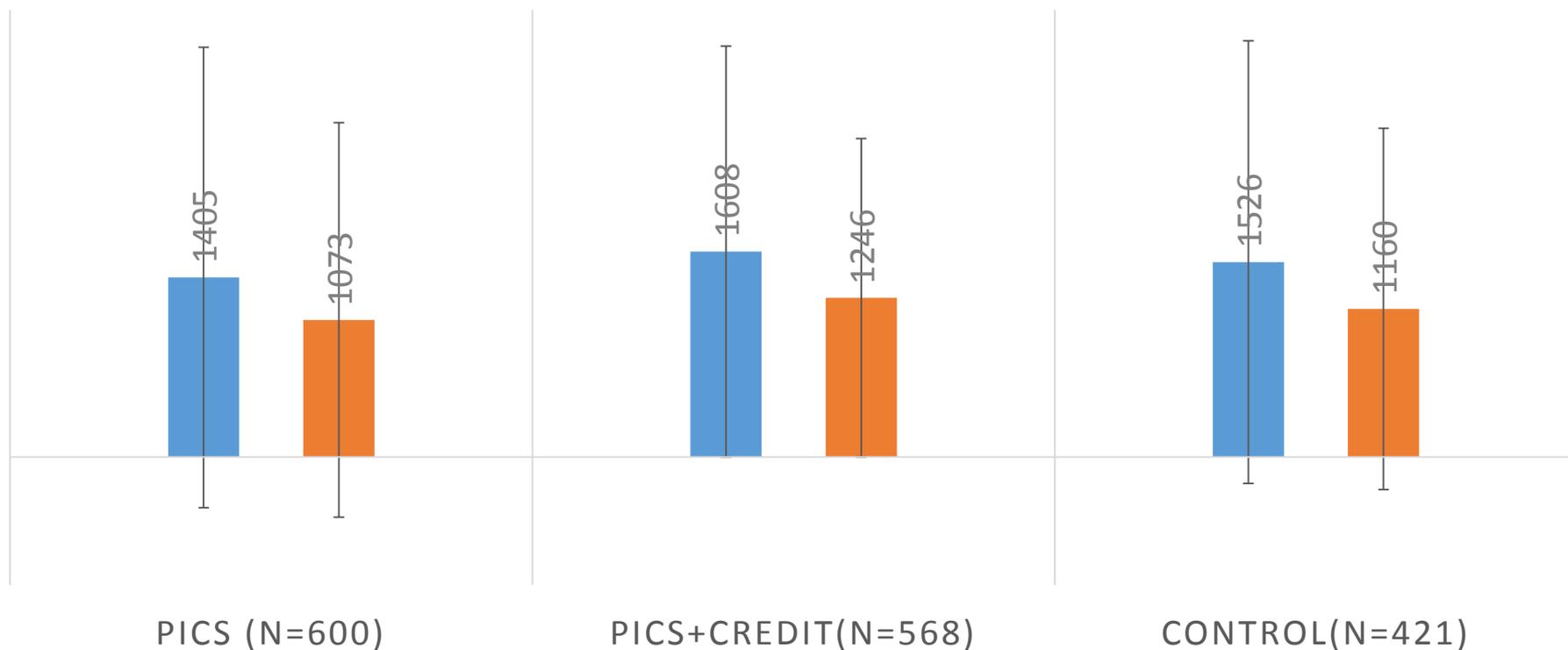
Baseline Comparisons: Gender disaggregates

■ Men ■ Women



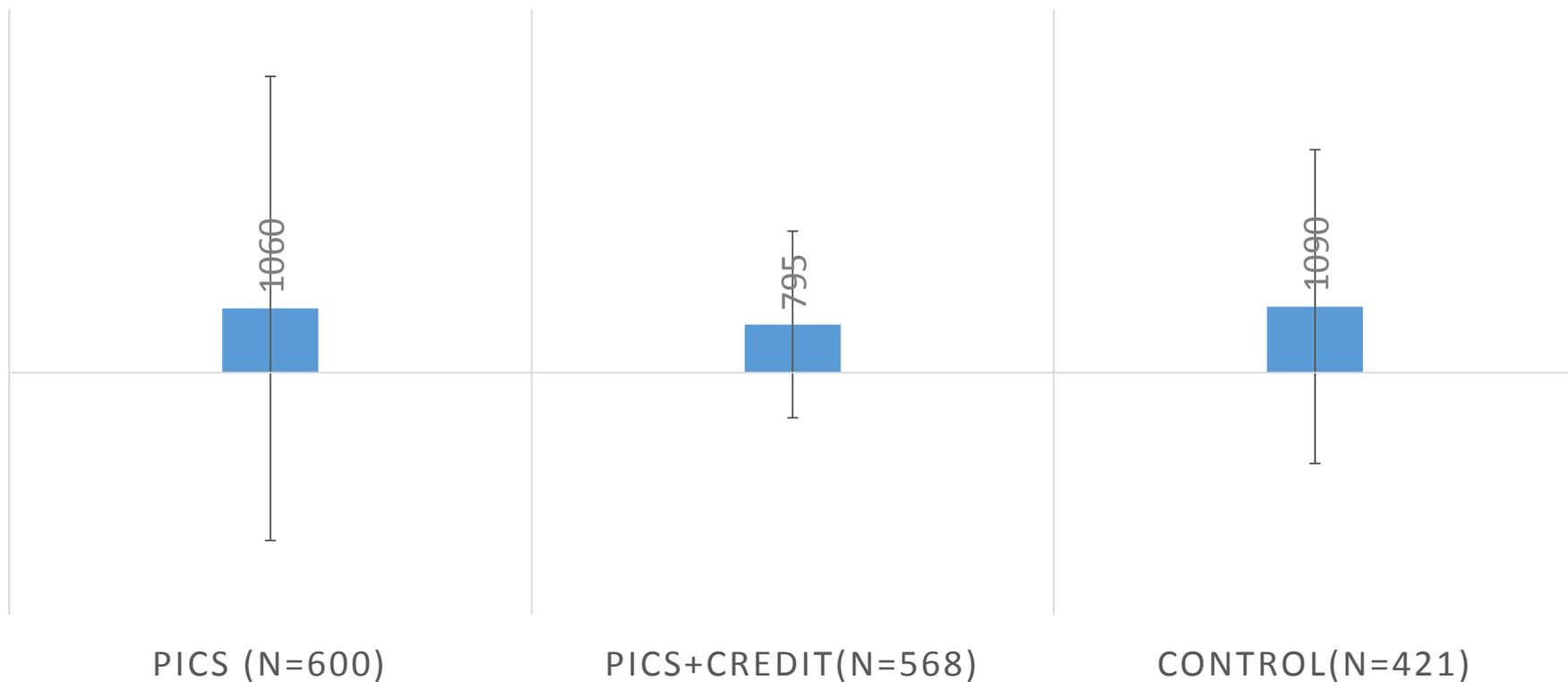
Baseline Comparisons: Maize Harvest and Storage (kg)

■ Maize Harvested(kg) ■ Maize Stored(kg)



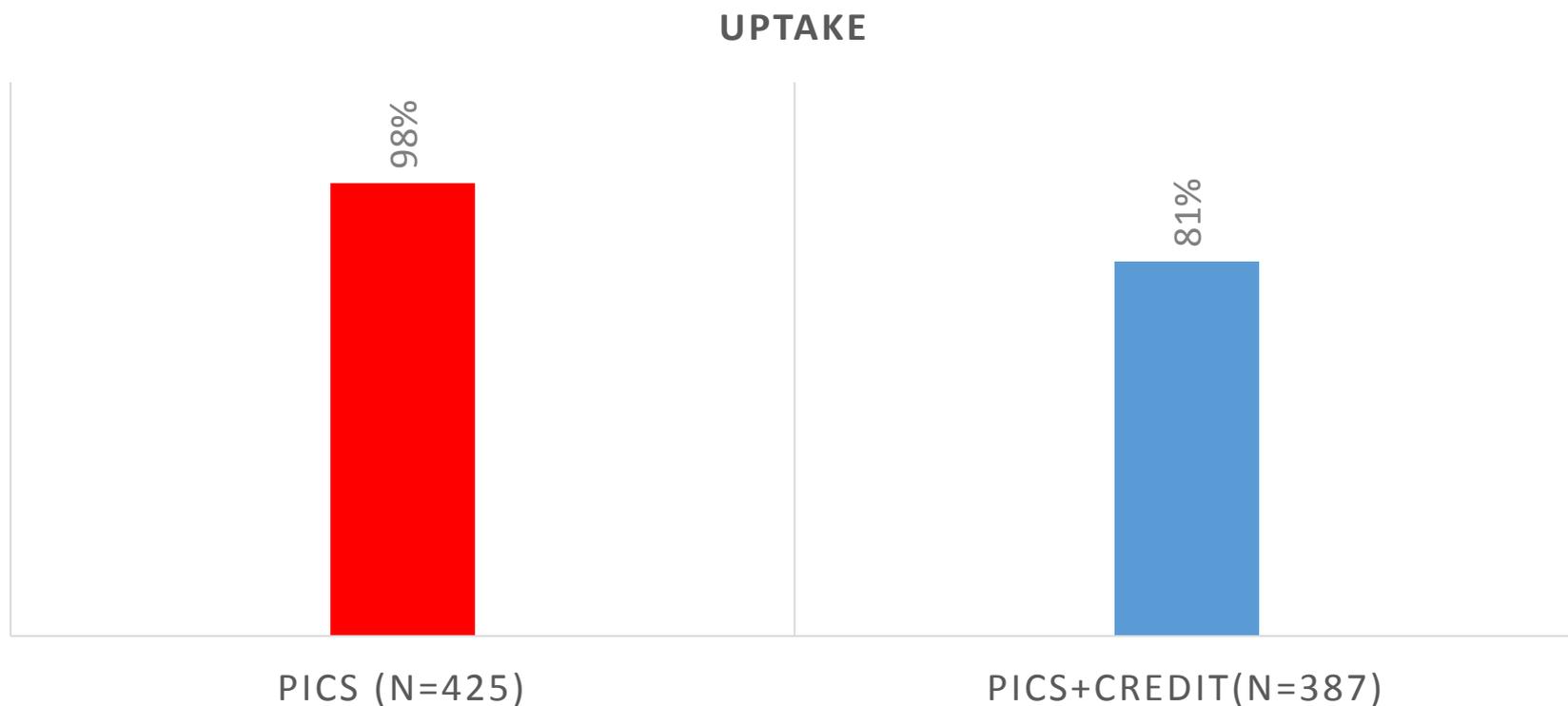
Bars show sample means,
while error bars show
standard deviations

Baseline Comparisons: Annual Revenue(USD)



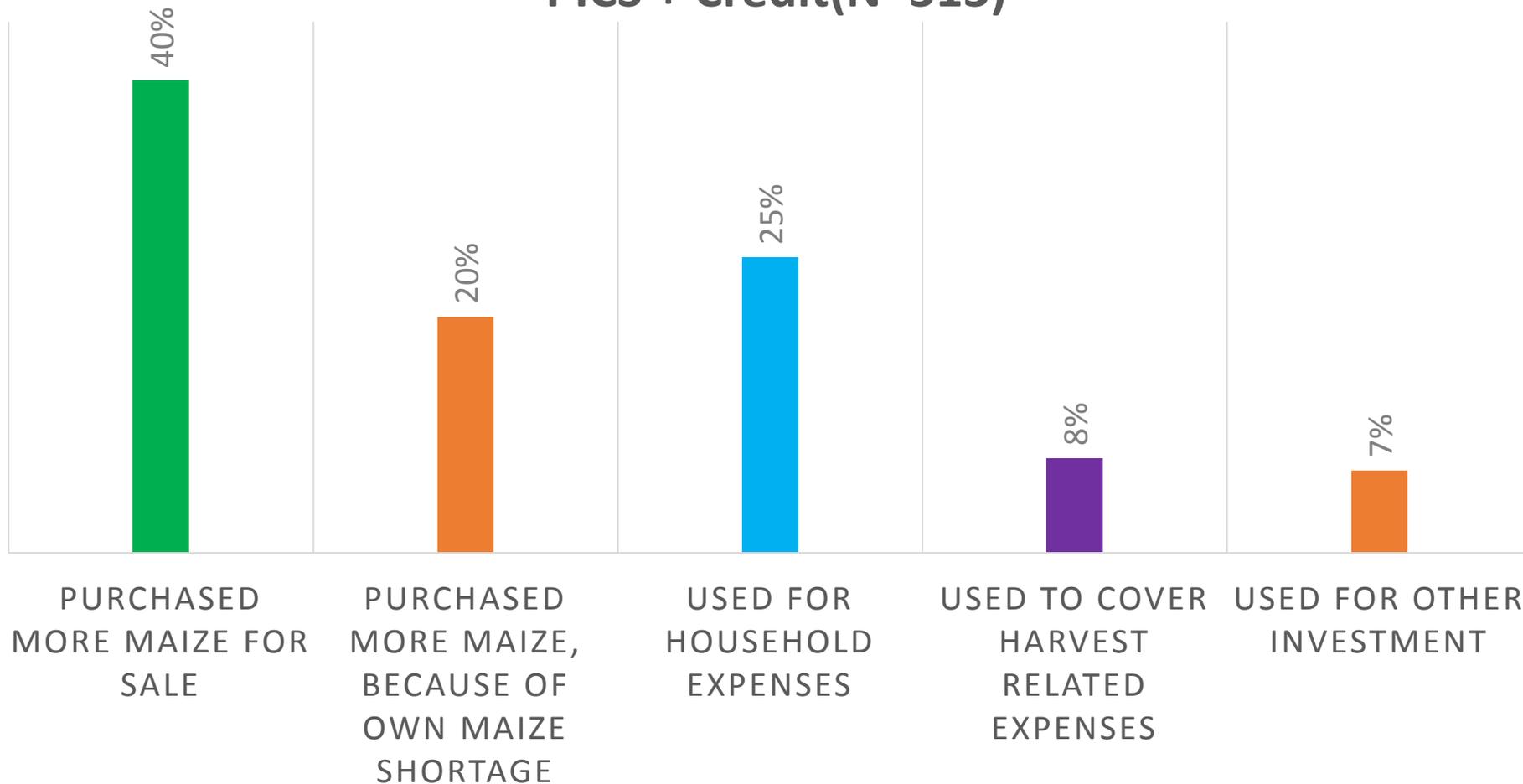
Bars show sample means,
while error bars show
standard deviations

Uptake: PICS, PICS + Credit



Note: people are free to refuse offer. We still survey and follow them if they are willing.

Loan Utilization: PICS + Credit(N=313)



Challenges:

Minimal rise in price of maize this year

- In contrast to previous years
 - More maize planted in response to high prices last year
 - Export Ban imposed by new government
 - Bumper Harvest in neighboring Zambia



Requires us to be flexible!

- Loan repayment delayed and ongoing
- 75% repayment so far

Lessons Learned

- People generally happy with PICS bags
 - Many wanted to buy more
 - Some groups wanted to start selling bags
- Combining PICS bags with credit reduces the risk for a lender
 - Collateral for the loan is safe, and of high quality.
- People see loan offer as business opportunity
 - Many people used loan to become maize traders
 - People who are credit worthy may not be the most credit constrained
- Challenges with lack of price rise highlight challenges associated with agricultural credit
 - Many outside factors affect loan profitability (weather, government policy, etc)



Lessons Learned

- Probably makes sense to expand loan for different crops
 - Rice and legumes may be more profitable to store and use for loan collateral
 - Government less involved
- Need to be flexible on loan repayment dates
 - Established relationships between borrowers and lenders are important.
- Mobile money can make lending and repayment more flexible
 - Reduces transportation and transactions costs associated with loan



Next Steps

- Journal collection on going
- Endline survey in May 2018
- Answer questions about impacts on consumption, sales, purchases, and storage



Project expansion into Malawi this year

- Compare outcomes in Tanzania with those in a neighboring country
- Focus on legumes (groundnuts and soybean)
- Increase focus on labor and gender impacts
- Baseline and intervention in March/April 2018
- Endline 2019



Thank You



Questions and Comments Welcome!

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TOP TAKE-AWAYS

What might be applied to other programs and contexts?

What are the indispensable lessons to share with others?

2

Ag technology can equal lower cost of credit

PICS bags can be used to lower the cost of credit by making collateral safer.

5

People see loan as business opportunity

Many people used the loan money to become maize traders.

3

Smooth relations with local partners is critical

In this case working with a local partner helped lower cost of credit, by reducing risk and logistics costs.

6

Most credit worthy, not necessarily most credit needy

While this loan product is new, the group of individuals part of this intervention had access to other sources of credit

1

Popularity of PICS technology

Anecdotal evidence strongly suggests that exposure to the bag and initial subsidy will raise demand (similar results in Uganda).

4

Agriculture credit affected greatly by outside risk

The lack of maize price rise shows that agriculture credit can be associated with a number of uncontrollable factors.

7

Mobile money equals greater flexibility

Mobile money can make credit repayment more flexible and also cheaper.

Questions and Answers

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Contact: jmaccartee@usaid.gov or koplanick@usaid.gov

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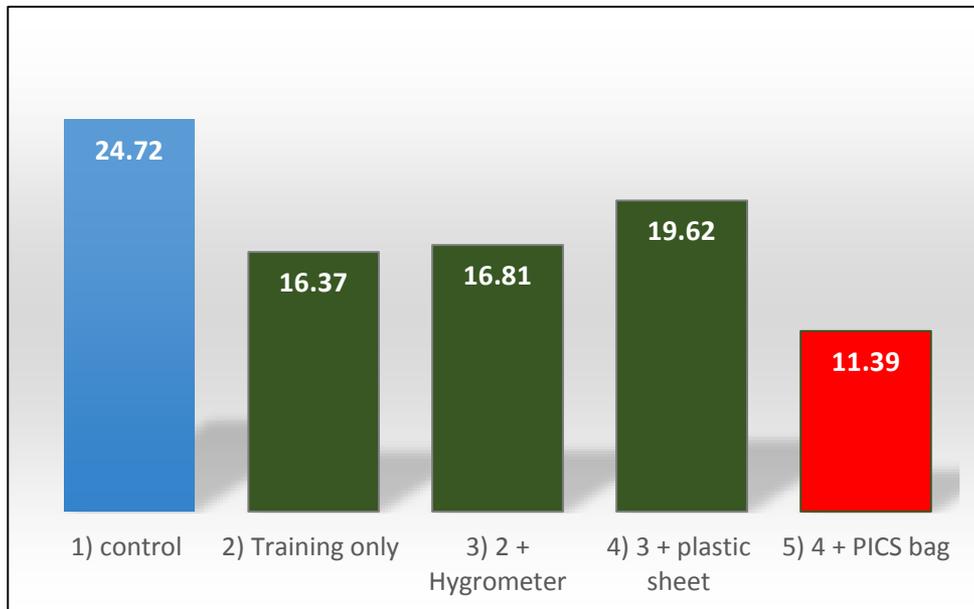
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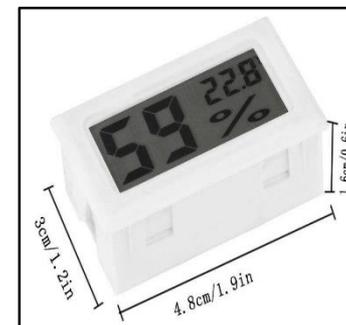
Impacts of drying and storage intervention in Southern Senegal

Average aflatoxin levels in maize by Intervention group (in ppb) after 6 months

Training on good post-harvest practices



Low cost moisture meter (hygrometer)
Cost: \$2.00



Low cost moisture meter (hygrometer)
Cost: \$2.50

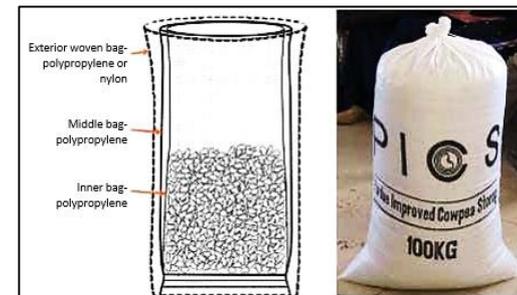
Plastic tarp for safe drying
Cost: \$3.25 per 10m²



Statistically different from control and statistically equivalent at 10% level.
Statistically different from all other groups at 5% level.

Aflatoxins are a big problem in our sample

- 23% above US legal limit of 20 ppb
- 29% above 20 ppb in control group
- Biggest effect is adding PICS bag to intervention.



Funded by USAID FPL Innovation lab

Baseline characteristics of participants, by treatment group

Variable Name	MEAN (Standard Deviation)					Total
	PICS-Treated	PICS-Exposed	PICS+Credit-Treated	PICS+Credit-Exposed	Control	
Maize harvested by household in June 2016(kg)	1,355 (1,573)	1,516 (2,248)	1,649 (2,137)	1,579 (2,021)	1,527 (1,732)	1,513 (1,889)
Maize Stored by household from 2016-17 season(kg)	1,036 (1,448)	1,130 (1,695)	1,377 (3,439)	1,085 (1,315)	1,160 (1,414)	1,158 (2,036)
Spent on storage chemicals(USD)	3.34 (5.69)	3.42 (5.61)	3.51 (11.05)	3.07 (5.00)	3.53 (5.41)	3.40 (7.01)
Progress out of Poverty Index score of household	48 (13.38)	48 (13.09)	49 (12.32)	48 (12.79)	49 (12.97)	48 (12.93)
Annual Household Revenue from all sources(USD)	1000 (4009)	826 (2192)	867 (1671)	637 (1178)	1045 (2585)	919 (2697)
Number of hermetic storage bags owned by household prior to intervention	0.17 (1.17)	0.13 (0.96)	0.14 (0.93)	0.37 (3.10)	0.45 (3.49)	0.26 (2.31)