2SCALE

Getting plant nutrition solutions to scale requires more than technology promotion

Photo: Joris Maatman | Rice collection after harvest, Kenya

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KEY MESSAGE:

Technical solutions for plant nutrition problems are available in abundance. To effectively promote their large scale use, local adaptation, business relationships for effective input supply and advisory services are required.

Introduction

The ambition of the 2SCALE programme is to develop inclusive agri-business arrangements which assure firms able to sustain their operations, to innovate and to remain competitive in local, regional and international markets. At the same time, these business arrangements need to be based on inclusive opportunity to participate, and fair reward for effort and performance by small producers, workers and traders, male and female, young and old, alike.

In the debate about improving business relationships and value chain functioning, at times the element of improving the primary production process gets less attention. In growing food markets however, with increasing absorption capacity, supporting large scale improvement in agricultural productivity and quality of produce can be a highly effective manner to improve the farm derived revenue of smallholder producers.

Invariably soil fertility management and plant nutrition are a core ingredient in sustainable intensification efforts. There is no lack of soil nutrition technologies and knowledge on how to apply them to improve productivity. Getting these solutions into large scale and inclusive use remains a major challenge. The 2SCALE programme has gained valuable experience with adapting and bringing to scale plant nutrition solutions; insights and the keys to success are presented here.

Examples of plant nutrition solutions

The 2SCALE programme has in its different agri-business development efforts invariably included activities focused on productivity improvement by smallholder producers. Several technologies for improving nutrient use efficiency have been promoted by 2SCALE agri-business partnerships (Table 1). None of the solutions are new inventions, they are known and proven beneficial technologies, which for some reason or the other, had not found mainstream use.

Urea Deep Placement (UDP) is an alternative for broadcasting urea in paddy rice production. It has as advantage that the nutrients are released more slowly, immediately within the root zone of the rice plants. This reduces the high losses occurring, mainly through volatilisation of ammonia, when broadcasting the fertiliser, which is the most common practice. UDP reduces fertiliser need, while increasing productivity, thus providing farmers with a higher return on their investment in fertiliser.

UDP also reduces weed growth compared to fertiliser broadcasting since short season annual weeds (majorly broad leaved weeds) find it difficult to utilize Nitrogen deeply placed 7 to 10 cm below the soil surface, giving a competitive advantage to the transplanted rice. As the weeds germinate after rice transplanting, the rice crop precisely utilizes the Nitrogen placed near its roots more efficiently than the weeds. The less vigorously germinating weeds are easily controlled using a push weeder, shredding them in situ and incorporating their organic matter within the paddy fields to improve fertility.

Inoculation of soybean fields with specific Rhizobium species is known to improve productivity under most circumstances of sub-optimal soil nutrient or soil moisture status. The inoculation improves the efficiency of the biological nitrogen fixation by the soybean crop. Inoculation was however not being applied by soybean farmers, even though the technology was proven effective.

In most Sub-Sahara African countries, compound fertiliser is usually only available as a single NPK blend. Sometimes this blend was once upon a time adapted to the main commercial crop in the country, sometimes not. Almost invariably the available blend does not correspond well with the current crop requirements. Through understanding current specific crop macro- and micronutrient requirements in specific soils, blends which better fit the demand of specific crops in specific regions of a country can be formulated, which provide a better return on investment for farmers.

Table 1 | Plant nutrient solutions promoted by 2SCALE

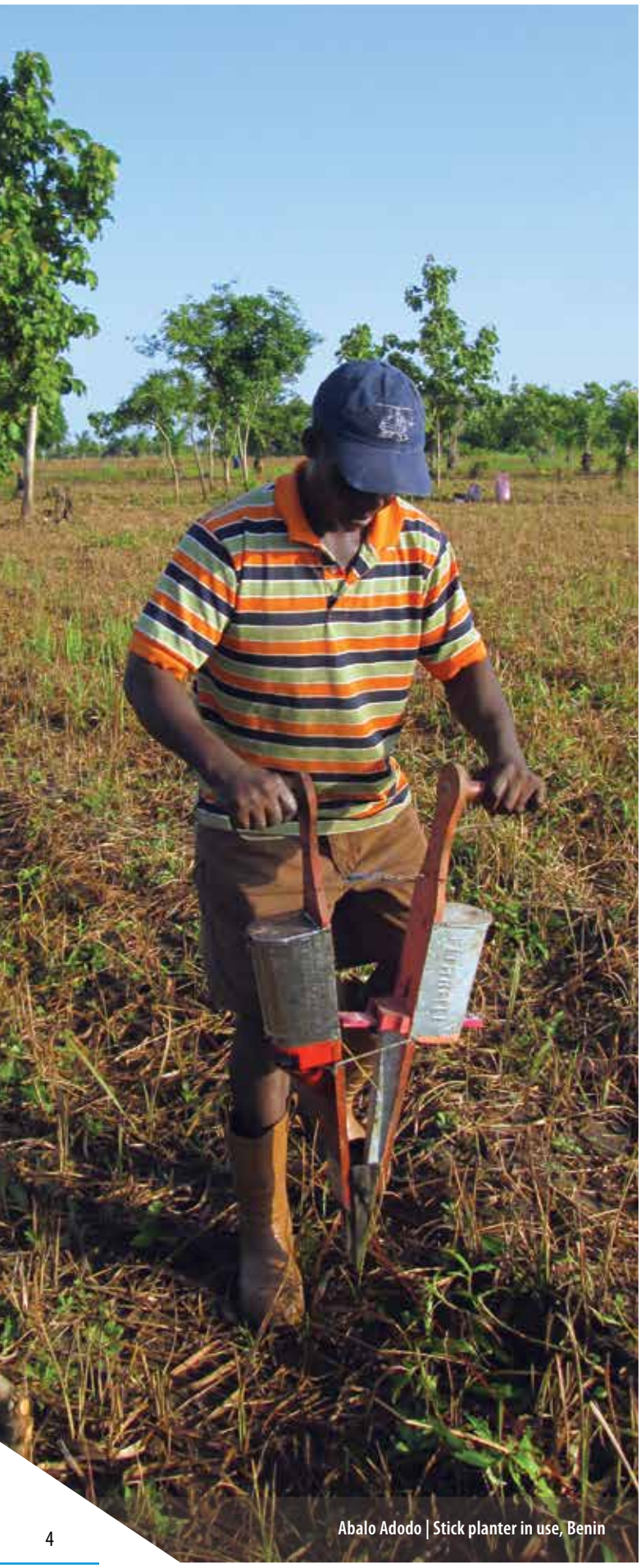
	Urea Deep Placement	Inoculants	Adapted fertilizer blends	Stick planter
Technology description	Placement of urea briquettes sub-soil, in between 4 transplanted rice plants. Alternative for broadcasting, maximizing nutrient use efficiency	Specific Rhizobium application to soybean plantings, to stimulate biological nitrogen fixation	Area specific fertilizer (mainly NPK-based) blends, including micro-nutrients, better responding to specific crop needs and thus increasing nutrient use efficiency	Simple device allowing for fast micro-dosing of fertilizer at planting of a crop, improving nutrient use efficiency and reducing labor requirements
Crops	Rice	Soybean	Rice and potato	Maize and soybean
Countries	Benin, Ghana, Kenya, Mali, Nigeria	Benin, Côte d'Ivoire, Ghana, Nigeria	Côte d'Ivoire, Ghana, Kenya, Nigeria	Benin, Mali, Nigeria
Associated services needed	Specialized laborers applying the briquettes; Financial services	Fast delivery services to keep the product alive		Specialized laborers providing sowing-fertilization services
Product innovation required	Briquette production; Briquette applicator	Commercial Rhizobia formulation production and retailing through a cold chain	Production and packaging of specific blends by local fertilizer industry	Local production of manual stick planters
Farmer capacity building and promotion required	Understanding the added value of UDP; Package of good agricultural practices	Demonstrate the value of inoculants	Advocacy to use the most appropriate blend	Demonstrate added value and economic benefit of the stick planter

Joris Maatman | Freshly harvested rice, Kenya

BOX 1 | INTENSIFICATION OF RICE PRODUCTION IN KENYA: A CONCERTED EFFORT REQUIRING COMPLEX BUSINESS NETWORKS

Kenyan rice producers have been noticing declining yield levels since 2000, while demand is growing, stirring price increases, which raises government concerns. 2SCALE facilitated agri-business relationships to intensify rice production to increase productivity in Kenyan irrigated rice schemes. A combination of measures, consisting of the use of good quality seed, a specific fertiliser blend including essential micro-nutrients as basal fertiliser upon transplanting, deep placement of Urea as top dressing and general good agricultural practices was found to increase rice productivity and profitability substantially.

To make a success of this intensification of production however, the input supply system required changes. A specific blend of fertiliser for irrigated rice was developed by Toyota Tsusho, which contained, in addition to NPK, micro-nutrients: Boron, Silica, Zinc and Copper. The Athi River Mining Company invested in the production capacity, promotion and development of a distribution network of Urea briquettes, complemented with local briquetting capacity. For efficient briquette placement, applicator design was adapted to allow for its local production. Local youth groups specialised in offering Urea Deep Placement services.



Abalo Adodo | Stick planter in use, Benin

A stick planter allows seeding and fertiliser application in a single go through the field. This saves labour, provides a precise amount of fertiliser next to the seed, and reduces the soil disturbance. A relatively simple device supports this labour saving and nutrient use efficiency improving technique. It was well known in Brazil, but not in Sub-Sahara Africa.

The four examples have in common that they are proven effective technologies in the hand of smallholder producers. There is a potential economic benefit of technology adoption, and there is ample understanding of how the technology functions. Still, the technologies are not finding a large audience of adopters. Obviously more is required than a technically proven sound technology

Lessons learned

Based on the 2SCALE experience three main requirements for successful promotion of the proven effective technologies were identified:

- Local testing and adaptation of technical solutions.
- Sustainable business networks to support the availability and use of the technologies.
- Effective methods of training and communication to accompany the technologies.

Local testing and adaptation of technical solutions

Obviously technologies need to be tested for local relevance and if relevant, adapted to the local context. In the case of the blended fertiliser, this is intrinsic in the solution itself. The key is an adapted blend, as well as a locally relevant advice of use. In reality, a compromise needs to be struck between being specific and a blanket advice for a crop in a specific area. Producing fertiliser blends for each crop in each locality is not possible. The key to successful fertiliser blends is in the compromise between the desire to be highly specific and the reality of the fertiliser market which dictates that scale is essential to keep the cost low, and the profit margins of interest for fertiliser importers, blenders and retailers.

UDP technology and the accompanying agronomic practices were adapted to the Kenyan circumstances through the involvement of farmer cooperatives, the rice research institute (MIAD) and the national irrigation board (NIB). Farmers managed trials were run for evaluation of the technology (plant vigour, tillering intensity, panicle grain setting and filling). This provided for the opportunity to understand the potential of the technology in Kenya, adapt where necessary and design strategies for wider promotion.

Sustainable business networks to support the availability and use of the technologies

Almost invariably soil nutrition solutions require external inputs, be it organic as in the case of inoculants, or inorganic as in the case of the

BOX 2 | STICK-PLANTER FOR MAIZE IN BENIN AND NIGERIA

Abalo Adodo | Stick planter, Benin

Maize producers in Benin and Nigeria are confronted with the limited availability of manual labour, as a direct result of youth migration. This creates difficulties for maize sowing and fertiliser application. The labour requirement for sowing and fertilisation following common practice requires is an estimated minimum of 16 man-days.

A technical solution emerged through the collaboration between national agricultural research in Togo and Brazil in the form of zero-tillage techniques and a hand-operated stick-planter. The stick-planter applies in one go seed and a well-placed micro-dose of fertiliser. For a field of 1 hectare a farmer needs 1.5 day of his own or hired labour using the stick planter.

As a result of the changed practices farmers are better able to plant timely, which is essential in their strategies for coping with shorter and less reliable rainy seasons as a result of climate change.

To make the technology locally available and adopted, local blacksmiths were trained in the production of the stick-planters, and jointly with farmer organisations and the blacksmiths, a farmer demonstration programme was developed to promote the use of the stick planter.

different fertiliser related technologies. For the sustainable production and retailing of these inputs, private entrepreneurs need to see a business case, and make the effort to develop and sustain the for-profit service of producing and distributing the inputs. In most of the cases however, there initially was limited private agri-business interest in the plant nutrition solutions. For the private enterprises a promising technology is not the same as a realistic business opportunity. The efforts needed to identify, test and promote the plant nutrition solutions are such that it is beyond the investment capacity, or at least beyond the investment willingness, of the private enterprises to embrace the technical solution as a business opportunity.

Involvement of larger companies

In all the cases of promoting nutrition solutions 2SCALE had to invest efforts in facilitating business relationships and networks. First and foremost in fertiliser production, scale matters. Fertiliser is in most African countries an imported commodity, and when it is not imported, it is produced by a single large company. As such the interest of a larger company is essential for triggering change in plant nutrient solutions. The role of the larger company can be limited to assuring the availability of desired inputs, but ideally the larger company can be a partner in technology promotion, with the motivation of market development as driver of its efforts. At which stage in the process the larger company is willing to become a co-investor in technology promotion depends.

In Kenya, in addition to promoting UDP as top-dressing technology, 2SCALE partnered with Toyota Tsusho to improve the base fertiliser application which is usually done by applying NPK. Together 2SCALE and Toyota Tsusho developed a blended fertiliser, specifically tailored to the needs of rice farmers. The fertiliser blend contains NPK in a ratio of 11:23:23 to respond to the specific need of Kenyan irrigated rice

Joris Maatman | Carrying the harvest from the field to the collection point, Kenya

crops. In addition the fertiliser was enriched with Boron, Silica, Zinc and Copper. Toyota Tsusho came on board early on, and partnered from the moment of soil analysis until the distribution and promotion of the specific fertiliser blend.

Complex business partnerships at different levels

The involvement of a larger company was in most cases not enough to make the plant nutrient solutions a success. Additional service provision was required in most cases to assure the success of the technologies.

In the case of UDP, briquettes are required, which are produced under high pressure from granular Urea fertiliser. This can be done centrally, or decentralised. In Kenya it was found to be more efficient to prepare the briquettes locally, as transport costs of briquettes are higher than for granular urea, because of the increase in bulk volume. For the local briquette production, Mwea Multipurpose Growers Cooperative (MRGM) bought a briquetting machine, with co-funding by 2SCALE, and got its staff trained on its operation. It is producing briquettes on demand for members and outgrowers at a fee of Ksh. 150 for each 50 kg bag of Urea. In Kisumu demand for briquettes emerged after UDP training of in total 2871 rice farmers in the Ahero irrigation scheme through 2SCALE. A private enterprise, Nyabon, purchased a briquetting machine with co-funding from 2SCALE, and is producing, stocking and retailing briquettes at a margin of 200 Ksh. per 50 kg bag, initially to the 12 rice producing cooperatives of the Ahero irrigation scheme, but demand for the briquettes increased with the spreading of UDP to the neighbouring counties of Migori, Homa Bay and Busia.

In addition to the production and retailing of the briquettes, the application of the briquettes needs specific attention. It can be done completely manually, but this has shown to be cumbersome. It is more efficient to apply the briquettes using a mechanical applicator, which places the briquettes sub-soil faster and with less effort. Rather than expecting each rice farmer to do this individually, service provision teams ("gangs") of youth specialised in this service developed, making the technology more accessible. To assure the

BOX 3 | INTEGRATED SERVICE DELIVERY IN SOYBEAN PRODUCTION IN GHANA

Fertiliser recommendations in Ghana are not based on a specific analysis of the availability of nutrients in the soil and the specific demands of particular crops. Recommendations have been based on long ago established soil conditions, most of which are out of touch with reality due to the rapidly changing soil environment.

2SCALE has supported Green-EF, an agricultural input importer and distributer, to engage in the supply of inoculants to soybean producers. The Agriculture Technology Transfer (ATT) Project (an IFDC project 2SCALE collaborates with) has supported Green-EF with a soil testing laboratory to offer service to producers. Through the laboratory, producers can, against a modest fee, determine the suitability of their soils for inoculation and receive a tailored fertiliser recommendation. The recommendation includes advice in liming to improve soil pH, a major and often underestimated factor in the effect of inoculants and nutrient use efficiency in general.

BOX 4 | INPUT DEALERS AS TRAINERS

Agro-input dealers at grassroots level often informally provide advice on the use of different inputs. Input supply companies recognise the role of input dealers as promoters of their products and their proper use. Not only do they provide input dealers with printed information to issue to farmers, they nowadays invest in offering training to agro-input dealers on agronomy, post-harvest handling and plant protection, to assure they can advise farmers properly on the effective use of their products. Input supply companies offering training to agro-input dealers are Bayer, Syngenta, Yara, Athi River Mining Company, Toyota Tsusho, Osho and Twiga. The provision of training is has really improved the competencies of the agro-input dealers, who are now assuming the role of agricultural advisors on effective use of inputs to the farming population. 2SCALE is partnering with input suppliers to improve the training programs and include elements of good agricultural practices.

availability of affordable applicators, NMC ltd., a Kenyan firm, has found a business opportunity and is moulding applicators locally from recycled plastic. Finally, specific financial services were developed for rice farmers, to assure easier access to land preparation, the package of good quality seed, specific fertiliser, crop protection and briquette application. All members of the MGRM cooperative have access to these services through the credit mechanism, disregarding age, gender, size of landholding or collateral.

In the case of the stick-planter, similar additional efforts in business network building had to be made. Local producers of stick planters had to be trained, and service provision teams of specialised labourers were developed to provide the service against a modest fee, rather than individual farmers each having to buy their own device.

In the case of soybean inoculants in Ghana, the technology was first promoted by 2SCALE with producers, using inoculant imported from Benin. Only after the successful adoption by farmers 2SCALE identified Green-EF, a small private enterprise, which was interested in the commercial importation and distribution of the inoculant, and recently has started co-investing in the local production and distribution of inoculant. The involvement of Green-EF has been essential in the development of a functioning cold-chain distribution system, which assures the delivery of fresh and alive rhizobium at field level.

Effective methods of training and communication to accompany technology

In all the plant nutrient solutions that were promoted, investments were made in agricultural advisory services. All of the solutions require behaviour change by farmers, and additional investments, be it in the inputs, or in the service provision to apply the inputs. Smallholder producers are forced to be conservative and risk averse in changing their practices, as they are cash short, and cannot gamble with their household food security. As a result the promotion of plant nutrition solutions requires first adaptation and testing under farmer control. Next particular efforts are needed to demonstrate convincingly the added value compared to current practice. The 2SCALE programme integrated these activities as part of the agri-business partnerships.

In the case of UDP of rice, the technology promotion was part of a larger training curriculum on the intensification of rice production, which encompassed nursery management, seedling rate, row planting, fertiliser application, improving weeding and machine harvesting as topics. The farmer training curriculum was developed through a joint effort of 2SCALE partners. The training of farmers was done by 2SCALE coaches. 2SCALE coaches are mainly staff of farmer cooperatives who are dedicating part of their time to facilitating the 2SCALE activities. In addition public extension staff were trained as trainers, to be able to increase the number of farmers that could be trained. During field days also input suppliers would provide training services.

In all efforts 2SCALE focussed on making advisory services economically sustainable. Either by assuring that individual or organised farmers would start paying for training services, or by embedding the training services in the business model of the input suppliers (Box 4). The main strategy of 2SCALE was to select coaches from within farmer organisations and companies. These coaches received through the programme small field allowances and reimbursement of expenses to support them in the implementation of training and coaching activities. Throughout the programme the coaches have been steered towards seeking opportunities for sustaining these costs in a different manner, either through direct payment by beneficiaries, or by absorption of the costs by their employers.

The involvement of industry partners, intermediary input dealers and organized producers in the development of training programs is essential. The collaboration between these partners provides for

a feedback mechanism with regard to the technology on offer. It will help the industry understand what does and does not work, to allow for the adaptation of their offer to better serve the demands of their customers.

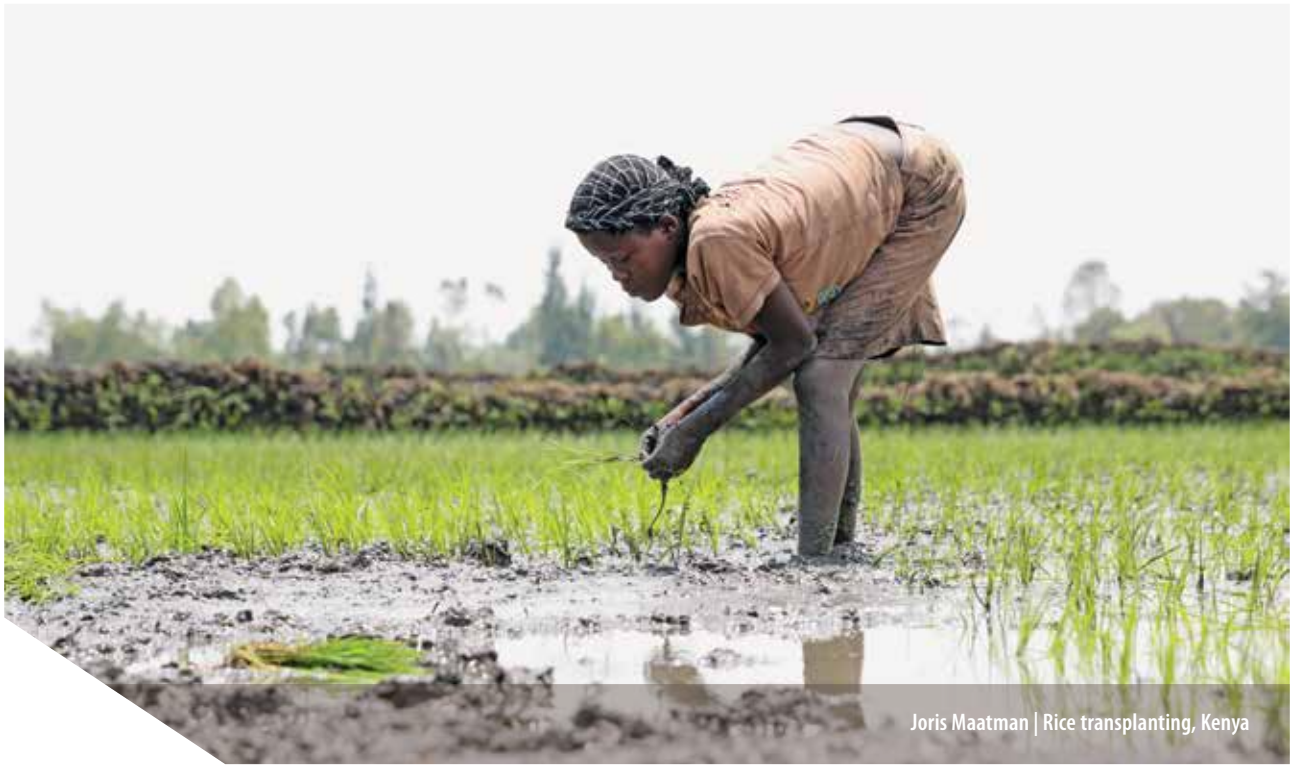
Conclusions

There are many soil fertility solutions and technologies, which are currently not being applied. In commercially oriented farming the incentives for intensification are in place, potentially sound solutions for soil fertility management can be adopted. In practice however, sustainable innovation in soil fertility management practices requires more than the availability of a proven effective technology.

A first requirement for the adoption of soil fertility solutions is technology testing, adaptation and promotion at farmer level. This requires joint effort from farmer organisations, public advisory services and private enterprises who have an interest through marketing inputs.

A second requirement for the successful adoption of soil fertility management solutions, are sustainable business networks. These business networks are needed to assure that the inputs required are effectively retailed up to village and farmer level. At times additional processing steps are required, specific equipment is needed or special farm services are necessary to make the soil fertility solutions a success. Moreover, access to capital is required for many soil fertility solutions, requiring adapted credit mechanisms.

These business networks do not develop automatically, they need to be facilitated. 2SCALE has worked successfully in brokering these business networks. In some instances developing these business networks requires convincing users and suppliers through co-innovation. If it succeeds however, economically self-sustaining soil fertility management solutions can emerge, which assist farmers in creating added value through intensification of production, and in the process, employment and profits are created in input production, processing, retailing and application.



Joris Maatman | Rice transplanting, Kenya

This paper is part of a series in which 2SCALE facilitators and coordinators share their experiences. Contributors: Abalo Adodo, Grégoire Oniankitan Agai, Mathias Ahounou, Geneviève Audet-Bélanger, Tekalgn Ayano, Judith Chabari, Assefa Degefu, François Dossouhoui, Peter Gildemacher, Olugbenga Stephen Idowu, Alhassan Issahaku, Peter Kirimi, Eric Lakoussan, Arnoldus Maatman, Janet Macharia, Douglas Magaja, Jacqueline Ndambuki, David Njenga, Irene Njogu, Francis Nthuku, Thompson Ogunsanmi, Gabriel Olengo, Kwame Pipim, Hiwot Shimeles, Faoussa Tadjou, Addis Teshome, Baba Togola, Mahamane Toure, Youssouf Traore, Niek van Dijk, Ajay Varadachary, Raphael Vogelsperger, Allan Wayira and Bertus Wennink.

2SCALE manages public-private partnerships (PPPs) for inclusive agri-business in Africa. Partnership agreements are developed with companies with inclusive business agendas. 2SCALE offers support services to companies, farmer groups and other relevant stakeholders – enabling them to produce, transform and supply quality food products to local, national and regional markets, including Base of the Pyramid consumers. 2SCALE strengthens the capacity of grassroots and value chain actors, supports innovation and coordinated action, and improves skills to assure effective participation in markets. The focus countries of the programme are Benin, Ethiopia, Ghana, Ivory Coast, Kenya, Mali, Mozambique, Nigeria and Uganda.

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