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AGROCARES SOIL SCANNER
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On-the-spot, easy and affordable soil testing for Kenyan smallholder farmers

Africa is facing an escalating soil fertility crisis and without immediate interventions, the continent continues to lose over 3,5 billion Euros per year worth of nutrients. To increase productivity whilst decreasing soil fertility decline, balanced fertilization is essential. Farmer cooperatives using soil scanners to provide real-time fertilizer recommendations may be part of the solution. AgroCares and Agriterra present their findings from a soil sensor services pilot for farmer cooperatives in Kenya.

Near InfraRed (NIR) soil scanner

In 2017, AgroCares launched a Near InfraRed (NIR) soil scanner in Kenya, which gives farmers real-time information on the nutrient status of their soil. An app translates the soil data on the spot into fertilizer recommendations for the selected crops. November 2018, AgroCares and Agriterra executed a joint evaluation on the use of the soil scanner at cooperative and farmer level, to identify success factors, possible bottlenecks and the added value of innovative soil testing services for farmers. The results seem promising: farmers have reported higher fertilizer efficiency, increased yields and, in general, willingness to pay for scans.

Soil scanner services through farmer cooperatives

In Africa, many farmers lack on-site soil and crop information and base their fertilizer selection on intuition or on tacit knowledge and advice from local agro dealers, without knowing the actual nutrient status of their soils. This can result in a mismatch between applied nutrients and required nutrients for productive soils. More so,

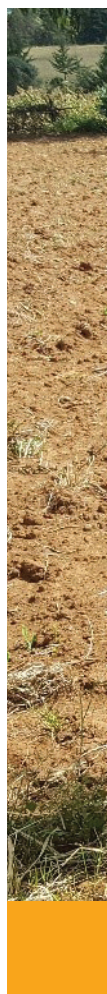
applying non-limiting nutrients result in economic losses and environmental degradation. What is needed, is real-time information on the nutrient status of soils for informed decision-making on fertilization. Worldwide, only about 5% of the farmers have access to reliable soil testing information. Conventional soil test laboratories are expensive and testing is done off field, advice is often complex and delivered with delay. But recent technological innovations in IT, sensor technology and machine learning, have opened up new possibilities.

AgroCares, a Dutch agro-tech company, works through a network of service providers who offer soil testing services to their networks of farmers. Since its release in 2017, 200 soil scanners were sold to various organisations, including input suppliers, agro dealers, NGOs and farmer cooperatives and unions in Kenya. The service providers buy the scanner for 3,000 Euro and a license for a specific application, for example the 'advisor application' of 1,800 Euro per year, with unlimited use of the database. The cooperatives offer soil testing as a service to their members and charge approximately 5 to 8 Euros per report.

Evaluation

For the evaluation, AgroCares and Agriterra conducted interviews with board members, managers, extension officers, input shop officers and farmers linked to three Kenyan primary cooperatives and one cooperative union

1. Meru Central Coffee Cooperative Union: 98.000 active members, 5 scanners, 5 operators, 1876 clicks in 13 months
2. Tarakwo Dairy Cooperative Society: 3.000 active members, 1 scanner, 192 clicks in 20 months
3. Olkalou Dairy Ltd.: 6.000 active members, 2 scanners, 2 operators, 118 clicks in 18 months
4. Tulaga Farmers Cooperative Society: 1878 active members, 1 scanner, 2 operators, 26 clicks in 2 months





Farmers interviewed indicated positive experiences with the scan, but it takes at least six months of investing to get these results. Cooperatives can achieve a breakeven point within one year. Soil testing gives members of organisations superior value: the costs of the scan are compensated by (1) reduced input expenses due increased efficiency and (2) increased yields and higher return of investment.

The evaluation further showed that the main implementation challenges were 'non-technical'. Farmers may have limited or no availability to recommended inputs and for the cooperatives, logistics of collecting soil samples and communicating fertilizer recommendation can be challenging. Furthermore, a majority of farmers has no knowledge about the importance of soil testing and extension officers have insufficient knowledge to provide tailored advice to farmers based on a scan. It is not easy to find motivated promoter farmers and to retain qualified operators.

HOW DOES IT WORK?



SoilCares, part of AgroCares, has developed a portable handheld soil Scanner using Near InfraRed (NIR) spectroscopy. How it works: a spectral image is sent to the application on the smartphone via Bluetooth. Subsequently, the smartphone application connects to AgroCares' global calibration database to convert the spectral image into the required soil data. How this data is interpreted and reported depends on the selected application.

There are applications for monitoring (only data presentation), liming recommendation and several fertilizer recommendation applications. The most used application is the 'Advisor application', which translates the soil data within 10 minutes into direct fertilizer recommendations for farmers for the selected crops. This application is used by 37 organisations in Kenya, 20% of which are farmer cooperatives, operating 97 scanners. The sensors can make about 30 soil samples per day.

Finally, some cooperatives have indicated they don't feel ownership and involvement over a soil scanner purchased with donor support.

A critical success factor for the implementation of soil scanner services, are the management and board of a cooperative. They need to be aware of the business potential and value for cooperatives and farmers and prepare a professional soil testing services business approach, supported by a SMART business and operational plan. The evaluation shows this is not always the case. After-sales support for technical challenges, coaching of operators and providing promotion materials are also important. The evaluation team therefore developed two tools to support a sound introduction of soil testing services at cooperatives-level: a **pricing mechanism calculation model** for cooperatives to know real costs, price setting, break-even point and profit; and a **services model** distinguishing four phases spread over two years to systematically reach out to the innovators and early adaptors.

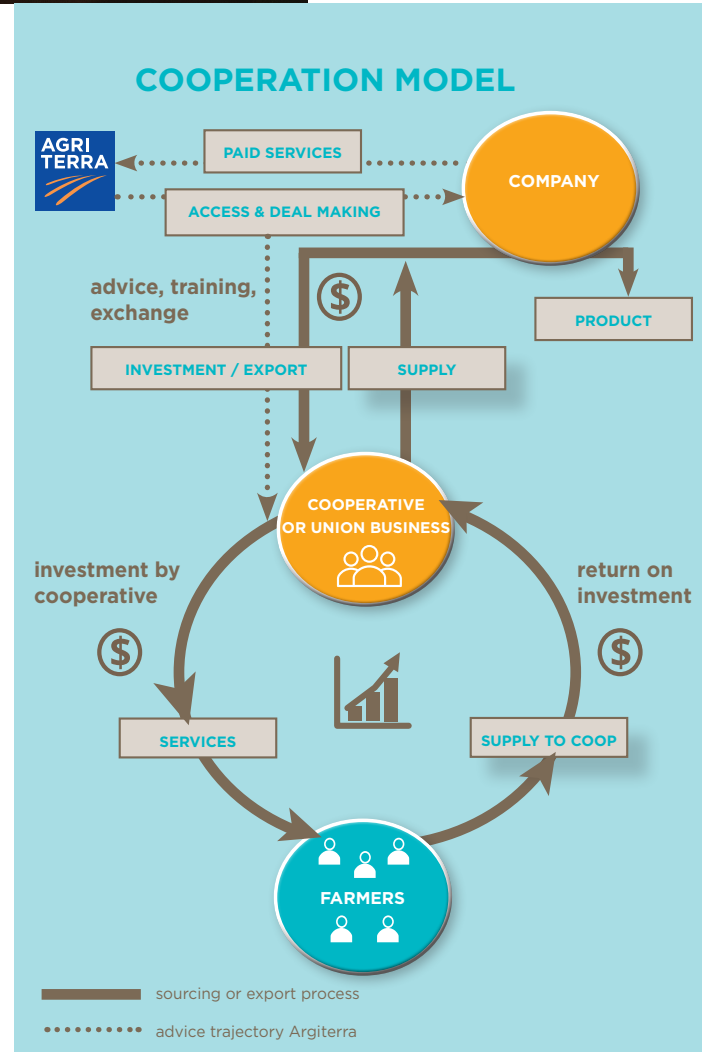
“It is fast, affordable and productive. Within 10 minutes the farmer receives a fertilizer recommendation for specific crop selection. On-the-spot soil testing benefits the farmer as well as the cooperative’s business”



The way forward

The soil scanner is a disruptive innovation and changes the way soil testing used to be done. Consequently, bringing an innovation to scale needs time and continuous support. Critical to the success is the position of the service providers, in this case the farmer cooperatives. They are well placed institutions to offer soil testing as they have an extension system in place and know their members. On-the-spot soil testing benefits the farmer as well as the cooperative’s business. It is fast, affordable and productive, but to make it efficient, it is recommended that a cooperative has at least 1000-1500 members and sees the soil testing service as a business.

Cooperatives should have their own input supply shop (or a good network) and have a check off payment system. They can even make soil testing compulsory for their members as a condition to supply to the cooperative (this works for example for coffee) or to have access to inputs. The next step for the scanner is to integrate soil test information in platforms for data analysis, e.g. by financial institutions or governmental bodies. AgroCares and Agriterra will continue their partnership and work on the two models and implementation of the scanner in other African countries.



Agriterra is an agri-agency founded by the Dutch agricultural sector that professionalises farmer organisations and cooperatives worldwide in order to better serve the needs and interests of their member farmers.

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