

# Maize marketing boards and sustainable intensification: Panel survey evidence from Kenya

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Selected Presentation, Agricultural & Applied Economics Association Annual Meeting  
Chicago, Illinois  
August 1, 2017



## Motivation: The problem

- Soil nutrient losses, low crop yields, and decreasing agricultural output growth in many African countries (Eicher 2009; Jayne et al. 1993; Montpellier Panel 2013; NAAIAP 2014)
- → Country wide agricultural shortfalls requiring imports including maize in Kenya (Drechsel et al. 2001; Sanchez et al. 1997; Sanchez and Logan 1992; van Ittersum et al. 2016)



## Sustainable Intensification: A possible solution

- **Sustainable intensification (SI)**: Possible solution to declining soil fertility.
- SI is “a process or system where yields are increased without adverse environmental impact and without the cultivation of more land” (Pretty & Bharucha 2014; Royal Society 2009)
- In Kenya and elsewhere in eastern and southern Africa, SI of maize-based systems is of particular interest
- Use of soil fertility management practices (SFM) on maize plots can contribute to SI in maize-based systems (Montpellier Panel 2013; Snapp et al. 2010)

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## Key policy issues and research questions

- What are the drivers of smallholder farmers' adoption of SFM practices and the **degree of SI** in maize-based systems?
- How are current government policies and programs affecting incentives for smallholders to adopt these technologies?
  - Input subsidy programs (ISPs)
  - Output price supports: National cereals and Produce Board (NCPB) in Kenya



## Maize marketing boards and smallholder behavior

- Previous research:
  - Maize marketing board activities affect maize prices and farmers' maize price expectations in Kenya and Zambia (Jayne, Myers, & Nyoro 2008; Mason, Jayne, & Myers 2015; Mather and Jayne 2011)
  - Increase in expected maize price associated with increases in maize production (Mason, Jayne, & Myers 2015; Mather and Jayne 2011)
- → Maize marketing boards (including the NCPB in Kenya) may also influence SFM adoption decisions

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## Kenya's NCPB operations

- Primarily purchases maize from traders and large-scale farmers at one price across all of Kenya. NCPB purchase price is announced after planting every year.
  - Purchases occur at depots throughout the country
    - Very few smallholders sell directly to the NCPB, but market prices are still influenced through the NCPB
  - Sellers deliver their maize to depots, where it is weighed, bagged, and accepted
  - Historically there is some delay in payment for the seller

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## SFM practices & prevalence on maize plots in Kenya

Case	Inorganic fertilizer?	Organic fertilizer?	Maize-legume intercrop?	Percent of maize plots in sample by case	Analytical SI category	Analytical SI ranking	Percent of maize plots by analytical SI category/ranking (excluding case 1)
1				1.9%	N/A (too few maize plots to include in analysis)		
2	✓			6.1%	Intensification	1	6.2%
3		✓		1.4%	Sustainable	2	17.3%
4			✓	14.0%			
5		✓	✓	1.6%			
6	✓	✓		15.3%	Weak SI	3	50.2%
7	✓		✓	34.0%	Strong SI	4	26.2%
8	✓	✓	✓	25.7%			
Intercropping with Legumes							89.1%
Use of inorganic fertilizer							80.2%
Use of organic fertilizer							52.3%

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## Approach

### • Three steps:

- 1) Estimate the effects of the NCPB's past maize purchase price and quantities purchased, and other factors, on a farmer's expected maize price pooled ordinary least squares (POLS)
- 2) Estimate the effects of the expected maize price (and other factors) on a farmer's maize-related SFM and SI decisions (logit, multinomial logit, and ordered logit)
- 3) Combine the results from (1) and (2) to obtain the estimated effects of the NCPB variables on SFM and SI adoption decisions
- All three steps use a Correlated Random Effects (CRE) model to control for time constant unobserved heterogeneity



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## Results: The NCPB and farmers' expected maize price

Explanatory variables (observed when SFM decisions made)	Coef.	Sig.	p-val
Transportation cost-adjusted NPCB maize price (t-1, real 2010 Ksh/kg)	0.112	***	0.007
NCPB purchases of maize at divisional level (Mt, t-1)	0.002		0.346

\*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively. p-values based on standard errors clustered at the household level.

- A one shilling increase in the lagged NCPB maize price (about a 7% increase) raises a household's expected maize price by an average of 0.11 Ksh/kg (about 0.5% of mean maize price/Kg)

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## Results: Expected maize price effects on individual practice adoption (CRE-Logit)

Dependent variable:	Maize-legume intercropping (=1)			Inorganic fertilizer (=1)			Organic fertilizer (=1)		
	APE	Sig	p-val.	APE	Sig	p-val.	APE	Sig	p-val.
Explanatory variables									
Expected maize price (real 2010 Ksh/kg)	-0.001		0.882	-0.022	*	0.072	-0.024		0.176

\*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels

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## Results: Expected maize price effects on combinations of practices adoption (CRE-Multinomial Logit) & on the degree of SI adoption (CRE-Ordered Logit)

Explanatory variable	Multinomial Logit				Ordered Logit			
	SI Category	APE	Sig.	P-val.	SI Ranking	APE	Sig.	P-val.
Expected (predicted) maize price (real 2010 Ksh/Kg)	Intensification	0.008		0.286	1	0.007	**	0.020
	Sustainable	-0.006		0.518	2	0.008	**	0.021
	Weak SI	0.021		0.160	3	0.007	**	0.019
	Strong SI	-0.023	*	0.093	4	-0.023	**	0.019

\*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels

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## Results: Effects of the NPCB on farmers' adoption decisions

Logit: Individual SFM categories	Maize-legume intercropping (=1)			Inorganic fertilizer (=1)			Organic fertilizer (=1)		
	APE	Sig	p-val.	APE	Sig	p-val.	APE	Sig	p-val.
Farmgate NPCB maize price (t-1, real 2010 Ksh/kg)	No effect			-0.003	***	0.005	No effect		

Explanatory variables	Multinomial logit: SI category				Ordered logit: SI category			
	SI Category	APE	Sig.	P-val.	SI Ranking	APE	Sig.	P-val.
Transportation cost-adjusted NPCB maize price (t-1, real 2010 Ksh/kg)	Intensification	No effect			1	0.001	**	0.013
	Sustainable	No effect			2	0.001	**	0.013
	Weak SI	No effect			3	0.001	**	0.011
	Strong SI	-0.003	*	0.060	4	-0.003	**	0.012

\*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

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## Conclusion and policy implications

- The NCPB does not have explicit policy goals related to shaping the incentives for households, however its activities have unintended consequences
- We find evidence that:
  - Increases in the previous year's NCPB price raise households' expected maize price
    - Reduces use of the package of SFM practices with the highest potential to contribute to SI in maize-based systems ("Strong SI"/SI ranking 4)
    - Increases the use of sets of practices with lower SI rankings (1, 2, and 3).
      - Likely these may be beneficial to longer-term soil health, but to a lesser degree than the highest SI ranked-package.
- Does the NCPB stimulate increases in maize production that can be sustained over time or that are short-lived?

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## Acknowledgements

- Funding: USAID/Mission to Kenya through the Tegemeo Agricultural Policy Research and Analysis II project (TAPRA II)
- Co-authors Nicole Mason, Joyce Makau, and Lilian Kirimi
- Bob Myers, Robby Richardson, David Mather, Thom Jayne, Milu Myunga, Ayala Wineman, Jongwoo Kim, and John Olwande for assistance with obtaining data, answering questions, and providing guidance and insights for general insights on agriculture in Kenya



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