

# A Short Report



Inspection of one of the Mavuno Zaidi demonstration plots. Photo courtesy of ICL Fertilizers, Kenya.

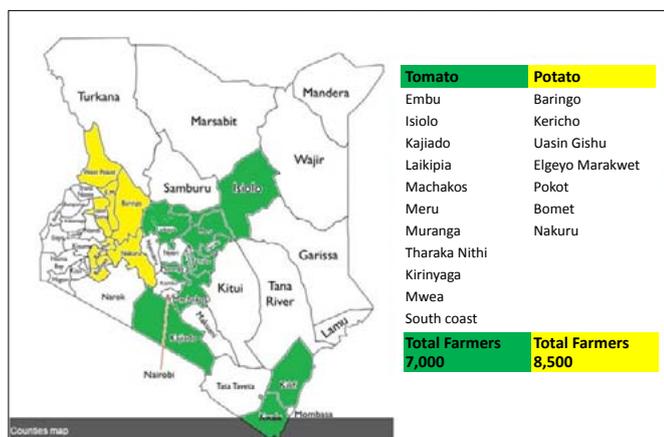
## Mavuno Zaidi - Large-Scale Farmer Outreach has Increased Potato Yields in Kenya through a Focus on Balanced Fertilization

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Potatoes are considered to be the second most important food crop in Kenya after maize (MOA, 1998; Wang'ombe and van Dijk, 2013). However, potato yields in Kenya have remained relatively low averaging 11 to 14 Mg ha<sup>-1</sup> compared to over 40 Mg ha<sup>-1</sup> obtained by developed regions like North America (Wang'ombe and van Dijk, 2013). Low productivity has been attributed to several factors, including limited availability to disease free certified seeds, disease and pest infestations, low soil fertility, as well as low use of fertilizers and fungicides (Muthoni *et al.*, 2013; Wang'ombe and van Dijk, 2013; Muthoni, 2016).

With a focus on addressing some of the constraints, a large-scale farmer outreach program dubbed 'Mavuno Zaidi' - a Swahili phrase that can be loosely translated as 'plentiful harvest' - was initiated in 2016, focusing on training farmers about good agricultural practices. The farmer outreach program was a partnership between Syngenta Kenya, a seed and agrochemical

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Map. 1. A map showing the different counties within Kenya covered under the 2016 Mavuno Zaidi project.

input supplier, and Israel Chemicals Ltd. (ICL), a producer and importer of fertilizers, and was implemented by Technoserve, a non-governmental organization (NGO) that serves small-scale farmers across Africa. The large-scale outreach program aimed to train up to 15,000 potato and tomato-producing small-scale farmers in 17 counties in Kenya (Map 1). Farmers were exposed to an integrated training program that encompassed business, agronomy and marketing skills. Syngenta offered agronomic expertise on seeds and crop protection, while ICL focused on soil fertility and crop nutrition, with Technoserve providing the training and implementing the project.

ICL identified unbalanced fertilization as one of the limiting factors to potato productivity in the country. In Kenya, farmers have relied on two main fertilizer products: Di-Ammonium Phosphate (DAP) which is NPK 18:46:0 and Calcium Ammonium Nitrate (CAN) which contains 26% nitrogen (N), limiting

fertilization to just N and phosphorous (P). The current fertilizer recommendation for potato production is four 50 kg bags of DAP per acre which is equivalent to 500 kg ha<sup>-1</sup> (KARI, 2008; Muthoni, 2016). Potassium (K) is a key nutrient for potato production but is hardly used because there is a widely-held belief that Kenyan soils are rich in K (Kanyanjua and Agaya, 2006). This has resulted in nutrient mining, and declining yields.

While potato farmers in the region mainly use two to four 50 kg bags of DAP acre<sup>-1</sup>, some farmers will also top dress with one to two 50 kg bags of CAN. This rate translates to 90-150 kg N ha<sup>-1</sup> and 225 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, with farmers yielding an average of 10-13 Mg ha<sup>-1</sup>. Based on nutrient removals for a target yield of 30 Mg ha<sup>-1</sup> using the AgPhD nutrient removal app, a balanced fertilization recommendation was developed, consisting of 90-100 kg N ha<sup>-1</sup>, 60-70 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, 170-180 kg K<sub>2</sub>O ha<sup>-1</sup>, 51 kg SO<sub>3</sub> ha<sup>-1</sup> and 5 kg MgO ha<sup>-1</sup>. The nitrogen fertilizer used in project demonstration plots was a control release fertilizer produced by ICL, where 30% of the N was coated with a polymer giving it a release period of two to three months. The coated fertilizer was also the source of SO<sub>3</sub> and MgO.

Results from 60 demonstration plots of 1,000 m<sup>2</sup> each, planted across seven counties in two season, yielded an average of 26 Mg ha<sup>-1</sup>, varying between 20-33 Mg ha<sup>-1</sup>. This compares to farmers' traditional practices which on average yielded 10 Mg ha<sup>-1</sup>, varying between 7-14 Mg ha<sup>-1</sup> (Fig. 1). Soil analysis of the demonstration plots before planting showed that the K<sub>2</sub>O level was above the adequate level needed for potato production, ranging between 400-840 ppm. It is therefore surprising that ICL's demonstrated practice was still able to show a good response to K. There is therefore a need to do further research on the soil analysis methods suitable for these soils, or review the limit levels for K for potato production in the region.

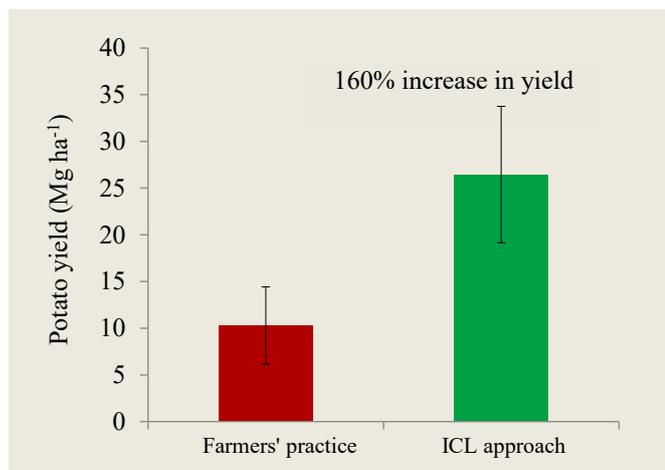


Fig. 1. A bar graph showing the difference in yield (Mg ha<sup>-1</sup>) between farmers' practice (N: 150; P<sub>2</sub>O<sub>5</sub>: 225; K<sub>2</sub>O: 0) and ICL's approach (N: 100; P<sub>2</sub>O<sub>5</sub>: 70; K<sub>2</sub>O: 180).

### Conclusions

Despite the fact that the fertilizers introduced during the outreach program were more expensive than farmers normally used, a cost benefit analysis by ICL demonstrated the profitability of implementing balanced fertilization (Table 1). ICL calculated a value:cost ratio of USD 23 for every extra USD 1 spent on fertilizer under the ICL fertilizer regime. This was based on a two-fold increase in yield that resulted in farmers receiving USD 380 gross profit above their normal production (Table 1). In 2017, Syngenta approached one of the banks in Kenya to offer credit financing to farmers to enable them to purchase inputs. By October 2017, 1,200 farmers who had a farm size of 0.25 and 1 ha (a total of 770 ha) had signed up for the credit facility, enabling approximately 370 Mg of fertilizer to be distributed to them. The Mavuno Zaidi project was therefore not only successful in increasing farmers' yields but also in increasing farmers' knowledge of balanced fertilization.

**Table 1.** Analysis of the financial differences between farmers' practice and the ICL Mavuno Zaidi approach.

Parameter	Farmers' practice	Mavuno Zaidi (ICL approach)
Fertilizer ratio (kg ha <sup>-1</sup> )	N: 90-150 kg ha <sup>-1</sup> P <sub>2</sub> O <sub>5</sub> : 225 kg ha <sup>-1</sup> K <sub>2</sub> O: 0 kg ha <sup>-1</sup>	N: 90-100 kg ha <sup>-1</sup> P <sub>2</sub> O <sub>5</sub> : 60-70 kg ha <sup>-1</sup> K <sub>2</sub> O: 170-180 kg ha <sup>-1</sup> SO <sub>3</sub> : 51 kg ha <sup>-1</sup> MgO: 5 kg ha <sup>-1</sup>
Fertilizer cost	USD 323-485 (15% of total outgoings)	USD 525-650 (7.5% of total outgoings)
Yield	10-14 Mg ha <sup>-1</sup>	26-33 Mg ha <sup>-1</sup>
Gross income	USD 2,300-3,200	USD 6,000-7,000
Value:cost ratio		USD 23 for every extra USD 1 spent on fertilizer



**Photos 2.** Potato demonstration plot. Photos courtesy of ICL Fertilizers, Kenya.

### References

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The paper "Mavuno Zaidi - Large-Scale Farmer Outreach has Increased Potato Yields in Kenya through a Focus on Balanced Fertilization" also appears on the IPI website at:

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