

Kenya Horticulture Competitiveness Project

Case Study: Soil Analysis

Soil testing and SMS-based fertilizer recommendations for smallholder farmers

Meet Mary, a smallholder vegetable farmer in Western region, Kenya. Every season, Mary goes to her local agrodealer and purchases whatever fertilizer is available and applies it to her soil at the recommended times and amounts. Unfortunately, each harvest, her crops grow smaller and more irregular. She doesn't understand why this is the case since she has been doing everything "right."

A simple soil analysis, however, would reveal that what Mary really needed was not fertilizer, but lime, which would have corrected her soil acidity and improved overall soil fertility and nutrient uptake. By continually applying fertilizer without lime, she was actually making her soil worse. However, since conducting the soil analysis and applying the recommended inputs, Mary's soils have started to recover and her crop yields have already increased dramatically.

IMPORTANCE OF SOIL ANALYSIS

Soil analysis is a simple and effective farm management tool to increase yields and profits. Soil testing determines the physical conditions, fertility (nutrient) status, and chemical properties that affect a soil's suitability for growing plants.

Benefits of soil analysis:

Customized recommendations from soil analysis provide farmers with recommendations on optimal soil nutrient and pH levels that if properly implemented will:

- Increase crop yields and overall farm profitability
- Raise fertilizer efficacy through ensuring optimal pH levels
- Reduce costs by using precise amounts of specific fertilizers and lime
- Reduce weed populations and improve efficiencies of other crop production practices (scouting, field spraying, harvesting, etc.) through greater plant uniformity throughout the field
- Increase plant health that increases pest and disease resistance (and reduces chemical application requirements)
- Improve environmental stewardship through reducing over-applications of fertilizers and other farm chemicals

THE PROBLEM

Despite its importance, soil analysis has not been accessible to smallholder farmers because of its high cost. Private companies are unable to offer the service at a price smallholders can afford due to upfront costs associated with setting up a nationwide distribution system, purchasing laboratory equipment, and training farmers.

THE SOLUTION

To overcome these challenges and make the model commercially viable, Fintrac's Kenya Horticulture Competitiveness Project (KHCP) has developed an innovative cost-sharing model with Crop Nutrition Lab Services (Crop Nutrition). This five-year project – funded by the United States Agency for International



Photo by Fintrac Inc.

Mary Afande Lwaka from Kakamega County, Western region, is one of the first 670 smallholders who have received personalized soil recommendations via SMS, enabling them to dramatically improve her yields and income.

Daktari Wa Udongo (Swahili for "Soil Doctor")

is a partnership between USAID-KHCP and Crop Nutrition Lab Services to bring professional soil testing services to smallholder farmers in rural Kenya.

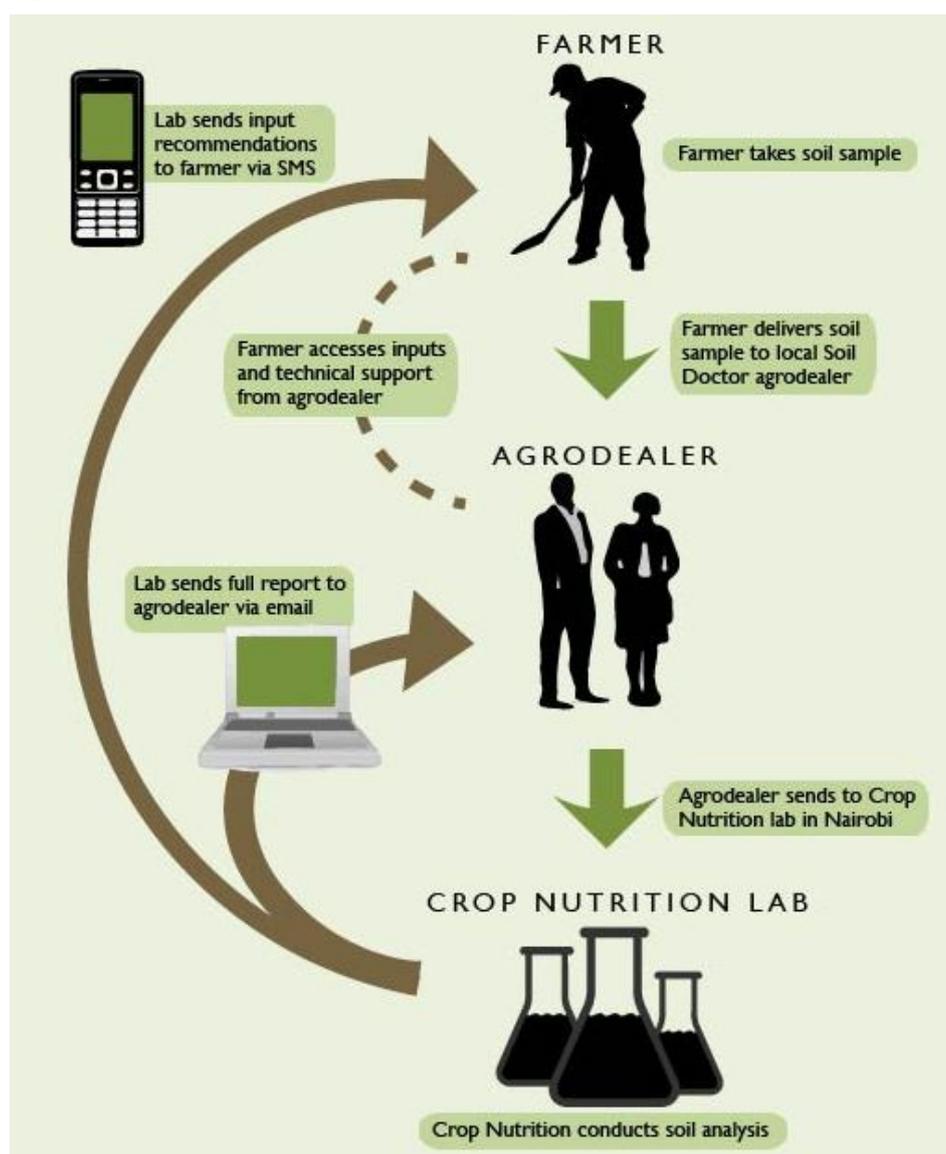
Development (USAID) through the Feed the Future initiative – is working to improve the incomes, food security, and nutrition for 200,000 smallholder farmers in Kenya. Crop Nutrition is a Nairobi-based business specializing in agricultural and environmental laboratory testing services. Both have a vested interest in making soil testing services available to smallholders: USAID-KHCP because it will help farmers increase yields and incomes, and Crop Nutrition because smallholders represent a huge market opportunity if they can overcome the barriers to entry. Through the cost-sharing model, USAID-KHCP covers the upfront costs to enable Crop Nutrition to profitably offer **professional, comprehensive soil analysis services to smallholders through a national agrodealer network.**

HOW IT WORKS

The Soil Doctor (*Daktari Wa Udongo*) service follows these steps:

1. Farmer (trained by field advisors) takes soil samples from his/her field.
2. Farmer delivers soil sample to local Soil Doctor agrodealer.
3. Agrodealer sends soil sample to Crop Nutrition laboratory in Nairobi.
4. Lab conducts quick and accurate soil analysis.
5. Lab sends SMS message to farmer with specific soil and fertilizer management recommendations.
6. Lab sends full analysis and report to agrodealer via email.
7. Farmer accesses inputs and technical support from agrodealer.

Figure I: The Soil Doctor Process



One of the keys to this model is bringing the cost of the tests down to an affordable price by investing in new soil analysis equipment. With the USAID-KHCP grant, Crop Nutrition purchased a new spectrometer analysis machine that can analyze soil matter at a much cheaper cost without the need for a wet-lab process that uses chemical reagents. The new dry process is much quicker, has significant environmental benefits, and most importantly, brings the cost per test down to \$30 (Ksh 2,500).

Even with the lower cost, however, considerable challenges persist. On the demand side, farmers must understand the importance of soil testing and its impact on their bottom line. On the supply side, agrodealers must make the soil testing services available and stock the required inputs. In order to make the model profitable, and therefore sustainable, the project is addressing both demand- and supply-side constraints.

Stimulating demand: Improving knowledge and capacity of farmers through training

To teach farmers about the importance of soil testing and how to sample their soil correctly, USAID-KHCP and Crop Nutrition are implementing a train the trainers model. Crop Nutrition advisors and USAID-KHCP agronomists train field technicians from the government and the project's 30 partner organizations in the details of soil analysis. These field technicians then conduct on-site trainings to demonstration farmers who, in turn, train the farmers in their respective communities. To date, approximately 4,000 farmers have benefitted from field-based training.

To date, 4,000 farmers have learned about the importance of soil testing.

Because farmers will only adopt new practices if they see the benefits firsthand, USAID-KHCP uses demonstration plots – established on lead farmers' plots or those of farmer groups – to illustrate the effects of soil testing. Through hands-on trainings, farmers learn to sample and label their soil correctly; where to take the sample for testing; how to interpret the results; and how to apply the recommended inputs. In most cases, a small portion of the demonstration plot is left as a control area, which does not receive any treatment. By the end of the first harvest, farmers can see the improved quality and quantity of the crops that received treatment. Although it still takes time to persuade lead farmers to see that the long-term benefits outweigh the upfront costs, these "early adopters" are influential in their respective communities and play a key role in convincing others in the area to adopt the new technologies.

Ensuring supply: Developing a national agrodealer network

Once farmers understand the benefits of soil analysis, they must be able to access the services. To reach even the most remote areas, Crop Nutrition is leveraging local agrodealers to serve as the main drivers of the Soil Doctor model. Each agrodealer makes about \$6 (Ksh 500) per sample, giving them a major profit incentive to promote the service among their farmers.

In order to ensure supply, Crop Nutrition is taking the lead by doing the following:

- Training 50 agrodealers and their agronomists in the Soil Doctor business model, soil sampling, lab results interpretation, and understanding soil fertility and fertilizer management recommendations.
- Developing an Agrodealer Network Operating Software to communicate effectively across the Soil Doctor network. The GIS web-based application will enable Crop Nutrition labs, agrodealers, and USAID-KHCP partners to track samples and access farmers' soil information and input recommendations in real-time.
- Developing a GIS Soil Fertility and Farm Input Information System to ensure agrodealers stock required inputs. The tool will display a dashboard of which nutrients are required in each area, so that fertilizer and lime companies can supply the correct inputs to the agrodealers, according to the farmers' needs within each dealer's geographic location.
- Increasing Crop Nutrition lab capacity – from 3,000 to 6,000 samples per month – to meet the anticipated increase in demand for lab services.

EARLY RESULTS

The Soil Doctor model is beginning to take off, with smallholder uptake of samples steadily gaining momentum.

- To date, 670 smallholders have submitted samples and are using the Soil Doctor service.
- Agrodealers are reporting strong interest in samples from local farmers and updating inventories of fertilizers and lime to meet the needs of the farmers based on the completed soil analyses.
- Crop Nutrition is receiving interest from agrodealers wanting to become part of its network because they see a direct benefit in terms of extra sales of fertilizers. When agrodealers have detailed discussions with farmers about the results, they also discuss alternative crops and sell them new seeds and chemicals.

THE CHALLENGES

Challenge 1: It is too expensive and farmers do not think it is worth the cost.

Cost will always be a challenge for the poorest and most vulnerable farmers. Though the cost-sharing model enabled Crop Nutrition to lower the price, it is still expensive for smallholder farmers. Most will not be willing to invest the \$6 per sample without first seeing results. Unfortunately, many farmers who have tried soil analysis in the past had negative experiences: some never received results; others received results but local agrodealers did not stock the recommended inputs; and others were able to implement the recommendations, but because most inexpensive analyses generally only test nutrient content (not pH), the recommendations did not improve crop yields. As a result of these negative past experiences, farmers have lost confidence in soil analysis.

Response: Demonstration plots and crop budgets

The primary way to convince farmers that soil testing is worthwhile is by proving the positive results firsthand. USAID-KHCP does this through demonstration plots (described above) coupled with simple crop budgets. The project covers the costs of the first soil test for demonstration plots so farmers can see the improvements in crop yields with their own eyes. To illustrate the cost-benefit ratio of the test, agronomists use a simple crop budget to walk the farmers through the cost of the test, the expected yield increases, and the resulting increases in net profit. The combination of seeing the results firsthand, talking to the demonstration farmers, and understanding the math convinces farmers that the long-term benefits of soil analysis outweigh the upfront costs.

Response: Discounts to jumpstart demand

In addition to demonstration plots, USAID-KHCP is working to jumpstart demand by offering discounted services to smallholders for a limited time. From September to December 2012, Soil Doctor discounted their price per sample from Ksh 2,500 (\$30) to Ksh 1,500 (\$18). This provides incentive for early adopters to take up soil testing, thereby exposing more smallholders to the benefits of the technology.

Challenge 2: Farmers believe it is worth the cost, but they do not have the money.

Response: Increasing incomes through good agricultural practices and improved market linkages

This is the core of USAID-KCHP's work. Even without investing in any technologies, USAID-KHCP teaches farmers to significantly improve their yields by employing simple good agricultural practices such as raised beds, proper plant spacing, and organic mulching. Combined with the market linkages created by the project, farmers can double and triple their incomes in one growing season. This increased income enables farmers to invest in soil analysis for the following season, giving them the opportunity to further increase their incomes.

Challenge 3: Farmers do not know how to take soil samples correctly.

Response: Train agrodealers as service providers

Using the train the trainers model described above, USAID-KHCP agronomists are teaching farmers how to take and label samples correctly. However, because the project ends in 2015, Crop Nutrition is training

agrodealers to act as service providers so they can continue to train farmers in proper techniques after the project ends. Though agrodealers are traditionally traders, not service providers, experience to date shows they are willing to provide training to smallholders because they understand the profit incentive.

Challenge 4: Farmers do not know how to label samples.

Response: Create uniform labels and train agrodealers on proper labeling

To encourage proper labeling, Crop Nutrition has created paper bags with very simple form fields for required information. Crop Nutrition provides these bags to agrodealers free of charge and trains them on how to fill them out with farmers.

Challenge 5: Farmers think they can just copy their neighbors' recommendations.

While climatic conditions may be similar in a given area, each plot and crop has its own unique soil composition and therefore requires its own soil test and recommendations. Farmers who implement the recommendations of a neighboring farm will often find the results disappointing. Persuading them that each plot needs its own sample every three years is challenging, especially given that most farmers have become accustomed to generic national guidelines.

Response: Individual training and soil testing.

USAID-KHCP agronomists and Crop Nutrition will continually train farmers and agrodealers on the need for individualized testing; however, no matter how good the messaging, many individuals will still (understandably) try to copy their neighbors' fertilizer recommendations. Crop Nutrition expects the results will start speaking for themselves as uptake increases.

Challenge 6: Agrodealers do not carry the recommended inputs.

Once farmers receive their tailored recommendations from Crop Nutrition, they go to their local agrodealer to purchase the recommended fertilizers and inputs. All too often, however, the local agrodealer does not have the recommended inputs in stock.

Response: ARC/GIS Soil Fertility and Farm Input Information System

Crop Nutrition will develop a web-based information system to serve as a key link between farmers, agrodealers, and input suppliers. The tool will display which nutrients are required in each area, so that fertilizer and lime companies can supply the correct inputs to the agrodealers, according to the farmers' needs within in each agrodealer catchment area.