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Evaluating Kenya's National Fertilizer Subsidy Program: Implementation, Crowding-out, and Benefit-Cost Assessment

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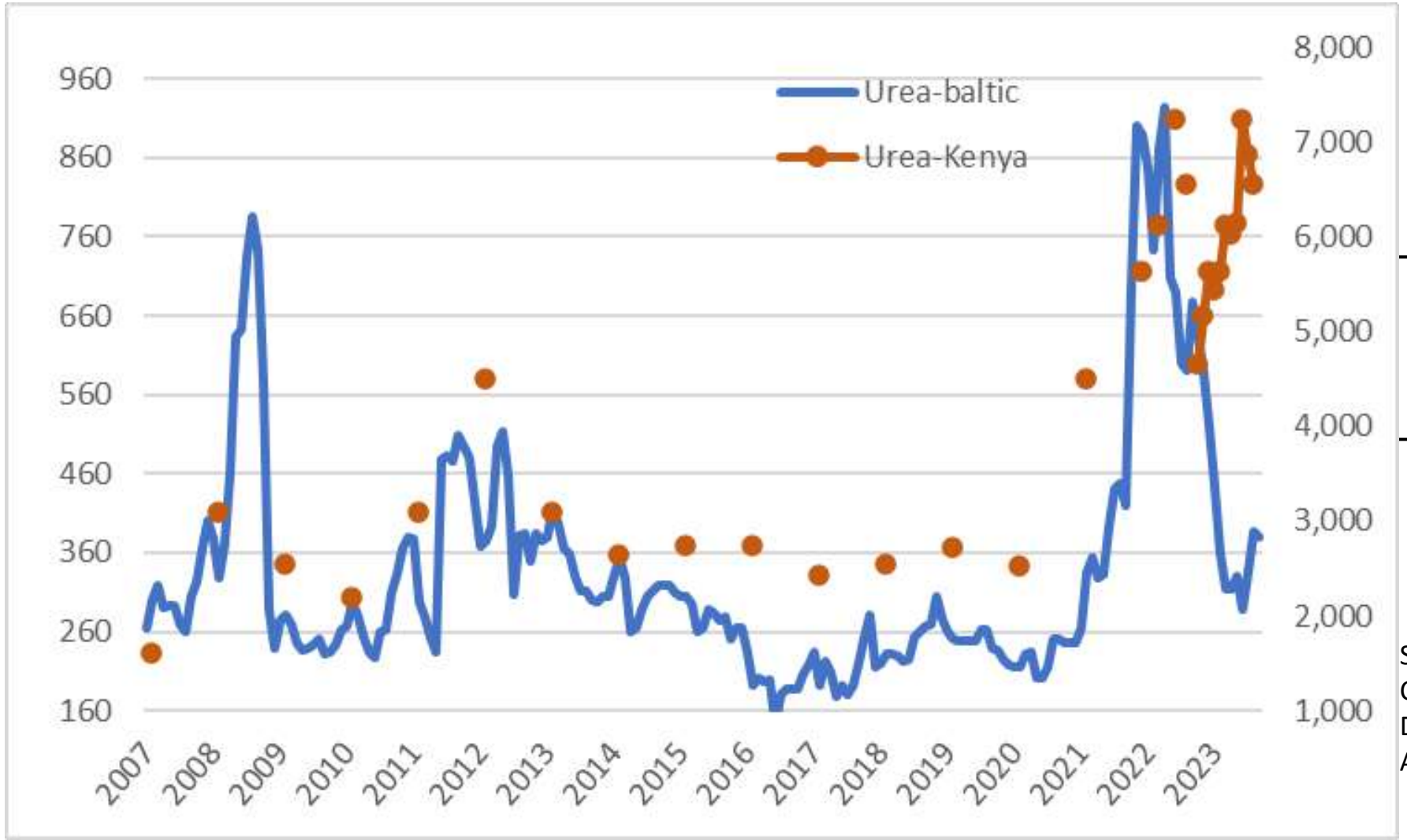
Background: Kenya's recent experience with ISPs

- 2017-present: Government piloted & scaled up National Value Chain Support Program (NVSP) ("e-voucher program")
  - improved design of prior targeted voucher programs (NAAIAP) that works through a private sector-friendly design: government distributes vouchers, private sector imports, distributes, retails program fertilizer
  - This supports development of private sector fertilizer supply chain
  - govt scaled it up to 27 counties; planned to scale up to all counties
- 2018: The government ended the National Fertilizer Price Stabilization Program (NFPSP) (managed by NCPB), due to various implementation problems and concerns
  - Because the government distributed & retailed subsidized fertilizer – private sector supply chain actors complained about crowding-out of commercial fertilizer sales
  - Farmers complained about late delivery of subsidized fertilizer
  - long distance to NCPB depots constrained smaller farmers from

International (FOB) urea price vs. Kenya retail price 2007-2023

Figure 1: Monthly Urea Fertilizer Prices: FOB Baltic ($US), Retail Kenya (KSh/50-kgbag) (2007-2023)



Source: World Bank Commodity Price Data (Pink Sheet), Africafertilizer.org

Government of Kenya's (GoK) Response

- April 2022 – in response to spike in food and fertilizer prices to levels not seen since 2007/08 international food price crisis:
- GoK reintroduced the government supply chain input subsidy approach, now called National Fertilizer Subsidy Programme (NFSP); implemented thru KNTC and NCPB
  - in 2022 long rains, NFSP fertilizer arrived too late for most farmers to use
- Sept 2022 – New government came to power; it had announced during campaign that it would implement an ISP for the 2023 long rains season
  - New govt could have scaled up the private sector-friendly NVSP
  - Instead, it scaled up the NFSP dramatically, while scaling down NVSP significantly
  - late 2022, Government procured 472,500 MT of fertilizer for NFSP
  - Estimated cost of fertilizer was KSh 54.3 billion ($US 543 million)
  - 175,060 MT of subsidized fertilizer sold to farmers by 30 June 2024 (37% of total NFSP stock – the rest over the following two seasons)

Main research questions

1) Who **benefited** from NFSP?
   - What share of farmers obtained NFSP fertilizer? Household characteristics? How much fertilizer did they acquire?

2) How was their **access** to NFSP fertilizer?
   - How far did farmers travel to obtain NFSP fertilizer and what types of fertilizer did they receive? Was subsidized fertilizer received in time for planting?

3) Estimate **crowding-in/out** of farmers' commercial fertilizer demand
   - If yes, to what extent?

4) What was the **cost-effectiveness** of NFSP in 2023 & 2024:
   - Used Benefit-cost analysis used to estimate Benefit-Cost Ratio

- **Overarching objective of the research –** provide evaluation of NFSP performance for GoK, other local policymakers & stakeholders to inform policies for future fertilizer or food price shocks.

Primary Data: Phone Survey conducted in Kenya (Sept. & Oct. 2023) - GeoPoll

- Random sample of farmers in 38 of 46 counties
  - Excluded some northern counties (Arid & Semi-Arid) & urban counties
- Targeted adult respondents (18+) belonging to households that were engaged in crop agriculture in the long rains season in 2023.
  - and who had some role in making farm decisions in the household
- Sample size: 1,510 farmers
- Sample representative of crop farmers in 38 sampled counties

- Questionnaire: Asked farmers about fertilizer use, fertilizer sources & prices, maize production, household characteristics, etc in both 2022 & 2023

Results: Inorganic fertilizer use in 2023 LR

- 76% of Kenyan farmers used inorganic fertilizer in 2023 long rains (LR) – commercial or subsidized
- 57% of farmers purchased commercial fertilizer
  - 84% of farms obtaining comm. fertilizer applied it to maize; 46% to beans
- 25% of farmers acquired subsidized fertilizer:
  - 19% from NFSP, 8% from county subsidy programs
  - 96% of farm obtaining NFSP fertilizer applied it to maize; 54% to beans

Results: Access to NFSP subsidized fertilizer

Registration, SMS notification, acquisition

- 48% of Kenyan farm households registered to obtained subsidized fertilizer from NFSP in 2023
- 32% of farms received an SMS notification
- 19% of farms obtained subsidized fertilizer from NFSP
- Characteristics of farmers more likely to register and receive NFSP fertilizer in 2023
  - larger farm size
  - related to community leader(s)
  - higher education of HH head
  - purchased commercial fertilizer in 2022

Results: Access & Timeliness

Distance to subsidized & commercial fertilizer:

- Average distance traveled to obtain NFSP fertilizer (NCPB depot or KNTC sale point) was 16km, compared with 9 km to obtain commercial fertilizer
- median cost of transport: 200 Ksh/50kg bag from NCPB; 100 KSh/50kg commercial
- Farmers traveled farther to obtain NFSP fertilizer compared with commercial fertilizer

Timeliness of fertilizer availability

- Farmers typically acquired NFSP fertilizer in first week of April 2023
- this was two weeks later than commercial fertilizer acquisition, on average

Results: Distribution of NFSP fertilizer by farm size

Category #1: 0 – 2 acres of land | #2 >2 acres & <= 5 acres | #3: > 5 acres

- Farms w/<=2 acres:
  - 62% of sample, 27% of total land
  - 21% obtained NFSP fertilizer; accounted for 34% of all NFSP fertilizer
  - average fertilizer application rates: 21 kg/acre (subsidized); 23 kg/acre (comm)
- Farms with 2-5 acres:
  - 27% of sample, 37% of total land
  - 29% obtained NFSP fertilizer; accounted for 32% of all NFSP fertilizer
  - average fertilizer application rates: 14 kg/acre (subsidized); 13 kg/acre (comm)
- Farms with 5+ acres:

Crowding out of farmers' commercial fertilizer demand

- Because farmers who receive subsidized fertilizer may have purchased commercial fertilizer in the absence of an input subsidy program, the degree to which each 100 kg of subsidized fertilizer increases total smallholder fertilizer use -- and thus improves food security -- depends on the extent to which the 100 kg of subsidized fertilizer crowds-out (or crowds-in) farmers' purchases of commercial fertilizer (Ricker-Gilbert et al. 2011).
- For eg, an empirical study from the Rift Valley (2014/15 and 2015/16) found that 100 kg of subsidized fertilizer crowded out -20 kg of commercial fertilizer purchases (Makau et al, 2018).
  - This implies a net increase total fertilizer use of 80 kg for every 100 kg of subsidized fertilizer (i.e. 100 – 20 = 80)

Result 3: How much commercial fertilizer was crowded out by the NFSP and county programs?

- Our study finds that in 2023, one kilogram of subsidized fertilizer reduced farmer commercial fertilizer purchases by **0.22 kilograms (-0.22 = 22%)**, on average
  - Thus, every 100 kgs of subsidized fertilizer added 78 additional kgs to total fertilizer use (i.e. 100 kgs of subsidized fert – 22 kgs of commercial fert = 78 kgs total fert)

Table 1: Crowding out by farm size group

FARM SIZE	MEAN	P-VALUE	N
<=2 ACRES	-0.21	(0.00)	933
BETWEEN 2 AND 5	-0.22	(0.00)	410
> 5 ACRES	-0.27	(0.00)	167

Table 2: Crowding out by Asset quintile

FARM SIZE	MEAN	P-VALUE	N
POOREST 20%	-0.20	(0.00)	303
20 - 40%tile	-0.20	(0.00)	281
40 - 60%tile	-0.21	(0.00)	354
60 - 80%tile	-0.22	(0.00)	297
RICHEST 20%	-0.27	(0.00)	275

- Overall: larger-scale, wealthier farmers had more of their commercial purchases crowded out by the subsidy in 2023.
- Larger scale farmers have the resources to buy commercial fertilizer, so will use subsidies the subsidy to offset the costs of their purchases.

Result 4: What was the economic impact and cost-effectiveness of NFSP?

- Financial Benefit-Cost Ratio = Incremental benefits / costs of program
  - BCR > 1.0 means that benefits exceeded the costs of the program
- BCR for 3 seasons = 1.11
- BCR for 3 seasons = 1.22 if program had been implemented through private sector (such as NVSP)
  - Using NVSP approach would have caused only 6% of the financial losses to private sector fertilizer supply chain actors as experienced with NFSP

<u>BCR is usually compared with Alternative Investment options:</u>

- Investment in public goods ag R&D, roads, & policy

Recommendation 1: Implement fertilizer subsidy program through the private sector – using a program like NVSP

1) In a crisis, an input subsidy program may be needed – but continuing to implement a large-scale ISP like NFSP that does not work through private sector supply chain will lead to significant negative impacts in short-, medium- and long-term on it and on farmers.

Short- to medium-term:

Smaller fertilizer importers, wholesalers & agrodealers may go out of business

→ Less competition in importation, wholesaling, and retailing of fertilizer

→ Farmer fertilizer costs will increase; those in some areas may no longer be at feasible distance from agrodealer that has fertilizer

Recommendation 2: Return to targeted, limited quantity subsidies; provide public goods & good enabling environment

2) A targeted approach with more limited subsidy benefits per farmer is much more effective and cost-efficient than untargeted for increasing inorganic fertilizer use (studies from various countries)
   - Can reach farmers that most need financial help in a crisis (or small amount at other times for learning/experimentation)
3) During a price crisis, Govt could scale up a private sector friendly targeted subsidy program by modifying targeting criteria to reach farmers with a bit more land
   - Yet, political economy challenge remains -- it is difficult for any government to phase out or take away subsidies
4) In long-term, keys to sustainable increases in

Recommendation 3: Approach crop productivity more holistically – fertilizer alone cannot sustain yield growth

- This was a key theme of the recent Africa Fertilizer Soil Health Summit 2024
- Focusing solely on inorganic fertilizer access is not very efficient because Maize-Fertilizer response rates are currently low compared to potential, due to low soil quality
- Subsidizing fertilizer price as the predominant or only strategy can be counter-productive for soil health of many farmers
- NEEDED: Provision of public good investments in extension to improve farmer adoption of complementary soil & crop management practices are key to sustainable increases in crop productivity
    - i.e. Crop rotation, intercropping maize with legumes, access to cost-effective soil sampling to better identify

ASANTE!! Questions / Comments?

QR code to view or download a Policy Brief from the forthcoming report

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EXTRA SLIDES

Background: Kenya's experience with input subsidies

- In response to regional & international food price crisis 2007/08, Kenya scaled up two input subsidy programs:

1. National Accelerated Agricultural Input Access Program (NAAIAP)
   1. Used existing private sector input supply chain: government distributes vouchers, private sector imports, distributes & retails the program fertilizer
   2. Helps develop private sector fertilizer supply chain
2. National Fertilizer Price Stabilization Plan (NFPSP)
   1. NCPB procured imported fertilizer thru auction; NCPB then distributed and retailed to farmers it at subsidized prices via NCPB depots
   2. Undercuts & crowds-out private sector fertilizer supply chain actors

Background: Kenya's experience with input subsidies

- 1996 to 2007: Significant growth of Kenya's private sector fertilizer supply chain
  - Liberalization of fertilizer, maize markets and foreign exchange created a predictable and supportive enabling environment for private sector investment in production & marketing of fertilizer and maize, cash crops, horticulture
  - Extensive public investment in road infrastructure
  - Together, this environment facilitated significant long-term investments in the private sector fertilizer supply chain in Kenya– this has been seen a continental success story.
  - For e.g., between 1997 to 2007, the average distance from farmer to nearest agrodealer fell by 73% in lower potential zones; by 34 percent in higher potential zones.
- 2008/09: Kenya scaled up two programs to respond to regional & international price crisis 2007/08:
  1. National Accelerated Agricultural Input Access Program NAAIVS) –

Results: Distribution of NFSP fertilizer by farm size

Category #1: 0 – 2 acres of land | #2 >2 acres & <= 5 acres | #3: > 5 acres

- Farms w/<=2 acres: accounted for 62% of farmers in the sample (37 counties) but cultivated a relatively small share of the total land (27%)
  - 21% obtained NFSP fertilizer; accounted for 34% of all NFSP fertilizer

- Farms with 2-5 acres: 27% of sample, 37% of total land
  - 29% obtained NFSP fertilizer; accounted for 32% of all NFSP fertilizer

Result 4: What was the economic impact and cost-effectiveness of NFSP?

Costs of implementing NFSP include:

- Cost of the program fertilizer
  - Govt costs to purchase program fertilizer + handling/distribution from port to NCPB depots + NCPB retail costs; farmer transport costs to access NFSP fertilizer
  - Farmers paid 64% of costs, govt paid 36% in 2023 LR. Since then, farmers have paid 46%, government paid 54%
- Administrative/management costs to run NFSP (assumed to be 5% of total)
- Financial losses incurred by private sector importers, distributors, and agrodealers
  - Demand-side crowding out of farmers' commercial fertilizer demand

Result 4: What was the benefit-cost ratio of the NFSP in 2023 Long Rains?

Benefits of NFSP include the value of additional maize production, which is attributable to NFSP:

1) Additional quantity of inorganic fertilizer used by farmers, attributable to NFSP
   - for each 100kg of subsidized fertilizer received, a farmer increases their total fertilizer use (subsidized + commercial) by 65 kg
2) Additional fertilizer applied to maize → Additional quantity of maize produced
   - 5.48 kg of maize for each kg of fertilizer
3) Valued additional maize at the average farmgate price of white maize in post-harvest period (Nov-Dec 2023)

Result 4: What was the benefit-cost ratio of the NFSP in 2023 Long Rains?

- Costs = Govt costs to purchase program fertilizer + handling/distribution from port to NCPB depots + NCPB retail costs

ITEM	EXPENDITURE
Quantity of fertilizer purchased by KNTC	= 472,500 MT
Quantity of fertilizer distributed to farmers by 30 June 2023	= 175,060 MT
Govt cost of NFSP fertilizer at NCPB retail	= KSh 5,450 / 50kg = US $886 / MT
Private sector retail price of same fertilizer	= KSh 5,473 / 50kg = US $869 / MT
Farmer subsidized price of NFSP fertilizer	= KSh 3,500 / 50kg = US $569 / MT
Govt cost share of NFSP fertilizer + 5% admin costs	= US $58,939,957

Key features of the NVSP (2017-) & NFSP (2023-)

	NVSP (2017-)	NFSP (2023-)	
	Private-sector friendly?		
Distribution & retailing of subsidized inputs	Private sector	Government (NCPB depots, KNTC sale points)	NVSP supports development of private sector input supply; NFSP undercuts & crowds it out
Use of e-vouchers?	Yes	Yes	E-vouchers can reduce subsidy leakage to non-eligible farmers

Key features of the NVSP (2017-) & NFSP (2023-)

	NVSP (2017-)	NFSP (2023-)	
	Which farmers benefit?		
Targeting criteria	Smallholders (0.5 - 5 acres)	No targeting: any farmer can benefit	NVSP targets support to smallholders only; most zones. NCPB fertilizer relatively costly for farmers to obtain for smaller farmers and those in lower potential zones
Spatial coverage	Most agro-zones	Most agro-zones	
Retail location of subsidized inputs (mean HH distance)	Agrodealers (6.6 km)	NCPB depots (17.8 km*)	

Key features of the NVSP (2017-) & NFSP (2023-)

	NVSP (2017-)	NFSP (2023-)	
	Benefits for eligible farmers		
Subsidy rate (commercial price discount on inputs)	2022: 40%	2023 LR: 41% 2023/24 SR: 52% 2023 LR: 55%	NFSP large max benefit implies that larger farmers may capture a disprortionately large share of subsidies. NVSP flexible voucher empowers farmers to choose inputs based on their specific preferences, opportunities & constraints. Also enables farmers to obtain inputs that typically provide best performance when used with complementary inputs.
Inputs eligible for subsidy	Inorganic fertilizer; certified seeds; agro-chemicals; and/or lime	Inorganic fertillizer	
Flexible voucher?	Yes	No	
Maximum benefit per farmer	KSh 5,000 on eligible inputs	up to 100 50-kg bags of subsidized fertilizer	

Result 4: What was the benefit-cost ratio of the NFSP in 2023?

- Benefits = value of additional maize produced

ITEM	EXPENDITURE
Farmers' incremental fertilizer use	= (1 kg - crowding out (%))*(1 - diversion (%))
Farmers' incremental fertilizer use per kg of fertilizer acquired by NFSP	= (1 – 0.22)*(1 – 0.16) = 0.655 kg
Total Incremental fertilizer use	= 175,060 MT * 0.655 = 114,699 MT
Incremental maize output (5.48 kg maize / kg fertilizer)	= 628,552 MT
Zonal-weighted average price white maize, Nov-Dec 2023	= 37 KSh/kg = US $245 / MT
Value of incremental maize output	= 628,552 MT * US $245/MT = $154 mil

- Value of incremental maize output = 119,041 MT * $65

Result 2: What dates did farmers receive subsidized fertilizer? Was it received in time for planting? How far did they travel and what types of fertilizer did they receive?

Table 3: Fertilizer Acquisition Types, Dates and Travel Costs.

VARIABLES	(1) National government-subsidized fertilizer		(2) County government subsidized fertilizer		(3) Commercial fertilizer	
	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)	Median
2023						
1) The most common type of fertilizer acquired by farmers	NPK 23-23-0	-	DAP	-	N/A	-
2) The most commonly preferred type of fertilizer by farmers for Maize	DAP	-	DAP	-	DAP	-
3) Distance traveled to acquire fertilizer, in km	16 (16)	10	11 (14)	5	9 (24)	3
4) Minutes spent collecting fertilizer	238 (205)	180	137 (130)	120	28 (43)	10
5) Week and month fertilizer was acquired	April, 1st week	April, 1st week	March, 4th week	March, 4th week	March, 3rd week	March, 3rd week
6) share acquiring fertilizer in time for planting during long	0.88 (0.40)	1	0.82 (0.38)	1	0.87 (0.34)	1

- NFSP distributed NPK and Urea, farmers preferred DAP. (GoK had concerns with DAP given soil acidity).
- Farmers had to travel nearly twice as far and wait eight times as long to acquire NFSP fertilizer compared to commercial

Result 1: What was the percentage of farmers who participated in the NFSP? How much fertilizer did they acquire in 2023 & 2022?

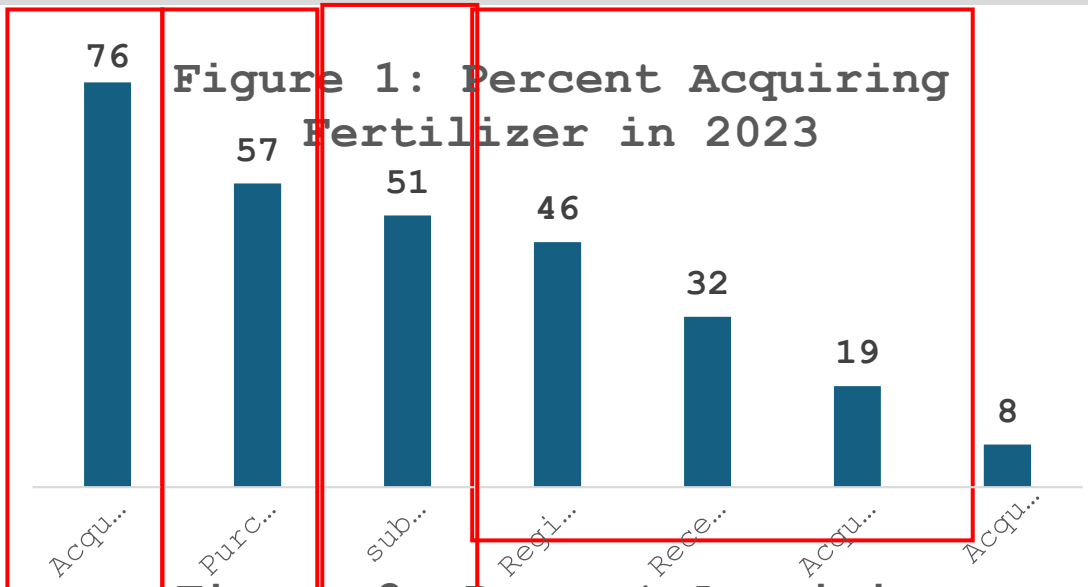


Figure 1: Percent Acquiring Fertilizer in 2023

Figure 2: Percent Acquiring Fertilizer in 2022

- In 2023 % acquiring fertilizer was high relative to 2022
- In 2023 many people also purchased commercial fertilizer in 2023 relative to 2022.
- In 2023 subsidized fertilizer made up more than half of total fertilizer, compared to <20% in 2022
- Big differences between % who registered for NFSP and who acquired it (46% vs 19%)
- Those who were more likely to register and receive NFSP fertilizer in 2023:
  - Larger farmer
  - connections with community leaders
  - More education
  - Those who bought commercial

Result 1: What was the percentage of farmers who participated in the NFSP? How much fertilizer did they acquire in 2023?

Figure 3: Land Distribution by Farm Size Category

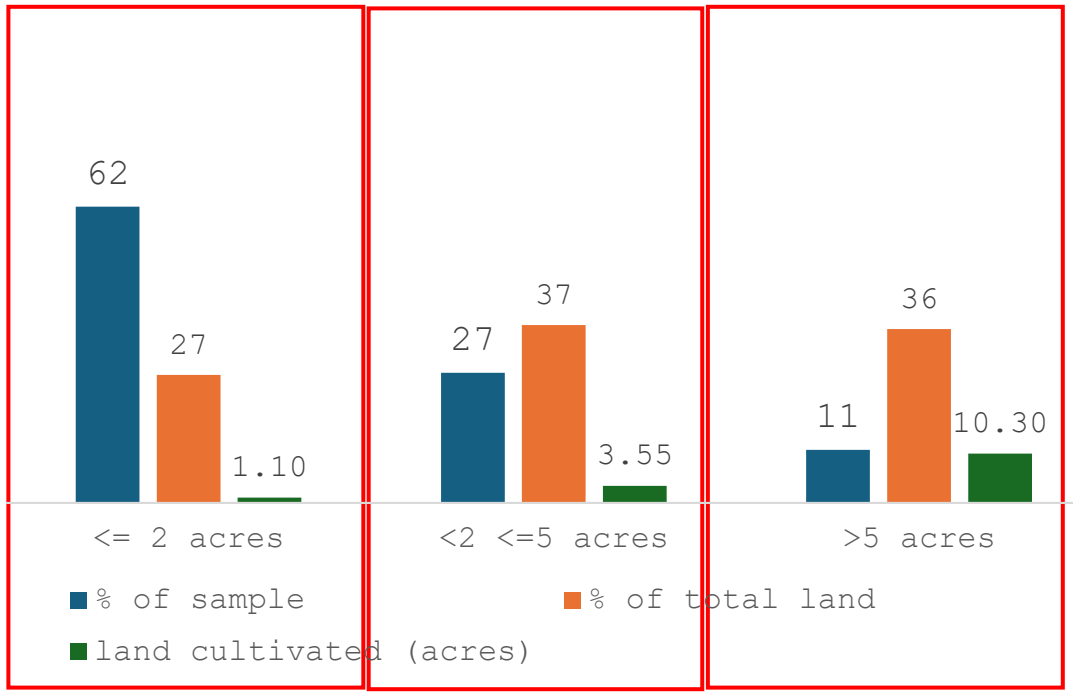
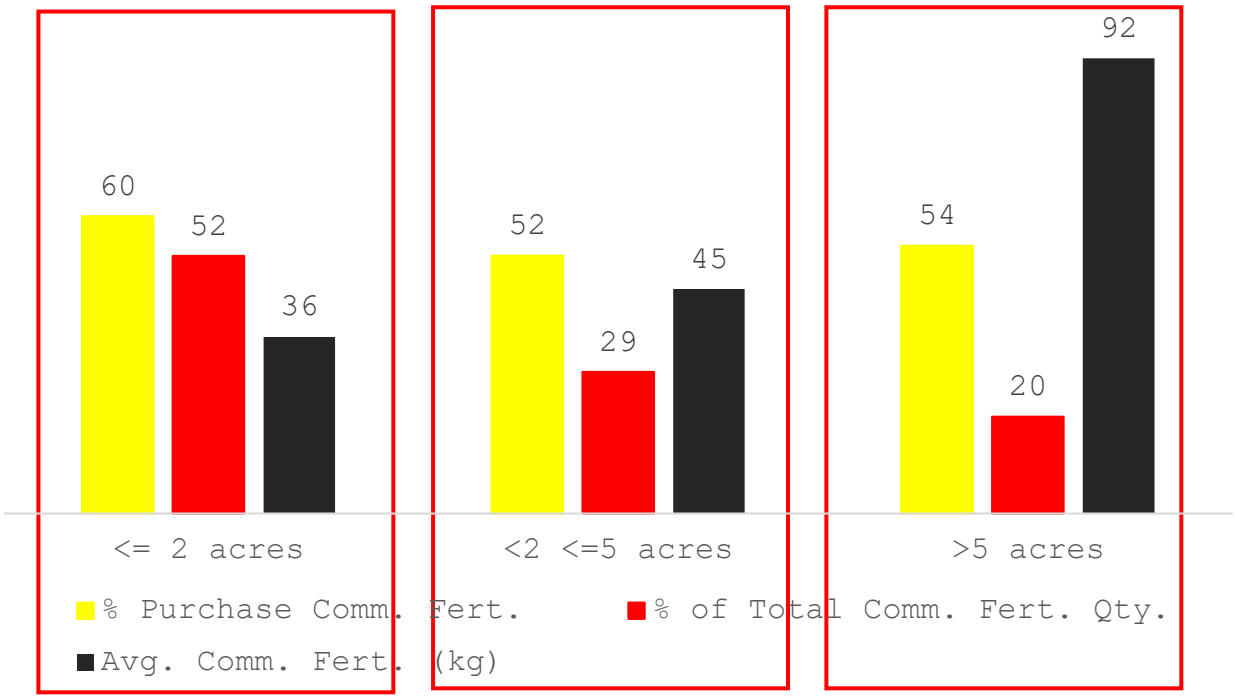


Figure 4: Commercial Fertilizer Purchases in 2023, by Farm Size Category



- Farms w/<=2 acres were most of the sample (62%), but cultivated a relatively small share of the land (27%)
- Farms with 2-5 acres were 27% of sample with 37% of total land; 5+ acres were 11% of sample with 36% of land

Result 1: What was the percentage of farmers who participated in the NFSP? How much fertilizer did they acquire in 2023?

Figure 3: Land Distribution by Farm Size Category

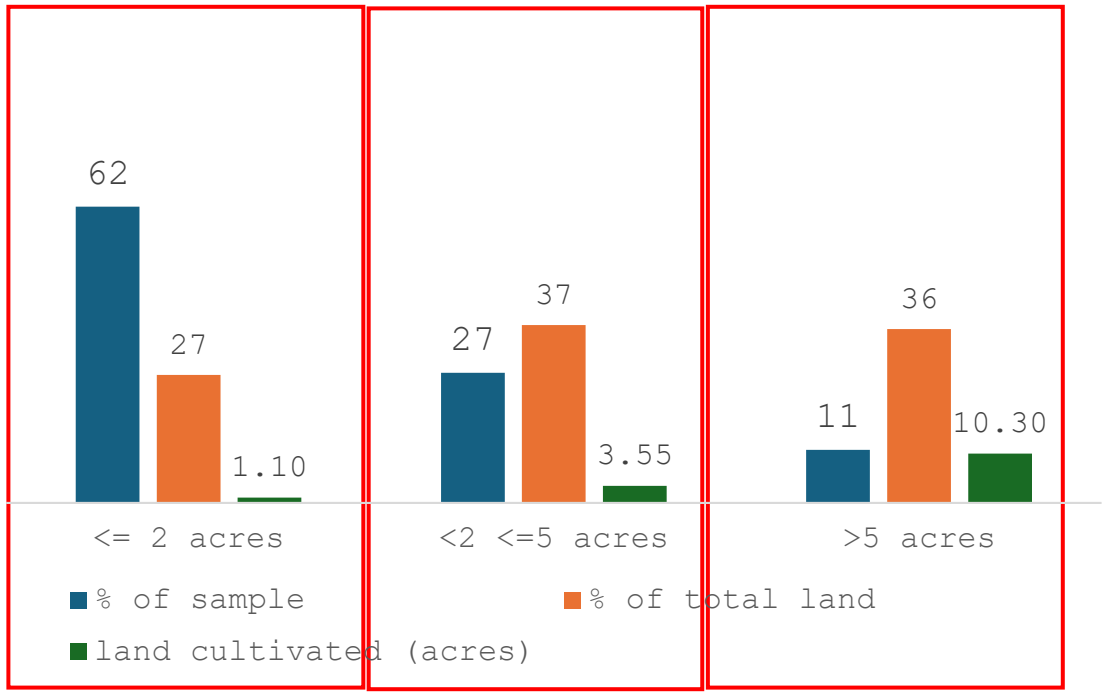
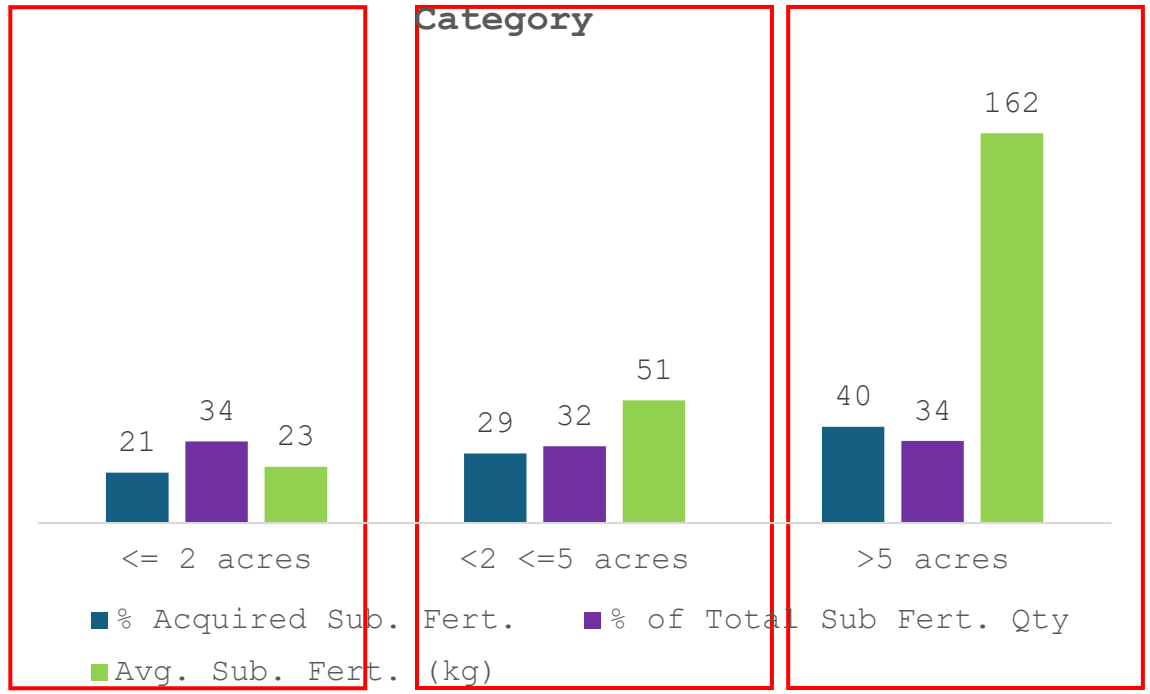


Figure 5: Subsidized Fertilizer Acquisition in 2023, by Farm Size Category



- Lower % of farms w/<=2 acres acquired subsidized fertilizer in 2023 compared with 2-5 acre & >5 acre
- And they acquired less of it
- Not surprising, as the NSFP was not targeted; and maximum benefit

Result 1: What was the percentage of farmers who participated in the NFSP? How much fertilizer did they acquire in 2023?

Figure 3: Land Distribution by Group

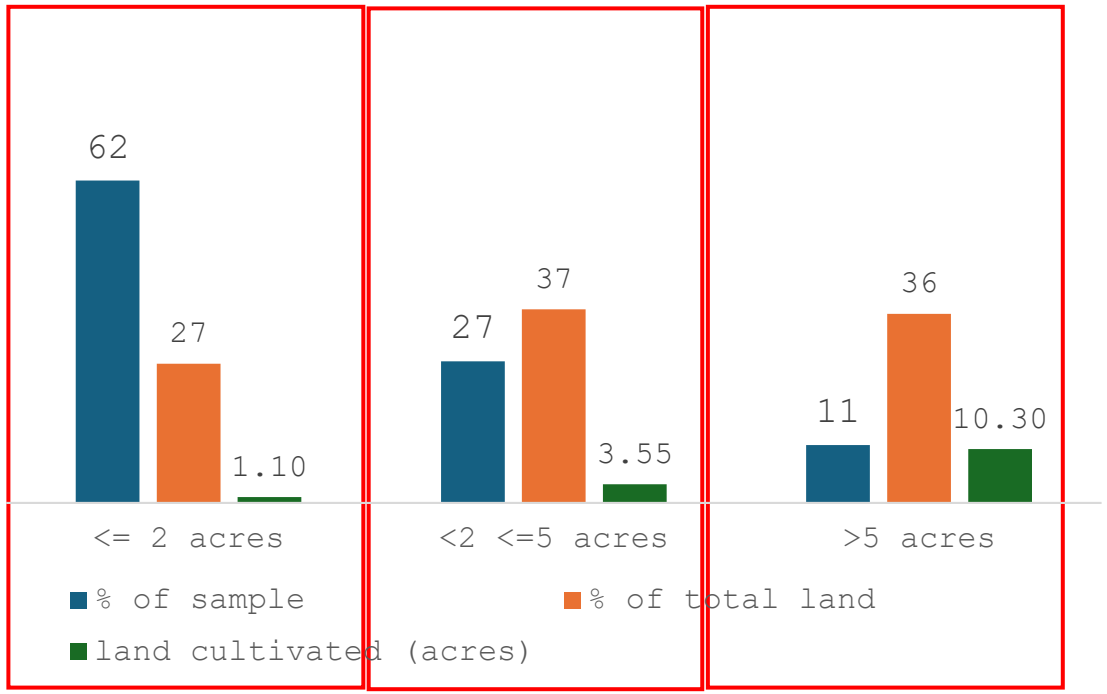
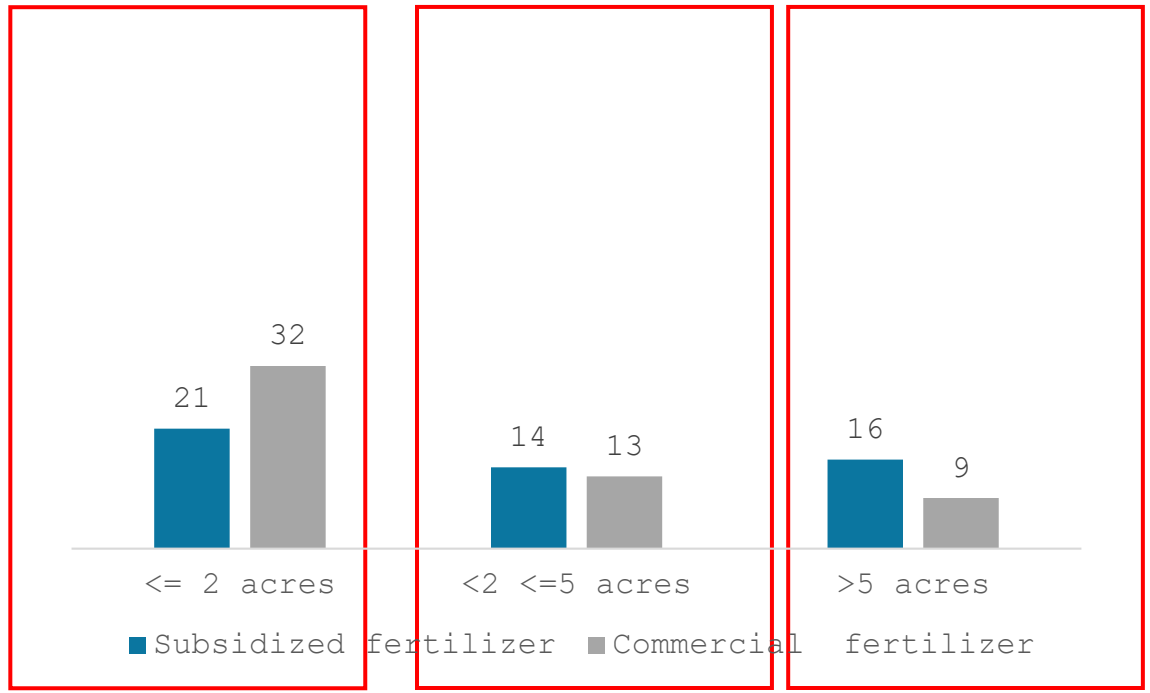


Figure 6: Fertilizer Acquisition per acre, by group and source



- On a per-acre basis smallest-scale farmers acquired more of both types of fertilizer (farmed more intensively)
  - Likely the people who need support.
- Larger farmers got a larger share of the subsidy benefit, but not using fertilizer as intensively.

Additional Considerations: What does the design of NFSP imply for the Kenya private sector fertilizer supply chain?

Short-term impacts on fertilizer supply chain actors (Opiyo et al. 2023)

Private sector excluded from participating in NFSP in 2023 & 2024

Effects on fertilizer distributors and retailers:

1) Fertilizer distributors (wholesale)
   - From 2020-2022, average volume of fertilizer handled fell by 33%.
   - But in 2023, average volume of fertilizer handled fell by 88% compared with 2022, largely due to subsidized fertilizer distributed by NCPB

2) Fertilizer retailers (agrodealers / stockists)

Why did GoK bring back NCPB-led approach instead of scaling up existing NVSP?

GoK claim #1a: *Could not use the pre-existing NVSP infrastructure to supply fertilizer nationally because: (a) NVSP had only been scaled up to 37 counties*

- But NCPB depots are not in all counties either!

GoK may claim that it would be too much work to make arrangements with private sector hub agrodealers & agrodealers in the other counties

- But GoK already had working relationships with main priv sector importers and hub agrodealers participating in NVSP
- Govt should not be involved with selection of agrodealers anyway -- hub agrodealers can better screen and select reliable agrodealers than LGAs could, while

Why did GoK bring back NCPB-led approach instead of scaling up existing NVSP?

GoK claim #1b,c: *Could not use the pre-existing NVSP infrastructure to supply fertilizer nationally because: (b) NVSP only targeted smallholders; (c) relatively few farmers were registered with NVSP*

- B - The e-voucher software platform that NFSP-2 used is the same that was developed, piloted & scaled up via NVSP!
- B - Modifying subsidy eligibility criteria is not difficult – NFSP did this year to year
- C- Zero farmers were registered for the new NFSP-2 program prior to late 2022!!
- C- GoK made a significant public awareness effort to registration of 1.5 million farmers for NFSP-2. They could just have easily been registered to the existing NVSP system.