Innovation for improved crop productivity in Swayimane, South Africa

Introduction

The rising costs of chemical inputs, particularly pesticides and fertilisers, significantly impact resource-poor smallholder farmers in South Africa. At the same time, soil erosion and water scarcity also pose significant constraints to productivity. These challenges have limited the capacity of smallholders to maintain high crop yields and to protect their crops against pests and diseases. Consequently, many farmers are unable to produce enough food to feed their families thus contributing to persistent food insecurity and poverty. In response to these challenges, smallholder farmers are continually searching for new innovative ideas to improve agricultural production.

Through the ELIFaNS project titled "*Expanding the Promotion of Local Innovation for Food Security and Healthy Nutrition to Strengthen Resilience with a Focus on Women (ELI-FaNS)*", the Prolinnova team in KwaZulu-Natal Province partnered with local community members in Swayimane to identify and promote local innovations aimed at improving crop productivity. The team identified local innovations that are focused on low-cost, eco-friendly alternatives for pest management, soil conservation, and agroecological, climate-smart agriculture.

Innovation to control maize stalk borer

The first example of an identified innovation is developed by Mrs Victoria Gumede, a smallholder farmer residing in Ekupholeni village, Swayimane. Her innovation involves sprinkling a small amount of soil from her field into the young, folded leaves of the developing maize plants to control stalk borer infestation and/or damage. This simple and low-cost way of controlling stalk borer showed strong potential for Participatory Innovation Development (PID) and the Prolinnova team visited her to learn more about it and also to start building a relationship that could lead to PID.

Mrs Gumede explained to the Prolinnova team that she had often noticed small holes in the newly developed maize leaves during routine weeding. Many of the affected plants either died or became stunted and failed to produce harvestable maize cobs. Upon further inspection, she found tunnels and larvae inside the stems of these plants. She recalled from her youth a practice of sprinkling soil on maize plants that was used by her father and began experimenting on her own with sprinkling some soil into the top of young maize plants showing early signs of damage ie holes in the leaves. In discussion with other farmers in the area, the Prolinnova team found that some applied ash to the top of the maize plants in a similar way, also to control stalk borer. Mrs Gumede observed a reduction in the presence of small holes on her maize leaves three weeks after applying the soil and attributed this improvement to her innovation. She highlighted that her innovation does not completely eliminate stalk borer populations but believes it reduces their numbers. She

Small holes on newly developed maize leaves which indicate stalk attack.

Credit: Mzokhona Mndali

mentioned that detecting stalk borer infestations but at the first sign of damage during weeding your maize, there is a need to take steps to control it. The underlying mechanism responsible for a reduction in stalk borer populations was not known to Mrs Gumede. During the conversation, she highlighted that she would like to know the effectiveness of her innovation. The Prolinnova team saw this as an opportunity to answer this question collaboratively with the innovator through a PID process.

Mrs Gumede's innovation requires no financial investment as it utilises available soil from the cropping land and involves the assistance of her children. The benefits of this approach include improved maize productivity and household food security. If adopted, this innovation could be a valuable solution for many resource-poor farmers in the Swayimane area. However, it is important to note that the innovation is labour-intensive as the soil is susceptible to being washed away after a rainfall event and needs to be replaced.

The KZN Prolinnova team with the innovator, Mrs Shozi, at her homestead.

Credit: Pakama Mahala

Mrs Shozi's common dry beans planted within furrows.

Credit: Pakama Mahala

Ridge and furrow cultivation method

The second example of local innovation within the Swaimane learning site involves the use of an adapted ridge-and-furrow cultivation method. The innovator is Mrs Hlengiwe Shozi who is a smallholder farmer residing in Mbhava village, Swayimane. Mrs Shozi manages a small household garden where she grows various food crops, including maize, *amadumbe* (taro), sweet potatoes, beans, and leafy vegetables such as spinach and cabbage for home consumption. In addition, she cultivates sugarcane at the bottom part of her farm, which she sells to a nearby sugar mill.

Mrs Shozi's homestead and fields are located on a steep slope which makes farming challenging due to heavy runoff and soil erosion during the rainy season, which is the main cropping season. When the Prolinnova team visited Mrs Shozi to gather more information about how her innovation came about, they observed a hedgerow of vetiver grass near her house. Mrs Shozi explained that rainwater from her roof used to run through her cropping land, eroding the soil and washing away crops, largely due to the steep slope of her land. In an effort to slow the flow of water and reduce erosion, she initially planted vetiver grass as a natural barrier. While this intervention provided some relief, it had limited success in fully controlling the speed of the water flowing into her cropping land.

Mrs Shozi began using the ridge-and-furrow cultivation method as a way to slow down runoff and manage soil erosion more effectively. After rainfall events, she observed that the soil in the furrows held moisture for long periods. She saw this as an opportunity and decided to establish her food crops directly in the furrows rather than on the ridge. Her innovation is a unique adaptation of a traditional farming practice of planting crops on ridges. This adaptation is particularly interesting because by planting crops within the furrows, they benefit from the harvested rainwater.

Mrs Shozi gets triple benefits from this innovation: reduced soil erosion, improved soil moisture, and enhanced crop productivity.

Sanele's two-layer raised bed system for vegetable production in his homestead garden.

Credit: Pakama Mahala

Using her cultivation technique, Mrs Shozi is able to take full advantage of the water collected in the lower areas during rainstorms. She has been using this technique successfully for over 5 years but does highlight that the innovation is labour intensive as it requires regular maintenance of the ridges, especially during the cropping season. Despite this, she has seen value in using the innovation to solve the challenge of soil erosion.

Two layered raised bed system

The third example of local innovation identified within the Swayimane learning site has been developed by Mr Sanele Nkala from Nomganga village. He is a young university graduate in the field of agriculture who has adopted permaculture as a farming technique. Permaculture is a very new concept within his community. Although completely self-taught, Sanele has reached a scale of production that allows him to feed his family and provide surplus vegetables for sale locally. His vegetables, which are grown without the use of synthetic chemicals, have gained popularity locally, particularly among health-conscious consumers. A group of nurses from a nearby clinic has also become his customer base. They are attracted by the quality of his produce and the health benefits associated with eating fresh, nutrient-rich and locally grown vegetables.

The Prolinnova Team visited Sanele to learn more about his small homestead farm. He explained that his journey into permaculture began with a field trip to a farm where he was introduced to the concept of permaculture and explored it further on the internet. With the knowledge gained, he started practicing it at his homestead farm. He went on to

explain that larger scale farms often rely on a slow composting process, where soil is mixed with compost and other organic materials, which are then left to decay for over a year before they can be used to cultivate crops. However, due to the limited size of his homestead farm, Sanele faced a challenge in waiting for such a long process to take place. As a result, he designed a system of two-layered raised beds.

For the bottom layer of his raised beds, Sanele uses a mix of organic materials readily available around his farm and household. These include vegetable remains (such as decaying cabbages, green peppers, beetroot leaves, and spinach), weeds, mulching grass, cattle manure, vegetable scraps and other kitchen waste such as spoiled food. He layers these materials to promote rapid decomposition. For the top layer of the raised bed, Sanele adds a mixture of soil, compost and cattle manure on top of the organic matter to create a nutrient-rich layer into which he plants his vegetable seedlings. Sanele regularly irrigates the raised beds and the moisture speeds up the decay of organic matter, thus releasing important mineral nutrients. This method allows Sanele to grow his vegetable crops continuously without the long composting periods typically seen on larger farms. This two-layer system saves time and also ensures that the soil remains rich in nutrients, which supports plant growth.

Conclusion

These three innovations show how small-scale crop and vegetable farmers are finding ways to solve their challenges and improve their livelihoods while also taking care of their natural resources. By spending time with communities seeing what people are doing differently, we are able to identify locally appropriate ways that other farmers can adopt and adapt, while also creating awareness about farmers' ability to innovate.

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Farmers find their own solution for combatting sorghum smut

Plant diseases, combined with low soil fertility and the effects of climate change, are the main constraints affecting sorghum production in the Ségou region of Mali. To combat sorghum smut, which is a fungal disease that affects the grain, low-income farmers have developed their own strategies. This is the case with a farmer innovator from Cinzana-Gare, Mrs Wondogo, who was using a solution made from the bark of *Balanites aegyptiaca* (known locally as *Zèguènè*) to combat the disease. She removed the bark and soaked it in water overnight (ie for about 14 hours). She then washed the sorghum seeds in the resulting solution and dried them in the shade before planting them. This local innovation was identified and documented through a project titled "*Improving food and nutritional security and the resilience of rural populations to climate change through farmer innovation in the Ségou, Mopti, and Dioïla regions*", known as PROFEIS-Mali Project, under the umbrella of Prolinnova Mali.

The local multi-stakeholders' platform (MSP) in Ségou, including farmer innovators, selected the local innovation to undergo the participatory innovation development (PID) process in order to improve and share with community members and to move towards mainstreaming the PID approach among agricultural and research development actors. The bark from *Zèguènè* is commonly known to form a natural protective coating to the tree, keeping away insects and other organisms that could attack it. The PROFEIS project technical team raised a concern that widespread bark removal could be a threat to sustainable management of this natural resource.

Therefore, Mrs Wondogo, MSP members and the project team discussed this matter, and a joint decision was made to conduct a joint experiment to evaluate the effectiveness of a solution including leaves and twigs compared to the bark-based solution for combating sorghum smut. The experiment intended to test whether the leaves and twigs would be as effective as the bark, because this would be an environmentally friendly alternative in the fight against sorghum smut. The experimentation involved five farmer innovators that conducted the experiments, agricultural advisors and researchers, and was supported by ADAF/Gallè, a non-governmental organisation based in Bamako and host organisation for Prolinnova Mali. Their role was to facilitate and document the process, including the discussions around the outcomes of the experimentation.

The experiment involved testing solutions that contained either bark, leaf or twig powder. Farmer innovators harvested the different plant materials, dried them in the shade and ground them into powder. The sorghum seed was washed in one of the three solutions before being planted in plots in the farmers' fields using a formal experimental design (500g of powder in 5 litres of water to treat 2.5 kg seed). Farmer innovators set up the experimental plots, sowed the sorghum and monitored the experimental plots, which each covering approximately 125 m². The treatments were evaluated by assessing the 'attack rate' for each treatment before the seed heads reached maturity. After harvesting and drying the seed heads, the different components were weighed to allow for comparison against the control, where the seeds were not treated with any solution. The farmer innovators were responsible for the measurements while agricultural advisors, researchers and the project team from ADAF/Gallè captured and analysed the data for generating the experimentation results.

The results were shared and discussed together with farmer innovators. Unfortunately, Mrs

Wondogo, the original innovator, was unable to participate in the experimentation due to eye problems, but she gave her consent at the beginning for the joint experiment to take place. The results showed that during the season when the experiment was conducted, the attack rate was generally fairly low (on average 3.25 plants attacked out of 80) for all the treatments, including the control. The grain and straw weights were also similar for all the treatments (approximately 730 kg/ha for grains and 2,893 kg/ha for straw). This low attack rate could have been related to the rainfall pattern during the flowering stage of the sorghum crop. Nevertheless, the results appear to demonstrate that the leaves of *Balanites aegyptiaca* were as effective as, if not more effective than, the bark in controlling sorghum smut. This will make it possible to limit the use of Balanites' bark and preserve this scarce environmental resource for these rural communities.

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Farmers inspecting the crop for signs of sorghum smut.

Credit: Bourama DIAKITE

Building our pool of Prolinnova trainers

Prolinnova has seen the need to expand the pool of trainers that can facilitate capacity building workshops for network members, particularly within the African Country Platforms (CPs). This led to a Training of Trainers workshop that was held at Mampuya Centre in *Toubab Dialow in Senegal from 7-17 July 2025. The training was funded by the Schmidt Family Foundation through their 11th Hour Project* and focused on training participants to facilitate trainings for facilitators in local innovation (LI) and participatory innovation development (PID), as well as associated topics.

The seven workshop participants were selected from a range of Prolinnova CPs, namely Scholastica Atarah from Prolinnova-Ghana, Jackson Kadiaka from Prolinnova-South Africa, Martha Opondo from Prolinnova-Kenya, Augustin Oudraogo from Prolinnova-Burkina Faso, Oumi Ndiaye (Prolinnova-Senegal), Abdou Thiam (Prolinnova-Senegal), and Paul Jimmy as Subregional Coordinator (SRC) from West and Central Africa (WCA) platform. The training was facilitated by Djibril Thiam (CP Coordinator for Prolinnova-Senegal), Maggie Rosimo from Prolinnova-Philippines, and Chesha Wettasinha and Brigid Letty, members of the Prolinnova International Support Team (IST).

The content of the training included sessions on clarification of concepts and assignments on how to share concepts within workshops (ie training methods). The training sessions at the Mampuya Centre covered the basics of participatory training methods including participatory rural appraisal (PRA) tools, concepts of LI, PID, multi-stakeholder partnerships (MSPs), local innovation support facilities (LISFs), participatory monitoring and evaluation (PME), and farmer-led documentation.

A key objective of Prolinnova is to see participatory approaches such as farmer-led joint experimentation being mainstreamed into formal agricultural research and development organisations and education institutions such as universities and agricultural colleges. Thus, the programme also covered the

concepts of institutionalisation and policy influencing.

One of the objectives of the workshop was to establish a common understanding of the concept of agroecology (AE), given that Prolinnova has always been said to 'promote local innovation in ecologically-oriented agriculture and natural resources management'. A number of the participants were from organisations with a strong AE focus and were able to share more about how the approaches of Prolinnova directly support one of the AE principles, namely the 'co-creation of knowledge'. Participatory innovation development that builds on farmers' own innovations is seen as an effective way to support the movement towards systems that allow farmers to work with nature.

During the course of the workshop, there were two days that exposed participants to real-life contexts to explore some of the concepts that had been covered during the training. This included a visit to a learning site at Kaolack where Agribio Services is working with farmer innovators that have developed two innovations related to desalinating irrigation water and reducing the salinity of the soil in the farmers' fields. The second day allowed the participants to discuss institutionalisation of LI/PID within the University of Thies and FENAB, which is a federation of farmer associations and organisations.

Besides exposing participants to a range of tools for evaluating workshops, the final day focused on supporting the participants to find ways to share their experiences from the training workshop with their colleagues. Towards developing the pool of trainers, the facilitator team will support and mentor the participants, in as far as available resources allow, to organise and facilitate PID training workshops in their own or nearby CPs. The feedback from the participants was very positive and the facilitators also highlighted that they too had opportunities for learning and felt like co-learners in the process.

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The desalination innovation at Kaolack

The farmer innovators found that by letting the water stand in concrete basins for 24 hours before irrigating with it, the salts would settle in the basin and then they could use buckets to scoop out the water from the surface. By not disturbing the salts that had settled out at the bottom of the basin, the water used for irrigating their crops was less saline. Later, they also started farming fish in the basins. The fish were not only a source of protein and income, but they also eat the algae that was previously blocking the pipes. Besides physical benefits, the farmers shared that their innovation has also strengthened the cohesion of the group.

A farmer at Kaolack explaining the use of concrete basins to reduce the salinity of the irrigation water.

Credit: Augustin Oudraogo

