

Factors Affecting Small Farmers' Use of Improved Maize Technologies: Evidence from Kenya and Zambia



**T.S. Jayne, J. Govereh, Z. Xu,
J. Ariga, and E. Mghenyi**

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Outline

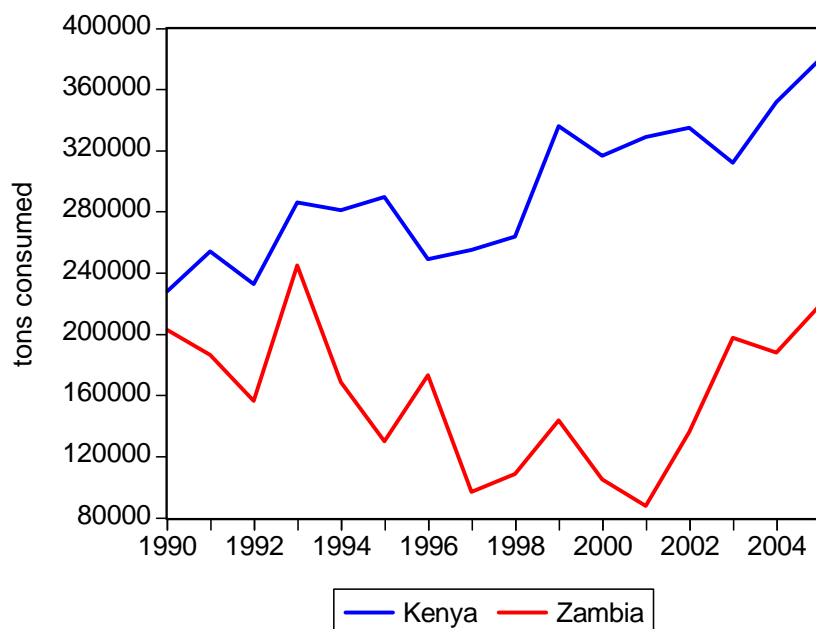
1. Problem statement
2. Objectives
3. Data and methods
4. Descriptive results
5. Estimation findings
6. Conclusions

Problem Statement

1. The “emerging” GRs of the 1970s-80s appear to have been lost
2. Declining use of improved staple food technologies since liberalization
3. Stagnant maize yields
4. Discordant strategies being advocated
5. What to do?

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- ❑ Invariably, discussions of how to promote uptake of productivity-enhancing technology raises issues of the appropriate role for the state in input/output markets
 - ❑ Should we re-think “liberalization?”
 - ❑ Contrasting cases of Kenya and Zambia

Fertilizer Consumption, Kenya and Zambia, 1990-2004



Kenya, 2003/04, nationwide sample (n=1,326)

		Use purchased hybrid seed		
		Yes	No	
Use fertilizer on maize	Yes	53.9%	7.4%	61.3%
	No	10.2%	28.5%	38.7%
		64.1%	35.9%	100%

Kenya, 2003/04,
high-potential zones (n=428)

		Use purchased hybrid seed		
		Yes	No	
Use fertilizer on maize	Yes	73.3%	9.8%	83.1%
	No	9.6%	7.3%	16.9%
		82.9%	17.1%	100%

Zambia, 2002/03,
national sample

		Use purchased hybrid seed		
		Yes	No	
Use fertilizer on maize	Yes			27%
	No			73%
		55%	45%	100%

Zambia, 2003/04, high-potential zones

		Use purchased hybrid seed		
		Yes	No	
Use fertilizer on maize	Yes	35%	16%	51%
	No	17%	32%	49%
		52%	48%	100%

Objectives

1. To understand why some small farmers use improved maize technologies while many others don't.
 - ❑ Country-level differences
 - ❑ Regional differences
 - ❑ Village-specific factor
 - ❑ Household-specific factors

Data

- ❑ Kenya: Tegemeo Rural Household panel surveys (1997, 2000, 2004)
 - n=1,326
- ❑ Zambia: Central Statistical Office panel surveys (2001, 2004)
 - n=5,420

Methods

- ❑ Probit models of improved maize technology adoption (fertilizer+maize hybrids)
- ❑ Truncated OLS / Tobits on quantity of fertilizer used per ha maize

Sources of explained variation in fertilizer use on maize (kgs per hectare)

	Kenya	Zambia
Year	1.5%	27.5%
agro-ecological zone	69.0%	41.0%
household characteristics	30.5%	31.5%
Total Variation	100.0%	100.0%

Findings:

1. Kenya: Probability of using improved tech:
 - ❑ Eastern Lowlands: 46%
 - ❑ High-Potential Maize Zone: 89%
 - ❑ Western Highlands: 82%
 - ❑ Coast: 4%
 - ❑ Zambia:
 - ❑ High-potential areas: 52% (28% of sample)
 - ❑ Low-potential areas: < 10% (72% of sample)

Findings (cont.)

2. Application rates –users only (kgs per ha):
 - ❑ High-potential (Kenya): 160-180 kg
 - ❑ High-potential (Zambia): 180-200 kg
 - ❑ other areas (Kenya): 98 kg
 - ❑ Other areas (Zambia): 81 kg

Findings (cont.)

3. Proximity to fertilizer retailer / paved road
 - ❑ Zambia: 25 km change: probability of using fertilizer 17% → 25% (+47% increase)
 - ❑ Use of fertilizer is supported by investment by rural retailers

Kenya: change in distance to nearest fertilizer retailer (1997-2004)

		Households not using fertilizer	HHs applying more than 50kgs per acre maize	National sample
Distance to nearest fertilizer retailer (kms)	1997	18.65	4.38	8.39
	2004	8.23	2.54	4.14

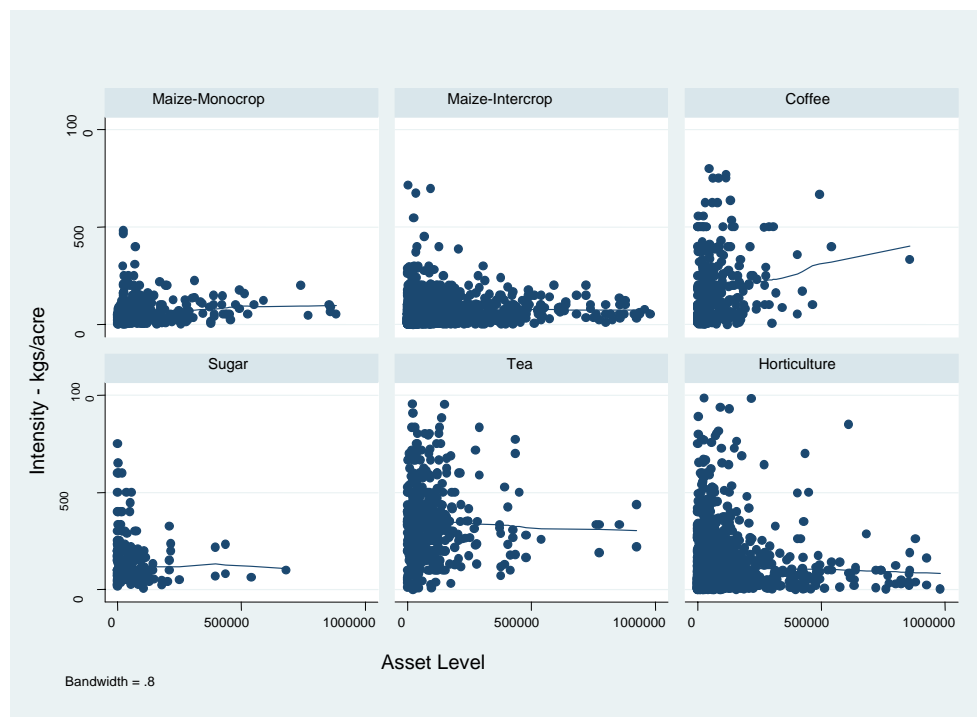
Dose Rates and Percent of Households Applying Fertilizer on Maize

	1995/96	1996/97	1999/00	2003/04
Mono-Crop Maize				
kgs/acre (users only)	59	69	72	67
% households using fertilizer	47%	47%	50%	59%
Inter-Crop Maize				
kgs/acre (users only)	57	59	62	66
% households using fertilizer	55%	56%	63%	66%

Findings (cont.)

3. Education of household head:
 - (+) in both Zambia and Kenya
4. Wealth / landholding size:
 - (+) in Zambia and Kenya
 - But after controlling for agro-ecological zones, no correlation in Kenya

Kenya: Fertilizer use by Household Assets



Findings (cont.)

5. Zambia: HH purchase of fertilizer **from private retailers** adversely affected by government fertilizer subsidy programs
 - ❑ Predicted prob. of purchase declines from 16.7% to 13.8% (21% decline) in villages where govt. programs were operating at relatively high level
 - ❑ Evidence of “crowding out”

Findings (cont.)

5. “Crowding out” partially driven by poor targeting

Zambia	Total Income	Assets	Landholding size
	'000 kwacha per capita		ha per capita
Fertilizer source:			
<i>Households not acquiring fertilizer:</i>	266	173	.15

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<i>Households not acquiring fertilizer:</i>	266	173	.15
<i>Cash purchases from private retailers:</i>	774	342	.20
<i>Government Fertilizer Support Program (50% subsidy)</i>	804	425	.23

Findings (cont.)

6. Households with civil service employee were 32 percentage points more likely to receive fertilizer in Zambia.
 - 16.7% vs. 49% probability

Conclusions:

1. Within both Kenya and Zambia: regional variation is greatest source of variation in fertilizer / hybrid seed use
 - ❑ Most likely reflects underlying profitability
2. Relationship between wealth and fertilizer use:
 - ❑ Wealth effect disappears in Kenya after controlling for regional differences
 - ❑ Wealth effect still important in Zambia

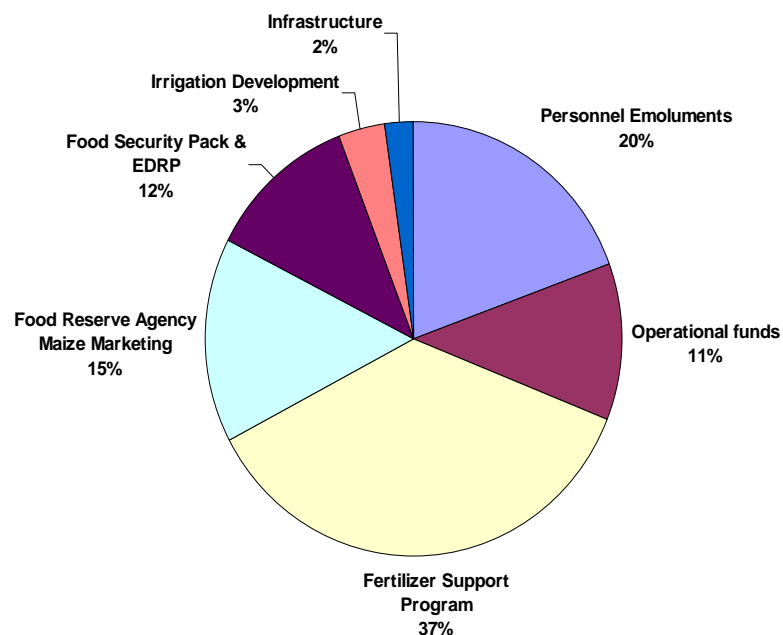
Conclusions (cont):

3. Importance of education
4. Importance of proximity to fertilizer retailer / paved roads
 - ❑ Need policy environment that supports investment in rural retailing
 - ❑ Investment climate markedly different in Zambia and Kenya

Conclusions (cont):

5. Private sector response to reform depends very much on
- ❑ how reform is implemented
 - ❑ Investment in complementary public goods

Public budget allocation to agricultural sector, Zambia, 2005





zikomo, asante sana

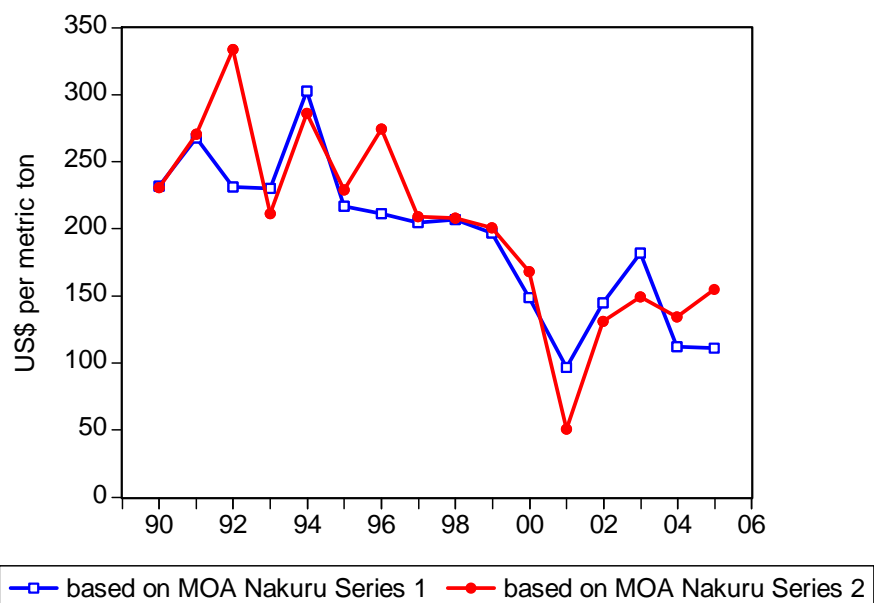
Fertilizer Consumption Changes (mean 1996-2002 / mean 1990-95)

Fertilizer use intensity	% growth in fertilizer use intensity (kg/ha cultivated) (mean 1996-2002 / mean 1990-95)	
	< +30%	> +30%
< 25 kg/ha	DRC (0.5, -47%)	Uganda (0.6, +237%)
	Angola (0.7, -69%)	Rwanda (1.8, +89%)
	Niger (0.9, +5%)	Mozambique (3.2, +142%)
	Guinea (2.0, -4%)	Ghana (3.6, +68%)
	Burundi (2.3, -6%)	Chad (4.3, +93%)
	Madagascar (2.9, -8%)	Cameroon (5.9, +77%)
	Mauritania (4.0, -64%)	Togo (7.0, +30%)
	Tanzania (4.8, -47%)	Cote d'Ivoire (11.8, +53%)
	Gambia (5.2, +15%)	Botswana (11.8, +294%)
	Nigeria (5.6, -73%)	Senegal (13.2, +67%)
	Burkina Faso (5.9, -28%)	Ethiopia (14.4, +71%)
	Zambia (8.4, -34%)	Benin (17.6, +76%)
	Mali (9.0, +7%)	Lesotho (23.2, +35%)
	> 25 kg/ha	Swaziland (30.5, -40%) Malawi (30.8, +9%) Zimbabwe (48.3, +9%)

Characteristics of smallholder farmers, Zambia 1999/00

	N=	Farm size (ha)	Asset values (US\$)	Gr. Rev., maize sales (US\$)	Gr. Rev., crop sales (US\$)	Total hh income (US\$)
Top 50% of maize sales	14,261	9.0	1,160	690	729	2,534
Remaining maize sellers	272,805	3.9	233	74	97	607
Households not selling maize	839,855	2.8	163	0	26	362

Nakuru - Mombasa Cost Differences (Di-Ammonium Phosphate, US\$/tonne nominal)



Price ratios, wholesale maize / DAP fertilizer at Nakuru (Ksh 90kg maize / Ksh 50kg fertilizer)

