

Results from Maize Insurance Pilot

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Index-Based Agricultural Insurance in Mozambique:
Recent Experience and Paving the Way Forward

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Maputo



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Outline

Motivation & Contract Details



Research Design



Sales and Demand



Impacts



Farmer Understanding



Primary Take-aways

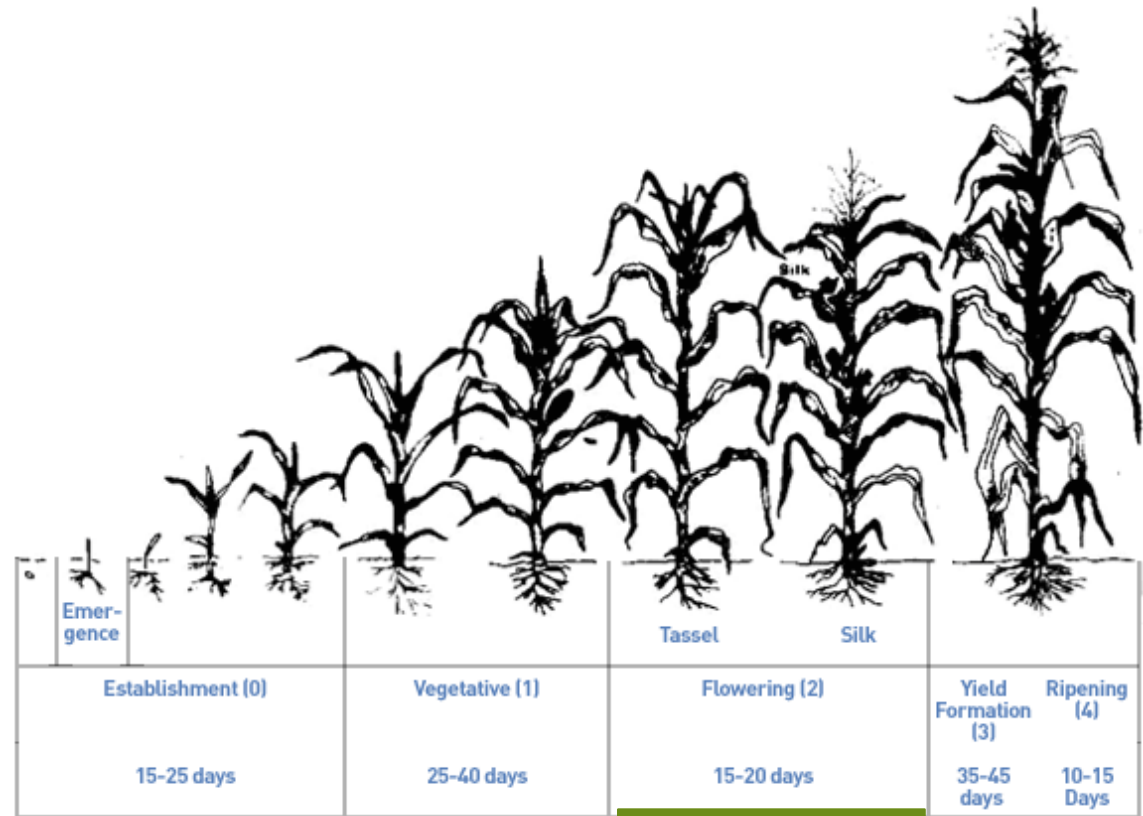


Research Objectives

- Does protecting farmers from drought risk make them more willing to invest on their farms?
- Can index insurance improve the protection against drought already offered by drought-tolerant maize (DTM) seeds?



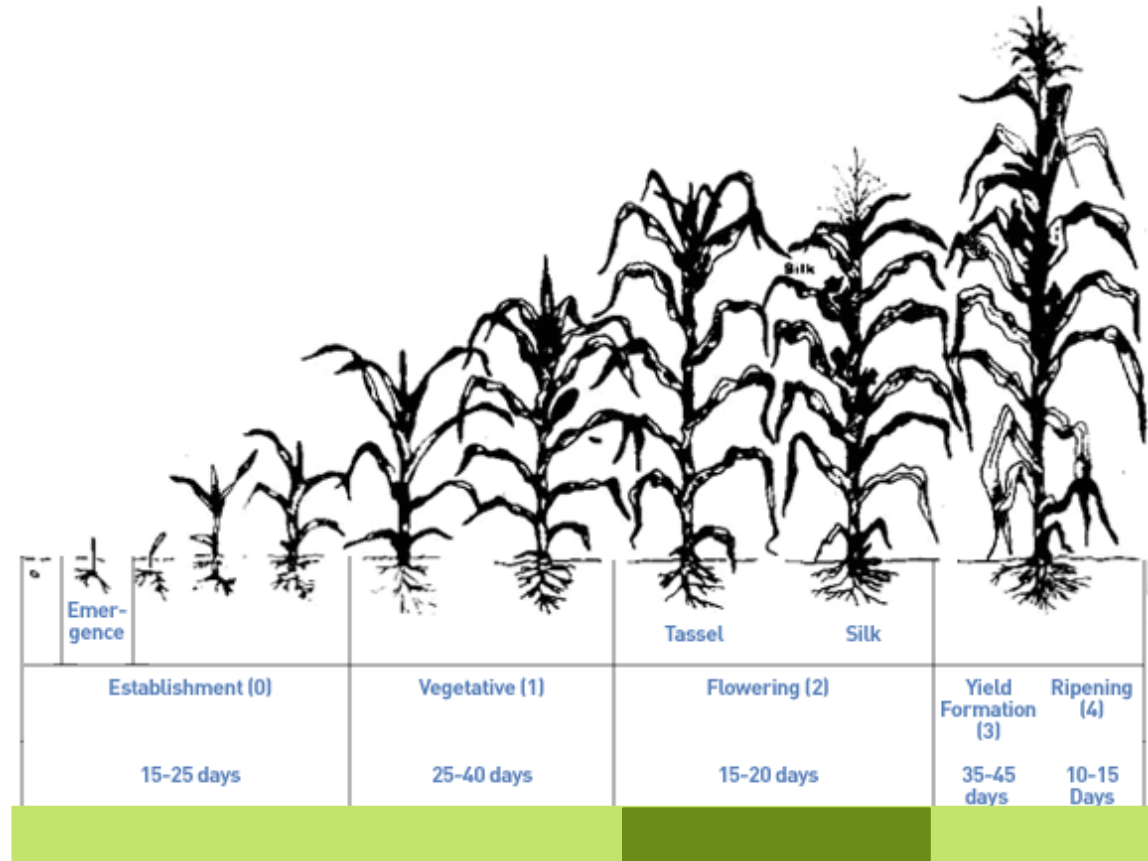
DTM & DTMII



- DTM provides protection against drought during the flowering stage of maize growth.
- Maize is still vulnerable to weather stress over the rest of the production cycle.



DTM & DTMII



- Pairing index insurance (II) with DTM can extend protection to the rest of the growing season.



The index insurance contract

Insurance *bundled* with seed purchase

- Purchase seed = purchase insurance
- Insurance covers the value of the seed
- Premium = 20% of insured value (price of seed)
- Seed company remits premium to insurance company at end of sales period.

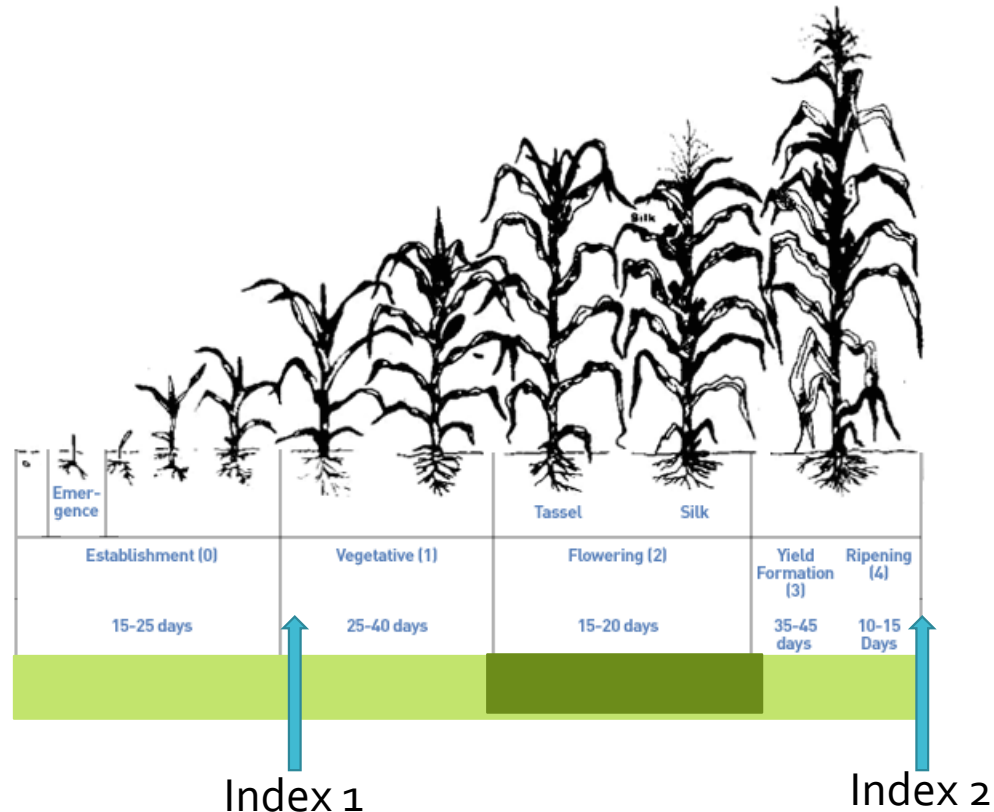




The index insurance contract

Two Indices

- Index 1: Early season drought
- Index 2: End of season predicted area yield
- Indices measured at contract zone level
- Payoff made if *either* index is triggered





The index insurance contract

The indemnity payment

- Seed replaced the following year
- Farmers trade voucher for new seeds
- Seed company sends vouchers to insurance company for reimbursement

Nome: _____

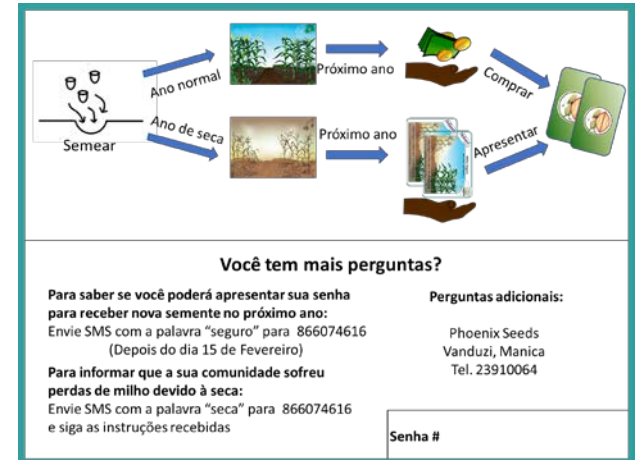
Kgs de Sementes: _____

Zona de Seguros: _____

Guarde este cartão!

Se a sua comunidade tiver seca, você poderá apresentar este cartão para ter reposição da semente no próximo ano!

Campanha agrícola 2017/2018 Apresentável em Outubro de 2018





Research Design

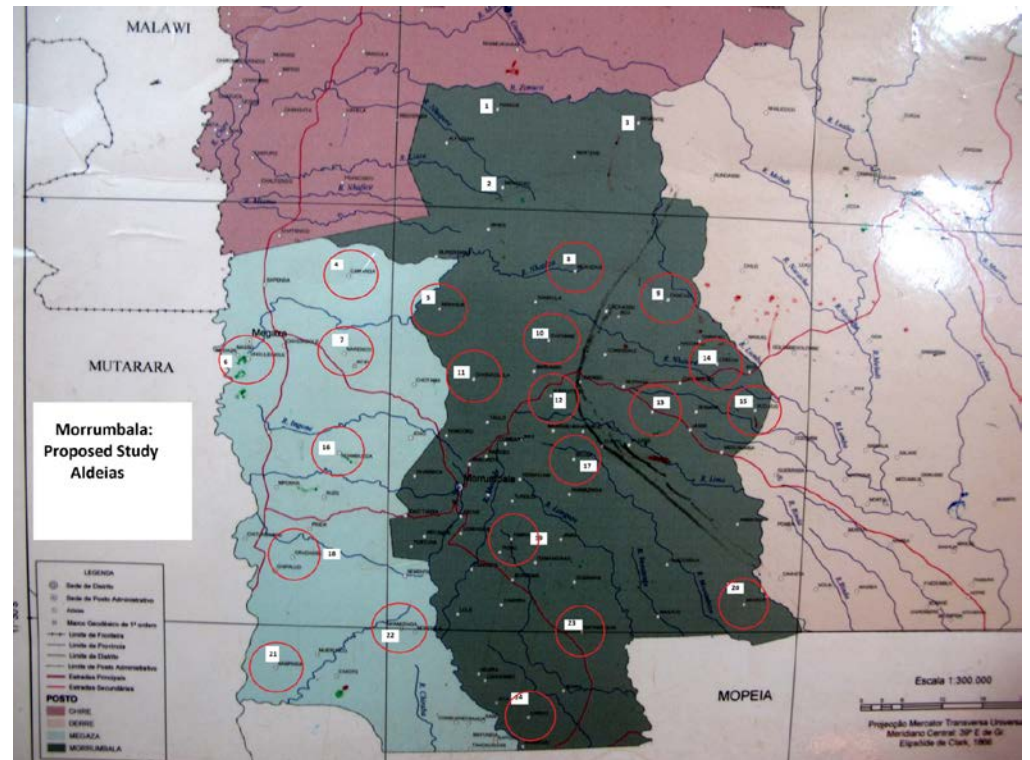
Community Selection

- Randomized controlled trial with 2 treatment arms
- 64 communities randomly assigned to 1 of 3 groups:
 - Treatment 1 (T₁): Only DTM marketed
 - Treatment 2 (T₂): Bundled DTM-with-insurance marketed
 - Control: Yearly surveys but no marketing



Research Design

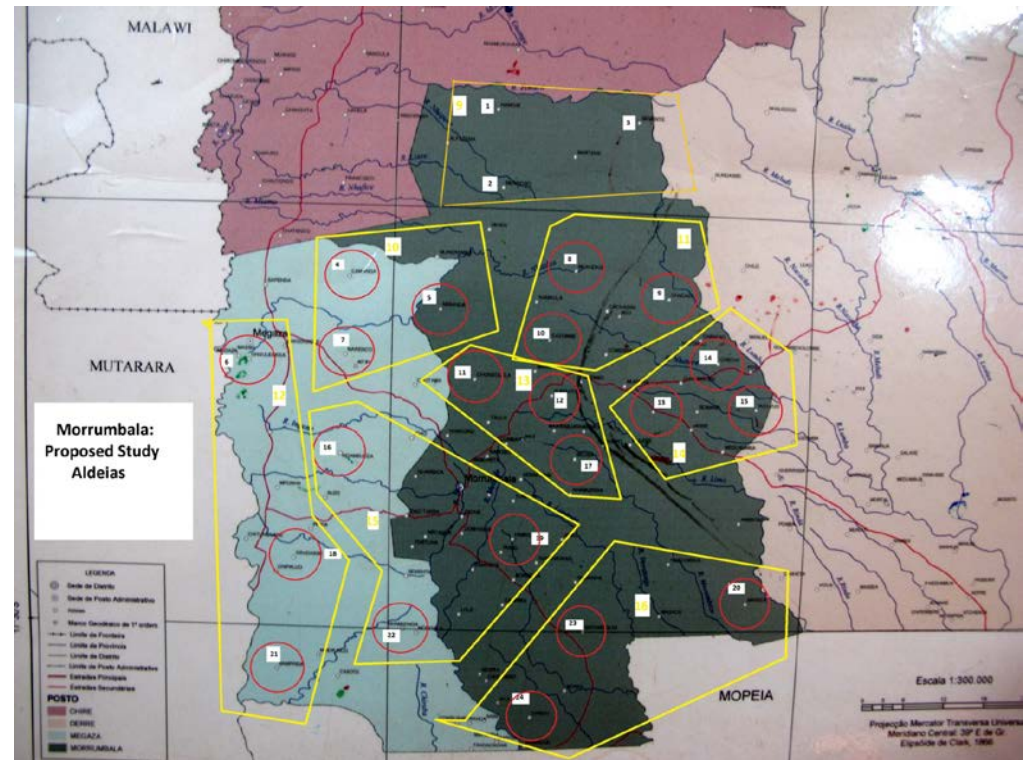
Community Selection Step 1: Identify feasible set of communities





Research Design

Community Selection Step 2: Create groups of three comparable communities

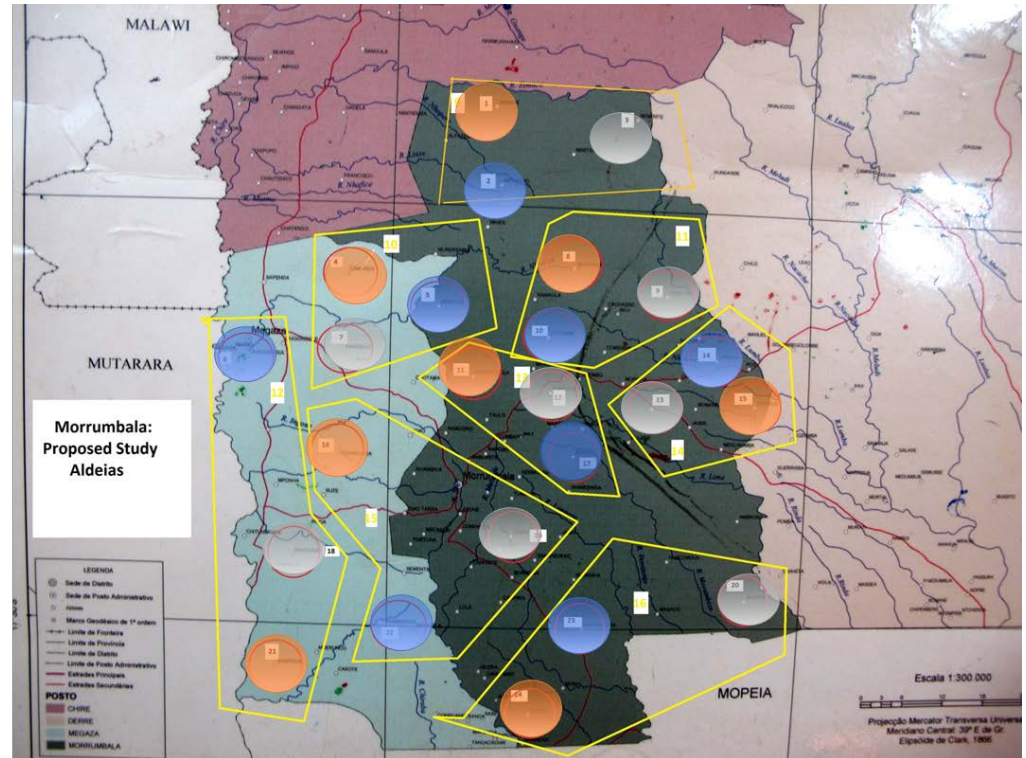




Research Design

Community Selection Step 3: Randomly assign each community in the group to a treatment type

- DT-Only
- DT & II
- Control





Research Design

Household Selection

- Random sample of households in each community
 - List of all maize-producing household in each community obtained from community leaders
 - 21 households randomly selected per community
 - 21 households x 64 communities = 1,344 households
- In T₁ & T₂ communities, marketing directed to sample households, but all households could purchase



Study Area & Households

Study Districts





Study Area & Households

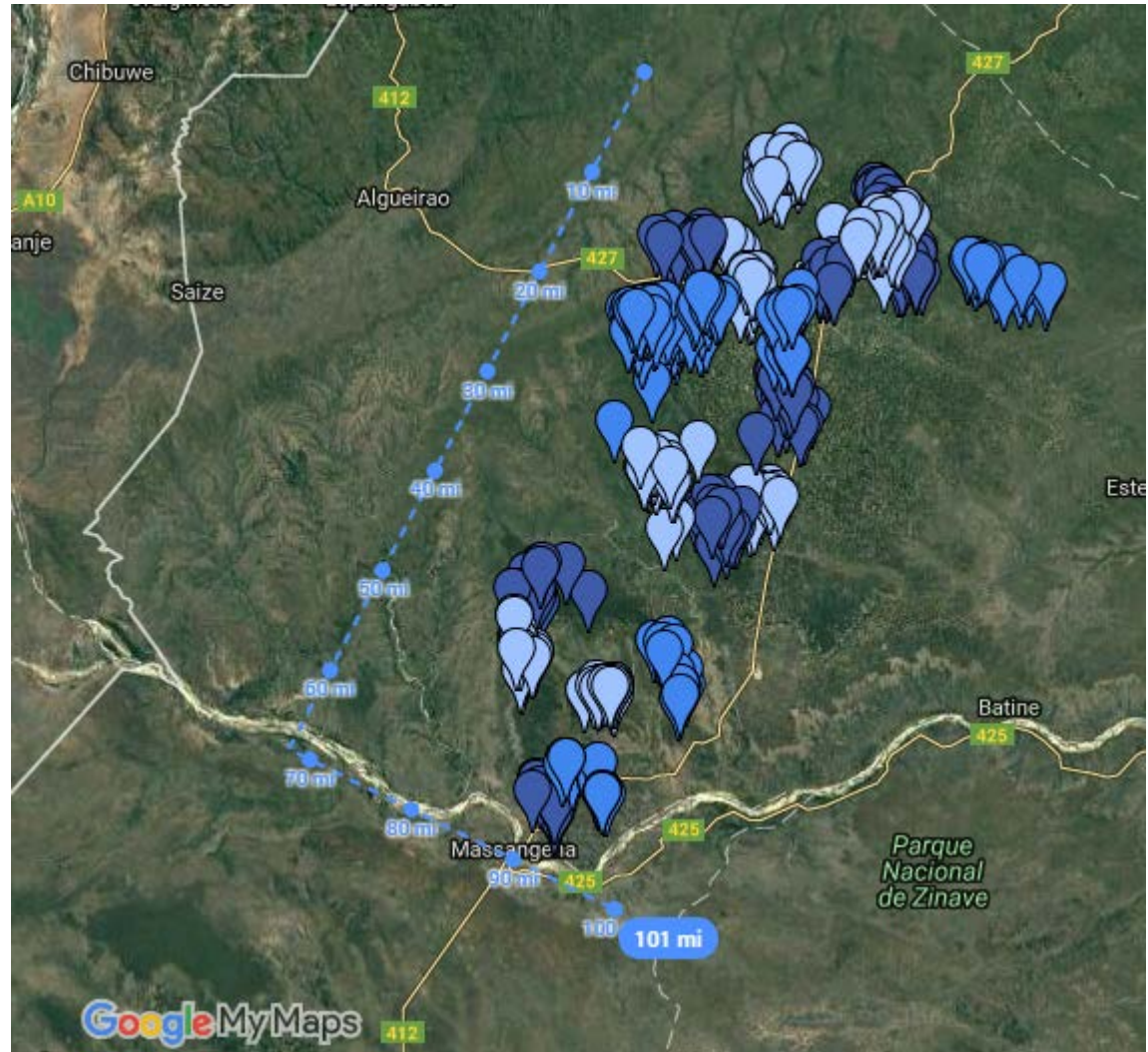
Study Districts



Sample households in Machaze District



Study Area & Households





Study Area & Households

Household Characteristics & Asset Ownership

HH Size	6.9
<u>Education of HH Head</u>	
Less than Lower Primary	39%
Lower Primary	36%
Upper Primary	15%
Secondary or Above	10%
<u>Simple Poverty Score</u>	25.7
Probability Below Natl Poverty Line	72%
Probability Below \$1.25/Day Line	78%
<u>Asset Ownership</u>	
Mobile Phone	56%
Bicycle	76%
Radio	57%
Solar Panel	45%

Agricultural Practices & Credit Access



Study Area & Households

Agricultural Practices and Yields	2015/2016	2016/2017
Area Planted (ha)	2.7	2.5
Use Improved Seed	9%	46%
Use Chemical Fertilizer	2%	3%
Yield (kg/ha)	80 ⁺	344
Seed Use (kg/ha)	5	19
Plant in Lines	70%	75%
Seeds per hole	4.3 (local) 3.0 (Improved)	4 (local) 3 (Improved)
Food Security and Credit Access		
Experienced Food Insecurity in the Past Year	78%	60%
Have or Could Get Formal Credit	10%	3%
Have or Could Get Formal Savings Account	5%	7%
Could Get a Small, Informal Loan ⁺⁺	43%	50%
Could Get a Medium Informal Loan	22%	37%
Could get a Large, Informal Loan	8%	20%

⁺ Nearly 50% of households experienced total crop failure.

⁺⁺ Small = USD 5, Medium = USD 25, Large = USD 100



Sales Summary

Drought-Tolerant Maize Price Schedule: 2017-18 season

	Seed Only	Seed with Insurance
Phoenix Seeds (OPV, ZM 523)	80 MTS	90 MTS
Klein Karoo (Hybrid, PRIS 601)	150 MTS	180 MTS



Sales Summary

Marketing Through Community Meetings

- Invitations distributed to each sample household via extension agent & community leader
- Community Meetings included:
 - Information about DT seeds and recommended practices (T₁ & T₂)
 - Information about insurance (T₂)
 - Opportunity to purchase seeds (OPV & Hybrid)
- Each year, sample households picked discount from a lottery
 - 10% discount (20% chance)
 - 25% discount (60% chance)
 - 50% discount (20% chance)
- Other community members (non-sample) allowed to participate, but not offered discount.

T1 Communities (DTM Only)



Sales Summary

Purchase Quantities (kg)

	2016		2017	
	ZM523 (OPV)	PRIS 601 (Hybrid)	ZM523 (OPV)	PRIS 601 (Hybrid)
Machaze	839	116	318	69
Nhamatanda	302	47	124	67
Total	1141	163	442	136

Meeting Participation and Purchase Frequencies

	2016		2017	
	% Attend	% Purchase	% Attend	% Purchase
Machaze	98	76	63	94
Nhamatanda	80	61	39	88
Total	88	68	49	91

T2 Communities (DTM-II Bundle)



Sales Summary

Purchase Quantities (kg)

	2016		2017	
	ZM523 (OPV)	PRIS 601 (Hybrid)	ZM523 (OPV)	PRIS 601 (Hybrid)
Machaze	692	107	172	7
Nhamatanda	395	53	103	41
Total	1087	160	275	48

Meeting Participation and Purchases Frequencies

	2016		2017	
	% Attend	% Purchase	% Attend	% Purchase
Machaze	98	63	26	66
Nhamatanda	95	49	43	71
Total	96	54	37	70



Demand Analysis

Purchase Amounts per Farmer

Volume Purchased (kg)	2016 (N=776)	2017 (N=316)
1	46%	54%
2	27%	24%
3 – 5	15%	16%
6 – 10	8%	2%
> 10	4%	4%
Mean	3.3 kg	2.8 kg
Median	2 kg	1 kg



Demand Analysis

Purchase Patterns over Time

Purchased Seed?	T1 (DTM Only)	T2 (DTM & II)
Never	35%	47%
Only in 2016	30%	30%
Only in 2017	13%	12%
In both 2016 & 2017	22%	10%

Price Sensitivity

2016



Demand Analysis

T1 (DTM Only)

Discount	Price	% Purchased Seed		Avg Purchase (kg)	
		ZM523	PRIS601	ZM523	PRIS601
50%	32.5	86%	38%	7.5	2.6
	92.5				
25%	48.75	80%	22%	3	1.3
	138.75				
10%	58.5	73%	16%	2.4	2
	166.5				
0% (non-sample)	65	n/a	n/a	2.1	1.4
	185				

T2 (DTM & II)

Discount	Price	% Purchased Seed		Avg Purchase (kg)	
		ZM523	PRIS601	ZM523	PRIS601
50%	42.5	78%	30%	5.6	4.8
	112.5				
25%	63.75	64%	8%	3.1	1.2
	168.75				
10%	76.5	65%	6%	1.8	1
	202.5				
0% (non-sample)	85	n/a	n/a	1.9	1.4
	225				

Price Sensitivity

2017



Demand Analysis

T1 (DTM Only)

Discount	Price	% Purchased Seed		Avg Purchase (kg)	
		ZM523	PRIS601	ZM523	PRIS601
50%	40	42%	22%	2.8	5.5
	75				
25%	60	55%	14%	1.6	1
	112.5				
10%	72	29%	9%	1.6	1.3
	135				
0% (non-sample)	80	n/a	n/a	4.8*	4*
	150				

T2 (DTM & II)

Discount	Price	% Purchased Seed		Avg Purchase (kg)	
		ZM523	PRIS601	ZM523	PRIS601
50%	45	62%	32%	6.7	1.5
	90				
25%	67.5	54%	13%	1.5	1.4
	135				
10%	81	50%	4%	1.1	2
	162				
0% (non-sample)	90	n/a	n/a	1	1
	180				



Demand Analysis

Price Elasticities

$$\ln(Q) = \beta_0 + \beta_1 * \ln(P) + \beta_2 * T2 + \beta_3 * 2017 + \epsilon$$

P	ZM 523	PRIS 601
β_1	-0.99	-0.74
β_2	0.11	0.11
β_3	-0.11	-0.14

- β_1 : Price elasticity of demand ≈ -1 .
 - 1% increase in price \rightarrow 1% decrease in quantity purchased.
- Could be driven by liquidity constraints.
 - 2 farmers took 100 mts to community meeting to spend on seed
 - 1 got 50% discount; 1 got no discount
 - Lucky farmer will buy twice as much



Demand Analysis

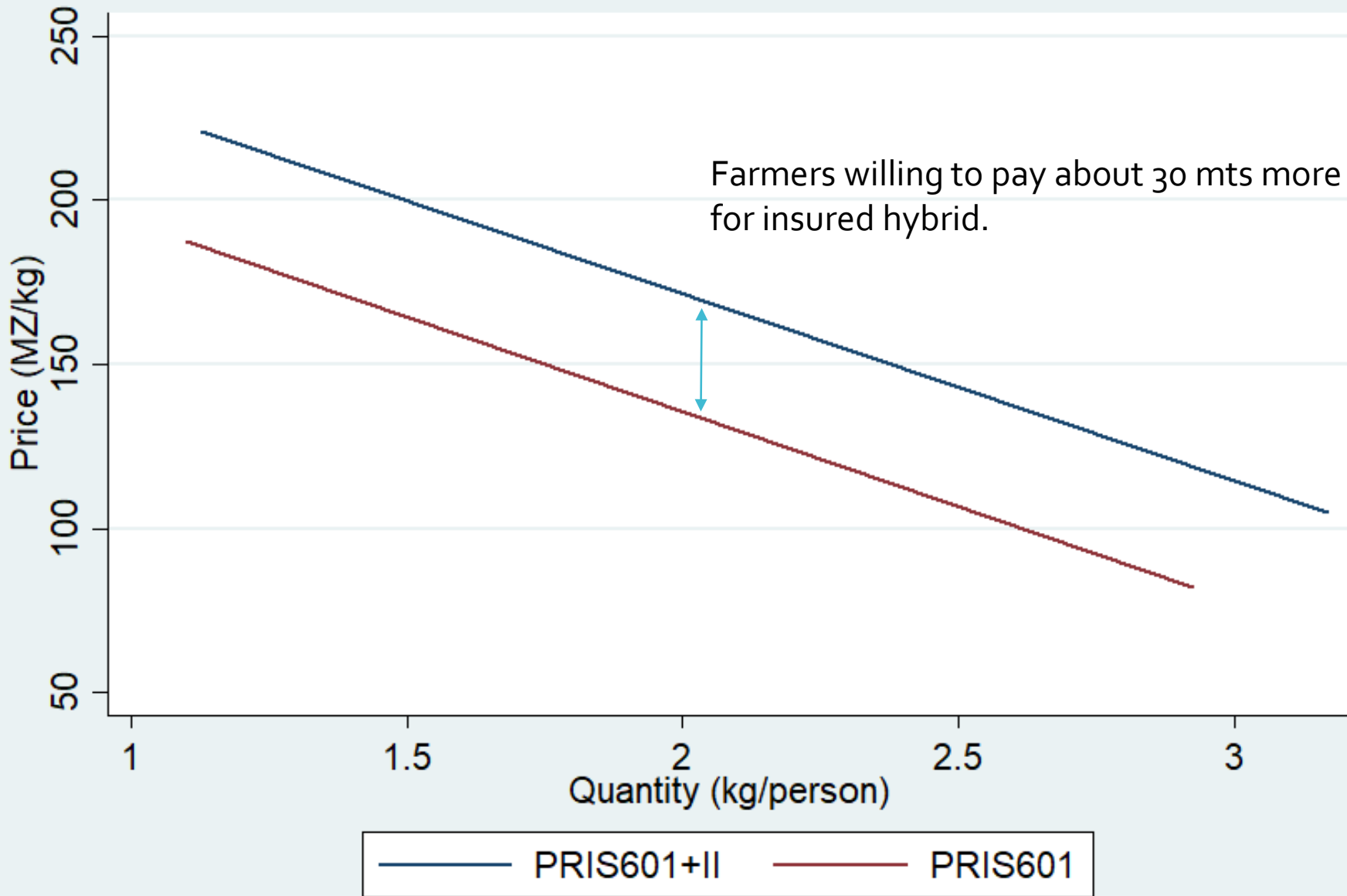
Price Elasticities

$$\ln(Q) = \beta_0 + \beta_1 * \ln(P) + \beta_2 * T2 + \beta_3 * 2017 + \epsilon$$

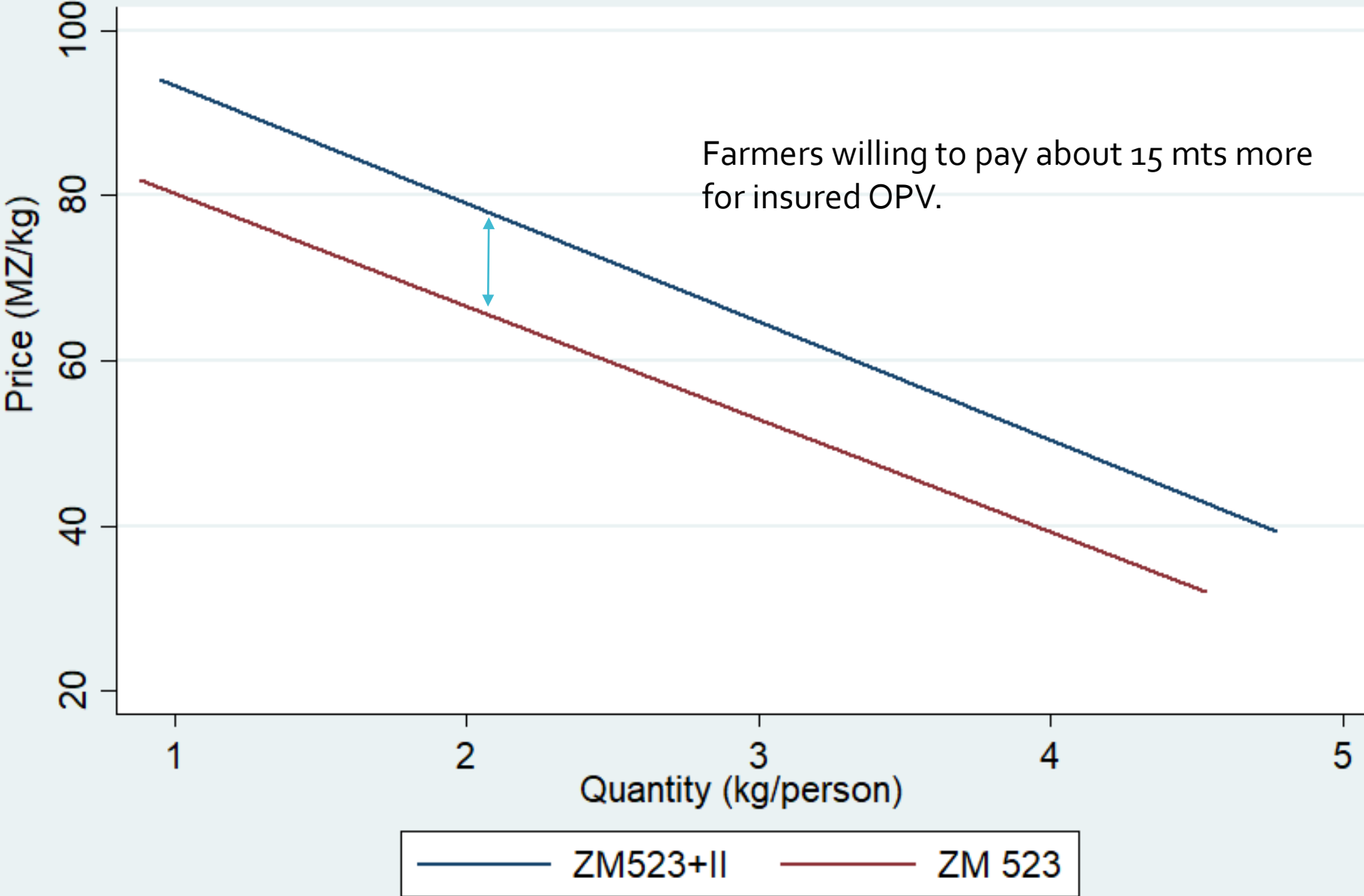
P	ZM 523	PRIS 601
β_1	-0.99	-0.74
β_2	0.11	0.11
β_3	-0.11	-0.14

- β_2 : Are farmers willing to pay more for insured seed?
- Easier to look at with a graph...

Demand for PRIS601 with and without insurance



Demand for ZM523 with and without insurance



Comparison of Midline Means



Basic Impacts

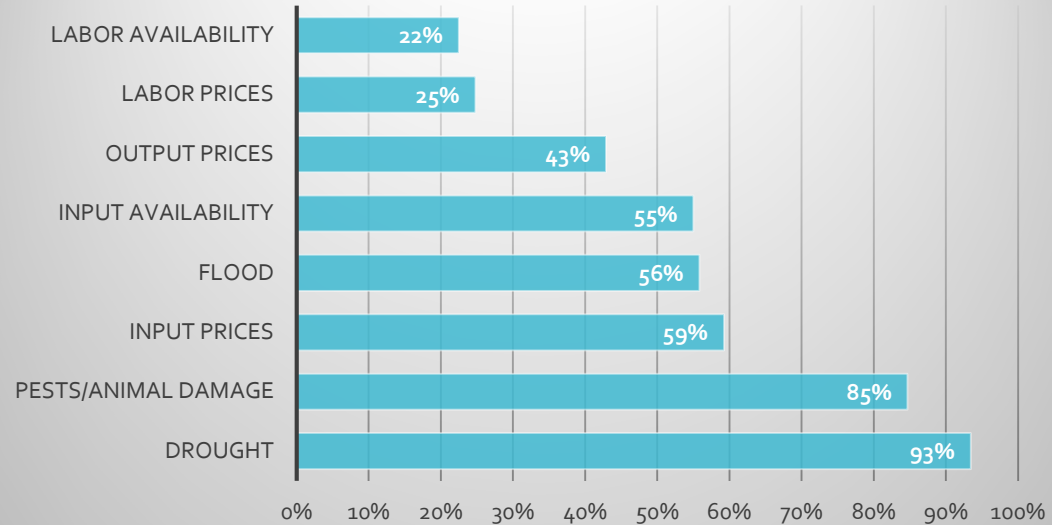
Outcome Variable	Control	DTM (T1)	DTM II (T2)
Planted DT Maize	.05	.40**	.30**
Planted Improved Maize	0.25	0.65**	0.56**
Maize area planted	2.28	2.34	3.02**
Maize yield (kg/ha)	315	321	325
Maize production (kg)	654	648	810
Seed Rate (kg/ha)	16.3	11.0	10.7
Plant in lines (improved)	0.68	0.85**	0.83**
Used fertilizer	0.01	0.04**	0.04**
Food Secure	0.39	0.41	0.38

2016-17 season was good rainfall year → might not expect big difference in yield: DT vs non-DT improved

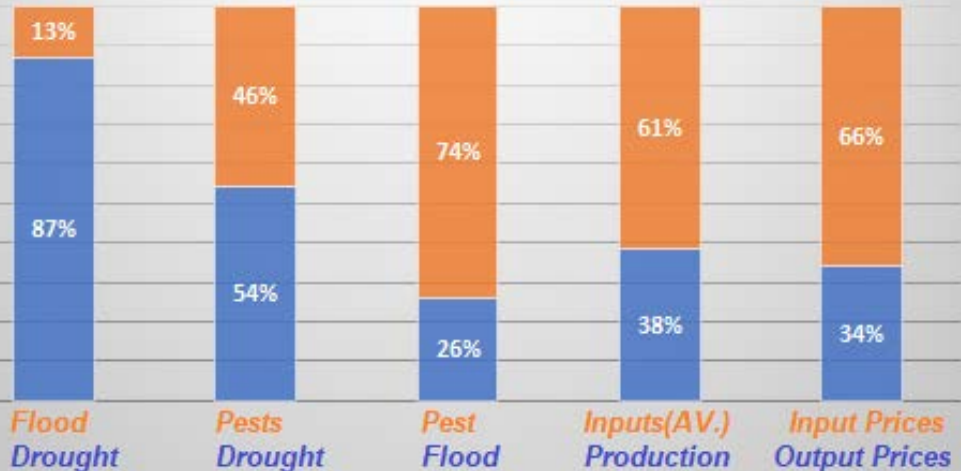


Risks & Concerns Identified by Farmers

Farmer Worries and Concerns



Which of the following is of greater concern?

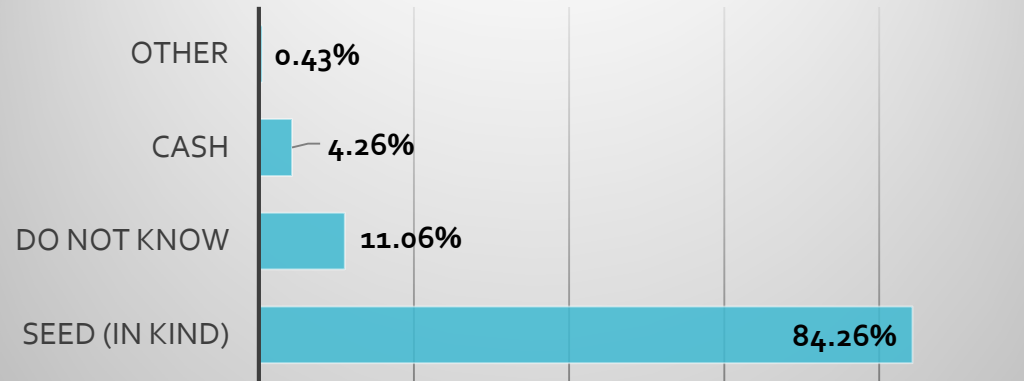




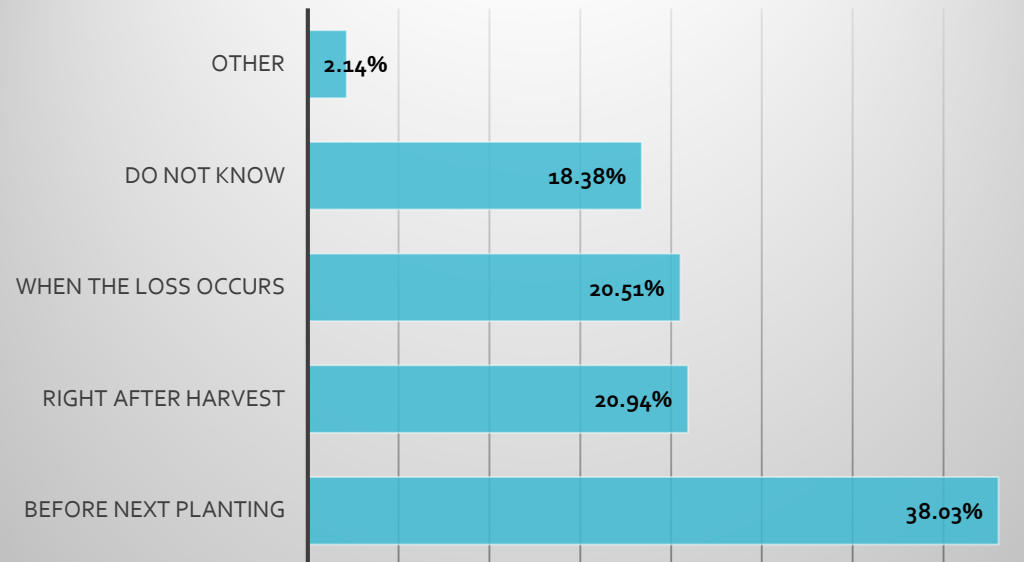
Understanding of Insurance Contract: Payments

At endline; T2 people who attended community mtgs

In what form would insurance payments be made?



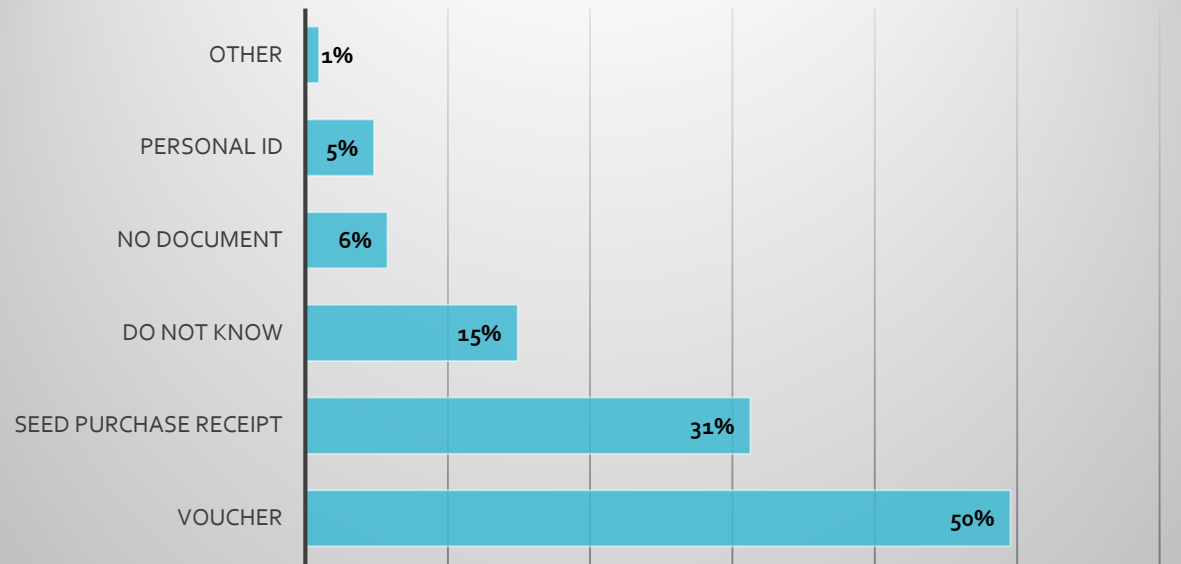
When would you receive this payment?





Understanding of Insurance Contract: Payments

What documents would you need to present
to receive this payment?





Understanding of Insurance Contract: Basis Risk

If the whole community has a bad production year and you also have a bad production year, would you receive an insurance payment?

No	19.23%
Yes	80.77%

If the whole community has a good production year and you also have a good production year, would you receive an insurance payment?

No	83.17%
Yes	16.83%

If the whole community has a good production year, but you personally have a bad production year, would you receive an insurance payment?

No	68.60%
Yes	31.40%

If the whole community has a bad production year, but you personally have a good production year, would you receive an insurance payment?

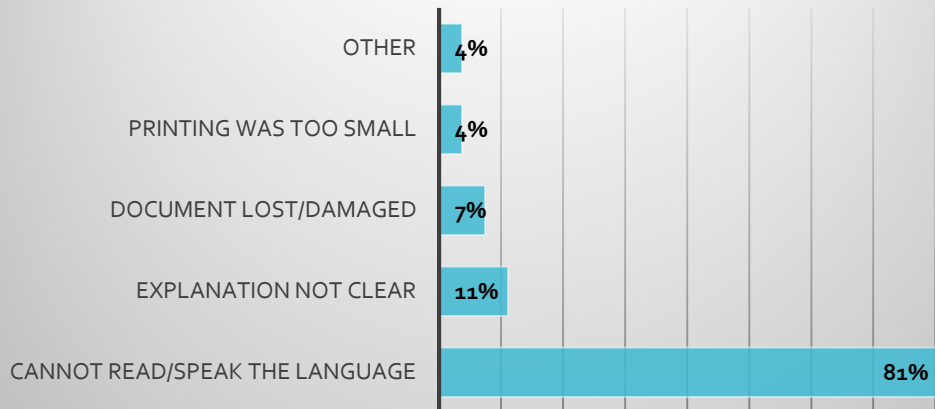
No	50%
Yes	50%



Was Documentation Useful?

- 73% of households recalled receiving documentation about how the insurance worked
- 83% claimed this information was helpful.
- Of those that said the information was not helpful, inability to read (illiteracy) or speak Portuguese was dominant reason.

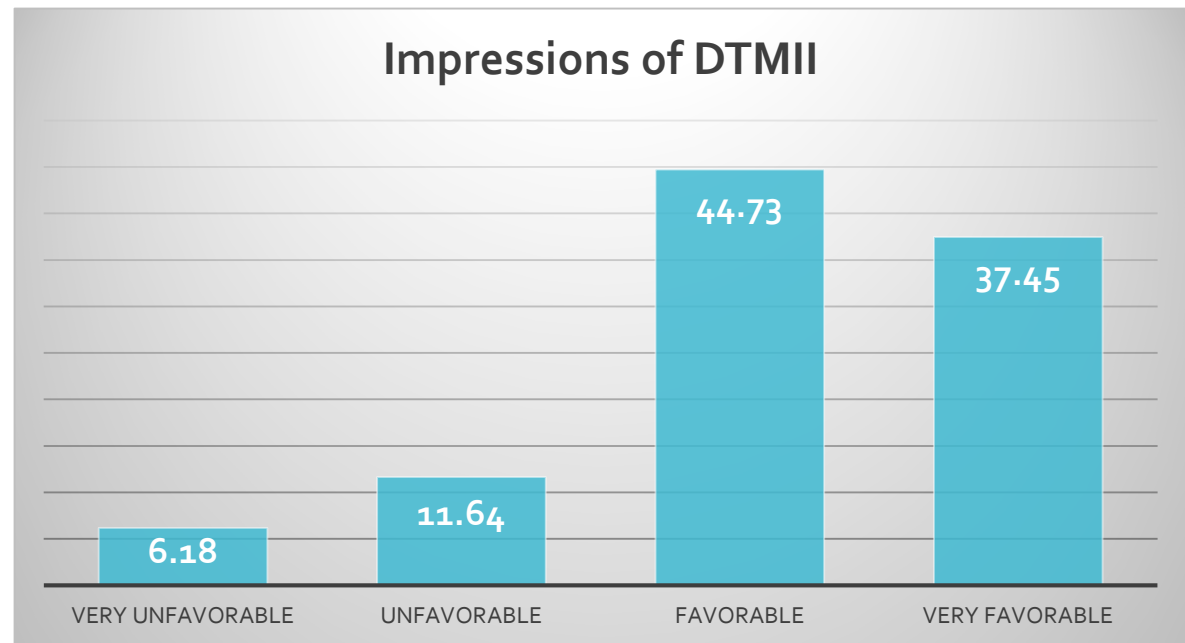
Why was the provided documentaiton not useful?





Farmer Satisfaction

- Seventy percent of sample farmers in T2 communities reported either using DTMII or knowing someone who had used DTMII.
- Of these, over 80% had positive impression of the insured seed.
 - In spite of no payouts yet





Main Takeaways from Pilot

- Farmers are very concerned about drought, so the benefits of DT and DTII would seem relevant.
- Farmers are willing to experiment: Most bought DT at least once
 - 65% in DT only communities
 - 53% in DT II communities
- But amount of DT seeds purchased very small:
 - median = 2 kg; median total = 32 kg
- Impacts of DT and DTTII on production and yields negligible because of small amounts purchased.



Main Takeaways from Pilot

Price Sensitivity

- Overall, farmers are quite sensitive to price
- Hybrid twice as expensive as OPV; Overall purchase of OPV about 3 – 4 times as much as Hybrid.
- Demand elasticities around -1 imply increase in price accompanied by proportional decrease in demand.
- Liquidity constraints may be important driver of this price sensitivity
- The higher price of insured seed reduces demand, but the reduction is muted because farmers value the insurance.



Understanding Demand

Factors affecting seed and insurance demand

- Characteristics of study communities
 - High poverty rates
 - Lack of liquidity/credit
 - Poor infrastructure and lack of access to complementary inputs
 - Maize production primarily for subsistence
- Use of retained/saved seeds still strong among subsistence households
 - Farmers may be less willing to pay for improved seeds when they have saved seed (OPV)
 - Might expect counter-cyclical patterns? (purchase more after bad year)
- Demand for insurance (biological in DT seed and especially index insurance) may require patience
 - Farmers need to learn about both types of insurance (biological & financial)
 - Bad year with lots of payouts may be required for farmers to learn and to build trust