Kenya | Long Rains 2016 | Maize Urea vs. CAN

ONE ACRE FUND

Farmers First

PHASE:	(1) Research Station	(2) 50 – 500 farmers	(3) 500 – 20,000 farmers	(4) Full Scale

Introduction

Fertilizer is one of the primary inputs that go into smallholder farming systems in East Africa. Together with seed, fertilizer provides the backbone of the One Acre Fund input supply program. It is common for program farmers to apply nitrogen fertilizer based on plant height. Many organizations across Africa promote this methodology, including One Acre Fund. Maize in particular – the most important grain in Kenya – is a heavy nitrogen (N) feeder, with up to 100 kilograms (kg) of N per hectare required to produce good yields. Maize plants require relatively little N when small, and greater amounts of N midway through the season, particularly in the month before flowering. This fertilizer is applied to maize as a "top dress" application. Urea (46% N) contains more N per unit than the CAN (26% N) top dress fertilizer that is currently offered to program farmers, and therefore could have an additional yield benefit if offered. In addition, increasing the top dress application rate from 123.5 kg/ha to 247 kg/ha may lead to additional profit gains. For this trial, we compared yields between urea and CAN at different application rates, and we are also in the process of analyzing soil acidity differences.

9.9%	**Yield increase from 123.5kg/ha urea top dress application**
$413	**Profit from 123.5kg/ha urea top dress application**
122	**Farmers participating in the research**
298,000+	**Number of farmers who may benefit from this trial**

Objectives

- The objective of this trial was to test the maize yield effect of urea compared to CAN at both 123.5 kg and 247 kg per hectare application rates. A secondary objective of the trial was to measure the soil acidity level effect of the different top dress options.

Hypotheses

- Urea applied as a maize top dress fertilizer will result in higher yields and profit/ha when applied at the same rate as CAN (i.e. at 123.5kg/ha and 247kg/ha application rates respectively), but soil acidity will be higher.

Methodology

One Acre Fund District: Bungoma South
One Acre Fund Site: New Huruma

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Agroecological Parameters*:

Alt	MAR	MAT	Soil										
			pH	C%	N%	P	K	S	Ca	Mg	Zn	Al	CEC
1,385 masl	1,400 mm	21.1˚C	5.31	1.27%	0.10%	19.94	0.24	13.25	3.32	0.88	6.28	1048	8.20

**MAR = mean annual rainfall (mm); MAT = mean annual temperature (˚C); P, S, Zn, Al as ppm; K, Ca, Mg as meq/100g, CEC in cmolc/kg*

Treatments:

1. **Control** – SC Duma 43 maize variety, 123.5 kg/ha DAP at planting, 123.5 kg/ha CAN as top dress, 25cm plant spacing, 75cm row spacing, weeding two times (standard 1AF maize program)
2. **Treatment #1** – SC Duma 43 maize variety, 123.5 kg/ha DAP at planting, 247 kg/ha urea as top dress, 25cm plant spacing, 75cm row spacing, weeding two times
3. **Treatment #2** – SC Duma 43 maize variety, 123.5 kg/ha DAP at planting, 123.5 kg/ha urea as top dress, 25cm plant spacing, 75cm row spacing, weeding two times
4. **Treatment #3** – SC Duma 43 maize variety, 123.5 kg/ha DAP at planting, 247 kg/ha CAN as top dress, 25cm plant spacing, 75cm row spacing, weeding two times

Experimental Design:

- Four side-by-side 10m x 10m trial plots, separated by 1m. The four top dress fertilizer configurations were randomly assigned to each plot in the farmer's field. The trial was replicated in 122 farmer fields.

Variables Measured:

- Maize yields in tons per hectare. We are processing baseline and endline samples for pH measurement.

Results

Treatment	Yield t/ha (vs control %)	Profit USD/ha (vs control)
Treatment #1 – Urea at 247kg/ha	3.79 (+11.6%)	$413 (+7.3%)
Treatment #2 – Urea at 123.5kg/ha	3.72 (+9.9%)	$431 (+11.9%)
Treatment #3 – CAN at 247kg/ha	3.79 (+11.6%)	$468 (+21.6%)
Control – CAN at 123.5kg/ha (standard method)	3.35	$385

*****_Differences between control and treatments were significant at the p=0.05 level (i.e. less than 5%)_

Interpretation and Discussion

The multi-plot trial configuration enabled us to compare multiple treatments to each other. Urea slightly outperformed CAN at the 123.5 kg/ha application rate. However, at the 247 kg/ha application rate, urea and CAN applications were roughly comparable. This means that switching to a urea top dress application would be effective at the 123.5 kg/ha level. However, in any case where we increase the application of nitrogen fertilizer, we want to be mindful of the effects that this can have on soil pH. For this reason, we are concurrently investing in efforts to increase the adoption of agricultural lime among smallholder farmers with acidic soil. In addition, the trial showed that there is a big profit effect of using 247 kg/ha CAN over 123.5 kg/ha. Given that there is a negative profit effect of urea over CAN at the 247kg/ha application rate, we are unlikely to recommend a urea application greater than 123.5kg/ha.

Next Steps

We will repeat this trial in varied soil contexts. The soils in New Huruma are more acidic that the district average, and therefore may have negatively affected the overall performance of additional nitrogen application due to decreased N availability. In the future, it is possible that we will recommend a urea top dress application to farmers in select sites, depending on soil conditions. Moreover, we will evaluate how the profitability of CAN application at 247 kg/ha changes across different growing conditions.