On-site soil testing increases yields with more than 25% at equal costs

Results of on-farm yield comparison between farmer practice and AgroCares soil test-based fertilizer recommendations

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Introduction

Many African countries aspire to increase productivity in a sustainable way. It is well known that managing soil fertility is essential to sustainably improve yields. Managing soil fertility starts with understanding the nutrient status of the soil and the nutrient requirements of the crops. Until recently executing soil tests with practical fertilizer recommendations were almost non-existent, time-consuming and expensive in remote areas.

AgroCares introduced Soil Scanners with a NIR sensor and connected to the SoilCares Adviser app in Kenya in early 2017. More than 20,000 farmers have benefitted until now from this on-the spot soil testing and practical fertilizer recommendations and many testimonies of successful results have been collected. With support of Kenya Market Trust (KMT) field experiments have been conducted to obtain quantitative results and to demonstrate the importance of soil testing to farmers.

Materials

In total 10 demonstration plots were established in 3 different counties: Kisii (5), Nyamira (4) and Kericho (1). All plots were planted with maize in the long rainy season of 2019. On each site, 2 adjacent plots of 10x10 m2 were selected; one was treated under conventional (farmers) practice and one was treated following the recommendations after soil testing with SoilCares scanner. Table 1 shows the soil data per plot obtained with the SoilCares Scanner.

Table 1. Soil test results; G=high, A=Adequate, L=low.

Plot	pH	Organic C	N tot	P tot	K exch	CEC	Soil texture
Kisii 1	L	A	A	H	H	A	clay
Kisii 2	L	A	H	H	H	A	clay
Kisii 3	L	A	A	H	H	A	sandy clay loam
Kisii 4	A	L	L	A	H	A	clay
Kisii 5	A	A	H	H	H	H	clay
Nyamira 1	A	A	H	H	H	A	clay
Nyamira 2	A	L	A	H	H	A	sandy clay loam
Nyamira 3	A	A	H	H	H	A	clay
Nyamira 4	L	A	A	H	H	A	clay loam
Kericho 1	L	A	A	H	H	A	clay

Based on the soil test results, fertilizer recommendations were provided by the "adviser application" of SoilCares. Table 2 shows the applications in each plot for the SoilCares advice and the farmers practice.

Table 2. Treatments in demonstration plots (100m2) for farmers practice and SoilCares based advice.

Plot	Farmers practice	SoilCares Advice
Kisii 1	3.7 kg DAP at planting + 2.5 kg CAN topdressing	0.50 kg urea + 0.5 kg SA at planting
Kisii 2	3kg DAP at planting + 2 kg CAN topdressing	0.55 kg urea + 0.5 kg SA at planting, 12.5 kg lime
Kisii 3	4kg DAP at planting + 3 kg CAN topdressing	1.5 urea + 1.5 kg SA at planting + 1.5 kg urea topdressing, 11 kg lime
Kisii 4	3.5 kg DAP at planting + 2 kg CAN topdressing	2.2 kg urea +1.7 kg TSP at planting + 1.5 urea topdressing, 3 kg lime
Kisii 5	3kg DAP + 3.5 kg CAN topdressing	1.3 kg urea + 1.3 kg SA at planting + 1.2 urea topdressing, 5 kg lime
Nyamira 1	3.9 DAP at planting + 4 kg CAN topdressing	2.5 kg urea + 2.5 kg SA at planting + 2.3 urea topdressing, 3.3 kg lime
Nyamira 2	3 kg DAP at planting + 3 kg CAN topdressing	2.7 kg urea + 2.7 kg SA at planting +2.5 kg urea topdressing, 9.9 kg lime
Nyamira 3	3.5 kg DAP at planting + 3 kg CAN topdressing	2.5 kg urea + 2.5 kg SA at planting + 2.3 kg urea topdressing, 5 kg lime
Nyamira 4	3 kg DAP at planting + 3 kg CAN topdressing	2.7 kg urea+ 2.7 kg SA at planting + 2.5 kg urea topdressing, 2.5 kg lime
Kericho 1	2.8 kg DAP at planting	2.2 kg urea at planting + 1.4 kg urea topdressing, 8.8 kg lime

Figure 1 shows that the SoilCares recommendation in general included more N compared to farmers practice, but far less P (less than 5% of the farmers practice application).

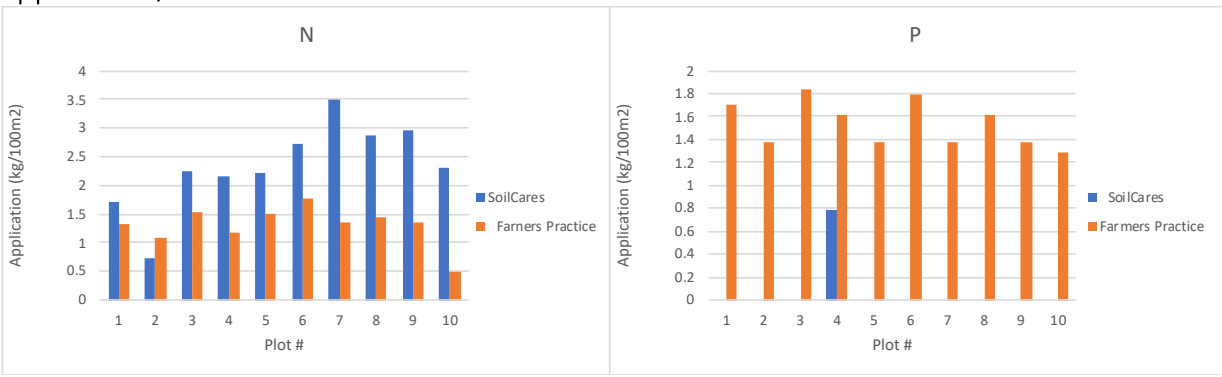

Figure 1. Application rates for N (left) and P (right).

Also, the SoilCares recommendation included soil test-based lime and compost recommendations (Figure 2). Farmers did not apply compost, manure or lime, as to their conventional practice.

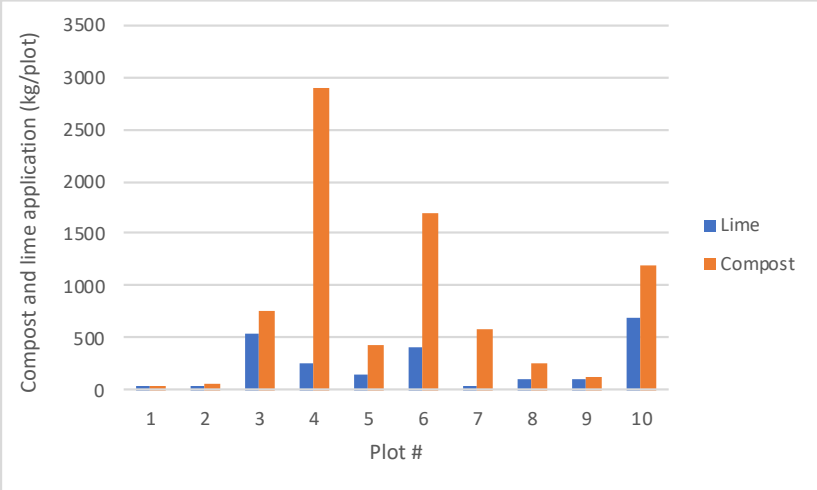

Figure 2. Lime and compost recommendations according to SoilCares' advice per plot.

All agronomic practices were applied and similar in both plots (farmers practice and SoilCares advice). Farmer field days were organized during the growing season and data on yields were collected after harvest by SoilCares staff.

Results

In all plots SoilCares recommendations exceeded farmer practice yields and on average, yields of the SoilCares plots were 26% higher compared to the farmers practice plots (Figure 3).

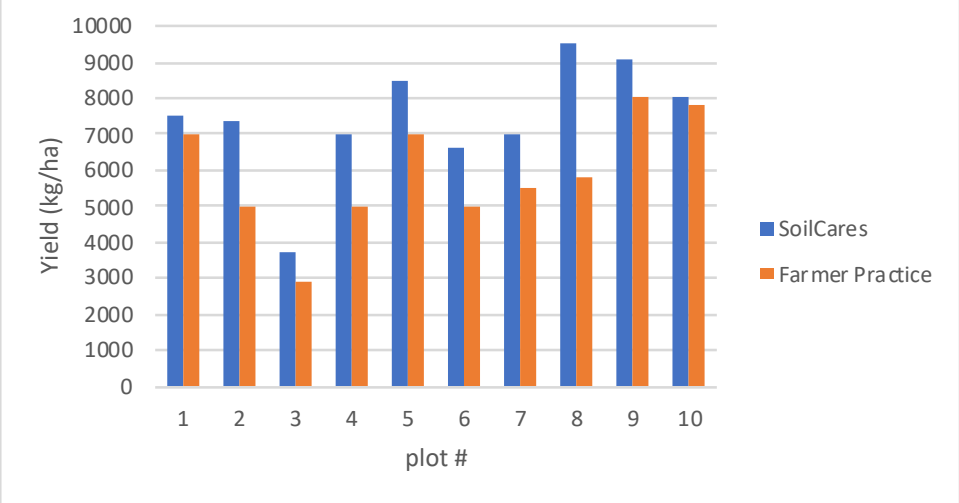

Figure 3. Yield per treatment for SoilCares advice and farmers practice.

There was no significant difference in yield per fertilizer expenditure between SoilCares and Farmers Practice (Figure 4). On average, expenditures on inputs on farmers practice and SoilCares' plots were 449±93 KSh and 447±116 Ksh per plot, respectively.

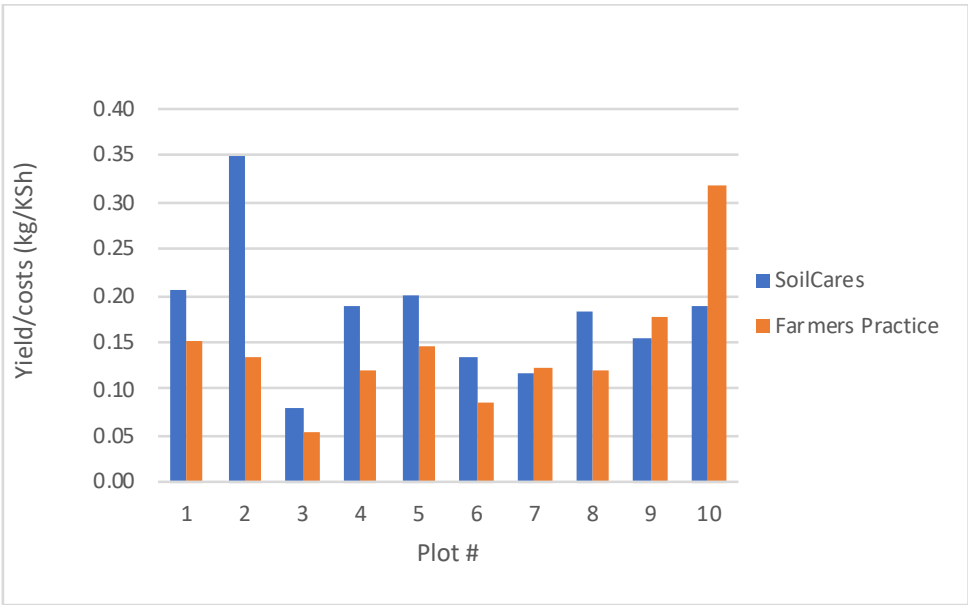

Figure 4. Yield per expense on inputs for farmers practice and SoilCares recommendation.

Discussion and Conclusion

Farmers applied DAP at relatively high amounts. As a result, the soils showed high soil P status (Table 1) and farmers could safe considerably on their P inputs. In other words, farmers have been applying P to their soils for years without the soil really needing it. Soil test-based fertilization showed that less P and more N increased yields with more than 25% without additional costs.

This study shows that soil test-based fertilization helps farmers to select the fertilizers their soil really needs.