PROLINNOVA South Africa
PROmoting Local INNOVAtion
in ecologically-oriented agriculture and natural resource management

nuffic

TRAINING AND MENTORSHIP IN PARTICIPATORY INNOVATION DEVELOPMENT

Cases of Joint Experimentation - Outcomes and Lessons Learnt

August 2015 to July 2016

Institute of Natural Resources

mahlathini development foundation

KIT

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1 PID REPORT AUTHORS

CASE	ORGANISATION	TITLE	NAME	SURNAME	EMAIL ADDRESS
Case 1: Prolonging brooding in hens in order to increase productivity in indigenous chickens	Farmer Support Group	Ms	Tema	Mathebula	Mathebulat@ukzn.ac.za
Case 2: Sinethemba egg production experiment	Sinethemba	Mr	Thabani	Madondo	Madondont@gmail.com
	Institute of Natural Resources	Ms	Zinhle	Ntombela	zntombela@inr.org.za
	Institute of Natural Resources (intern)	Ms	Nonjabulo	Bambalele	nbambalele@inr.org.za
Case 3: Joint experimentation with Agroforestry systems for the improvement of fodder production in smallholder farming systems	Institute of Natural Resources (intern)	Mr	Sylvester	Selala	mselala619@gmail.com
	Institute of Natural Resources	Ms	Zanele	Shezi	zshezi@inr.org.za
Case 4: Ntenetyana natural resources management rehabilitation	Lima Rural Development Foundation	Mr	Lumko	Mboyi	lumko92@gmail.com
Case5: Exploration of weed management processes in the CA-SFIP conservation agriculture experimentation in EC.	Mahlathini Development Foundation	Mr	Mazwi	Dlamini	mazwi@mahlathiniorganics.co.za
		Ms	Erna	Kruger	erna@mahlathiniorganics.co.za
Case 6: PID implementation in Kwazulu-Natal: NGoba, Emaswazini and Nkandla	Mahlathini Development Foundation	Ms	Phumzile	Ngcobo	phumzile@mahlathiniorganics.co.za
Case 7: Comparing broiler rearing systems to identify the preferred broiler rearing method for small scale farmers	SaveAct	Ms	Nomonde	Mncube	leanda@saveact.org.za

2 BACKGROUND TO THE PROJECT

Through their Tailor-made Training Programme, Nuffic has made funding available to Mahlathini Organics to work with KIT (The Dutch Royal Tropical Institute) and the Institute of Natural Resources (INR) to provide a training and mentorship programme that builds capacity in undertaking joint experimentation.

Joint experimentation, sometimes known as participatory innovation development (PID) is seen as an effective mechanism to develop solutions that are appropriate to the local environment rather than introducing solutions from outside, which often do not fit the social and physical context.

PID, which gives recognition to different sources of knowledge and idea (farmers, scientists, practitioners, market agents, etc.), stimulates innovative behaviour amongst stakeholders. It recognises and builds on the innovative capacity of farmers, but draws on other sources of knowledge too.

The Nuffic initiative comprised a 5-day training event followed by an implementation and mentorship component and then ending with a 3-day feedback session. The five day training workshop was conducted from 17 – 21 August 2015, attended by 24 participants from five Non-Governmental Organizations namely: LIMA Rural Development Foundation, SaveAct, Farmer Support Group, Zimele, Institute of Natural Resources and Department of Agriculture and Rural Development – Okhahlamba District Office. The five day session covered the theory of joint experimentation and other participatory approaches used for determining research needs and designing and evaluating trials.

After the PID workshop in August 2015, each of the organisations was allocated funds to run a PID project with smallholder farmer in communities with whom they work. There PID projects were funded by Nuffic and the funds were channelled through the Institute of Natural Resources. A feedback workshop was held in Pietermaritzburg at African Enterprise from 11 -13 April 2016. The aim of this feedback session was for each participating organisation to give feedback of the type of innovations they have implemented.

This report is a consolidation of the final reports prepared by each of the organisations that received funding through the Nuffic initiative for PID activities.

3 CASE 1: AN INNOVATION IN PROLONGING BROODING IN HENS IN ORDER TO INCREASE PRODUCTIVITY IN INDIGENOUS CHICKENS

3.1 Background and introduction

Eradicating food insecurity remains one of the major challenges affecting rural households in South Africa. In KwaZulu-Natal, rural communities form the majority of the population and are characterized by high levels of poverty, lack of access to basic services and dependency on social grants in order to survive. Small scale agricultural production is practiced to improve food security and rural farmers are often seeking to diversify their livelihoods for increased income. Still, agricultural production in rural areas is practiced at the back drop of erratic weather conditions, poor soils, theft and limited resources. Small scale farming systems often succumb to sudden shocks due to limited knowledge on how to address them and lack of access to resources (Tarwireyi and Fanadzo, 2013). Many rural farmers rely on indigenous knowledge practices and this knowledge often evolves, is lost or modified over time with new cultural practices and norms.

Increased access to healthy and sufficient food remains at the forefront of many development interventions and with time, a more inclusive bottom up approach has been adopted. Participatory Innovation Development (PID) is an example of a bottom up approach that recognizes indigenous knowledge whereby rural farmers are not just recipients of technologies but are innovators and custodians of their own transformation. PID lays emphasis on *equal* participation by farmers and recognises different sources of information (formal research, extension, farmers) whereby farmers can question and modify experiments conducted in their fields using indigenous knowledge and own experiences in order to attain improved results.

The Institute for Natural Resources (INR) conducted a workshop on PID where the main focus was on farmer led joint experimentation and participation. In order to test PID in the field FSG, in partnership with INR sought to identify local innovation(s) that could be tested and improved together with farmers. One innovation was identified in Busingatha, Bergville whereby a farmer had a unique method of rearing indigenous chickens in order to increase productivity.

Indigenous chickens are chickens kept under free range on which no breed selection or improvement by cross breeding has been done. The chickens form an important part of family life in rural households providing a source of meat and eggs and playing important cultural roles. They are known for their good mothering abilities, survival under harsh conditions due to their ability to scavenge for food and low input requirements which make them a viable production system for economically constrained households. Rural chickens, as they are alternatively known have low production potential due to constant exposure to risks that jeopardize productivity. Constraints in indigenous chicken production

include diseases, predators and poor nutrition (Justus *et al,* 2013*).* However, productivity can be increased if management is improved and the innovation from Busingatha provides a way in which increased productivity can be achieved. This report serves to give final update on the process that took place in testing the innovation with farmers.

3.2 Methodology

3.2.1 Focus group discussion

A focus group discussion (FGD) was held with group members in Busingatha to gain insight on the traditional way of poultry production and to introduce the innovation. From the meeting it came to light that most of the farmers owned indigenous chickens but had no specific management system as they let the chickens scavenge throughout the day for food and water. Some farmers scattered yellow maize once in the morning, thereafter letting the chickens out for the rest of the day. Indigenous chickens were kept for meat and eggs and used in some cultural practices.

According to Tariweryi and Fanadzo (2013), rural households experience difficulties in rearing indigenous chickens due to constraints such as predation and poor nutrition amongst others. In Busingatha, challenges included temperature extremes, i.e., freezing temperatures in winter and hot temperatures in summer, thus resulting in high mortality rates of chicks. In addition, eggs rot in summer due to excessive heat. Newcastle disease was identified as the most prevalent and caused the highest level of mortalities among chickens. Eye infections and foot rot were among the common diseases. Mosquitoes and mites were identified as major disease vectors in summer. The chickens, when kept outside often fall prey to predators. The farmers did not consider chickens as a significant source of income but rather as a supplementary source of food for the household. They sold or exchanged them with neighbours, once in a while, to prevent inbreeding.

Mayende, the farmer who came up with the innovation described a unique way of rearing indigenous chickens, whereby hens incubate eggs for 42 instead of 21 days and one hen is selected to raise chicks. The purpose of this type of management is to increase the number of chickens in a short period of time. The innovation was tested with Mayende and two other farmers from Busingatha community. The farmers were the following:

a) Mama Zondo
b) Phumzile Phakathi

3.2.2 PID experimental design

Each of the three household participating in the PID experiment had a total of four hens placed inside a hut (innovation treatment), and another four hens placed outside (traditional/control practice).

<u>Control (refer Table 1 below)</u>

Four indigenous hens: In this treatment the hens were managed and bred in the conventional/ traditional method.

Innovation (outlined in Table 1 below)

Four indigenous hens in this treatment the hens were managed and bred using MaYendes' innovation. Feed was provided for chickens under the innovation and the chickens in the control were fed with household maize.

Table 1: Outline of Experiment

C1 I1	**C2 I2**	**C3 I3**	**C4 I4**
8 hens	8 hens	8 hens	8 Hens
HH1	HH2	HH3	HH4

3.2.3 Brooding "sitting on eggs" (refer to Appendix 1, 2 and 3)

- At laying stage (from each household) hens laid eggs in nests for a period of three to four weeks. The eggs were continuously collected and placed away.
- As the hens turned broody, four were placed inside the house, to start incubation.
- Of the four hens, the hen with the first set of chicks to hatch became the "mother hen" to all the other chicks. In other words, all chicks from other hens were given to this "mother hen". Therefore, the mother hen sat on eggs for 21 days only.
- The remaining three hens sat on eggs for 42 days as they hatched two clutches of eggs, with the second clutch placed just after the first batch had hatched. This was done during the night, so that when daylight came, the hen remained inside the nest.
- At the end of the 42 days, these three hens were returned to the rest of the flock.
- Returning the hens to the flock eliminated the period of raising chicks as they started laying eggs soon after thus beginning the cycle again.

3.2.4 Raising chicks (one hen)

Once the first clutches of eggs were hatched, the hen was placed in a dairy crate with her chicks. Chicks were continuously placed under the crate as they hatched from the other hens. This was carried out at night in order to prevent the hen from attacking young chicks. As the younger chicks came in, the older chicks were put in larger crates, which were placed outside during the day to expose the birds to sunlight. This was done until the chicks were old enough to be weaned.

Figure 1: Set up of experiment (hens placed inside as they turned brood.

Table 2: List of Activities from September 2015 to July 2016

CORE ACTIVITES	TIMEFRAME (September 2015-July 2016)										
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July
1. Focus group discussion, identification of households and setting up of PID											
2. Purchase of supplies- feed, feeding trays, crates, vaccinations, drinkers, nests											
3. Continuous collection of eggs from nests											
4. Placing of hens inside house at onset of broodiness											
5. Eggs returned to nests at onset of broodiness (daily monitoring)											
6. Chicks separated from hens after hatching (monitoring of chicks)											
7. New clutch of eggs placed in nests (counting number of eggs hatched/number of eggs set)											
8. Continuous observations, diseases, parasites, broody behavior, chick integration etc.											
9. PID Presentation											
10. Presentation at Farmer's forum											
11. Three households in Obonjaneni identified to test innovation											
12. Farmer Learning and sharing session											
13. Site visits to Obonjaneni											
14. Purchase of inputs (dairy craters, chicken coops and drinkers)											
15. Farmer Learning and sharing session (site visits to Busingatha)											
16. Farmer Learning Event											

3.3 Results

Table 3: The Innovation and Control Treatments in each Household (10 January 2016- 10 April 2016)

Households	**Minah Yende**		**Phakamile Zondo**		**Phumzile Phakathi**	
	Innovation	**Control**	**Innovation**	**Control**	**Innovation**	**Control**
Initial number of hens	4	4	4	4	4	4
Final number of brooding Hens	3	1	2	2	2	1
Hatch rate	51%	30%	56%	40%	63%	0
Mortality rate	High ≥15	Low ≥ 5	Moderate ≥10	Low ≥ 5	Low ≥ 5	None
No of chicks	32	6	36	10	32	0
Disease prevalence	*Staph. hyicus infection and round worms*	No signs of disease	*Staph. hyicus infection and round worms*	*Staph. hyicus infection and round worms*	*Dermatitis (one incident)*	

The table above shows the results of the innovation and control treatments. In the innovation treatment 3 hens in Mayende's household and 2 hens in Ms. Zondo and Ms. Phakathi's households remained broody for 42 days. In Ms. Zondo and Ms. Phakathis's household the remaining hens became un-broody when the second clutch of eggs was placed. In the control treatment, the hens became un-broody and left the nests, due to disturbances from dogs and the heat. In Mazondo and Mayende's household, the hens that remained broody in the control, incubated their eggs in secluded areas in the veld, by the garden or on a tree. The hatch rate was low, between 51% and 63% due to the high number of eggs going rotten under the hot and humid conditions. Chick mortality was initially low but increased after the summer rains due to an outbreak of Staphylococcus infection where chloriprim was administered to treat the infection. The number of chicks in the innovation increased at a faster rates than those in the control, however this resulted in a higher feed cost. At the end of phase one of the PID the number of chickens in the innovation treatment was considerably larger than in the control treatment in all three households.

3.3.1 Observations by farmers

The number of chickens increased over a short period of time as the innovation eliminated the period of raising chicks for the broody hens. After the second clutch of eggs hatched, the hens were placed outside with a rooster so they could start laying eggs.

Semi-intensive management allowed for increased protection of chickens from predators and closer monitoring of diseases.

Farmers noted that in terms of behavioral patterns, hens that had good mothering abilities accepted chicks from other hens easily and were able to raise them until weaning age. Hens that did not have good mothering abilities were aggressive and more likely to abandon the chicks altogether. As the chicks grew in number and size, the crates became too small to accommodate them and the cost of feed increased.

Innovation requires a housing structure in order to work and requires time and labor, compared to the traditional way of rearing chickens.

3.4 Rolling out innovation

3.4.1 Presentation at Farmers' Forum

The findings from the PID pilot were presented at the farmers' forum in Bergville in April 2016 and farmers from Obonjaneni and Mlimeleni expressed interest in testing it in their households. Three farmers from Obonjaneni came forward and they are the following:

a) Ellen Moloi
b) Maria Mbhele
c) Thembi Mlangeni

3.4.2 Farmer learning session

A farmer learning and sharing session was held in Busingatha where farmers from Obonjaneni were also present. The session was an information exchange session where the farmers from Busingatha explained the innovation and demonstrated how they implemented it in their households. Obonjaneni farmers shared that they had heard about innovations in poultry production before, particularly when it came to changing feed type to increase productivity. The Obonjaneni farmers had also tried other techniques such as separating chicks from hens so the hens could start laying eggs but had never heard about swopping chicks in the early hours/late in the evening. The session ended with visits to the PID sites in Busingatha where more discussions took place and the Busingatha farmers shared their lessons. One of the points highlighted was that previously farmers believed that only industrial chickens required intensive management. However, taking part in the PID showed them that improved management in terms of feed, housing and disease control can increase productivity in indigenous chickens.

3.4.3 Local learning event

The local learning event was held in Obonjaneni on 06 July 2016 and was hosted by FSG. The purpose of the event was to present PID pilots and disseminate knowledge on the identified innovations. The event was attended by community members from aMazizi and aMangwane areas, INR, LIMA and Philakahle and had a total of 60 people. FSG farmers from Busingatha presented on the innovation in indigenous chickens. The farmers were initially reluctant to take part in the PID as it seemed labour intensive however after testing the innovation, found that the number of chickens increased. Farmers shared the challenges and highlights of the PID and an information brochure was handed out (Refer Appendix 4). INR presented on agroforestry carried out in Zwelisha which focused on determining the effect of alley cropping of pastures with leguminous trees to increase fodder productivity and conducted a site visit with aMangwane farmers to Zwelisha. During feedback, one point that was highlighted was that intercropping forage with trees contributes towards enhanced soil fertility and trees provide shelter for the cattle. The PID sought to find a way to address the shortage of adequate forage during the dry winter months. If implemented successfully this type of

cropping system can serve as a dual source of income. Mr Mduba from Potshini presented on planting potatoes in bags using organic and inorganic methods and comparing it to planting on the ground. Due to heat and water stress the potatoes did not produce a yield.

Figure 2: Local Learning Event, Obonjaneni, Bergville

In conclusion, the aim of PID is to discover new and improved ways of farming in response to changing climatic conditions and to disseminate the new knowledge.

4 CASE 2: SINETHEMBA PID EGG PRODUCTION EXPERIMENT

4.1 Background

Potshini is a communal tenure rural community in the lower Drakensberg, in the greater Emmaus area. It falls within the Bergville town and the Okhahlamba Local Municipality. Around 200 families live in the community. Public infrastructure includes electricity, sanitation, community hall a primary and secondary school and a small post office. Sinethemba Youth Club was convened six years ago to respond to the deepening poverty, food insecurity and increased burden of people living with HIV/AIDS in Potshini. Through this intervention a soup kitchen, supported by the Department of Social Development has been set up in the area. Home based care volunteers support this operation. The idea of this experiment started when Mr Madondo and the members of the Sinethemba youth club wanted to produce eggs that will feed in to the soup kitchen. However, they wanted to find a cheaper way of producing eggs by feeding them yellow maize. Yellow maize was known to be cheaper than the layers mash, so at the beginning of the project 50kg of yellow maize was R90 and laying mash was R145. Mr Madondo wanted to have free range layers that are fed yellow maize and to aid with egg production; he proposed to put a rooster with them. When he presented this idea in the PID training, he was advised that it is not necessary to put a rooster, layers can produce eggs without a rooster, the rooster is only necessary if the eggs need to be fertilised.

4.2 Experimental design

There were two groups of layers:

- 10 layers were fed with mash and kept in the cage.
- Another ten (10) layers were fed crushed yellow maize and kept on a free range system in a fenced garden (
- Figure 3B).

Figure 3 (A): Layers in a cage fed laying mash; (B) Layers kept in a free range system and fed yellow maize.

4.3 Process

At the beginning of the project there were ten layers on both sides (caged and free range). Three layers from the free range side died, hence there was an imbalance, Zanele and Zinhle from INR advised that Mr Madondo removes three layers on the cage treatment so that there will be a fair comparison. In the first two days the chickens in both treatments laid eggs similarly. However, as time went the farmer started seeing a drop in the number of eggs laid by the chickens in the free range system. He started investigating; he closed all the possible spaces that could allow the entry of dogs because he suspected that they might be eating the eggs. So he started searching for the eggs and realized that the chickens are hiding eggs. He spotted the areas in which the eggs were laid and that's where he would go to collect them. The chickens in the cages were consistent with laying eggs; Mr Madondo would get eggs in the morning and later in the afternoon. The free range chickens were very inconsistent; sometimes he would find three eggs and some day he would find five eggs and some days he would find nothing at all.

Mr Madondo then decided that since with the free range chickens there are so many factors that affect egg production, he decided to give both treatments the same feed, he fed them yellow maize. The chickens in the cage started to reduce their egg production gradually until there were no eggs at all. He kept on feeding them yellow maize and there were no eggs for about two weeks. After this period, he started seeing eggs again, but they would lay one egg per chicken and then they would not lay for about four days and then lay again. These observations made Mr Madondo realize that yellow maize is not good for egg production.

4.3.1 Challenges

- Initially when the project was at a planning stage, people were very keen to participate on the project; however, when the project started people were dragging their feet's and Mr Madondo ended up working alone. This was a challenge in terms of data collection because Mr Madondo was working during the day. Although he would ask his kids to look after the experiment, sometimes they didn't record if they have collected the eggs and there would be no money either to show that the eggs were sold.
- The free range chickens are prone to dogs and crows; the eggs were being eaten because they were not laid in a secure place. This interrupted the data collection because the farmer didn't know if the chickens didn't lay eggs or they were eaten by crows/dogs. The farmer ended up feeding his dogs the layers mash, as he realised that they were attracted by it. Thereafter the dogs stopped interfering with his experiment.
- Free range chicken doesn't like to lay their eggs in designated nests instead they hide them from crows and dogs; however, it becomes a problem to find these eggs.

Figure 4: Shows the eggs laid in the napier fodder in the garden

- The cage is flat on the bottom, when chickens lay eggs they sit with them and get spoiled by chicken droppings (Figure 5). This adds an extra job of washing the eggs before taking them to the market.

Figure 5 : Showing where eggs sit in the cage and how they look after collection

Initially before the experiment begun, Madondo had a small chicken house that he used to keep layers. He removed the layers from the cage and took them back to this house. He created basins/nests where the chickens lay and go, and with this method, the eggs are always clean.

Figure 6 : Shows how the chickens are kept outside the cage and where they lay eggs

The feed prices increased dramatically, yellow maize price went up and became way more expensive than the layers mash (Table 4). The purpose of the project became irrelevant at this point because yellow maize was not cheap anymore.

Table 4: Feed prices from December 2015 to February 2016

	December 2015	**January 2016**	**February 2016**
Yellow maize (50kg)	R90	R260	R320
Layer mash (50kg)	R145	R245	R295

4.4 Conclusion

Yellow maize proven not to be good for egg production and therefore could not be used as a cheaper option for feeding layers.

5 CASE 3: JOINT EXPERIMENTATION WITH AGROFORESTRY SYSTEMS FOR THE IMPROVEMENT OF FODDER PRODUCTION IN SMALLHOLDER FARMING SYSTEMS IN ZWELISHA, BERGVILLE

5.1 Introduction

Poor condition of grazing areas in communal areas during the dry season, has led to smallholder farmers exploring option for including fodder production in the farming systems. Mr Mbhele, a semi commercial dairy farmer in Zwelisha in the Bergville area, whom was previously involved in an agroforestry (AF) research project, perceived AF as having potential for producing supplementary feed for his cattle. Through the participatory innovative development (PID) or joint experimentation project funded by Nuffic, the institute of natural resources (INR) worked with Mr Mbhele to conduct an on farm research on AF systems.

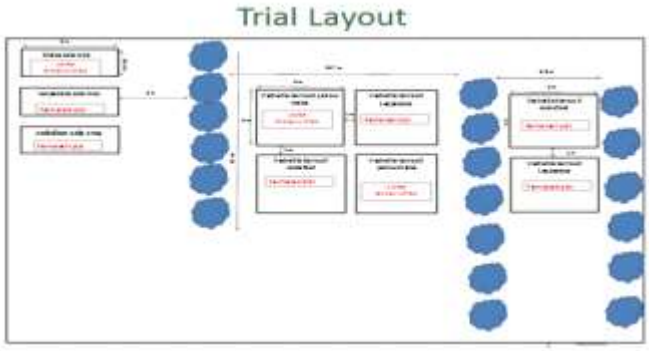
The main aim of the experimentation was:

- To test how different fodder species (Lesbedeza and cocksfoot and yellow maize) perform under AF systems
- To determine the palatability of the species (Vachellia leaves, Lesbedeza) used in agroforestry

5.2 Methodology

5.2.1 PID process and farmer engagement

The INR research team met with the farmer through a series of visits to discuss possible options for experimentation. With the farmer having prior knowledge of AF, the communication between the researches and the farmer was more effective and well balanced. The farmer put forward what he wanted to experiment with and the INR team work with him the design the experiments, the trial layout is shown below.



5.2.2 Data collection

Data on the trial was collected by the farm assistant who lived in the close proximity of the experimentation site. From time to time the farmer and the INR team would visit the site to see the progress of the trial. The data collected included the following:

- Planting date
- Date of germination
- Overall plant growth

5.2.3 Results and discussion

Due to low rainfall there was patchy germination in most of the trial plots, which has resulted in lower yield. The grasses grew better than the maize with the effect of having trees in between pastures was not observed. Surprisingly, though visual than the experiments. This could be attributed to a lot of factors. Traces of erosion were observed mostly in the Lesbedeza plot. This could have been one of the contributing factors for patchy germination.

Having not being able to detect any difference in yields between the control and the experiments, the research team and the farmer opted for testing if the pastures gave a potential for providing supplementary feed for dairy cattle. The leaf samples (Lesbedeza; Cocksfoot and Vachellia karoo) were collected and send to the lab for full feed analysis. The results have shown that the pastures (Lesbedeza and Cocksfoot) contained relatively higher nutrient content compared to commercial feeds. This indicated farmers could explore options for growing their own fodder to supplement the feed purchased from the store during the dry season.

5.2.4 Famer Field Day

The INR team organised an information sharing day where other famers in the area were invited to come and learn about the outcomes of the experimentation. During the information sharing day farmers showed interest in growing their own fodder and having realised that the nutrient content for the fodder species is relatively higher than that of commercial feed. During the information sharing day the farmer (Mr Mbhele) mentioned that he was happy with the outcomes of the experimentation and would like to grow Lesbedeza on a large scale (2ha of land). Other benefits of AF were discussed and the discussion led to coming up with ways to do experiments better in the future.

Figure 7: Farmer Field Day, 04 April 2016

5.2.5 Challenges and recommendation

Weeding on the Cocksfoot and Lezbedeza plot proved to be difficult and the famers assistant (Thabo) suggested that it would be better to grow the Cocksfoot and Lezbedeza in rows to make the weeding easier. The Cocksfoot was left too long before it was cut, therefore it was suggested that the Cocksfoot should be cut on regular basis to encourage regrowth. With regard to the Lesbedeza, there was a discussion around if it should be cut when it is still small or when it has matured? There was a suggestion to sample the Lezbedeza when it is still young and soft and later when it has matured and investigate if there is change in nutrient content with age of the pasture species.

5.2.6 Phase 2 Experimentation: Over-sowing maize with oats

As per trial layout, the plan was to harvest maize for winter feed on the 3 plots, and over sow with oats. The planting of oats took place on 04 May 2016 on the experimental site. Two more farmers (Mrs Ndawo and Mrs Bocibo) also planted in their vegetable gardens.

Figure 8: **Oats planted on 04 May 2016 (left); Figure 3: Farmers on site during PID learning event (right)**

Figure 9: Farmer learning event at Obonjaneni where PID activities were shared

5.2.7 Farmer learning event: 06 July 2016

FSG in collaboration with INR facilitated the learning event through Sivusimpilo-Okhahlamba Farmers Forum. The purpose of the event was to allow discussion and reflection on PID experimentation. The event was attended by 60 farmers from Amangwane and Amazizi communities and other local NGO's (World Vision, Philakahle and LIMA). The following experimentation activities were shared:

Table 5: PID activities presented during the learning event

Activity	Area	Presented by
Agroforestry Trial	Zwelisha	Thabo Bocibo and INR team
Indigenous chicken brooding	Busingatha and Obonjaneni	Mrs Minah Yende, Mrs Zondo, Mrs Moloi and FSG team
Potato planting in bags	Potshini	Mr Siphiwe Mduba and Mrs Mabaso

5.2.8 Discussion and comments

Indigenous chicken brooding

Mrs Yende shared that her chickens have increased to 37 through this innovation. Chicks are protected from predators, and they stay in the house until they are well developed. The farmers shared that through the support of FSG who took some chicks that were affected by sores in the eyes, now they know the type of disease and how is being treated. The level of adoption of this practice is gradually increasing, 3 more farmers from oBonjaneni have started to raise chickens in this manner. With the information handout that has been put together by FSG in local language, Philakahle representatives showed interest and are committed to sharing with their farmers. The other important point raised by present NGO's was that if more farmers continue to adopt this practice, they would need support with markets to generate income with indigenous chickens.

Agroforestry trial

Thabo Bocibo presented the different fodder species planted in between the Vachellia karoo trees to increase fodder production with Mr Mbhele. As farmers had seen on site, cattle farmers were very interested in the trial. The INR team responded that the project will run for the next 4 years and there will be further learning opportunities to sensitise farmers about AF. Farmers will also be taken to the formal research sites for further learning. Mr Mbhele's site is local and is open to farmers for exchange visits. INR will continue to work closely with FSG and Sivusimpilo Forum in organizing farmer field days for sharing of lessons. The forum leaders recommended that such projects should also be presented to Okhahlamba Livestock Association.

Potato planting in bags

Mr Mduba shared that 4 farmers in Potshini started an experiment of planting potatoes in bags to prevent moles. They used different sources of fertility (kraal, poultry manure and grass) mixed in the bag with soil. They compared with potatoes planted on the ground. Due to drought, the potatoes did not germinate. Gogo Mabaso shared that her potatoes grew well and she was able harvest from the bags. The ones grown on the ground did not survive the drought. She further shared that she was consistent with irrigating in the bags, and got good yield from bags.

Way forward and conclusion

Farmers exchanged knowledge beyond experimentation but going to an extent of sharing about marketing opportunities and selling produce amongst each other. Such learning platforms stimulate farmer innovativeness and willingness to learn from each other as oppose to waiting for external agents to give them knowledge**.**

6 CASE 4: NTENETYANA NATURAL RESOURCES MANAGEMENT REHABILITATION: PILOT 2015/16

6.1 Introduction

Lima Rural Development Foundation (Lima) was involved in the implementation of a Natural Resources Management (NRM) project during the years 2013 to 2016 in the Eastern Cape Village of Ntenetyana. This area is high priority due to the level of poverty of the rural community, the high degree of alien plant invasion and the presence of an important dam feeding Mt Frere town, 20 km away. The Lima NRM project was aimed primarily at securing water resources by removing Invasive Alien Plants (IAPs) above and around the Ntenetyana dam. The project prompted farmers in the area to look at returning to their lands, which had been abandoned when the IAP infestation became uncontrollable. The figure below shows a Google Earth image of the site, with the extent of IAPs outlined in orange, and the proportion of IAPs that has been removed in green.

Figure 10: Extent of Invasive Alien Plant infestation and surrounding dam area

Farmers detailed how they had left their croplands due to infestation by IAPs, inaccessibility of the areas and low crop yields. The problem of soil acidity increasing and becoming intolerable for other plants to grow has been identified and well documented in literature. There was an arising need to test whether the crop yield that farmers currently get from home based gardens, would be realised when returning to the previously abandoned areas located some distance from their homesteads. The issue wattle plantations encroaching into farmer's grazing land was also raised.

Through the engagement with the Participatory Innovative Development (PID), Lima Community Facilitators where given the opportunity to try and find innovative ways to solve the problem and introduce participating farmers to joint experimentation. Different rehabilitation methods where discussed and lessons learnt from previous grassland rehabilitation in the area were also put forward

by Lima NRM program workers. Community Facilitators attended a 5-day training course on how to plan and execute joint experiments and ensure participation by farmers and other stakeholders. Through the 5-day training course, Community Facilitators compiled brief project proposals that would assist in testing the possible solutions to the farmers' problems. PID funding contributed to inputs and some equipment needed to execute experiments.

Lima Community Facilitators compiled a draft project plan from the approved proposal and this was shared and finalised with a group of interested farmers from the Ntenetyana village: Mrs Manyala, Mr Maphasa and Mr Mabumbulu. The farmers committed their time and allocated land where experiments could be set up and monitored.

6.1.1 Aim of study

After the 5-day preparation training, the PID had the following broad objectives:

- Introduce farmers in the selected area of Ntenetyana to PID;
- With the farmers, explore limitations that are associated with agricultural development in the area, particularly those related to the increasing wattle infestations;
- Explore solutions associated with the use of abandoned areas in Ntenetyana and determine the sustainability of the solutions for farmer implementation.
- Plan an experiment with interested farmers that addresses the problems identified by the farmers.
- Implement the experiment;
- Document findings of the experiment.

The objectives associated to the actual experiment, as planned with farmers following the initial engagement are described below as Joint Experiment objectives:

- To find out if liming will have an impact on the usability/productivity of previously wattle infested croplands;
- To compare two different methods of excluding livestock from grassland rehabilitation trials.

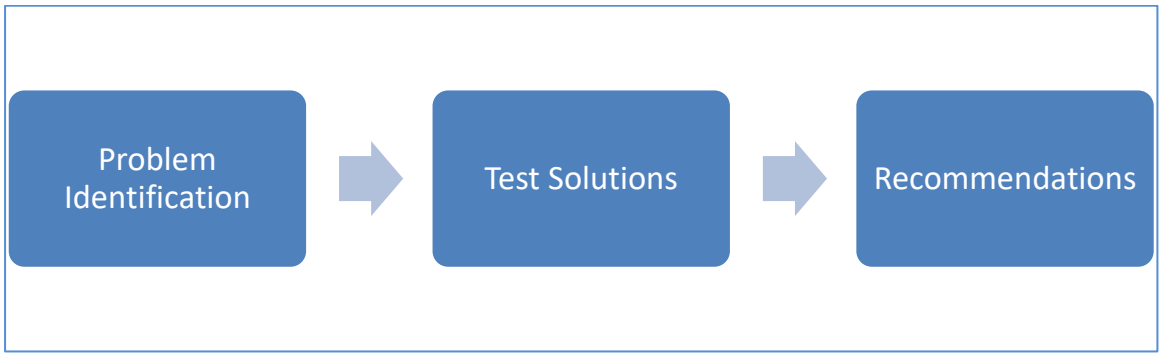


Figure 11: Experimentation Process that farmers and community facilitators went through during the Joint Experimentation

6.1.2 Project Implementers

The parties involved in the project included:

- Participating farmers: Mrs Manyala, Mr Maphasa, Mr Mabumbulu, Ms Mathintwa, Ms Nozukiso, Mr Mxhalaba;
- Lumko Mboyi (BSc Environmental Sciences, NatureStamp / Lima Rural Development Foundation)
- Ndumiso Mhlongo (BSc Environmental Sciences, Lima Rural Development Foundation)
- Teboho Pelesa (NDip Crop Production, Lima Rural Development Foundation) and
- Local Extension Officer from the Department of Agriculture: Mr Nxhumalo, partially involved at the initiation phase.

6.2 Approach

6.2.1 Consultation

A number of farmers who showed an interest in returning to their abandoned croplands and in rehabilitating grazing rangelands were engaged. It was anticipated that the results from this experiment would provide a way forward for other interested farmers; furthermore, that the process would provide all parties involved with an opportunity to learn how the PID process links *research* and *practise.*

In order that reliable information could be obtained, the following steps were incorporated into the decision-making process:

- Farmers and other stakeholders (community leaders) were consulted and introduced to the idea of experimentation;
- Learning and sharing session was held to explore the current innovations in the area;
- 2 workshops were executed at the beginning of the experimentation to engage farmers towards planning and implementing experiments;
- Engagement with Local Extension Officers was aimed at ensuring that the officers would play a pivotal role in improving sustainability and sharing of learnings.

6.2.2 Experiment implementation

Experiment 1:

This involved testing maize and sugar bean crop production after dolomitic lime has been applied. The participating farmers allocated a portion of land that was previously infested/partially-infested by Black Wattle. The experiment was designed as shown in the tables below;

Table 6: Brief description of treatments for the crop production experiment

Description	
Gardens invaded by wattle and used without intervention **Treatment**	Control
Gardens invaded by wattle and used with intervention	Treatment 1

Table 7: Distribution of treatments for the crop production experiment

	Crop 1 (Maize) 12.5m^2	**Crop 2 (Sugar Bean) 12.5m^2**
Control (C)	C, Crop 1	C, Crop 2
Treatment 1 (T1)	T1, Crop 1	T1, Crop 2

Notes: 5 x 5 m plots were established in previously invaded croplands, which is 25m^2 per farmer and 12.5m^2 per crop. This allowed for **two 12m^2 treatments** per crop i.e. crop 1 using **normal methods** will be planted at previously invaded gardens **without intervention** and at previously invaded gardens **with intervention**.

Unfortunately, only 1 of the 3 farmers continued with the experiment and hence only one result was obtained.

Figure 12: Experiment gardens

<u>Experiment 2:</u>

This involved the planting of *Erogrostis teff*, a fast growing annual grass species that produces seed and provides soil cover for degraded areas. Areas that had been cleared of Black Wattle are often left exposed to soil erosion and loss of topsoil, thus the experiment was aimed at determining the most effective technique(s) to assist in the accumulation of soil basal cover. The experiment was designed as per the table below. The different treatments were tested for basal cover at the beginning and at the end of the PID project, for the purposes of this report; however, a participating community group from the NRM program continues to monitor the germination and progress weekly.

Table 8: Brief description of experiments on land rehabilitation techniques

	Rows Planting	**Scattered Planting**
Not Fenced off	Not fenced, Rows planting	Not fenced off, scattered planting
Fenced off	Fenced off, Rows planting	Fenced off, Scattered planting
"Control"	Not fenced and not planted surrounding area	Not fenced and not planted surrounding area

Table 9: Implementation plan

Activity	Timeframes	Person Responsible	Notes
1. Consultation with farmers in the area • briefing and introduction to • Joint Experimentation • selection of study sites and participants • finalize experimental design and crop selection	1-30 Sept	Lumko, Teboho and Ndumiso	Lessons from previous efforts were be incorporated into experiment planning and design, as part of the PID Approach
2. Soil Sampling	1-30 Sept	Lumko, Teboho and Ndumiso	Soil samples were done on all plots during this period as it takes almost 3 weeks to process results. Results of the soil analysis was shared with farmers and how best-to-follow recommendations was discussed
3. Land preparation • tilling the soil • applying recommendation • securing seedlings	1-15 Oct	Investigating farmers and facilitator; Ndumiso Mhlongo	A till/no till idea was explored with Farmers and Conservation Agriculture Specialists from Mahlathini Organics
4. Planting	15 Oct – 15 Nov	Facilitators and investigating farmers	Include buying of seedlings
5. Fencing of Plots	Before planting	Investigating farmers/ project	Only where necessary. This was the farmers responsibility and show of commitment to the project
6.Measuring germination rates, plant growth and basal cover	15 Nov-Marc 2016 (Harvest)	Investigating farmers	N/A
7. Measuring each crop yield	Marc 2016 (Harvest)	Facilitators and investigating farmers	N/A
8. Analysing results with investigating and interested farmers.	Jan-March 2016	Facilitators and investigating farmers	N/A
9.Presenting findings to Stakeholders	March-April 2016	Facilitators and investigating farmers	Photographs will be used to monitor, troubleshoot with specialists and produce visual feedback material

6.3 Findings

Experiment 1

Due to the lack of commitment from the participating farmers, this experiment did not yield usable results.

Experiment 2

From this experiment, it was determined that:

- Cattle can be deterred from eating new seedlings by using "brush-pack", although this was not as effective as the fence;
- Planting in rows was more effective for germination than a general broadcasting method;
- Where fencing of rehabilitation efforts is not possible, there is a need for greater community involvement to assist in controlling cattle.

The basal cover increased gradually across all plots monitored, although this was mainly attributed to the summer season.

Table 10: below list the results from this experiment

Month/Experiment	Dec (Basal cover %)	Jan (Basal cover %)	Feb (Basal cover %)	Mar (Basal cover %)
Not Fenced, rows planting	15	20	40	45
Not Fenced off, scattered planting	15	20	35	45
Fenced off, rows planting	15	15	40	55
Fenced off, scattered planting	15	20	40	50
Not Fenced and not planted surrounding area	15	15	20	25

The fenced off areas (max 50 and 55% basal cover) showed much higher increases in basal cover compared to other plots (max range 25-45% basal cover). Areas that were scattered showed a high increase in basal cover initially (5%), although this may be due to the visibility of scattered seedlings to the observers.

Figure 13: Brush pack protecting grass from being grazed

6.4 Discussion on process learnings

The list below includes some of the key process learnings from both experiments. This feedback was also shared with the local community:

- Good community buy-in is required for the implementation of field experiments that lack are not near the implementer's homesteads;
- Manage expectations early from both the implementers and participating farmers, to ensure that each party knows their role and responsibility in the project. This issue was highlighted in the project by the lack of willingness to provide labour by some of the participating farmers. As a result, experiment 1 was not successfully executed.
- Several factors influence expectations. In this case, the method of government working with farmers (i.e. getting payment from farmers and doing everything, from ploughing to harvesting, and taking a proportion of the harvest) created confusion as to the roles and responsibilities of the farmers within the PID project.
- Formal commitments should be required from participants - more especially when inputs are involved. While this is important, it is difficult to execute as it may appear intrusive and deterring to farmers, who are not necessarily incentivised to explore new methods and practises. One needs to make sure that the problem is weighted as a high priority by all involved, and not just one or two farmers.
- One needs to improvise when things do not go according to plan! For example, in experiment 1, the experiment was condensed onto a smaller piece of land when 2 farmers lost interest in the work
- Clear communication lines with farmers and the project team is important and could have been improved. It is not always easy to have formal meetings, as people are busy. However, one can use simple check-up calls or texts to communicate developments and changes.

6.5 Fast facts from successful joint experimentation

As a result of this experiment, the following recommendations are put forward –

- Grassland rehabilitation can be done using low input methods such as brush packs; and this intervention can yield better results than not placing any intervention to protect grass seedlings;
- Brush packs showed signs of assisting the grasses in maintaining moisture and withstanding dry conditions; and
- Livestock was sufficiently deterred from the planted grass by branches simulating as a fence.

6.6 Acknowledgements

The experimenters would like to extend thanks and appreciation to the Prolinnova Fund for their contributions to the inputs that were used during this experimentation. Thanks are also extended to Mazwi Mzizi and Sanelisiwe of the Mahlathini Organics organization for their inputs and advice during the initiation of the experimentation process.

7 CASE 5: EASTERN CAPE, PARTICIPATORY INNOVATION DEVELOPMENT PILOT: EXPLORATION OF WEED MANAGEMENT PROCESSES IN THE CA-SFIP CONSERVATION AGRICULTURE EXPERIMENTATION

7.1 Summary

A short experiment was done during the hot dry 2015/2016 season in Matatiele in association with the Grain SA SFIP (Smallholder Farmer Innovation Programme) in Conservation Agriculture (CA). This experiment aimed at evaluating the effectiveness of mulch, linked to CA, on the growth and yields of maize and beans as staple crops in the surrounding rural areas. Thatch grass material was laid over the plots after germination of seeds that had been planted. Growth of both maize and beans was increased in mulched plots with greener, stronger and bigger crops. Crops in plots with no mulch had poor growth, and plants were pale and weak. Mulch played a crucial role in retaining moisture; mulched plots were greener for longer periods of time. Mulch played an important role in suppressing weeds while unmulched plots faced severe water and nutrient competition. Mulching plots significantly increased maize and bean yields.

7.2 Background

Matatiele is a small town situated in the northern part of the Eastern Cape Province and plays host to many villages along the mountains separating South Africa and Lesotho. Towards the southwest the town leads onto the Elundini Municipality and the Greater Kokstad Municipality towards the west and extends to the Umzimvubu Municipality on the South. The area is predominantly African with IsiXhosa and SeSotho as the two local languages and most of the people reside in the rural areas and formal townships around the area. Most of these people are females that make up to 54% of the estimated 205 464 populations. The Municipality's community is a very young one with an estimated age of 35 years totaling up to 71% and just 7% of those over 65 years of age. These figures clearly point out that the municipality has to focus energies into more youthful initiatives. One of those could be the tourism sector as Matatiele is overwhelmed with a good number of visitors making use of the R56 going into and out of the town. Matatiele is one of the four local municipalities with the Alfred Nzo District (Matatiele Local Municipality, 2016/17).

This is generally a farming community where livestock and crop production, notably of maize and beans as important staple crops for the 41.6% of poor households is common. However; these livelihood activities are facing challenges in soil erosion and declining soil fertility and productivity and over grazing. The municipality has seen a number of programs seeking to deal with and provide increased resilience to climate change that continuously degrades the environment. Summer temperatures sit at an average of 26 ˚C and the area experiences extremely cold winters. The area sees a fair amount of rainfall ranging between 500m and 1000m falling from October through to April (Matatiele Local Municipality, 2016/17).

Mahlathini Development Foundation (MDF) in partnership with Grain SA has been implementing the Conservation Agriculture (CA) program through the appreciation of the farming nature of the area. A number of villages have been part of the program for the past three years. CA is one of the strategies under the Climate Smart Agriculture (CSA) umbrella in responding to the adverse effects

of climate change. The need for producing food for the unemployed in the area is of essence but a balance has to be maintained between these two. This is crucial to the sustainability of not only the livelihood activities but also that of the environment as the basis for this.

Farmer experimentation participants from Sehutlong and Nkau, which are two of the villages in the area, have been experimenting with CA for the past three years. People here found the intercropping difficult, mainly as this complicated the weeding of plots. Weeds are a major problem. Participating farmers have had to weed a number of times within the season and weeds can be very destructive with potential of halving harvest expected. In response to this two farmers in each of the participating areas were asked to participate by trying out different planting practices that will decrease the amount of work and increase the efficiency of weeding, namely:

- Planting maize and beans in mono crop blocks rather than inter cropping for ease of weeding. These were compared with the intercropped trials and all other variables were kept the same i.e. varieties, herbicides, spacing ect
- Using mulching as a weed suppression strategy in both the block planting and intercrop trial plots, compared to the unmulched trial plots.

Two farmers in two areas lived up to their promises in taking part in this short experimentation, namely Bulelwa Dzingwa and Jabulani Hlathi from Nkau as well as Mamolelekeng Lebueoa and Matshepo Futu from Sekhutlong. The process used the same variety of maize and beans per person, but different varieties for the different locations.

Monitoring was conducted three times per season working closely with a local facilitator (Bulelwa Dzingwa) who was learning to do the monitoring independently of the facilitator and also to introduce aspects of the monitoring and observations to the farmers. A small process of farmer-led documentation was run and managed by Bulelwa across the two areas. This had costs attached to it and the budget was as follows:

Table 11: Experimentation budget

Item	Description	Units	Amount
Inputs for trial plots	Support for inputs (including seed, herbicide, pesticide and fertilizer	6 x 400m² = 2400m² Thuthaneng = 800m²	R3 200
Implements	4 x hand planters (MBLI from Afritrac), 2x knapsack sprayer, with nozzles	R900 x 4 R500 x 2	R4 600
Facilitation support	Local facilitation (Bulelwa Dzingwa)	R200/day x 10 days/month x 6	R12 000
Farmer documentation	1x camera, journal for farmers	R1 600 R80@6	R 2 080
Farmers Day	Arrangement, venue, refreshments	Venue-R400 Refreshments R2 100	R2 500
TOTAL			**R24 380**

7.3 PID Implementation

The Participatory Innovation Development (PID) farmer experimentation project was implemented in two areas within Matatiele. This was done through selecting two farmers to be participants within a larger group in two different sub areas. This particular short term experimentation was done in conjunction to the great CA experiment. The CA system has been proven to do well for the farmer's crops but at high labor costs especially weeding. Generally, farmers weed once throughout the season and that has become a culture, this however, negatively impacts the crops as weeds compete with crops for both water and nutrients.

The integration of mulch with the closely planted seeds was tried out in response of this short fall. The CA system principles can be enhanced to respond better to specific areas, one way of doing things may not necessarily be as good for other areas. This was the very case for the Matatiele area, more especially with its sandy soil that cannot hold water for longer periods of time due to overgrazing and ongoing desertification. Mulching of field crops is not a common practice but for the small sized plots that we use for trials, this was very possible and farmers were willing to try this out. They normally mulch the vegetables in their gardens, but they appreciated the impact they saw hence wanted to experiment with this concept for their maize and beans.

Late August to early September served as a time where the PID experiment was delivered and explained to the farmers, activities initiated within that timeframe were:

- Soil sampling
- Measuring of trial plots
- Herbicide spraying and
- Layout of PID plots (into 6 blocks/ per farmer)
- Planting of PID plots
- Setting up a monitoring process for the experimentation.

7.3.1 Soil sampling and measuring of trial plots

For the farmer experiments, soil sampling was done for all four farmers' plots and taken for analysis. This helped with recommendations in terms of types and amounts of fertilizers required. Normally farmers do not do soil tests and put plenty of manure in their plots. More often than not the manure they put in their fields is low in nutrients as they would have evaporated and if they do use fertilizer they use it based on witnessing the effect in their counterpart's fields or through pure hearsay. The Measurements of the plots were standardized to 5x5m 2 by eight block plots per farmer. This is illustrated well by Table 1 below.

Table 12: The planned PID layout

Trial (All plots are mulched)	Maize & Beans	Beans	Maize	Maize
Control (un-mulched)	Maize & Beans	Beans	Maize	Maize

7.3.2 Herbicide spraying

Herbicide spraying was done along with the participating famers. Individuals had to take practice runs of spraying before actually using herbicide. Spraying can be very tricky and as a measure to help people spray more efficiently, dye was introduced to help clearly distinguish sprayed and unsprayed areas. For the spraying Dual gold, Round up, Decis and Actripon were used for the four farmers. The Actripon is an adjuvant that holds the herbicide and pesticide stick together also making sure that is sticks onto the weeds sprayed. Decis forte was for the cutworm and stalkborer. A sixteen-liter knapsack sprayer was used and the following measurements and dilutions were followed:

- Six litres of water
- Round up - 90 ml
- Dual gold - 60 ml
- Decis Forte - 3 sachets
- Actripon - 10 ml.

Figure 14: Herbicide spraying.

This was a participatory exercise done in partnership with the farmers, after having an herbicide workshop. Here a range of herbicides were talked about as well as dangers of the chemicals being used and safety precautions required when spraying. Far more often than not, farmers do not take seriously the dangers and appropriate attire to be used when spraying. An even more sensitive case is the actual storage of these chemicals and the dangers they pose to young ones in the homes. Chemicals should be kept in their original containers with labels on them and not decanted into cool drink bottles and so on as it can be mistaken for something else. Farmers were active and did the spraying for all the plots.

7.3.3 Planting

Four plots were planted, two in Nkau and Sekhutlong. Mr Hlathi and Mrs Dzingwa's (residing in Nkau) plots were planted on the 27th of October and in Sekhutlong planting of the two PID plots for Matsepo Fufu and Mamolekeng Lebeuoa was done on the 30th of October 2015. Six blocks were planted initially and two bean single crop plots were planted later per PID experimentation plot. The plots were first planted and mulch was put on later, after seed had germinated. The thinking behind this was the thick mulch would make it difficult for emerging crops to push through. Thatch grass was used for mulching but was not enough to allow for the 5cm thickness that was outlined when

the experiment was first designed. Due to this, some plots had grass cut from the nearby veld to supplement insufficient thatch grass.

Participants in Nkau used Ukulinga as the sugar bean variety and Colorado (Yellow OPV) variety for maize variety. Given the dry conditions they chose the yellow breed having in mind their sheep and chickens needing feed. Sekhutlong participants preferred Ukulinga for the bean variety and Boarder King (White OPV) for maize. Their decision was influenced by great experience they had with the Boarder King variety and appreciated its taste and big cob size. The spacing used for planting was as follows:

- Maize (mono-cropping): 50 cm apart in row and in between rows
- Intercropping (maize and beans): 50 x 50 cm for maize and 25 x10 cm apart for beans.

Table 13: Plots planted on the first planting dates

Trial (Mulched)	Maize & Beans	Maize	Maize
Control (un-mulched)	Maize & Beans	Maize	Maize

Figure 15: Planting of experimental plots in Sekhutlong.

Figure 16: Laying of mulch in Matsepo Futu's plot.

7.3.4 Monitoring of PID plots

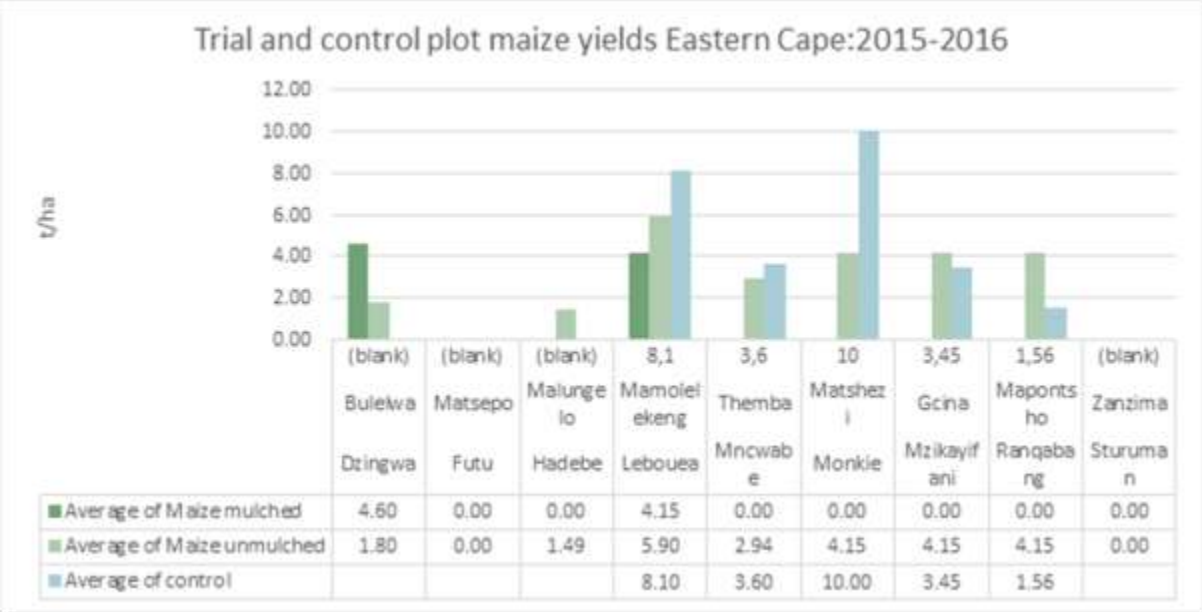
A monitoring formwas created and discussed with the local facilitator. A large percentage of it was translated into IsiZulu for the purposes of the farmers gaining better understanding of what was required of them. The implementation of this process by the farmers was expected to take place in the last two weeks of November 2015 (16 – 30 November) and was to be a weekly farmer activity thereafter. Farmers were to experiment with the monitoring form, and alterations were due if required. By the end of November, a camera was handed over to the local facilitator who worked with farmers in both Nkau and Sekhutlong. The camera was used to document changes in the plots, also to capture snapshots of other related activities and events such as topdressing, incidence of hailstorms, etc. Rain gauges were also installed at two houses, one in each area where farmers were tasked with recording measurements after each rain event. As time went, farmers voiced concerns of trouble and difficulty with filling in the long form on a weekly basis. We than turned to our local facilitator to do the recording in a small booklet for all the experiments. Of the four PID plots planted, one faced pig damage. They ate all the crops and that was the end of the experiment. A couple of weeks later the remaining bean plots were planted in all three experiments.

7.4 Results and discussion

The hot dry weather conditions of the previous season had a big impact on the crops. However; the CA plots did yield food for the participating farmers. This is a clear indication of the positive impact of the system in adapting to unfavourable conditions. The intercrop as well as the introduction and availability of hybrid seeds is another strategy of dealing with ongoing drought conditions. Mixed planting plots had better growth as opposed to single crop plots of both maize and beans, which tells us that intercropping has a beneficial effect for both maize and legumes. Beans that were planted a bit later in plots with mulch cover and those with no mulch cover never germinated. At the time dry conditions were at their peak and thought to be responsible for this.

Mulch played a crucial role in retaining moisture in the soil, especially given the conditions. Mulched plots were moist for longer periods of time. Plots with no cover over them experienced drier soils and this was evident through weak, pale maize crops. Moreover, those unmulched plots had a lot more weeds when compared to mulched plots. There were some weeds visible in plots with mulch cover which was due to insufficient material but they were heavily suppressed and there was very little space for growth. Had there been enough cover over the plots, there would have been a very few weeds, if any. Unmulched plots were weed infested and those weeds heavily competed with crops for water and nutrients which resulted in poor yields. This was also clear from the colour of the crops. Mulched maize was much greener, taller, stronger and bigger when compared to its counterpart and this is illustrated in the pictures below.

Figure 17: Plot with mulch and no mulch showing differences in crop growth and weed incidence.



	(blank) Bulelwa Dzingwa	(blank) Matsepo Futu	(blank) Malungelo Hadebe	8,1 Mamoleleng Leboueа	3,6 Themba Mncwabe	10 Matshezi Monkie	3,45 Gcina Mzikayifani	1,56 Maponts ho Ranqabang	(blank) Zanzima Sturuman
Average of Maize mulched	4.60	0.00	0.00	4.15	0.00	0.00	0.00	0.00	0.00
Average of Maize unmulched	1.80	0.00	1.49	5.90	2.94	4.15	4.15	4.15	0.00
Average of control				8.10	3.60	10.00	3.45	1.56	

Figure 18: A comparison of maize yields for trial and control plots in the Eastern Cape for the 2015-2016 growing season

Figure 19: Matshepo Futu cooking some of the maize from her plot as 'green mealies". She did not record her yields (left). Bulelwa Dzingwa, the local facilitator, with Mrs Ranqabang in Nkau to weigh and record her crop yields (right).

What can be seen in the small summary table below is that the maize and bean yields were higher in the mulched plots than the unmulched plots and that the control plot maize yields (under conventional tillage) were higher than the CA trial plots.

Table 14: Summary of yields obtained (tons/ha)

Yields (t/ha)	Mulched	Unmulched	Control
Beans	1.5	0.8	
Maize	4.4	3.5	5.3

When looking at the maize yields, mulched plots have a higher yield than un-mulched plots. There was a bit of extra moisture in the plots that kept the roots of the plants moist and active with life through organic matter supporting microbial life for better nutrient provision to the crop. Beans yields similarly are much higher for the mulched plots. Once more cover is proven to have favored growth of beans far more then no cover presence.

7.5 Conclusion

Organic mulch material has a great potential in promoting better crops growth and resultantly better yields in dry conditions and even better in soils where minimal soil disturbance has occurred. Mulch not only retains moisture and supports microbial life but also suppresses weed germination and growth, this provides an ideal situation for maize and beans to grow and yield more food. Less competition allows food crops to grow and prosper more. Further experimentation is required to build up from this short study and will be evaluating crop germination through a layer of mulch. Mulch will be laid on the plots immediately after planting and yields from the two practices will be compared**.**

8 CASE 6: TESTING OF SWEET POTATO VARIETIES UNDER DIFFERENT SOIL FERTILITY SOURCES TO IDENTIFY THE MOST PREFERRED VARIETY BY FARMERS

8.1 Introduction

Participatory innovation development (PID) is aimed at breaching the gap between modern technological advancements and innovations that come from the ground. It is a process aimed at finding solutions to problems faced using not only modern technology but also taking into account the embedded knowledge that exists in the communities in which we work. It appreciates the results different innovations bring about but aims at making more important the process in which it happens. These innovative ideas are adaptation strategies and hence the process needs to be taken in detail so as to make properly informed decisions based on experience and sound results.

This report documents the activities of PID projects carried out by Mahlathini Development Foundation across the UThukela and UThungulu districts of KwaZulu-Natal in the communities of Winterton - Emaswazini, Bergville - Ngoba and Nkandla - Mpotholo respectively. The various communities had different ideas which they wanted to investigate further and the progress, results and lessons learnt from challenges encountered with these are documented below.

8.2 PID at Emaswazini – Sweet potatoes

8.2.1 Background

AmaSwazi community is one of the land reform beneficiary groups that have been relocated from one place to another over several years. These series of removals and relocations might have resulted in the loss of institutional memory and some of the indigenous knowledge. It is usually taken for granted that each rural community would have a certain level of embedded knowledge, mostly in farming, which was not the case in MaSwazini during our first engagement. It was found that all the households have home fields, one away from home and they are owners of large communal fields which are all loaned out to commercial farmers.

Thuthukani Self Help Group of AmaSwazi area in Bergville was formed as part of the Zimele Community Self-help Program that aimed at empowering rural women to start small savings and champion their own development. The groups start with 10 members and grow as they start different projects that include craft, guesthouses, agriculture, home based care and orphan care.

The group owns a communal garden where they produce vegetables for household consumption and to sell surplus to their neighbours. The garden had been operational for less than two years and it hadn't been in full use. The group was facing challenges such as members not attending meetings, and a lack of resources such as tractors and oxen for ploughing and water for irrigation.

8.2.2 PID experimentation design

Farmers wanted to plant half of their 8300 m^2 garden with potatoes or sweet potatoes. Due to the economic situation they were facing, hand tools were used but under ideal situations use of a hired

tractor would have been the preferred choice. The farmers were asked how they view their soil. The response to this was that soil testing has never been done in the garden, however farmers believed the plot had good soils judging by the good produce for the previous two seasons. In the garden the farmers stated that they had previously separated it into two and had planted sweet potatoes and sugar beans. The farmers stated that the main reason for planting beans was to fix nitrogen within the soil.

Farmers spread goat and cattle manure in the garden prior to discing and planting. The main reason for using the machinery was that the plot is big and farmers could not plant it by themselves. Farmers further showed understanding of the disadvantages of ploughing, by stating that there was an understanding that the top fertile soil goes beneath the subsoil when ploughing and that this reduces the "quality' of the soil in the longer term, resulting in less water infiltration taking place and the soil being prone to erosion. However, according to the farmers' observations this was not the case in the garden as the soil absorbs the water during rainy seasons. In discussions with the group it was decided to focus on a high value crop for their communal garden. Mrs Tholiwe Dora Mazibuko had planted sweet potatoes on her plot previously and she and the group members thought it was successful. She sold her sweet potatoes to the community at one of the Farmers' Day the group held. The experience the group had with sweet potatoes influenced the group to choose sweet potato for PID experiment, but the group wanted to know:

- Which sweet potato variety is good for their area
- Whether fertilization plays any role in sweet potato production in their area compared to the previous year's crop which was not fertilized
- Whether the perception that "fertilizer spoils the taste on sweet potato" is true.

They opted for experimentation with sweet potato varieties, including orange fleshed sweet potato as this crop can be planted late, has good yields even under drought conditions, is nutritious and fetches a good price locally. Four different improved varieties were obtained from ARC –VOPI in Roodeplaat (50 kg bags of vines for making cuttings):

- Ndou (white flesh, red skin – dry and dense tubers)
- Monate (white flesh, red skin, dense tubers)
- Impilo (orange fleshed)
- Bopelo (orange fleshed).

Note: Though Monate was one of the varieties sourced, the quantity was not enough to be put under experimentation; the group decided that one member (Mr Mabaso) should plant it for preservation of the vines. In addition they used their local variety and planting method as the control. Fertilizer (2:3:4) and lime was acquired for the trial plot according to standard sweet potato planting requirements [2 x 50 kg 2:3:2; 3 x 50 kg lime, 1 x 50 kg LAN for top dressing]. The group monitored crop performance and final harvest under different fertilization regimes. Different varieties were cooked and tasted to determine if the taste differed for the different treatments (dealing with the perception that chemical fertilizer affects the taste).

The design of the trial is shown in the table below.

Table 15: Trial design at Emaswazini

Sweet potato variety	Bopelo	Impilo	Ndou
Plot 1 (3m x 5m) 4 rows	Kraal manure (10kg or l/row ~2kg/m^2)	No fertilizer	Fertilizer: 2:3:2 (1 handful/m^2)
Plot 2 (3m x 5m)	No fertilizer	Fertilizer: 2:3:2 (1 handful/m^2)	Kraal manure (10kg or l/row ~2kg/m^2)
Plot 3 (3m x 5m)	Fertilizer: 2:3:2 (1 handful/m^2)	Kraal manure (10kg or l/row ~2kg/m^2)	No fertilizer
Plot 4 (3m x 5m)	Control: Local variety	Control: Local variety	Control: Local variety

Note: Lime was applied as follows: 50 kg lime per 4 plots – thus 50kg/60m^2 ~ 1,5tons/ha

8.2.3 Land preparation

Preparation and planting was done on 21 and 22 January 2016. The pictures below are an indication of activities undertaken.

Figure 20: Ploughing of the trial plot and collection of vines, kraal manure, etc for planting (left); Marking out of trial blocks and plots and addition of lime (right).

Figure 21: Addition of manure and fertilizer to the experimental plots and preparation of ridges for planting of vines.

Figure 22: Planting of vines on the ridges after careful preparation.

8.2.4 Results of the experimentation

The results of the experiments are summarised in the table below.

Table 16: Monitoring and yields for the sweet potato trials in Emaswazini from 15 m^2 plots

	Fertilizer	Kraal Manure	Non-fertilized
Ndou			
Germination	Germinated very well, rained for the week after planting	Germinated well, rained for a week after planting (some plants were planted upside down, reason for gaps on germination	Germinated well as it received week long rain.
Growth	Excellent growth, dark blue leaves, more biomass than other plots (soil is covered).	Good growth though it is less than chemical fertilized plot, soil is not fully covered.	Good growth but third if compared.
Weeds	Weeds before weeding and even after weeding - they grew back faster.	So many weeds, even when weeded didn't die off.	There are fewer weeds compared to the other two plots.
Yields	4.05 kg	1.49 kg	3.23 kg
Impilo			
Germination	Germinated well	Germinated well	Germinated well
Growth	The variety doesn't have much leaves / biomass. The plot looks well and its flowering	In comparison, this is a very good plot for growth. Cracks on soil have emerged as the sign of fruiting.	
Yields	6.88 kg	6.58 kg	3.32 kg
Bophelo			
Yields	1.78 kg	3.75 kg	2.88 kg

Note: The local variety that served as the control (planted under no fertilization regime) yielded 7.06 kg.

8.2.5 Local learning day at Emaswazini

Local learning days aim to facilitate farmer to farmer learning (as the understanding is that the transfer of knowledge is better if one learns from one's own peers) and also to create relationships between interested groups and relevant stakeholders. The local learning day event that took place at Emaswazini on the 2nd June 2016 was no different. The learning event was attended by:

- 90 Community members from Emaswazini, Ezibomvini, Vimbukhalo, Mhlwazini, Potshini, Stulwane and Emmaus/Eqeleni.
- LED officer from Bergville Local Municipality
- NGO staff members from Lima RDF, SaveAct and Philakahle
- Masters Student at Rhodes University.

Outline of the day

Seven members of the community garden at Emaswazini (Winterton) had been doing experimentation with new varieties of sweet potatoes (2 orange fleshed, and one white fleshed) and compared the growth of these to their local variety using fertilizer, manure or no soil amendment/treatment. They had also implemented a number of water harvesting and conservation strategies in their garden including a run-on ditch and a small dam and have access to a treadle pump for pumping water from the stream below the garden. On the day Mr Madondo brought the Inkuku khaya chicken coops for small scale poultry production with a few broilers to demonstrate this containerised housing system for poultry.

The community members prepared tables and stations in the garden where they cooked each of the varieties planted (Ndou - white fleshed, Impilo and Bophelo - orange fleshed) and also samples of each of the treatments. Visitors looked at the growth of the vines and tubers in the field and tasted then scored the different sweet potatoes under the different production regimes (fertilizer, manure and nothing). Each visitor scored their preferences after having tasted the different varieties and then gave an indication of whether there is a difference in taste according to the treatments - mostly whether using fertilizer produces a less sweet tuber or not. They also compared the new varieties to their local one and community members took them through this process.

A presentation was given on the process of experimentation and how it was conducted and visitors were given the chance to interrogate the process and also thereafter to volunteer for doing similar experiments in their home villages. Vines of the three varieties were shared with interested individuals. Discussions were held and suggestions made for processes to over-winter the vines and sweet potatoes in the somewhat harsh environment of a cold dry Drakensberg winter.

Scoring and ranking of sweet potato varieties

Below are two tables that summarise the scoring for each of the varieties of sweet potatoes against the three treatments. From the table it is clear that the participants and visitors were able to differentiate between the taste of the sweet potato varieties grown under the three treatments (fertilizer, manure and no soil amendment). They clearly preferred the taste of sweet potatoes grown with manure.

Table 17: Scoring of three sweet potato varieties against the three treatments

	Fertilizer	Manure	Nothing
Impilo	84	130	104
Bophelo	101	109	108
Ndou	94	128	78
SUM	279	367	290
AVERAGE	93	122	97

Note: the numbers denote the sum of the scores given by each participant where 3 is very good taste, 2 is average taste and 1 is a not very good taste

Table 18: Comparison of the taste of the three different varieties of sweet potato planted

Sweet potato variety	Score for taste
Impilo	33
Bophelo	0
Ndou	29

Note: Here each participant made one tick for their most preferred sweet potato variety

Participants preferred the Impilo and Ndou varieties and did not vote at all for the Bophelo. Bophelo is the variety that has the deepest orange flesh and a distinct 'carrot' flavour which participants said was strange for a sweet potato. After discussion it was agreed that having a sweet potato cross carrot for nutrition purposes and especially for young children was in fact not a bad idea and to 'temper' their initial taste aversion in this case. There was a lot of interest from visitors in also planting the new varieties and tubers and vines were shared with them. Visitors were shown the water harvesting practices and the treadle pump in action as well as the Inkukukhaya chicken coops. These ideas will be properly introduced in their areas as interest to experiment with these new ideas was high.

Sweet potato sales

After the tasting of sweet potatoes, those in attendance were very keen on buying some sweet potato for themselves. Impilo variety grown under fertilization was the most purchased. Farmers had to dig out the sweet potatoes on the spot. A total 45 kg of Impilo was sold with 1.5 kg of the local variety sold.

Snapshots of the day

Photos from the day are provided below.

Figure 23: left to right: Sweet potato trials, rainwater harvesting and garden pond and Inkukukhaya chicken coops for small scale poultry production – the three new ideas introduced and shared during the local cross visit.

Figure 24: left to right: Participants registering for the day and listening to one of the farmer experimenters from Emaswazini describe their process and the outcomes of the sweet potato trials.

Figure 25: The process of scoring taste for different varieties and different treatments.

Figure 26: A presentation of the sweet potato experimentation process and outcomes in terms of growth and yield was given in the hall after the field walks and participants asked questions and discussed various points, including how to over winter the sweet potato vines in the cold dry climate of the Drakensberg.

8.3 Overwintering sweet potato vines

A new set of experiments were designed at the end of the season to address the difficulty of overwintering vines in the Bergville area. The winters there are very cold and dry and vines often do not survive until the following season. These activities were carried over from the experimentation in Emaswazini where three sweet potato varieties in three treatments had been planted. The aim was to further explore ways of keeping vines over winter. Possible methods discussed and implemented were:

- Burying the vines
- Burying and watering
- Burying, mulching and then watering.

The further exploration was to be carried out at the community garden. Farmers that attended the cross visit at Emaswazini from Bergville villages were interested in trying sweet potatoes and asked for vines. The interested groups were then given the vines.

Figure 27: Vines from Emaswazini, these were stuffed in bags upon delivery.

8.3.1 Experiment design

Emaswazini community garden

The two ladies in Emaswazini (Mrs Mazibuko and Mrs Ntshingila) had finished burying the vines and had mulched the plots. The Impilo variety was the only one with dry grass put over it (mulched), grass was cut just outside the garden. To get water to irrigate the sweet potato vines, a treadle pump was used. The ladies were shown how to use the pump and the ladies were to pump the water from a neighbouring stream to the corner of their garden and carry the water on their heads to the garden. The process of watering the vines was to take place at least once a week until the vines are used. Later on the length of the pipe was extended by another by another 350 m. This enabled farmers to pump water straight up onto the plots. Potentially they could also pump water into their small pond. One challenged noted was the increased time and energy for pumping water over an even greater distance.

Figure 28: Experimental vines buried, Impilo variety mulched.

Mr Mabaso had kept the Monate variety sweet potato vines and they were in good condition when they were overwintered because they had been taken out a day before planting. The previous growing season the variety did not do too well because of the severe hailstorm that had hit. The plot was five lines on an area of 4 m x 4 m.

Figure 29: **Mrs Mazibuko and Mrs Ntshingila planting Monate vines**

Ndunwana

Smallholder farmers in Ndunwana were not too familiar with sweet potatoes and were even further interested to hear that they come in a number of varieties. Boniwe Hlatshwayo attended the local learning event day and had a taste of the different varieties. She told the news to a few other ladies who also wanted to try it out. Concerns about goats that were likely to eat up her crop once it had emerged resulted in Boniwe planting her sweet potatoes at her mother, Nomgqibelo Hlatshwayo's homestead and this took place on the 21st June 2016. The labour force on the day consisted of the three ladies and the Mahlathini staff, being Thabane Madondo and Mazwi Mzizi. The garden used was a small fenced off piece that was just enough to plant two 5 m rows of each variety. However weeds had to be cleared out first, ridges dug and vines buried. The activities lasted approximately an hour after which vines were shared with the other ladies and a brief recap was done prior planting in their own plots.

Figure 30: Pulling out weeds and opening rows (left); Madondo showing ladies how to cut and put vines in the rows (right).

Figure 31: Vines buried in the ground.

Eqeleni

Following the demonstration at Ndunwana also on the 21st June 2016, Emmaus - Eqeleni was the next stop where the team met Simephi Nkosi and four other ladies who also wanted to plant the vines. Unlike at Ndunwana, this group was familiar with sweet potatoes and did have some in their gardens as well. Simephi Nkosi had vines in the garden that were supplied by the Agricultural Department's official, Mr Khuboni. The group agreed that vines would be planted once and will not be taken out. Each of them took a handful of a number of different vines to plant in their plots.

Ezibomvini

On the 22nd June 2016, the field team met the group of ladies at Mrs Hlongwane's homestead, where the vines were to be buried. Once they have grown well they will then be shared among the rest of the group. Mrs Hlongwane has a fenced garden where she preferred the vines to be put. The ladies were hard at work opening up ridges for the vines. The vines were planted and buried then mulched and watered. The total plot size is 9 m x 4 m.

Table 19: List of participants who over-wintered the sweet potato vines

	Name and surname	Community	Variety
1.	Boniwe Hlatshwayo	Ndunwana	Bophelo, Ndou, Impilo
2.	Makho Mdluli	Ndunwana	Bophelo, Ndou, Impilo
3.	Shiyiwe Mazibuko	Ndunwana	Bophelo, Ndou, Impilo
4.	Simephi Nkosi	Eqeleni	Bophelo
5.	KaMthethwa	Eqeleni	Ndou, Bophelo
6.	KaSithole Zimba	Eqeleni	Impilo, Ndou
7.	KaJoshua	Eqeleni	Impilo, Ndou
8.	Tombi Zikode	Eqeleni	Bophelo, Impilo
9.	Mrs Hlongwane	Ezibomvini	Bophelo, Ndou, Impilo

The above listed are the participants who overwintered the sweet potato vines, these varieties are now present in these communities and can be shared with interested individuals as and when needed.

Figure 32: Ridges opened up and vines planted at Mrs Hlongwane's home - to be shared with the group later (left and middle); Mulching of planted vines (right).

8.4 PID at Mpotholo (Nkandla)

8.4.1 Background

Nkandla Farmers joined a farmers' day which was held in Bergville around Conservation Agriculture (CA) and were very keen to try it out and were even more eager to use animal drawn no-till planters. Farmers have large fields of 2 - 5 ha and they work in cooperatives along with local Department of Agriculture officers. Previously challenges with low yields and soil erosion were faced, which further supports the farmers' interest in CA. Six farmers joined the experimentation with plots of 1 000 m^2 each.

8.4.2 The experiment

The experiment included the planting of single row intercropping of maize (PAN SC 701) and Gadra beans which were planted 1 - 5 days after the maize. The farmers used tractors and even a car to pull the no-till animal drawn planter as they do not have oxen. One farmer planted a mixture of summer cover crops (SCCs) in his fencing in home garden at the beginning of the season (November 2015) and the other participants did relay cropping of the SCCs (sun hemp, millet and sunflower) later in the season.

8.4.3 Planting at Mpotholo

Experimentation here consisted of using the Afritrac animal drawn no-till planter pulled by a tractor or vehicle. Six individual larger scale farmers had planted their cropping fields. Fields are not fenced and roaming livestock are an issue. The effect of the drought here was quite severe. Three of the six participants had planted late November with little to no germination. Replanting had to be done (10 December) to respond to the poor germination rates that occurred. The farmers were adamant that pulling the planter behind the tractor is a very cost effective practice for them stating that they only needed 5 litres of diesel to plant 1 ha in this way. Previously with the ploughing, discing and planting they used as much as 20 l/ha.

Figure 33: Using an animal drawn planter pulled by a tractor for ploughing larger areas (left); the crossbar to which the planter is attached works better than a chain for producing straight rows (right).

Table 20: Results obtained (% Ground cover and % Germination)

Name and Surname	Trial Size (m^2)	Control size (m^2)	% Ground cover	% Germination	Notes
Mr Njabulo Buthelezi	6400		35% (fields fallow for around 10 years)	~5% -replanted 10/12	Good ground cover and organic matter due to long fallow
Mr Jafta Nene	1000	~1 ha	5-10%	~5% replanted 09/12	
Mr Senzo Ntuli	1000	~1 ha	0-5%	~0-5% - replanted	
Mr Elson Maphalala	1000	~3.5 ha (also no till planting of Colorado maize)	0-2% (planted continuously for around 10-12 years)	~70% (20/11) the best germination for him ever.	Extremely low organic matter in soil. Capping and run off.
Mr TM Gasa	800 (4x200)	In garden no control	25-30% cover	Crop rotation trial: SCC- ~85-90% Maize ~30% Beans ~40%	Capping and runoff at the lower end of the plot
Mr Sdashi Zondi	4000 (4x1000)	~3,5 ha (Planted 02/12 using no till)	5-10%	SCC-maize-beans Maize+WCC (25/11) SCC~overall ~ 40% Sunnhemp ~25% Cowpea ~ 10-15% Dolichos ~7-9%	Sunnhemp and cowpeas germinated despite heat and drought. Beans did not germinate at all, Dolichos struggling. Maize late.
Mr Sangweni	1000	~1 ha	0-5%	~5% need to replant	

Note:

- WCC (winter cover crop) – black oats, fodder rye and vetch planted in Feb 2016 but did not germinate
- Issues with variable planting depth as well as variable release of the seed from the planter were encountered. It was established that if the seed hopper is not the right size, seed gets stuck underneath the plate. This was especially the case for the beans and the Colorado maize (OPV yellow maize) that has a slightly smaller seed size. Mahlathini staff (Mr Madondo) assisted in re calibrating the seed hopper and wheel for seed planting depth during the replanting which took place on the 10 December 2015.
- The drought tolerant SCCs used in the crop rotation trials germinated a lot better than the maize and beans.

Figure 34: **Mr Elson Maphalala's field - he was very impressed with the no-till planter and planted his whole field of around 4 ha using this method "stress free" (left); Maize was battling to germinate and low ground cover with runoff and capping adding to plant stress conditions (middle); Mr Maphalala with Mr Madondo (right).**

Figure 35: Good ground cover and germination of the summer cover crops in Mr Gasa's plot (left); Mr Gasa and the field workers look on (right).

Figure 36: Mr Zondi's SCC mix germinated reasonably well although the Dolichos was struggling - the lack of cover and organic matter in the soil is clearly visible, adding to drought stress conditions (left); the maize did not germinate well and the beans did not germinate at all (right).

8.4.4 Results and Issues

Six farmers participated and replanted a number of times even though their efforts were fruitless especially with the beans and winter cover crops. Germination rates of 0% were achieved because of the excessively dry weather conditions. Farmers themselves were very positive about the process even though the results were not forth coming. Due to the excessively dry weather conditions that prevailed this past growing season, farmers' crops really struggled for all the farmers except for Mr Zondi and Mr Maphalala who obtained some yields from their fields with Mr Zondi having obtained 140 kg and Mr Maphalala 50 kg of maize grain respectively. The SCC mix grew well and farmers let their cattle graze on it once it was ready. Mr Zondi has since kept 250 ml (1 cup) of sun hemp seed.

8.5 PID – Ngoba (Bergville)

8.5.1 Background

Ngoba is a new village that was included as an expansion area within Bergville in the CA Programme and also because of an attempt to work more closely with the local Department of Agriculture. In this area the Department supports no-till (CA) farmers and there were talks of a group clubbing together to buy a no-till planter (animal drawn). It was considered a good idea to start the trials and experimentation in this area. The Department has however not followed through with the joint venture and only succeeded in carrying out the introductions to the farmers in the area.

8.5.2 The experiment

The experiment included the planting of double row intercropping of maize (PAN 6479) and beans (PAN 148) as well as maize and cowpeas, which were planted simultaneously. MBLI planters and traditional hand hoes were used for planting that took place from the 16th to 28th of December 2016.

A Four block trial was set up:

- 10 m x 10 m summer cover crop mix (sun hemp, millet and sunflower) - Dolichos was planted separately
- 10 m x 10 m maize – white hybrid (PAN 6479)
- 10 m x 10 m beans (PAN 148)
- 10 m x 10 m winter cover crop mix (Sai oats, fodder rye and fodder radish) - planted into maize for summer season

8.5.3 Experimentation progress

Figure 37: Mrs Dladla's trial plot in Ngoba - It had been very dry and hot in the area. The crops germinated but were not weeded well and had been eaten by livestock.

Figure 38: Mrs Fikile Bhengu standing in front of her weed infested cowpea plot. She planted the crop rotation trials (left); The SCC (Dolichos and sunnhemp) germinated but are being outcompeted by weeds (right).

Figure 39: SCC showing signs of unsatisfactory growth due to harsh growing conditions (left); Mrs Fikile Hlongwane's fields after livestock damage (middle); Maize and cowpeas intercrop in Mam Ntombenhle Hlongwane's field (right).

8.5.4 Issues and results

Given the extreme weather conditions, the expectation that the SCCs would germinate and grow better than the maize and beans was well justified. The results were however disappointing as there had been extreme grazing pressure from goats and cattle. In a number of villages cattle had not been sent to the mountains for summer grazing as the veld had not recovered after winter due to lack of rain. Livestock were thus roaming freely within the fields. SCCs as well as subsequent WCCs germinated but did not grow to maturity due to grazing from stray livestock. No maize was harvested while some farmers managed to salvage some beans. Mam Vimbephi Dladla obtained 5 kg of dry beans while others obtained no harvests at all. One case of spontaneous adoption is Mrs Bhengu's neighbour who saw the CA trials and used the method to plant a plot of maize for himself. His plot was fenced and germination and growth reasonable

Figure 22: Volunteer planting by Mr Celani Mntambo in his fields showing good growth.

8.6 Potshini Chicken rearing experiment

Subsequent to the results that were obtained from crops experimentation, further ideas were explored with the farmers at Ngoba, Bergville on the 5th May 2016 where a meeting was held with 7 farmers in the village. The idea of rearing chickens in chicken coops as opposed to free range and exploring the various differences or even similarities was discussed. Mr Madondo, shared his experience of using these with the farmers.

Figure 40: Laying hens in chicken coops at Mr Madondo's homestead (left); Eggs collected from chicken coops also at Mr Madondo homestead – showing the challenge of the cages (right).

8.7 Conclusion

The process of PID yielded positive results even though there were many factors that were unfavourable including the recent drought. Winterton - Emaswazini's PID, which was to ascertain which sweet potato variety is most suitable to the area as well the effect of soil amendments on the taste of sweet potato determined that the local variety produces more yield in kilograms however, in terms of taste and the effect of the different fertilization regimes, Impilo variety proved to be more popular and produced the second highest yields to the local variety. As a result of the Emaswazini local learning event, sweet potato vines of the various varieties (Impilo, Ndou, and Bophelo) were shared with Eqeleni, Ndunwana and Ezibomvini farmers meaning that these are now available in the various communities for planting.

The effect of the recent drought was seen more in the Ngoba (Bergville) and Nkandla (Mpotholo) PID where in these areas poor germination was experienced and unsatisfactory yields obtained for the CA trials. Farmers were able to respond to this by planting later than usual as well as replanting some of their plots but those that did achieve good germination ended up not obtaining good yields due to stray livestock. They also planted cover crops. Learning together has led the participants to be keen on further experimentation. Participants in Ngoba have been first to put their hands up for further experimentation where they will be experimenting with layer pullets reared in chicken coops versus free range and comparing the different variables.

9 CASE 7: Comparing broiler rearing systems to identify the prefered method for smallscale farmers

Acronyms
EDO – Enterprise Development Officer
SCG – Savings Credit Group
CIG – Commodity Interest Group
EFG – Enterprise Focus Group

9.1 Background

Saveact have embarked on a new phase of enterprise development. New groups have been formed from existing savings groups (SCGs) and Commodity Interest Groups (CIGs) that show an interest in a specific enterprise programme. These programmes include:

- Broilers
- Layers
- Maize
- Potatoes
- Sheep
- Organic Vegetables.

The most popular programme to date had been broiler production with the modular Inkukukaya Broiler units having been chosen, in consultation with the Kwazulu-Natal Poultry Institute (KZNPI), as the preferred method of rearing grain fed broilers for small scale farmers. This new technology has been growing in popularity in the poultry industry particularly with small scale farmers in rural communities.

9.2 Aim and objective

Through PID, Saveact aimed to run an experiment which would compare differences of market-ready birds that were reared the traditional or existing way to those that were reared in the Inkukukaya cages. Factors that were analyzed were weight differences and mortalities in the batch. Farmers consensually agreed on the treatment which represented their traditional/existing method of rearing broilers.

9.3 PID pilot description

Three groups were chosen to conduct the experiment namely:

- Masisukume (Ndodeni, Centocow)
- Zibambele (Lupongolo, Umzimkulu)
- Ramohlakoana (Maluti, Matatiele)

9.3.1 Masisukume (Ndodeni, Centocow)

Masisukume is an EFG consisting of 10 members all of which are women. This group falls under the Centocow area. This is a vibrant group with seven of its ten members being under the age of 35. The house they use for rearing chickens is well ventilated and has concrete flooring. Almost all the women

have indigenous chickens in their households but all are relatively new to broiler farming. When they feel they have adequate knowledge to run a broiler enterprise, they said they will venture into layer production; to diversify their enterprises.

Figure 41: Masisukume (Ndoneni Centocow)

9.3.2 Zibambele (Lupongolo, Umzimkulu)

Zibambele is an EFG consisting of 11 members all of which are women. This group represents two savings groups which are under the Umzimkhulu region. The chicken house is a normal (rural) room with sufficient space for rearing the birds. They have two meeting venues (roughly 300m apart) which are alternated between poultry trainings. Many of the women have started farming broilers on a small scale prior to joining the EFG. They showed knowledge of poultry diseases in terms of symptoms, but did not know the names of the disease and their respective vaccines and medications. This also applies to other aspects of poultry farming; their knowledge is minimal. Nevertheless, their zest for poultry farming has enabled them to learn swiftly.

Figure 42: Zibambele (Lupongolo, Umzimkulu)

9.3.3 Ramohlakoana (Maluti, Matatiele)

Ramohlakoana is an EFG consisting of 14 members with 3 men and 11 women. The group is a registered co-op and was able to acquire funding from an Irish company to build a broiler house capable of running 1000 birds. The building is complete but is awaiting an electricity connection from the Municipality. The

newly formed group expressed an interest in learning about broiler production and subsequently formed an EFG. The Inkukukaya unit was placed in late November with a supply of 25 day-olds.

Figure 43: Ramohlakoana (Maluti, Matatiele)

9.4 Experimental designs

Each group applied their traditional/existing method (Treatment 1) alongside the Inkukukaya method (Treatment 2). All three groups were provided with 50 birds – 25 birds in Treatment 1 and 25 in Treatment 2 being reared concurrently. In order to give a more precise weight analysis, feed supply was constant in all three replicates. On completion of the experiment the results were shared with the participating groups along with all existing and future poultry EFGs in an attempt to improve Feed Conversion Ratio (FCR), decrease mortalities and minimise all future avoidable costs (brooding, flooring etc).

Table 21: Inputs requirements

Input	Treatment 1 (Existing/Trad)	Treatment 2 (Inkukukaya)
25 Bird Broiler Unit		1
25kg Starter Crumbles	1	1
65kg Finisher Pellets	1	1
Day-Old Chicks	25	25
Brooding Blanket		1
Water Trough	1	
Feeding Trough	1	

9.5 Record keeping

Data Sheets were provided to each group. These sheets were filled in daily to record the mortality rates and any notes that may be relevant during the course of the 6 week cycle. This information was recorded in the Broiler Daily Record Sheet (Appendix 5).The individual weights of each bird from both treatments were recorded at the end of the 6 week cycle to determine the yield achieved per production system. This information was recorded in the Broiler Cycle Yield Sheet (Appendix 6). A further sheet was provided to record the sales of the birds from each treatment. This was not a part of the PID experiment but is an important record sheet to assess the profitability of the Poultry enterprise. This is called the Broiler Sales Record Sheet (Appendix 7).

9.6 Parties involved

The Saveact enterprise development team who implemented the proposed PID experiment were:

- Dumisani Magubane (EDO)
- Nomonde Mncube (EDO)
- Khotsofalang Matekase (Intern EDO)
- Three Selected Broiler EFGs

The experiment was conducted in the Matatiele and Underberg Region of the Eastern Cape and KZN.

9.7 Systems Compared

Figure 44: Traditional/existing broiler rearing method **Figure 45: Inkukukaya cage broiler rearing method**

PS. No vaccinations were provided for both systems as day-olds were vaccinated prior to purchase

9.8 Results

9.8.1 Joint-Learning Experience

Participants were not familiar with the PID method of learning and were used to being taught the 'right way' by outsiders. It was clear that not all participants were committed to the joint learning process.

9.8.2 Experimental Result

Mortalities were higher on Treatment 1 (Traditional Method) at 17.8% vs 12% (Treatment 2) however birds reared in the Inkukukaya cages were generally weaker than the other birds with some birds showing signs of lameness. This was thought to be the result of the hardened floor surface of the plastic moulded cage. It was felt that vaccinations should have been administered to both treatments.

Feed Provision

Broilers eat an average of 1kg starter, 1.5kg grower and 1.5kg finisher (no brooding, and lighting). Treatment 1 (Traditional Method) consumed 3.9kg of feed and Treatment 2 (Inkukukaya system) birds consumed 3.6kg

Weight

The weight of broilers to be slaughtered on average is 2.4kg at 6 weeks. Treatment 1 (Traditional Method) had an average weight of 2.1kg and Treatment 2 (Inkukukaya system), 2.6kg at 6 weeks

Feed conversion ratio

$$FCR = \frac{\text{Feed intake}}{\text{average daily gain}}$$

Treatment 1 (Traditional Method) FCR = 1.86 per 1kg of live weight
Treatment 2 (Inkukhukhaya system) FCR = 1.38 per 1 kg of live weight

Problems

- Birds were removed from the Inkukukaya cage due to leg problems, and therefore true weights could not be compared at the end of the cycle
- Records were not being kept as agreed upon.

Opportunities

- Adapt by using Inkukhukhaya method for brooding, 1 – 2 weeks
- Adopted the Inkukhukhaya method for full rearing cycle (6 weeks), start selling early (at a lower price) or obtain bigger weights at 6 weeks
- Selling early is useful since rural markets are not reliable; sales are intermittent. It prevents feed shortages
- Create a weekly timetable for member duty to ensure everyone contributes

9.9 References

Justus O, Owour & Bebe BO, (2013). Journal of Agriculture and Rural Development in the Tropics and Subtropics. Vol. 114 No. 1 (2013) 51–58

Tarwireyi L & Fanadzo M, (2013). Production of indigenous chickens for household food security in rural KwaZulu-Natal, South Africa: A situation analysis, African Journal of Agricultural Research

APPENDIX 1: MINAH YENDE'S HOUSEHOLD

Mayende's household: (from left) nests placed inside hut as hens turn broody, mother hen kept in dairy crate with young chicks, as chicks get older they are kept in a chicken coop with the mother hen until old enough to go outside.

APPENDIX 2: PHAKAMILE ZONDO

Mam Zondo's household (from left): Nests collected and placed in hut as hens turn broody, mother hen placed in dairy crate with young chicks, as chicks get older they are kept in a chicken coop with the mother hen, when indoors chicks are allowed to roam freely, at three months, chicks are weaned

APPENDIX 3: PHUMZILE PHAKATHI'S HOUSEHOLD

Phumzile Phakathis's household (from left top and bottom), hens placed in hut as they turn broody, mother hen placed in dairy crate with chicks, as chicks multiply they are in a chicken coop and after three months, chicks are weaned.

APPENDIX 4: PID POSTER PREPARED TO FACILITATE SHARING

Izinzuzo zecebo

a) Inani lwezinkukhu luyanda ngesikhathi esifushane kunokujwayelekile ngoba izikhukhukazi ezifukamela kabili, azi-wakhulisi amachwane kodwa zibuyela phandle ziyozalela kabusha.

b) Ukunakwa okunzulu kwezinkukhu kuzi-vikela ezilwaneni ezifana nezinja, nojakalasi kanti futhi kuyasiza ekutheni izifo zisheshe zibonakale.

Izingqinamba ezingabakhona

a) Indawo: njengoba amachwane akhula ngesibalo kanye nosayizi, ikesi liba lincane, kudingeka indlu

b) Izindleko zokudla ziyenyuka uma izinku-khu zikhula ngobuningi

c) Kudingeka isakhiwo/indlu ukuze icebo lisebenze

d) Ehlobo amaqanda asheshe abole

In Partnership with:

Royal Tropical Institute

Institute of Natural Resources

FARMER SUPPORT GROUP

Making land work for rural people

PARTICIPATORY INNOVATION DEVELOPMENT (PID)

Icebo Lokwandisa Inani Lezinkukhu Zesizulu (Busingatha)

UNIVERSITY OF KWAZULU-NATAL

INYUVESI YAKWAZULU-NATALI

PARTICIPATORY INNOVATION DEVELOPMENT(PID): Indlela Yokwandisa Izinkukhu Zazemakhaya

Isendlalelo se PID

Icebo lokwandisa isikhathi sokufukamela kwezikhukhukazi zomdabu laqanjwa u mama u Minah Yende wase Busingatha, lapho inani lezinkukhu zomdabu liye lehla ngenxa yezingqinamba ezihlukahlukene.

Lezi zinqinamba zifaka ukunyuka kwezinga lokufuya izinkukhu zomshin, ukuntuleka kwezindlu, izifo, ukuzalela okusezingeni eliphansi, nokwebiwa. *Noma izingqinamba zikhona, izinkukhu zomdabu zibalulekile ngoba zikhiqhiza inyama namaqanda ngaphandle kwezindleko eziphezulu.*

I PID Ihlukane kabili:

1. Ukuphinda ukufukamela kwezinkukhu kabili (42 days) esikhundleni sika 21 days lo ojwayelekile
2. Ukufaka wonke amachwane nesikhukhukazi esisodwa ukuze siwakhulise

Ukufuya Izinkukhu Uebenzisa Lelicebo

Udinga izikhukhukazi ezimbili kuya kwezine ukuze icebo lisebenze.

"Amaqanda"

Izikhukhukazi uma zizalela qoqa amaqanda

Uwabeke endaweni ephephile

"Ukufukamela"

a) Uma izinkukhu sezifuna ukufukamela buyisela amaqanda ezidlekeni bese uzingenisa endlini.

b) Isikhukhukazi esizochamisela kuqala uzosifaka e ekesini namachwane aso (bona isithombe)

c) Uma ezinye izikhukhukazi zichamisela (emvakwa 21 days) khipha amachwane ebsuku noma ekuseni ngovivi uwafake kulenkukhu esekesini bese ufaka amanye amaqanda phansi kwazo ukuze ziqhubeke nokufukamela *(lokhu ke ukuphindelela isikhathi sokufukamela, sibe izinsuku ezingu 42 kuno 21 days lo ojwayelekile).*

d) Emuva kwezinsuku ezingu 42, khiphela izikhukhukazi ebezifukamela phandle, ungazami ukuphinda ukuzifukamelisa ngoba angeke zisahlala emaqandeni.

e) Inkukhu ekhulisayo ikhiphele phandle namachwane ayo zonke izinsuku ukuze ishwaye umoya namachwane azofunda ukuqwhanda.

APPENDIX 5 BOILER DAILY RECORD SHEET

BROILER DAILY RECORD SHEET			
Treatment Number			
Group Name			
Date Placed			
FEED & WATER MUST BE FILLED DAILY IN THE MORNING & EVENING. DRINKERS MUST BE CLEANED DAILY			
Day	**To Do (Eg Vaccinations)**	**Morts**	**Notes (Eg Very hot weather)**
1			
2			
3			
4			
5			
6			
7			
8			
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10			
11			
12			
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42			

APPENDIX 6: BROILER CYCLE YIELD SHEET

BROILER CYCLE YIELD SHEET		
Treatment Number		
Group Name		
Date Placed		
No.	**Notes (Eg Condition of bird)**	**Mass (g)**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
	Total	

APPENDIX 7: BROILER SALES RECORD SHEET

BROILER SALES RECORD SHEET				
Treatment Number				
Group Name				
Date Placed				
Date	Customer	Units	Price	Total