

Custom Fertilizer Blends— Long Rain Season, Kenya (2015)

Farmers First

PHASE:	Research Station	50 – 500 farmers	1,000 – 20,000 farmers	Full Scale
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Introduction

Fertilizer use in Africa has historically been low, with a continent-wide average of eight kilograms (kg) total fertilizer per hectare (ha) per year. There have been recent reports of aggregate fertilizer use increasing in Africa¹. This has corresponded to a 50 percent cereal grain increase between 2005 and 2013. However, fertilizer choices for smallholder farmers continue to be limited. The composition of the available fertilizers tends to include only the “macronutrients,” nitrogen (N), phosphorous (P), and potassium (K). These fertilizers may or may not align with the specific nutrient deficiencies of the soil (such as zinc, magnesium or calcium-deficient soils). If any one essential micronutrient is limited, crop yields will respond poorly to fertilizer. In addition, soil acidity may also impede micronutrient availability. In 2015, One Acre Fund sought to try a holistic approach to fertilizer use. If total nutrient management and soil acidity are simultaneously addressed, this may improve crop yields and fertilizer use efficiencies for smallholder farmers.



David Guerena/One Acre Fund.

-1.1%	Maize yield change with the custom fertilizer	-\$40	Change in farmer profit (USD/ha)
198	Phosphorus use efficiency with the control (kg grain/kg P fertilizer applied)	347	P use efficiency with the improved methods (kg grain/kg P fertilizer applied)

Context and Trial Rationale

- Common commercially available fertilizers may not account for soil micronutrient deficiencies.
- Micronutrient deficiencies may be limiting crop response to fertilizer, resulting in low fertilizer use efficiencies and low return on farmer investment.
- Soil pH may be limiting phosphorus availability.
- Plants may benefit from an increase in N fertilization by switching from CAN to urea fertilizers.

¹ Sanchez, P. 2015. En route to plentiful food production in Africa. Nature Plants DOI:10.1038

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Major Intervention Trials

Field assessment: Trials were conducted on farmer fields in the long rain season of 2015 in western Kenya. The trial design was as follows:

Trial configurations:

1) **Control:** WE1101 Hybrid maize seed; 123.5 kg/ha DAP at planting (25 centimeters (cm) x 75cm spacing); 61.75 kg/ha CAN applied at knee-height; 61.75 kg/ha CAN applied at shoulder-height.

2) **Treatment:** WE1101 Hybrid maize seed (25cm x 75cm spacing); 123.5 kg/ha Mavuno fertilizer (10-26-10 +micronutrients 200 kg/ha calcitic lime at planting; 61.75 kg/ha urea applied at knee-height; 61.75 kg/ha urea applied at shoulder-height.

A. Trial Results

Treatments	Yield [†] (tonne/ha)	Profit (USD/ha)	Profit change (USD/ha)	P use efficiency (kg maize grain/kg fertilizer P)
Control	4.5	\$1,372	N/A	198
Mavuno/lime/urea	4.5	\$1,332	-\$40	347

[†] Differences between control and treatment yields were not significant, $P=0.42$

B. Adoption: Low

- The increased prices of the Mavuno, lime, and urea relative to the core program may reduce adoption amongst farmers.

C. Operability at Scale: Medium

- Switching fertilizer type would result in a substantial change in existing One Acre Fund training materials and a redesign in currently used micro-dosing fertilizer scoops. This would pose some challenges at scale. However, these challenges could be overcome if the impact was great enough.

Next Steps

In 2016, One Acre Fund will:

- Investigate methods to increase P fertilizer use efficiency. It is clearly evident from this trial that our current P fertilizer efficacy is not optimized. This may be limiting fertilizer impact among our core program farmers.
- Identify and trial alternative P fertilizer sources and chemical compositions that may have greater plant availability.
- Continue to explore the effectiveness of lime application on nutrient (P) use efficiency.