

The Impact of Subsidies on Commercial Demand. Evidence from sub-Saharan Africa



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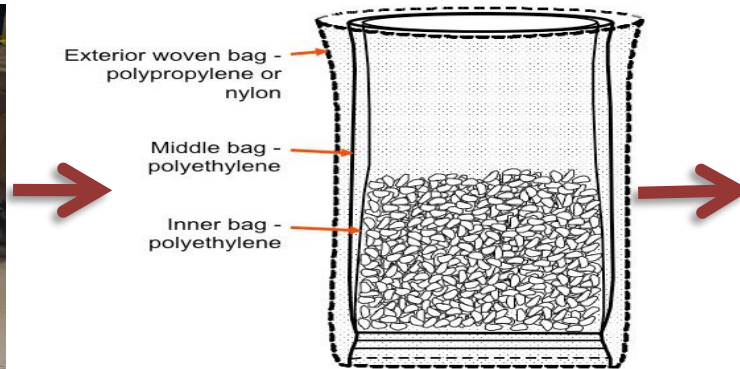
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Technology Intervention – PICS Bags

Traditional storage technologies in Africa are ineffective at preventing loss

- grain PHL is estimated at 10-20% of production, valued at \$4b annually (World Bank, 2011)



Courtesy: Murdock et al., 2014



- PICS developed by Purdue Scientists in collaboration with African partners during 1980's-90's
- Currently being deployed across Africa to prevent post-harvest loss with funding from BMGF.

PICS is a new technology.

QUESTION: How do you get people to adopt/buy it?

Effective, but upfront cost is higher than traditional storage.

- PICS = \$2.50, lasts 2-3 years
- Normal bags = \$0.50, last one year (max)
 - No insect protection
 - Need to buy chemicals
- PICS more cost effective after 1-2 years



Is there a role for a PICS bag subsidy?

Pros

- Provides new information
- Reduces financial risk
- Creates opportunity to share information among farmers
- May buy more bags in the future?

Cons

- May displace or crowd out commercial purchases.
Buy fewer bags in future?
- Money spent on subsidy could go to other things (opportunity cost)

Displacement / Crowding out

Whenever a project or program gets involved in a market where private sector is active, there may be some impact.

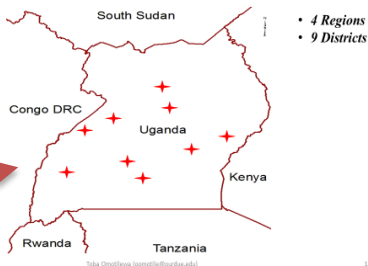
- Part of the discussion in the U.S. healthcare debate
- Big question is how much the subsidy reduces commercial purchases, (if at all).
- Matters for efficiency of the program and use of project or public funds.

Set up a study to estimate this in Uganda

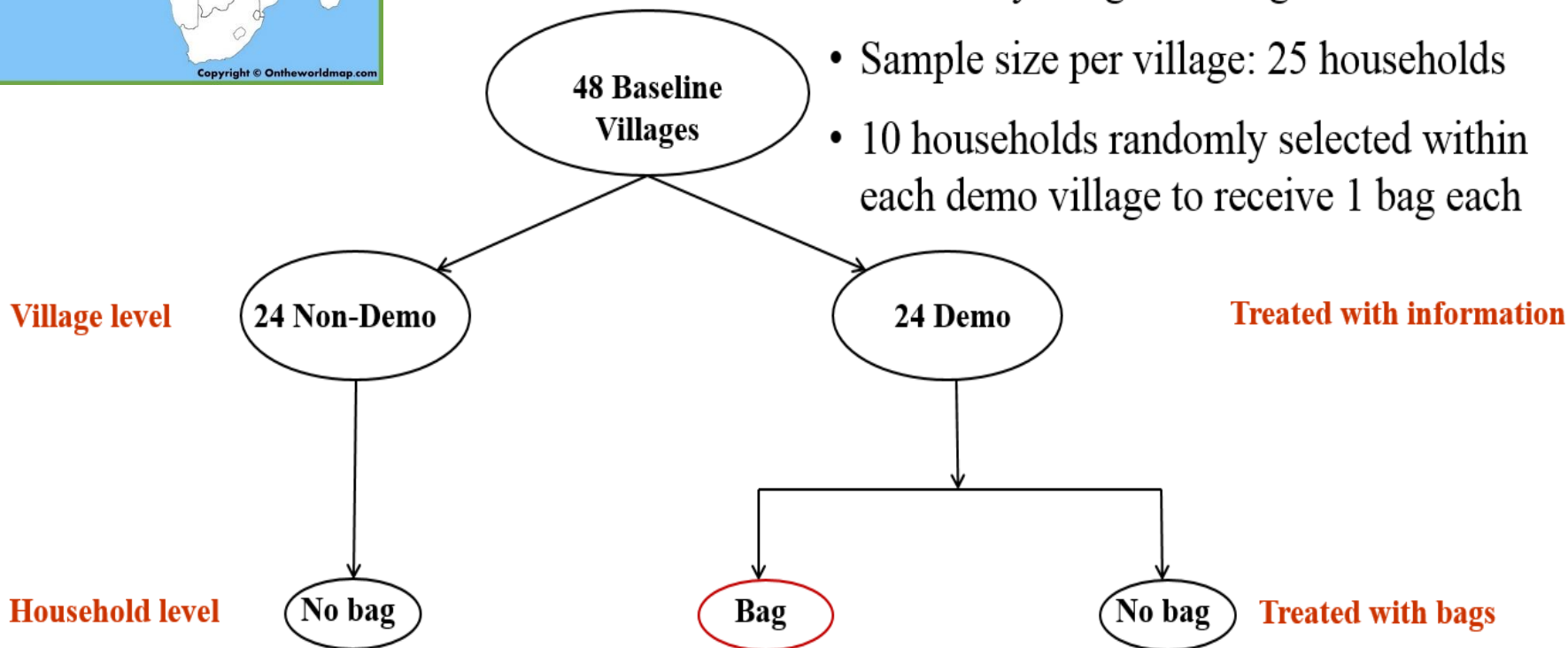


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Sampling



- Randomly assigned village demonstrations
- Sample size per village: 25 households
- 10 households randomly selected within each demo village to receive 1 bag each



Timeline of study

*Baseline Survey
(2014)*

*Intervention
(2015)*

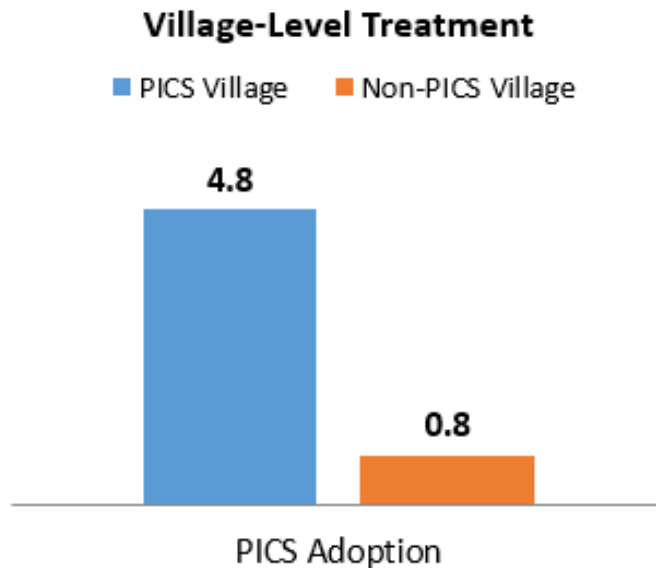
*Post-intervention survey
(2016)*

Awareness Building Demonstrations



By 2016 Adoption in Uganda was not high yet, but grew from zero in 2014

Percentage of households adopting PICS by first season 2016



- Households in PICS demo-villages more likely to adopt

Need to reach people in non-demo villages

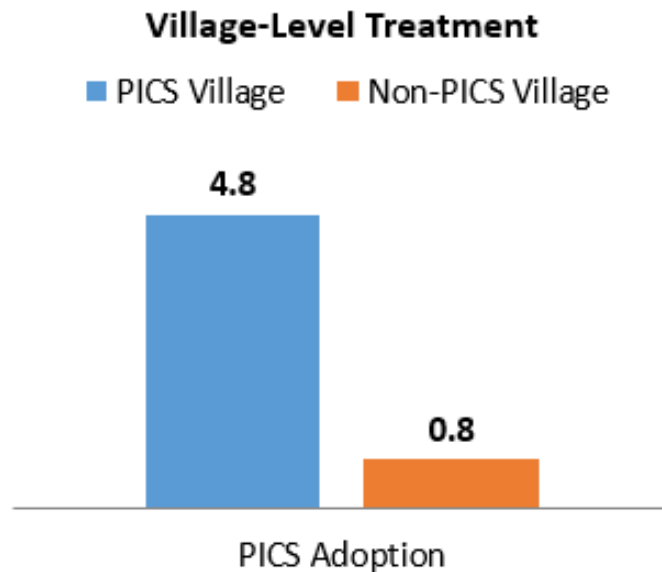
Crowding out/in Question

Question: Compared to other households, the households who got one free bag were?

1. More likely to buy another bag at full price.
2. Less likely to buy another bag at full price.
3. No different

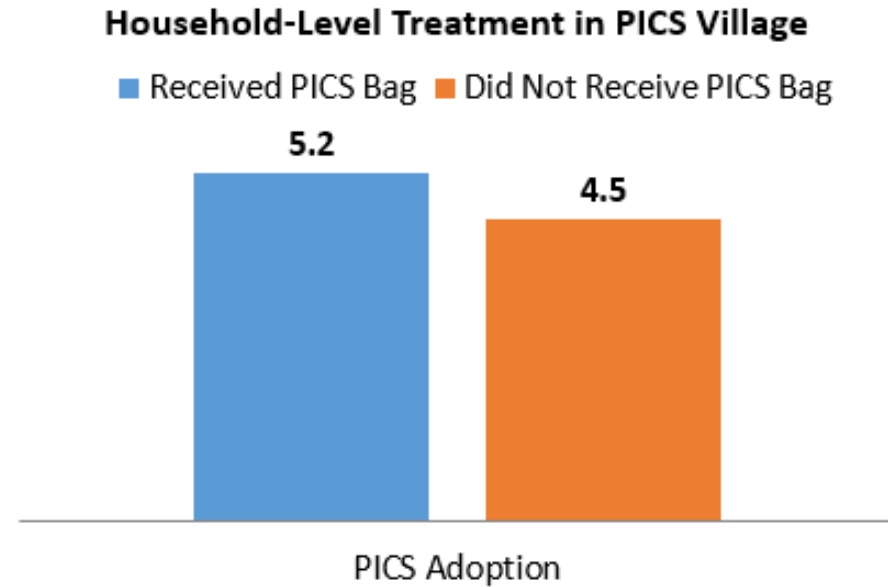
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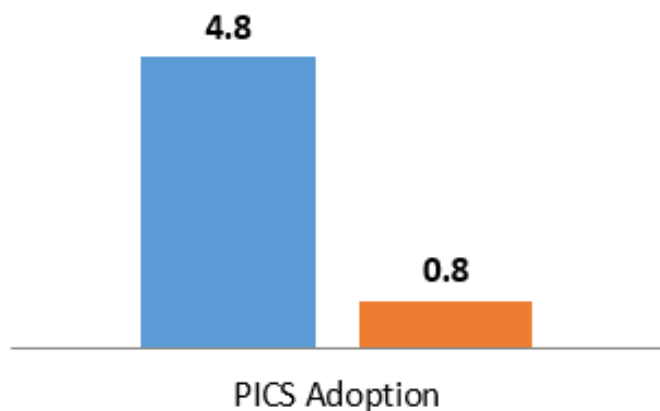


- Households given a free bag within PICS demo villages slightly more likely to go out and buy another

By 2016 Adoption in Uganda was not high yet, but grew from zero in 2014

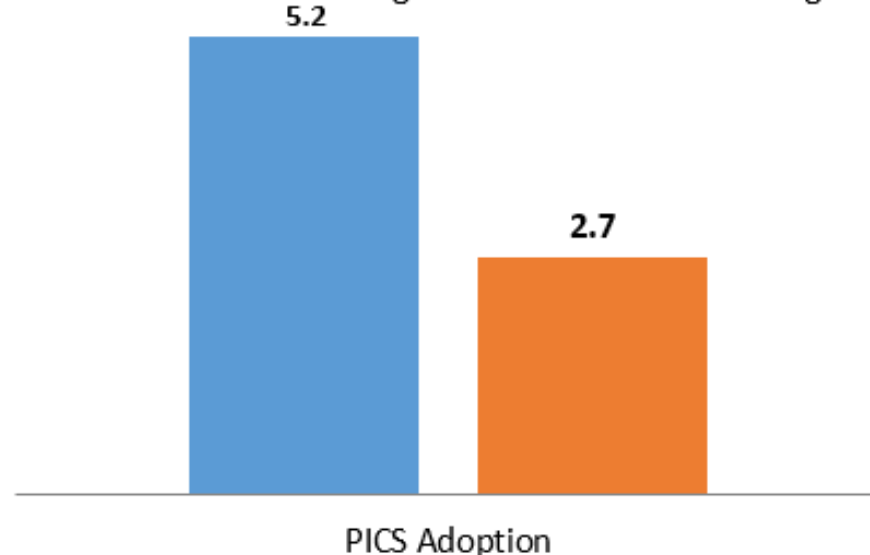
Percentage of households adopting PICS by first season 2016

Village-Level Treatment
■ PICS Village ■ Non-PICS Village



- Households in PICS demo-villages more likely to adopt

Household-Level Treatment
■ Received PICS bag ■ Did not receive PICS bag



- Households given a free bag within PICS demo villages more likely to go out and buy another compared to whole sample

Need to reach people in non-demo villages

Conclusions on PICS bag subsidy

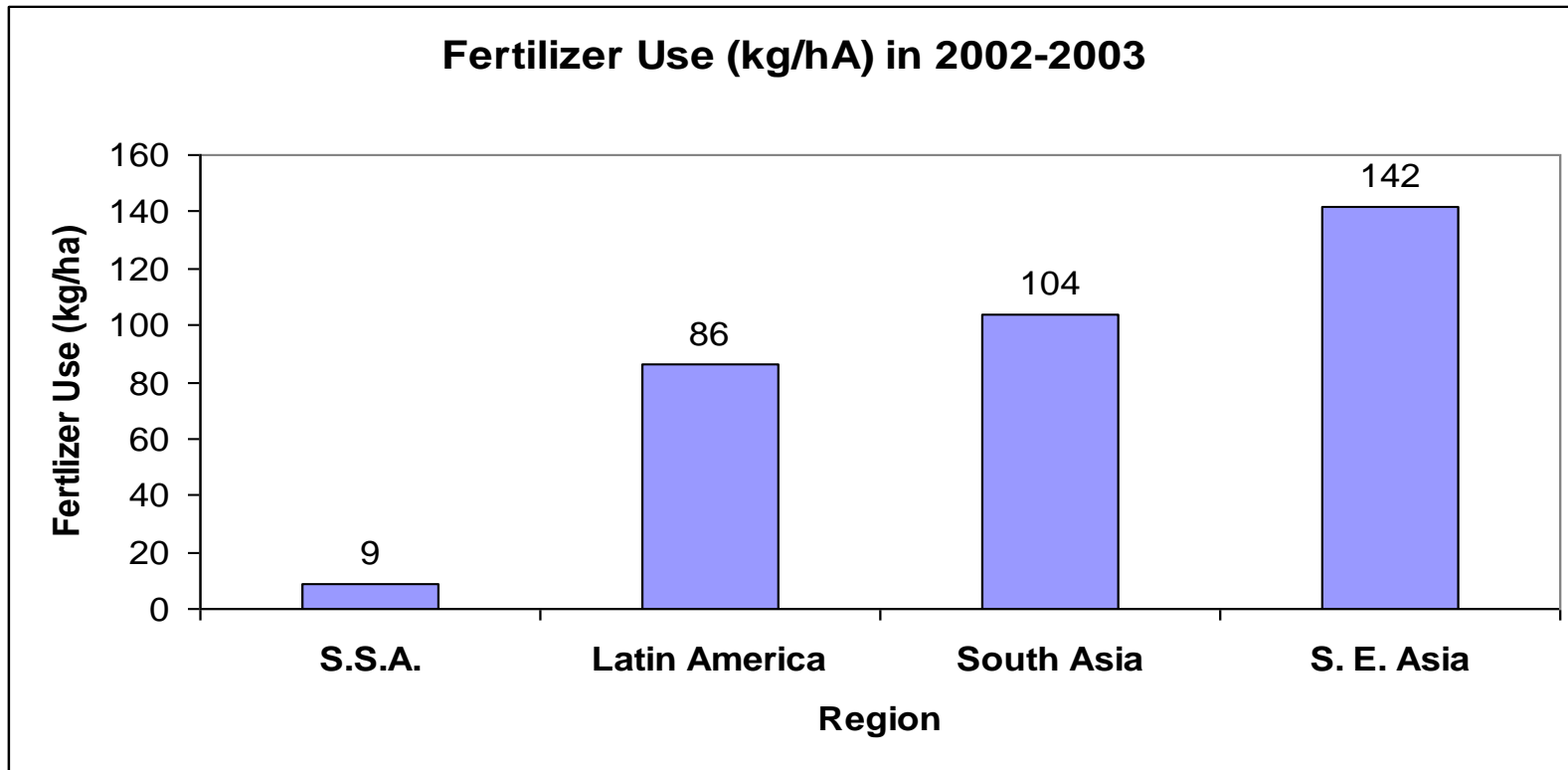
- New product, limited/one-time subsidy seemed to increase commercial purchases (**crowding-in**)
- Subsidy creates information, and reduces risk for people to try out PICS
 - Potentially tell others about it
- Plan to return in a few years to do follow up to see longer term effects.

New Example: Another input heavily subsidized in Africa

- Inorganic/mineral fertilizer
 - Nitrogen, Phosphorus, Potassium (NPK)
 - Urea



Sub Sahara Africa (SSA) has the lowest fertilizer use of any developing region in the world.

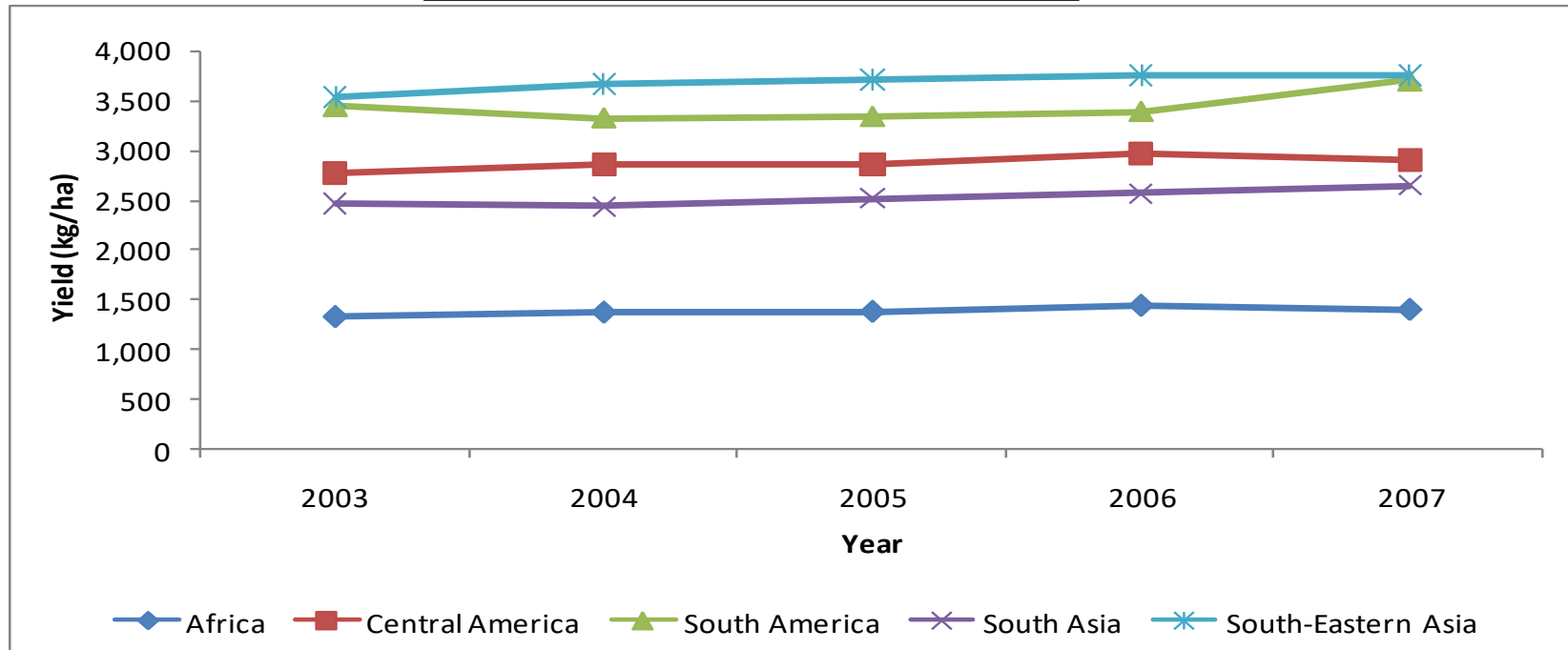


(Crawford et al. 2006)

Fertilizer use is low in Africa but it is not a new product. Available for purchase for 40+ years in many countries.

African cereal yields lower than other regions of the world.

Cereal Yield 2003-2007



Five Year Average Yield

Africa = 1,383 S. America = 3,438
S. Asia = 2,524 S.E. Asia = 3,682
C. America = 2,868 Midwest = 12,500

(FAOSTAT)

Policy side: view of low fertilizer use inspired Abuja declaration in 2006

- Many governments in SSA committed to increasing smallholder inorganic fertilizer use.
 - Part of Comprehensive African Agricultural Development Process (CAADAP)
 - Often achieved through input subsidy programs (ISP)
 - Belief that it would drive productivity and rural development
- 10 countries spent US \$1.05 billion in input subsidies in 2011 (Jayne and Rashid 2013).
- Equivalent to 28.6% of public spending on agriculture.

Expenditures of Input Subsidy Programs

Country	Annual Program Cost (USD million)	% of Ag Budget
Malawi	152 to 275	47 to 71%
Tanzania	92 to 135	39 to 46%
Zambia	101 to 135	21 to 40%
Senegal	36 to 42	26 to 31%
Ghana	53 to 112	20 to 31%
Nigeria	108 to 190??	?? (officially 26%)
Kenya	22 to 81	9 to 26%

Source: Jayne and Rashid (2013)

Why is fertilizer use so low?

- People don't have credit to buy fertilizer, seed and other inputs.
 - Must have cash at planting and wait to get paid at harvest
- Not profitable to use inputs given the price of fertilizer and the price of corn in many places
 - High transport costs
 - Lots of risk
- People may not know how to use fertilizer efficiently.



Example: Malawi implemented a large fertilizer subsidy program in 2005/06



- Former British colony
- Slightly smaller than Pa.
- 14 million people
- GDP per capita US\$800 PPP
- Agriculture employs 90% of population
- 14% pop. Infected with AIDS in 2003

**Most people engaged in subsistence maize (corn) growing.
Majority of poor are net consumers of food.**

“Malawi Shows Obama’s Goal for African Self-Reliance is Possible”



Bloomberg News: July 17, 2009

According to the Article:

Malawi Government ignored international recommendations and subsidized fertilizer.

Program started in 2005/06

Program Cost:

US \$73 million in first year; \$127 million next year; around \$200 million now.

15% of National budget in 2008/09

Other countries now subsidizing too.



As with any policy, there are pros and cons to subsidizing fertilizer.

Pros

- May be cheaper than subsidizing food.
- Can boost domestic production
- May increase food security

Cons

- Displacement/crowding out. May not be contributing to total fertilizer use
- Encourage less efficient fertilizer use
- Many other uses for the money (opportunity cost)

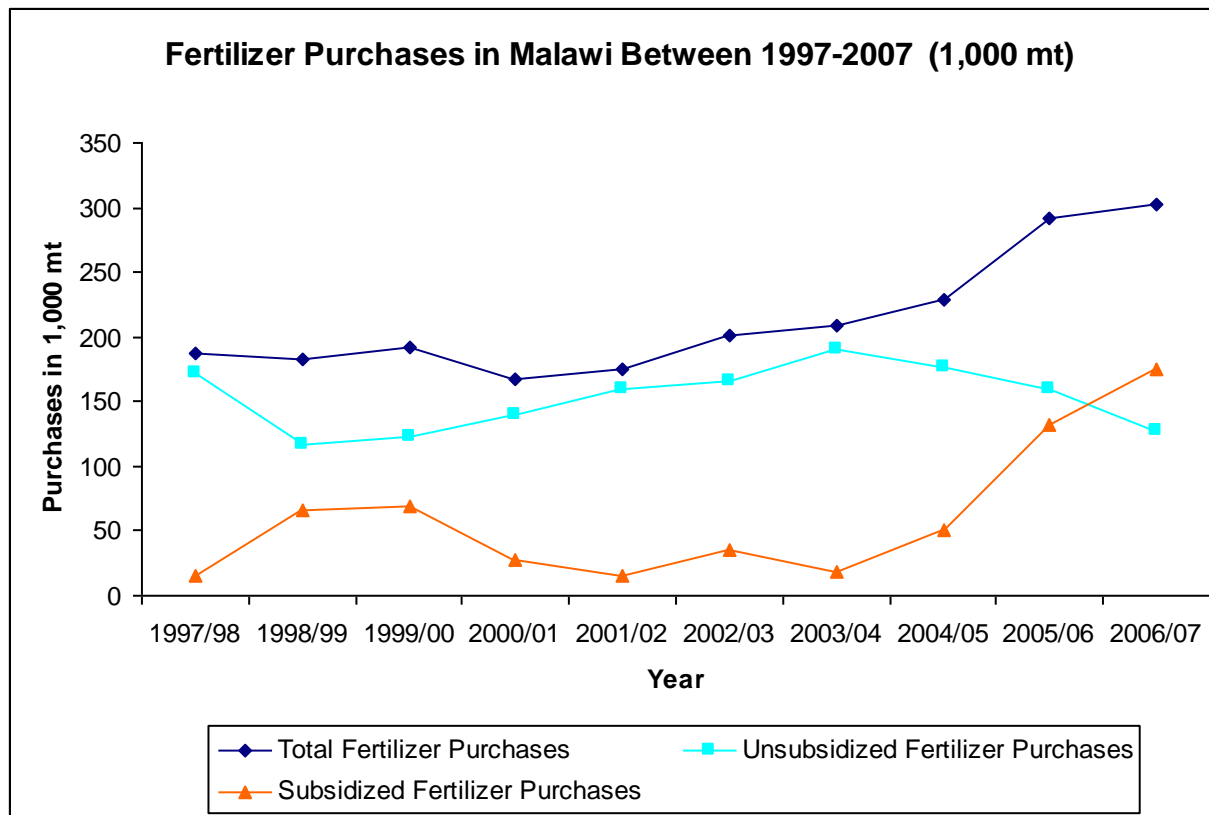
This policy should be thoroughly evaluated.



Fertilizer Coupon Allocation

- Distributed regional level based on area under cultivation
- Methods for local coupon allocation had the potential to vary across villages.
 - Village leaders & distribution committee
 - Need to understand who was targeted?

Malawi distributed 147,000 mt of subsidized fertilizer In 05/06



Source: Malawi 2006/07 Agricultural Input Subsidy Evaluation

Subsidized purchases and total purchase have increased. But commercial purchases have declined.

Some findings on Crowding Out in Malawi

Source of fertilizer	Years before Subsidy (in kg)	Years after subsidy (in kg)	Difference (in kg)
Subsidized	10,333	184,252	173,919
Commercial	158,209	60,648	-97,561
Total Fertilizer per Year	168,542	244,900	76,358

- Subsidized fertilizer use up.
- Commercial fertilizer use down.
- Total fertilizer use up but evidence of displacement

Does not consider all the factors that affect fertilizer use

Findings: Factors that affect how much subsidized fertilizer a farmer receives in Malawi

Positive Effect

(Make you get more)

- Distance to road
- Assets
- Land
- Rainfall
- Number of elderly men
- Years lived in village

Negative Effect

(Make you get less)

- Female headed household
- Number of elderly women in home

Factors that affect how much commercial fertilizer a farmer buys

Positive Effect

(Make you buy more)

- Land
- Assets
- Maize price
- Rainfall

Negative Effect

(Make you buy less)

- Subsidized fertilizer
- Distance to market
- Fertilizer price

On average people who get a kg of subsidized fertilizer buy

**0.22 kilograms less
commercial fertilizer**

So on average 100 kg of subsidized fertilizer adds only 78 kg of new fertilizer to total fertilizer use

Displacement = -0.18 for the poorest 20%
& -0.30 for the wealthiest 20%

Fertilizer use has gone up, but maize:fertilizer response rates are low

Recent Estimates of Maize Response to Nitrogen Applications in SSA

Study	country	Agronomic response rate (kgs maize per kg N)
Morris et al (2007)	W/E/S Africa	10-14
Sheahan et al (2013)	Kenya	14-21
Marenja and Barrett (2009)	Kenya	17.6
Liverpool-Tasie (2015)	Nigeria	8.0
Burke (2012)	Zambia	9.6
Snapp et al (2013)	Malawi	7.1 to 11.0
Holden and Lunduka (2011)	Malawi	11.3
Pan and Christiaensen (2012)	Tanzania	8.5 to 25.5
Minten et al (2013)	Ethiopia	11.7

(adapted from Jayne & Rashid, 2013, and Burke et al. 2015)

Most of these response rates are too low to break even in a benefit/cost ratio setting, (other than maybe Kenya)

ISP vs other long run investments

Returns in Ag Growth to Investments & Subsidies in India, 1960-2000

Returns to Ag. GDP	1960's		1970's		1980's		1990's	
Rup. prod/Rup. spent	Return	rank	Return	rank	Return	rank	Return	rank
Road investment	8.79	1	3.80	3	3.03	5	3.17	5
Education investment	5.97	2	7.88	1	3.88	3	1.53	3
Irrigation investment	2.65	5	2.10	5	3.61	4	1.41	4
Irrigation subsidies	2.24	7	1.22	7	2.28	6	NA	6
Fertilizer subsidies	2.41	6	3.03	4	0.88	8	0.53	8
Power subsidies	1.18	8	0.95	8	1.66	7	0.58	7
Credit subsidies	3.86	3	1.68	6	5.20	2	0.89	2
Agriculture R&D	3.12	4	5.90	2	6.95	1	6.93	1

Source: Fan et al. 2007

Compare with R&D investment in Africa (Fuglie and Rada 2013):

- National research B/C = 1.6 for small countries; 4.4 for large countries
- International CGIAR research B/C = 6.2 across Africa

Conclusions about fertilizer markets and fertilizer subsidies

- Fertilizer subsidies may be ok in the short term
 - Introduce farmers to fertilizer if they are not familiar
- Subsidies need to be targeted to people who don't buy commercially
 - Reduces crowding out of commercial fertilizer and does not harm the private sector
- In the long run investments in roads and infrastructure lowers fertilizer price makes using it more profitable.
- Develop banking and agricultural credit system.

Overall conclusions on subsidies

Our two examples of agricultural technologies from Africa suggest that.

- 1) Subsidies may make sense if they are limited, short-term for a new product.
 - i) Provide information
 - ii) Reduce financial risk
- 2) For an existing product/service, need to understand why people are not buying it and what constraints they face to buying it.
- 3) Viable commercial markets are important in the long-run but some degree of crowding out may be ok, if new people are adopting from subsidy.

Thank you for your time!



Questions / Comments?

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