

APPENDIX 5: KWAZULU-NATAL MIDLANDS ANNUAL PROGRESS REPORT

CA Farmer Innovation Programme (CA-FIP) for
smallholders in KZN Midlands.

Period: October 2017 - September 2018

**Farmer Centred Innovation in Conservation Agriculture in upper
catchment areas of the Drakensberg in Midlands of KwaZulu-
Natal**



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Identification of the project

Description and selection of study areas

The KZN Midlands programme has been expanding the CA Smallholder Farmer Innovation Programme (SFIP) activities piloted in Bergville to other maize growing areas in the Midlands, i.e. Estcourt, Ladysmith, Greytown and New Hanover.

Communities targeted in this season expanded from Cornfields to include 4 new learning groups in Swayimanye (New Hanover). Work in Nkandla and Mpholweni (Greytown) has been discontinued. The level of commitment from community members in these areas has been low.

Approach and Methodology

The farmer-centred innovation systems research process underpinning the programme, which is based on working intensively with farmer learning groups and local facilitators in each of the villages, has been continued and strengthened.

Within the learning groups farmer innovators volunteer to set up and manage farmer-managed adaptive trials as the 'learning venues' for the whole learning group. Farmer Field School (FFS) methodologies are used within the group to focus the learning on the actual growth and development of the crops throughout the season. New ideas (CA practices) are tested against the 'normal' practise in the area as the controls. Farmers observe, analyse and assess what is happening in the trials and discuss appropriate decisions and management practices. Small information provision and discovery-learning or training sessions are included in these workshops/ processes. These are based also on the seasonality of the crop and the specific requests and questions from farmer learning group participants.

Local facilitators are chosen from within and by members of the learning group to be a person who has the required experience, knowledge and a willingness to support the other farmer innovators in their implementation. Facilitators are only chosen and appointed where people with the appropriate skill and personality exists. Local facilitators receive a stipend for a maximum of 10 working days per month, for their support to the farmer innovators. They fill in detailed timesheets outlining their activities against which they claim a monthly stipend.

Learning group members agree to a season long learning process and put forward the farmer innovators to run the trials. Each prospective innovator is interviewed and visited and signs an agreement with the Grain SA team regarding their contribution to the process. They undertake to plant and manage the CA trials according to the processes and protocols introduced as well as a control plot of the same size. For the latter, farmers provide their own inputs.

The adaptive trials are also used as a focus point for the broader community to engage through local learning events and farmers' days. Stakeholders and the broader economic, agricultural and environmental communities are drawn into these processes and events. Through these events *Innovation Platforms (IPs)* are developed for cooperation, synergy between programmes and development of appropriate and farmer led processes for economic inclusion. These IPs also provide a good opportunity to focus scientific and academic research on the 'needs' of the process.

In this season (2017-2018) we have continued to focus on the following elements of the model, namely:

- a) Support farmers who are in their 1st, 2nd seasons of implementation,
- b) Inclusion of summer cover crops in the cropping mix
- c) Use of the two-row tractor drawn planter
- d) Promotion of VSLAs

Financial reporting

Below is a summary of the key result areas and budgets provided under the 2017-2018 project cycle.

Table 1: Midlands SFIP budget outline for 2017-2018

Milestones/ Outputs	Key activities	OUTCOMES/ DELIVERABLES	Budgets
	Capital Equipment		R 148 204,00
Farmer experimentation Bergville	Administration and sundries	travel accommodation, admin, publications, monitoring and evaluation	R 98 643,00
	Farmer centred innovation systems	farmer experimentation, researcher managed experimentation, savings groups, farmer centres...	R 281 620,00
	Innovation platforms	Stakeholder meetings, platform building and events	R 57 780,00
Sub - TOTAL: Oct 2017 - Sept2018			R 586 247,00

Expenditure by MDF has followed the key activities above. Regarding capital equipment and Farmer Experimentation, a few modifications were made, given the co-funding that was received through the KZNDARD Land Care programme (R104 750). This provided for increased budgetary allowances and thus also meant savings on capital equipment of around R96 674, which has been used within the Farmer centred innovations systems key activity area.

Expenditure on capital equipment and farmer experiments is detailed below.

Table 2: Expenditure on the Capital Items and farmer Experimentation portions of the budget; 2017-2018

Date	Inputs	Amount	Paid for by Grain SA	Farmer's payments	
2017/11/22	Soil health Analysis - Oakdene		R 50 616,00		
2017/10/31	Farmers AgriCare; Gramoxone, Dual Gold, Decis Forte	R 2 671,30			
2017/11/14	Victoria packaging (masks, bottles), and TWK (paraquat)	R 638,50			
2017/12/15	Soil health Analysis - Oakdene		R 12 312,00		

2018/01/17	Maize thresher; Madzikane - FarmWorld	R32 319,00		R2 000,00	Note: R9 800 paid by Mr Xaba, 2017
Sub-total		R35 628,80	R 62 928,00	R 2 000,00	
	Total	R96 556,80			
Budget	Description	Amount	KZNDARD Landcare	Amount	
Capital equipment	Soil samples, tools, quantitative measurements	R 148 204,00	Co funding farmer experiments, capital expenditure	R 104 750,00	
Farmer experiments	Seed, herbicide, fertilizer	R 45 000,00			
	Total	R 193 204,00		R104 750,00	

Key activities: October 2017-September 2018

Four learning groups have been set up in Swayimanye (New Hanover). Interest in commercial maize production (green mealies) here is high due to the community's proximity to a large town - Pietermaritzburg. Individual members of the learning groups are part of a farmers' Association in the area. Thirty four (34) participants conducted CA trials. Farmer level experimentation has expanded to include planting with a 2-row tractor drawn planter for the larger fields and the experimentation layout and planting procedure were adopted to also suit this process. Intercropping has been used in all the villages and planting of cover crops (both summer and winter mixes) has been actively promoted.

The Cornfields (Estcourt) area focus has continued, despite the understanding both in the community and by the facilitators that this is likely a marginal area for maize production due to climatic conditions and extremely poor soils in the area. Eight (8) participants conducted CA trials.

Initial discussions and workshops have been held for a potential expansion into the Estcourt area of Thabamhlophe and two new learning groups are to be started in a new area in Umshwathi Municipality called Appelbosch (Gobimsimbi and Nomiyele).

Stakeholder engagement has included open days/ farmers days co-hosted by LandCare (DARD), a co-funder of this programme for this season and a range of networking meetings and processes.

Results achieved to date

Five learning groups have been supported under this process. Training/learning workshops have been conducted for the following topics:

- **How to implement CA:** introduction to the principles, soil health, crop diversification and different planting options for CA
- **Working with herbicides and knapsack sprayers:** information on different herbicides, their uses and safety measures, as well as operation of knapsack sprayers, protective clothing, etc.
- **Trial plot layout and planting** using different CA planting equipment such as hoes, MBLI planters, and animal drawn not till planters.

- **Top dressing and pest control measures** for mid-season growth of crops and planting of cover crop mixtures where people have been interested in this option

The learning groups provide the innovation platforms also for discussion of the value chain issues, such as bulk buying, harvesting, storage and milling options and marketing.

Stakeholder engagement and awareness raising have included the following:

1. Quarterly presentations to the Ubuhlebezwe LM LED forum on agriculture.
2. Cooperation with the UKZN, running a research process on Climate Smart Agriculture through the Water Research Commission – CA is one of the technologies they are demonstrating in their sites in KZN (Swayimanye) and the Free State.
3. A PROLINNOVA networking meeting to discuss local innovation systems and support for these
4. A Greenfund concept proposal meeting called by the INR with a number of organisations to put together a consortium proposal.
5. A farmers' day in Swayimanye co-hosted by LandCare and a year-end function for one of the cooperative groups.
6. A mid-season review in Swayimane including a number of other interested community members, looking at progress, issues, different maize cultivars and discussing the role of cover crops.

The table below outlines activities related to objectives and key indicators for the period of October 2017-September2018.

Table 3: SUMMARY OF PROGRESS (OCTOBER 2017 - SEPTEMBER 2018) RELATED TO OBJECTIVES AND KEY ACTIVITIES

Objectives	Key activities	Summary of progress	% completion and comment
1. Document lessons learned	Documentation for learning and awareness raising	- Printing of hand books and learning support materials for groups and individuals - Sharing of information through innovation platforms processes -Articles and promotional material	- 500 copies of Individual savings books and 50 group savings books have been printed (100% complete) - Madzikane, Matatiele, Bergville (100% complete) -4 articles of the GrainSA monthly magazine (one on Swayimane specifically) and 1 for the Adaptation Network newsletter. (100% completion)
	Final report	- 6 monthly interim reports	- Interim and final reports (100% complete)
2. Increase the sustainability and efficiency of CA systems	1 st level experimentation: 40	- 34 participants in Swayimanye planted 400m ² intercropping trials as advised. One larger field planted in Swayimanye 2 using the two- row planter- also using intercropping	- Basic CA design- intercropping with maize beans and cowpeas on a 100m ² - 400m ² plot, with a control plot managed entirely by the participant. Adaptation trials included late season planting of beans with a mixture of winter and summer cover crops. Yield measurements

		- Planting in Mpholweni has not taken place;	done and planning for the coming season completed (100% complete)
	2 nd level experimentation: 13	- 8 participants in Cornfields planted their 400m ² inter-cropping trials.	- Participants opted to continue with intercropping practice from their 1 st year. Yiled measurements and planning for the coming season completed. (100% complete)
	Develop and manage PM&E framework; – weekly and monthly M&E visits	- M&E forms redesigned and used - Digital monitoring system piloted	- Monitoring of planting and crop growth awa yields and germination and growth of cover crops (100% complete)
	Facilitation of innovation platforms	- Co-facilitation of information sharing and action planning with stakeholders and role players	- A farmers information day awa a mid season review were held in Swayimanye (incl farmers from other areas, local and academic stakeholders, DARD, and the LM. - CA introduction to potential expansion areas held (100% complete)
	CA working group, and reference group	- Planned for August 2018	

A performance dashboard is indicated below. This provides a snapshot of performance according to suggested numbers and outputs in the proposal.

Table 4: Performance Dashboard: September 2018

Outputs	Proposed (March 2017)	Actual (Sept 2018)
Number of areas of operation	3	2
Number of villages active	4	5
No of 1 st level farmer experiments	24	34
No of 2 nd level farmer experiments	6	8
No of local facilitators	4	3
No of direct beneficiaries	75	53
Participatory monitoring and evaluation process (farmer level)	Yes	Yes
Soil biological assessments (Bgvl, SKZN)	36	46
Stakeholders forums	6	12

The table below summarises the planned and actual farmer trial implementation for the 2017-2018 planting season. A total of 53 trial participants volunteered through the planning processes across 6 villages in three areas. Forty two (42) of these farmers planted trials.

Table 5 : Summary of farmer innovation numbers and areas planted per village; KZN Midlands 2017-2018

Area	Village	Farmers selected	Farmers planted (1 st level)	Farmers planted (2 nd level)	Experimentation	Comments; incl planters used.
Estcourt	Cornfields	13		8	Intercropping, late season beans, cover crops.	Farmers planted using hand hoes and MBLI planters. The group is not well established
Greytown	Mpholweni	8	0			Group members were unprepared to do the planting for themselves
New Hanover	Swayimanye 1	6	8		Intercropping, late season beans, cover crops.	Very active group members; Hand hoes and MBLI planters used
	Swayimanye 2	9	9		Intercropping, late season beans, cover crops.	Very active group members; Hand hoes and MBLI planters used. One 2 row tractor drawn planter demonstration
	Swayimanye 3	8	8		Intercropping, late season beans, cover crops.	Very active group members; Hand hoes and MBLI planters used
	Gobizembe	9	9		Intercropping, late season beans, cover crops.	Very active group members; Hand hoes and MBLI planters used
TOTAL		53	34	8	Area of trials	1,36ha

Of the 53 participants selected, 42 participants planted their trials. In Mpolweni no planting was done and in Cornfield 8 of 13 participants planted. In Swayimane all trial participants planted and two more participants were brought on board.

Overall process

As this is an existing 'technology' the farmer level experimentation is in essence an adaptation trial process.

Year 1:

Experimental design is pre-defined by the research team (based on previous implementation in the area in an action research process with smallholders). It includes a number of different aspects:

- Intercropping of maize, beans and cowpeas
- Introduction of OPV and hybrid varieties for comparison (1 variety of maize and beans respectively)
- Close spacing (based on Argentinean system)

- Mixture of basin and row planting models
- Use of no-till planters (hand held, animal drawn and tractor drawn)
- Use of micro-dosing of fertilizers based on a generic recommendation from local soil samples
- Herbicides sprayed before or at planting only
- Decis Forte used at planting and top dressing stage for cutworm and stalk borer
- Planting of cover crops; summer and winter mixes

Experimental design includes 2 treatments; planter type (2) and intercrop (2). See the diagram below.

		PLOT 1: Hand Hoe		PLOT 2: Planter	
10m or 5m		Maize 1, bean 1	Maize 2, Bean 1	Maize 1, bean 1	Maize 2, Bean 1
		Maize 1, Bean 2	Maize 2, Bean 2	Maize 1, Bean 2	Maize 2, Bean 2
10m or 5m					
		PLOT 3:	OR repeat plot 1 and 2	PLOT 4:	
		Hand hoe	Planter	Hand hoe	Planter
		Maize 1, cow pea	Maize 1, cow pea	Maize 1, Dolicho	Maize 1, dolichos
		Maize 2, Cow pea	Maize 2, Cow pea	Maize 2, Dolicho	Maize 2, Dolichos

Figure 1: Example of plot layouts for the 1st level farmer trials

The basic process for planting thus includes: Close spacing of tramlines (2 rows) of maize (50cmx50cm) and legumes (20cmx10cm) intercropped, use of a variety of OPV and hybrid seed, weed control through a combination of pre planting spraying with herbicide and manual weeding during the planting season and pest control using Decis Forte, sprayed once at planting and once at top dressing stage.

For the tractor drawn two row planter the layout has been adapted to incorporate both close spacing and inter cropping. Rows are planted with the following order and spacing; Maize-50cm -Beans-25cm-Beans-50cm Maize

Year 2:

Based on evaluation of experiment progress for year 1, includes the addition of options that farmers choose from. Farmers also take on spraying and plot layout themselves:

- A number of different OPV and hybrid varieties for maize
- A number of different options for legumes (including summer cover crops)
- Planting method of choice
- Comparison of single crop and intercropping planting methods
- Use of specific soil sample results for fertilizer recommendations
- Early planting
- Own choices

Year 3:

Trials are based on evaluation of experimentation process to date; to include issues of cost benefit analysis, bulk buying for input supply, joint actions around storage, processing and marketing. Farmers design their experiments for themselves to include some of the following potential focus areas:

- Early planting; with options to deal with more weeds and increased stalk borer pressure.
- Herbicide mix to be used pre and at planting (Round up, Dual Gold, Gramoxone)
- A pest control programme to include dealing with CMR beetles
- Intercropping vs crop rotation options
- Spacing in single block plantings
- Use of composted manure for mulching and soil improvement in combination with fertilizer,.
- Soil sample results and specific fertilizer recommendations
- Planting of dolichos and other climbing beans
- Summer and winter cover crops; crop mixes, planting dates, management systems, planting methods (furrows vs scatter)
- Seed varieties; conscious decisions around POVs, hybrids and GM seeds
- Cost benefit analysis of chosen options

Possible agrochemical spraying regime options

1. Roundup 2 weeks before planting - if there has been some rain. DualGold at planting (just after with Decis Forte/Kemprin).

2. Gramoxone at planting (just before or after planting) with or without Dual Gold and Decis Forte/Kemprin – Dual Gold does not work on dry soil (followed by heavy rain)

Soil fertility

Soil samples for fertility analysis at Cedara were taken for the 4 learning groups in Swayimanye (New Hanover).

A summary of the results for these samples is presented in the small table below. This provides a more in-depth analysis of generic fertilizer requirements than provided in the interim report.

A generic fertilizer recommendation of:

- 250kg/ha MAP (5x 50kg bags) (equivalent to 40kg/ha of P) and
- 150kg/ha LAN (3x50kg bags)(equivalent to 60kg/ha N)

has been used for all farmer-led trials, These amounts were based originally on fertilizer requirements averaged for the Bergville area.

Soil samples were taken for most of the new entrant farmers (29 of the 40 new farmers). The summary below outlines the soil fertility recommendation results. From these results however, it can be seen that the average recommendation for MAP of 250kg/ha can be reduced to 125kg/ha or (2,5 x50kg bags/ha). The LAN recommendation will remain 3x50kg bags/ha

Table 6: Soil fertility analysis summaries for new Midlands villages in Swayimane; 2017-2018

AREA	pH	% Acid sat	%C	%N	%Clay	MAP	LAN	KCL	Lime	
						50kg bags/ha			t/ha	

Mayizekane 1	4,4	29,7	1,6	0,3	39	2	1,9	0	3,0 (6)	Note: Average was taken for those needing lime – No in brackets is maximum amount required
Mayizekane 2	4,4	29	2,6	0,2	39	1,8	3,1	0	3,6 (11,5)	
Mayizekane 3	4,4	12,2	2,3	0,1	39	3,4	2,6	2	1,7 (3,5)	
Gobizembe	4,3	30,3	2,5	0,2	44	2,9	2,9	2,9	3,4 (10)	
AVERAGE	4,4	25,3	2,3	0,2	40,3	2,5	2,6	1,2	2,9	

In addition, the acid saturation in all 4 villages is high, linked to the low pH of these soils. Attention will need to be given to ensuring the lime requirements are tailored towards the needs of each village – or failing that, the generic quantity of lime recommended needs to be increased from 1-2,9 t/ha.

Progress per area of implementation

Information from the interim report is not repeated here.

Introduction

Natal Midlands is still a new area in terms of the Grain SA SFIP program and four out of the five groups that have come on board are in their first cropping season. The four new learning groups are based in Swayimane and all the participants undertook CA experiments. Out of the 34 participants that joined the programme, 24 participants (71%) managed to harvest and the remaining ten participants obtained no yields mostly due to livestock invasion, poor soils and excessively wet late season weather.

Cornfields is in its second cropping season of CA where horizontal up-scaling has been quite slow. Despite the status quo, the 2017/18 growing season has seen an improvement in overall yields. Of the 13 participants who said they would plant, 8 managed to undertake the trials and all of them managed to harvest which is a significant improvement from the previous growing season. The remaining five participants did not plant citing poor rainfall and said they would plant in the upcoming season.

The learning groups consist predominantly of women between the ages of 40 and 96 years old. More than 80% of the participants are unemployed and depend on pension and social grants as a source of income. In the Swayimane community, the participants also grow a wide variety of crops such as maize, beans and sugar cane for consumption and selling surplus and also own livestock. Cornfields participants grow maize and have vegetable gardens. Water is a major limiting factor especially in Cornfields where it often does not rain for months at a time.

A Case for Conservation Agriculture

Beyond just being a potential solution to excessive evaporation, soil erosion and reduction in yields, conservation agriculture has proven to be a viable option to addressing food insecurity in rural communities as its emphasis is on the planting of grain and leguminous crops which are

staple foods in rural South Africa. Furthermore, many people can no longer cope under the pressure of ever increasing food prices, hence household food production is becoming more and more a necessity rather than just an option. Livestock integration through the planting of cover crops is another major plus for rural farmers, who often have major problems with overgrazing. The zest with which people undertake CA suggests that they are beginning to realise the potential of farming to the betterment of their lives.

Summary of the 2017/18 growing season

Planting of CA trials for the 2017/18 growing season took place between December 2017 and January 2018 (see table 1 below). The season is now coming to an end with almost all participants having harvested their maize, beans and cowpeas.

Table 7: Summary of participants and inputs delivered in the 2017-2018 season

Names of the Local facilitators are given in brackets. These are the chairpersons of the cooperatives.

In Swayimane, the Mayizekanye and Gobizembe groups all planted as per CA demo and each participant had both maize+bean (M+B) as well as maize+cowpea (M+C) intercrop plots where planting was done using hand hoes (*refer to table 2*). Maize germination in Mayizekanye was generally good (85%) although there were trials which had poor germination such as Lungile Phungula's plot which had 35% germination (*refer to table 2*). In Gobizembe average maize germination was 79.8% which was also quite good. Germination for beans was generally lower than for cowpeas.

In terms of soils, Mayizekanye has mostly brown to reddish brown, deep and well drained soils although there were signs of erosion. The soils in Gobizembe are mostly reddish brown and there are some fields with shallow, rocky soils. The lack of uniformity in growth and colour in some trials suggests that there are issues with soil fertility. Some of the farmers enquired about MAP as they were impressed at the appearance of the maize trial compared to their own plots and testified that their yields have declined over the years, due to mechanical ploughing. The participants were proactive in terms of managing their trials except for a few who did not do any weeding. Stalk borer was the number one maize pest identified in all groups, especially in the farmers' own plots, followed by CMR beetles and aphids in beans and cowpeas. Locusts, crows and snails were also quite common, especially in Gobizembe (*refer to table 2*).

Area	Planting Date	Maize	Beans	Cowpeas	Number of Participants
Mayizekanye (Mrs Shandu)	16 /01/2018	PAN 6479	Gadra	Mixed brown	9
Mayizekanye(Mrs MaNene Mkhize)	17 /01/2018	PAN 6479	Gadra	Mixed brown	8
Mayizekanye (Mrs Nxusa)	18/01/2018	PAN 6479	Gadra	Mixed brown	8
Gobizembe	29/11/ 2017	PAN 53	Gadra	Mixed brown	9
Cornfields	20/12/2017	PAN 6479	Gadra	Mixed brown	13
Total no of participants					47

Table 8: Swayimane: Personal information, trial layouts and growth monitoring; 2017-2018

PERSONAL INFORMATION					TRIAL LAYOUT					ISSUES			GERMINATION %		
CORNFIELDS															
No	Name	Surname	Age	Yrs	size of trial	Planter	Plot 1	Plot 2	Plot 3	Plot 4	Pests	presence	Maize	Beans	Cowpeas
1	Gwaja	Khumalo	63	2	400m2	Hand hoe	M+B	M+B	M+B	M+B		0%	50%	45%	n/a
2	Moses	Sithomo	64		400m2	Handhoe	M+B	M+B	M+B	M+C		0%	41%	20%	30%
3	Mbuso	Mkhize	48		400m2	Hand hoe	M+C	M+C	M+B	M+B	Termites, Amaye, CMR beetles, stockborer.	1%	85%	35%	73
4	Mdumeni	Miya	67	2	400m2	Hand hoe	M	B			No pest issues	0%	90%	70%	n/a
5	Zakhe	Xaba	53	1	400M2	Hand hoe	C	M+B	M+B	M+B	CMR Beetles and flies	0%	81%	harvested	Harvested
6	Shintshile	Mbatha	60	1	228m2	Handhoe	M+B				Stockborer	1%	60%	harvested	n/a
7	Florence	Luthuli	46	1	400m2	Handhoe	M+C	M+C	M+B	M+B	CMR Bettles	20%	74	40	72.5
MAYIZEKANYE 1															
1	Nomusa	Shandu		1	300m2	Hand hoe	M+B+C	M+B+C	M+B		Locust on beans	None	68%	86	90
2	Tholakele	Shandu	49	1	400m2	Handhoe	M+B	M+B	M+C	M+C	Termites, ants, stockborer	None	70%	0%	0%
3	Ntombi	Shandu	51	1	400m2	Hand hoe	M+B+C	M+C	M+B	M+C	Stock borer, CMR Beetles,	4%	82%	84%	87%
4	Eunice	Maphumulo	51	1	400m2	Handhoe	M+B	M+C	M+B	M+C	Termides, stockborer	0%	69%	35%	72%
5	Lungile	Phungula	47	1	200m2	Hand hoe	M+C	M+B	M+C	M+B	Ants like pests	0%	35%	0%	25%
6	Cantrine	Maphumulo	50	1	400m2	Hand Hoe	M+B	M+B	M+C	M+C	Stockborer, Termides, CMR Beetles	8%	86%	9300%	9300%
MAYIZEKANYE 2															
1	Velaphi	Shangase	59	1	300m2	Handhoe	M+B	M+B	M+C	M+C	CMR beetles	0%	83%	83%	61%
2	Fikile	Maphumulo	56	1	350m2	Handhoe	M+B	M+B	M+C	M+C	Monkeys, cut worms, CMR Beetles	4%	95%	95%	95%
3	Thembi	Mkhize	66	1	300m2	Handhoe	M+C	M+C	M+B	M+B	Stockborer	0%	83%	85%	88%
4	Qondeni	Bhengu	61	1	300M2	Handhoe	M+C	M+B	M+B		Cattle Grazing or trampling	30%	87%	88%	87%
5	Gabengani	Ndlela	96	1	300M3	Handhoe	M+C	M+B	M+B				80%	75%	80%
MAYIZEKANYE 3															
1	Dumazile , Khonzeni,	Nxusa	66	1	1300		M+C	M+C	M+B	M+B			90%	unclear	95%
2							M+B	M+B	M+B	M+B					
3	Ntombikhona	Mchunu	49	1	256m2	hand hoe	M+C	M+B	M+B	M+C	CMR Beetles	None	25%	23%	32%
4	Ina	Maphumulo	78	1	400m2	Hand hoe	M+B	M+B+C			CMR Beetles, crows, Aphids	60%	by birds)	80%	90%
5	Babhekile	Nene	54	1	300m2	Hand hoe	M+B	M+C	M+B		CMR Beetles	0%	88%	88%	90%
6	Agnes	Gabela	96	1	400m2	hand hoe	M+C	M+B	M+B	M+C	crows eat seeds at planting	0%	62%	n harvested	83%
GOBIZEMBE															
1	Khombisile	Macanyane	53	1	400m2	Hand Hoe	M+B	M+B	M+C	M+C	Locust	No pest	84%	Harvested	70%
2	Ntombiyomuntu	Ngobese	66	1	400m2	Hand Hoe	M+C	M+B	M+B	M+C	Locust	No pest	88%	Harvested	90%
3	Mthephi	Chonco	61	1	200m2	Hand Hoe	M+C	M+C	M+B	M+B	Locust	No pest	71%	Harvested	90%
4	Janet Ntombencane	Gasa	62	1	400m2	Hand hoe	M+B	M+C	M+C	M+B	Locust	No pest	91%	83%	95%
5	Lindiwe	Zondi	43	1	400m2	Hand Hoe	M+B	M+B	M+C	M+C	Crow, snails	No pest	74%	Harvested	94%
6	Khanyisile	Xasibe	46	1	400m2	Hand hoe	M+C	M+C	M+B	M+B	signs of stalk borer	talk borer	74%	85%	84%
7	Busisiwe	Khoza	56	1	400m2	Hand hoe	M+C	M+B	M+B	M+C	No pests	No pests	62%	85%	86%
8	Gugu	Ximba/Zondi	49	1	400m2	Hand hoe	M+B	M+C	M+B	M+C	No pests	No pests	Livestock		
9	Khwezi	Majola	66	1	340m2	Hand hoe	M+C	M+B	M+C		directly heated by the sun), low rooting depth, rocky.	No pests	95%	0%	None

Yields of Beans and Cowpeas – Swayimane and Cornfields

The MDF team was focused on weighing beans, cowpeas and maize during the months of June and July. The average yields for beans vary significantly across areas where some participants attained no yields and others attained yields of up to 1.2 t/ha. Figure 2 below gives a summary of the average yields in the four areas in Swayimane as well as in Cornfields. Gobizembe had the lowest average yields for both beans and cowpeas as the trials did not grow well. Cornfields attained average yields of 0.77 and 0.36 t/ha for beans and cowpeas respectively. Mayizekanye 1 attained average yields of 0.23 t/ha for cowpeas and 1.04 t/ha for beans which suggests that the beans performed much better than cowpeas. According to the farmers their bean yields would have been higher had it not been for the late summer rains which resulted in pod damage. Similar to Gobizembe in terms of climate, Mayizekanye also had challenges with excessive rainfall which resulted in yield losses for Gadra bean which does not handle prolonged wet conditions well at maturity. Despite the abovementioned, some participants such as Mrs Shandu and Mrs Nxusa managed to get yields > 1 t/ha for their bean intercrop. Cowpeas performed reasonably well across all areas, however there were yield losses due to late harvesting. Farmers were reluctant to harvest cowpeas as they are not very familiar with the crop.

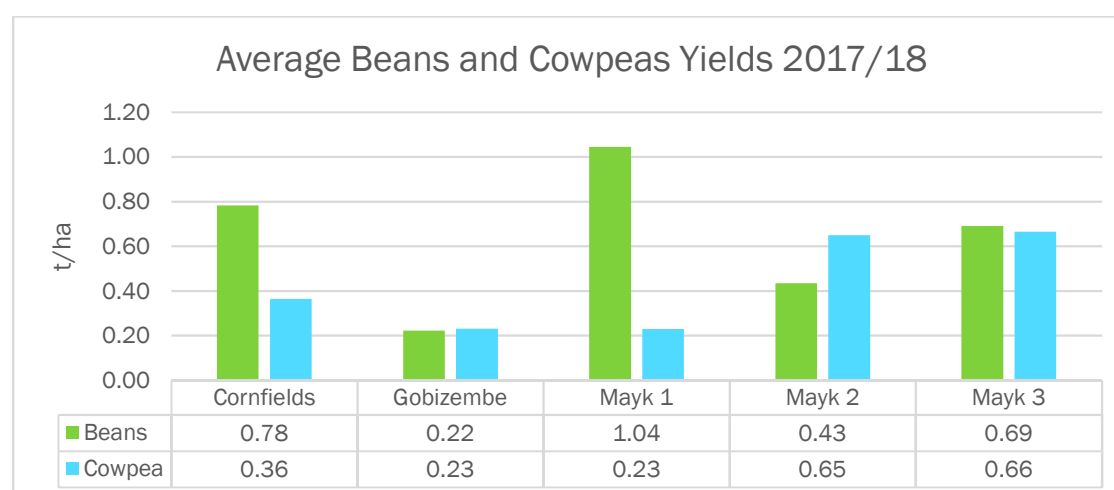


Figure 2: Average yields for beans and cowpeas in KZN Midlands villages

Swayimane: Gobizembe

The learning group in Gobizembe consists of middle aged and elderly women who are unemployed and derive their livelihoods from various farming activities. Production of Amadumbe is very popular in the area as in the rest of Swayimane and the women also grow vegetables, sugar cane and grain crops for consumption and sale of surplus. Livestock farming is also prevalent, although to a lesser degree and it includes cattle, goat, pig and poultry farming.

Khombisile Mncanyana

Khombisile Mncanyana is a 53 year old woman who lives with her three children. She joined the programme because of her passion for farming and a desire to learn more about CA and what it entails. She planted the 400m² trial and attained a bean yield of 0.44 t/ha from the maize and bean intercrop and 1.35 t/ha from the bean sole crop. For cowpeas Mrs Mncanyana attained a yield of 0.087 t/ha.



Figure 3: Khombisile Mcanyana, bean harvest from intercrop (left) and cowpea (right)

Rita Ngobese

Rita Ngobese is a 66 year old pensioner who lives with her husband and grandchildren. She is a passionate farmer who grows a wide range of crops such as amadumbe, potatoes, ntufesh (Mustard spinach), spinach and beans amongst others. She also grows avocados which she sometimes sells locally. For the bean intercrop, the yield was 0.440 t/ha and for the sole crop it was 0.925 t/ha. For cowpeas, she attained a yield of 0.157 t/ha.



Figure 4: Rita Ngobese with her bean and cow pea harvest, bean intercrop (l), bean sole crop (r), cowpea intercrop (c)

Lindiwe Zondi: Lindiwe Zondi is a 43 year old lady who lives with her husband and three children. She is unemployed and spends most of her days tending to her various farming activities. She is a passionate potato grower and she also grows vegetables for her family. She undertook the trial experiment with the aim to understand more about planting under no till and its role in improving soil fertility. For beans she attained a yield of 0.280 t/ha and 0 t/ha for cowpea. The cowpeas went rotten due to wet weather conditions.



Figure 5: Lindiwe Zondi with her bean harvest

Mayizekanye Group 1:

Nomusa Shandu

Nomusa Shandu from Mayizekanye lives with four grandchildren. She is unemployed and survives mainly through her farming activities. She attained a yield of 1.5 t/ha for beans with 86 % germination and 0.083 t/ha for cowpeas with 90% germination. Most of the cowpeas went rotten due to the wet weather.



Figure 6: Mrs Shandu (l), her bean yield (R)

Ntombi Shandu

Ntombi is a 49 year old lady who is self-employed. Her family consists of 23 members whom she supports mainly through her agricultural activities. She attained a yield of 2.585 t/ha for beans with 84% germination and 0.412 t/ha for cowpeas with 87% germination.



Figure 7: Ntombi Shandu, her beans (c) and cowpeas (r)

Mayizekanye 2:

Mambedu Ndlela

Mambedu Ndlela, affectionately known as gogo Ndlela is a 96 year old lady who lives with her sons and two grandchildren. She receives an old age grant and also grows amadumbe, potatoes, vegetables and field crops for household consumption. She is a keen farmer who enjoys listening to new ideas and trying out new practices. In fact, she was not part of the original group but joined during planting as she wanted to learn about CA. Mrs Ndlela attained a yield of 0.687 t/ha for beans with 70% germination and 0.254 for cowpeas with 80% germination.



Figure 8: Mambedu Ndlela and her bean harvest

Thembi Mkhize

Thembi Mkhize is a 66 year old pensioner who lives with her grandchildren. She grows maize and a wide variety of beans for the local market and also grows vegetables from time to time. She is the voice of authority in the group, a natural born leader, she is also the chairperson of the group. She

attained a yield of 0.917 t/ha with 87% germination for beans and 0.536 t/ha for cowpeas with 88% germination.

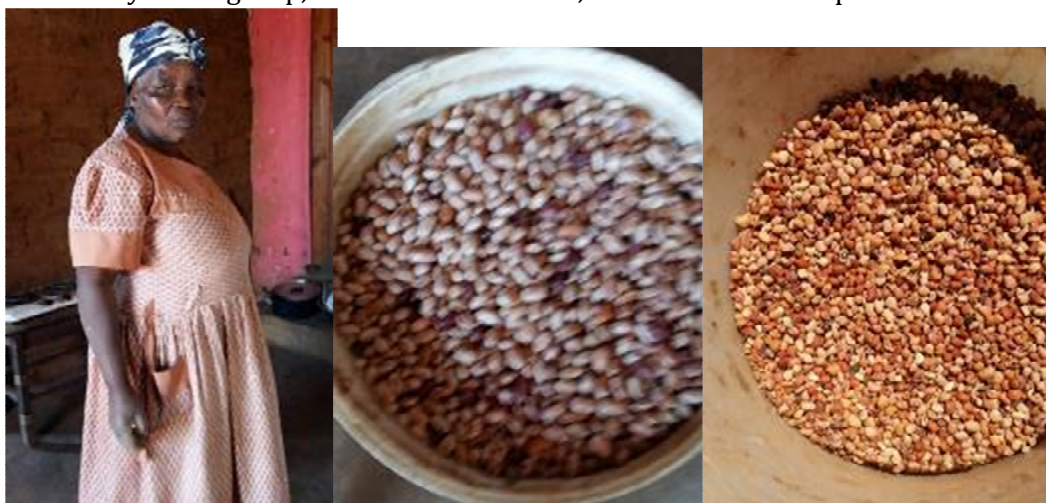


Figure 9: Thembi Mkhize's beans and cowpeas

Mayzekanye 3:

Dumazile, Khonzeni and Mathemba Nxusa

Dumazile, Khonzeni and Mathemba Nxusa are a close-knit family who rely on farming as the main livelihood. They undertook to plant the trial as a group as this is how they normally work. The three women grow maize, beans, amadumbe and sweet potato mainly for market and do most

of the work themselves. The group attained a yield of 1.204 t/ha for beans with 80% germination and 0.38 t/ha for cowpeas with 90% germination on their trial plot and a total yield of 2.042 t/ha on their sole bean plots.



Figure 10: Dumazile Nxusa's beans from sole bean plot (l), beans from trial plot (r)

Agnes Gabela

Agnes Gabela lives with her daughter and three grandchildren. She is a pensioner and a full time farmer who grows a range of field crops. She attained a yield of 0.966 t/ha for beans and 0.412 for cowpeas with 83% germination.



Cornfields

The 2017/18 growing season started out bleak in Cornfields as there was little hope anything would grow due to the absence of rain. The group only started planting on the 20th of December 2017 and when the MDF team conducted a site visit in January, some of the trials had not germinated. It finally rained late in January which had a positive impact on the growth of the trials.

Fisokuhle Ngcobo

Fisokuhle Ngcobo lives with her daughter and grandchildren at kwaMbombo right at the entrance of Cornfields. No one is employed in the household and the family survives mainly on child grants. She undertook to plant CA trials in 2016 but attained no yields as the maize tasselled and produced cobs at a low height and was subsequently eaten by chickens. She got no yield for beans and cowpeas. In the 2017/18 growing season she changed the site of her trial and planted closer to home, which has proved beneficial for her as she attained a yield of 1.22 t/ha for beans.



Florence Luthuli

Florence Luthuli is a 46 year old female who lives at Entabeni eybovu with her three children and she is a first year participant. She is also unemployed and survives on child grants and farming. She also owns cattle and goats. Her yields for beans and cowpeas were 1.03 and 0.48 t/ha respectively.



Moses Sthomo

Moses Sthomo is a 64 year old male who lives eMatendeni with his wife and three children. He is a pensioner and sometimes gets seasonal employment which is how he supports his family. He is also a passionate farmer and grows maize for consumption and selling surplus. This season is his second season in the programme. Although he was not happy with the yields he got this season, he stated that there was an improvement. For beans he attained a yield of 0.855 t/ha and a yield of 0.248 t/ha for cowpeas.



Shintshile Mbatha

Shinsthile Mbatha is a 60 year old female who lives with her four grandchildren and the first year of the program. She receives an old age grant and she also grows vegetables for household consumption. Her trial did not perform well, she attained a yield of 0.104 t/ha for beans.



Maize Yields

Maize yields for the KZN Midlands site vary significantly across and even within the same areas. The three groups in Mayizekanye had yields ranging from 0 t/ha to 7.16 t/ha, with most farmers ranging between 1.22 t/ha and 2.00 t/ha which is quite low in light of economic viability. Mrs Nxusa and Agnes Gabela had a yield of 7.16 t/ha and 5.72 t/ha respectively which is quite good, however they are the exception rather than the rule.

Gobizembe maize yields ranged from 0.44 t/ha to 3.88 t/ha. Ntombiyomuntu Ngobese and Khombisile Mncanyana had the highest yields of 3.34 t/ha and 3.88 t/ha respectively and Mrs Chonco had the lowest yield which was 0.04 t/ha.

Cornfields yields are higher than initially expected, although still quite low in terms of cost vs. benefit. The highest yield attained was 3.56 t/ha from Zakhe Xaba and the lowest was 0.56 t/ha from Fisani Ngcobo. Most of the participants in Cornfields ranged between 1.2 t/ha and 2.00 t/ha.

Figure 11 on the following page gives a graphical representation of final yields.

In any crop production system, final yield is often dependent on a wide variety of factors. Management practice is a significant contributor to final yield and in the context of the CA trials, there were instances where farmers did not weed and others fell victim to livestock invasions. A few participants increased the spacing of maize and beans and also thinned out the maize thinking the 2-3 plants per basin would compete with each other. This reduced their yields. Furthermore, most of the fields had been ploughed for many years, and the soil nutrients are considerably depleted which showed in the growth of the trials where some of the maize had purple and yellow leaves and in a few cases in Gobizembe and Cornfields, crop growth was uneven. Cornfields was also affected by a hailstorm earlier in the year which caused damage to the maize and bean crop.

In Gobizembe there are farmers who did not harvest at all, as in the case of Mrs Majola and Mrs Ximba who suspect that their soils may be acidic. In Mayizekanye, one participant, Mrs Phungula planted her trial on virgin land and germination was < 20% for maize and 0% for beans and cowpeas. All of the maize was eaten by cows. Another participant, Mrs Eunice Maphumulo thinned out her maize out of fear it would suffocate and also had a big problem with crows, she had a final yield of 1.76 t/ha. Although she had already sold the SC701 variety, she mentioned that the cobs in the control (SC701) were bigger than those of PAN 6479 although the latter was much better in terms of appearance and quality. Most of the participants that obtained some yields mentioned that the PAN 6479 is much sweeter than their usual SC701 variety.

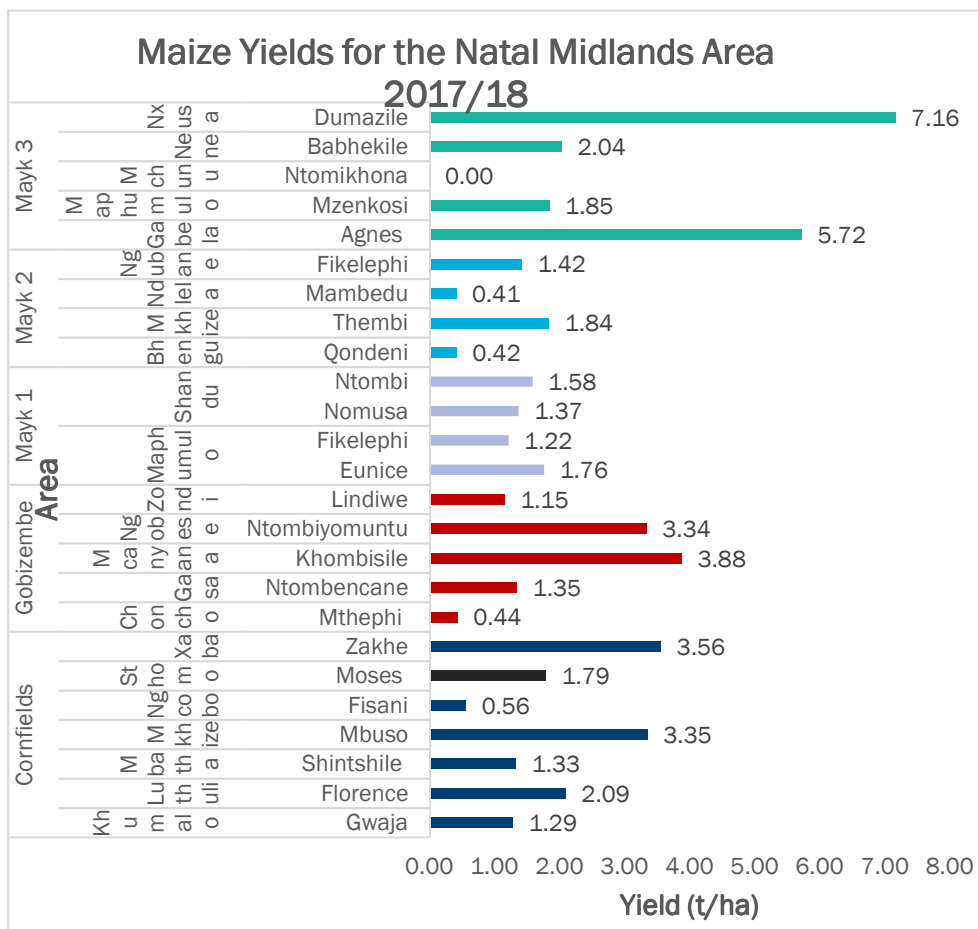


Figure 11: Maize yields for KZN Midlands;2017-2018

Mayizekanye 3: Dumazile Nxusa

Table 7 below shows the yields of participants from Mayizekanye. Mrs Nxusa had the highest yield which was 7.159 t/ha. She harvested a total of 40 bags with an average weight of 28.409 kg/bag which is the highest across all areas. She also had an average weight of cob of 0.071 and average weight of grain of 0.323 kg. The inter row spacing for beans was 50 cm instead of the recommended 25 cm for the trial, as a result there were many weeds between her maize and bean plots. It is interesting to note that she achieved these yields despite being a first year participant who was initially sceptical about planting a different variety

MAYIZEKANYE 3 MAIZE YIELDS											
Name	Surname	No of bags	Av. weight (kg)/bag	Av. Weight of cob	Av. weight of grain	weight of cob + grain	% Grain weight	Grain weight (kg)	area (m2)	Weight (t)	weight (t/ha)
Babhekile	Nene							48.89	240	0.05	2.04
Agnes	Gabela	12	17.21	0.04	0.19	0.223	0.83	171.66	300	0.17	5.72
Mzenkosi	Maphumulo	2	17.21	0.05	0.19	0.237	0.81	27.69	150	0.03	1.85
Ntomikhona	Mchunu	0	0	0	0	0	0	0	0	0	0
Dumazile	Nxusa	40	28.41	0.07	0.32	0.39	0.82	930.63	130	0.93	7.16
Average Yield											1.23

Table 9:Mayizekane Group 3:2 Maize yields017-2018



Figure 12: Maize and bean intercrop plot (l), Mam Nxusa and her sisters processing maize after harvesting (r)

Mayizekanye Group 2:

Thembi Mkhize

Thembi Mkhize decided to implement the maize and bean intercrop in her household plots as well. In the CA trial, her total yield was 2.04 t/ha, although the yield could be higher. Some of the maize had already been eaten when the MDF team visited her for weighing. Her house is situated near a natural forest and she has a serious problem with monkeys eating her maize. She often spends hours outside chasing them and when she is not home she employs someone to be on the lookout. She sells the maize to local traders and also sells beans in Wartburg, a nearby town. The control could not be measured as SC701 is sold as green mealies and was already sold out.



Gobizembe

Gobizembe farmers planted PAN 53 in their CA trial and said that their yields for the current season were lower than what they normally get. They believe this is due to the intercropping. The farmers are not yet convinced that intercropping can contribute positively to final yield.

Khombisile Mcanyana

Khombisile Mcanyana, pictured below attained a yield of 3.88 t/ha and she was happy with her yield. She noted that her cobs were uneven in size - cobs from plants towards the bottom of her field were larger than those at the top-end of her field.



Rita Ngobese

Rita Ngobese attained a yield of 3.34 t/ha with mostly small to medium sized cobs and she believes the low cob weight was due to competition for nutrients and water as her maize crop had thin stalks and was light green in colour throughout the season. The CA trial was planted below a row of avocado trees, which may have had an impact on the yield as avocado trees have extensive root systems and most likely competed with and overshadowed the maize. She separated her maize yields according to her trial plots. The yields were 0.140 kg and 0.208 kg respectively, for the maize and cowpea and maize and bean intercropped plots.



Figure 13: CA Trial (l), Maize from bean intercrop (c), maize from cowpea intercrop (r)

Cornfields

The maize yields in Cornfields for the 2017/18 growing season came to a total of 13.983 t/ha and ranged from 0.561 t/ha to 3.562 t/ha for the CA trials with an average yield of 1.998 t/ha. In 2016/17, the total yields were 5.782 t/ha with more than half of the participants having attained no yields. About 55% of participants who planted in the 2016/17 did not come back in the 2017/18 growing season. Extreme dry weather conditions as well as hard and degraded soils were largely to blame for the poor yields. Mdumeni Miya, one of the participants who planted in the current growing season did not plant the maize and bean intercrop but planted sole crops in an effort to improve his yield. His final yield is yet to be recorded. Two participants, Moses Sthomo and Mbuso Mkhize planted the trial as well as a control and in both cases the control yield was higher than the trial yield. In Moses Sthomo's trial, the total yield is 1.791 t/ha compared to 3.244 t/ha in the control and the average cob weight is higher in the control compared to the trial. Mbuso Mkhize's control also has a higher yield compared to the trial which is 3.798 t/ha for the control and 3.55 t/ha for the trial, however the difference is not significant.

Table 10: Cornfields maize yields; 2017-2018

CORNFIELDS MAIZE YIELDS (2017/18)													2016/17
Name	Surname	Trial Description	Number of bags	Average weight (kg)/bag	Average Weight of cob	Average weight of grain	weight of cob + grain	%grain weight	Grain weight (kg)	area (m2)	Weight (t)	weight (t/ha)	Weight (t/ha)
Zakhe	Xaba	2(m+b), 2(m+c)	5.5	24.750	0.071	0.258	0.329	0.785	106.857	300	0.107	3.562	n/a
Fisokuhle	Ngcobo	2(m+b), 1(m+c)	2	6.779	0.025	0.121	0.147	0.827	11.216	200	0.011	0.561	0.186
Gwaja	Khumalo	2(m+b), 2(m+c)	2	12.177	0.029	0.114	0.142	0.799	38.589	300	0.039	1.286	0
Florence	Luthuli	2(m+b), 2(m+c)	4	14.460	0.046	0.141	0.186	0.755	62.804	300	0.063	2.093	n/a
Shintshile	Mbatha	2(m+b), 2(m+c)	1	10	0.046	0.141	0.186	0.755	26.689	200	0.027	1.334	n/a
Moses	Sthomo	2(m+b), 2(m+c)	3	14.782	0.039	0.137	0.176	0.780	53.743	300	0.054	1.791	0
		Control	35	17.781	0.042	0.170	0.212	0.803	518.977	1600	0.519	3.244	
Mbuso	Mkhize	2(m+b), 2(m+c)	10	10.039	0.033	0.141	0.174	0.812	100.649	300	0.101	3.355	0.872
		Control	14	11.060	0.025	0.152	0.178	0.857	151.902	400	0.152	3.798	
Average Yield												1.998	

Zakhe Xaba

Zakhe Xaba is in his first season of CA and he attained the highest yield of 3.562 t/ha for maize with 81% germination. His trial did not look good when the team visited him for monitoring as germination was very patchy and most of the area was covered with weeds. The MDF team visited Cornfields again on the 10th of May, and the trial had grown quite vigorously but the maize was light green, possibly due to a Nitrogen deficiency. The cobs had fully developed and most were medium to large in terms of size. His average cob weight came to 0.329 kg.



Figure 14: Maize and beans, 26/01/18 (L), Maize and beans 10/05/18 (R)



Figure 15: Zakhe Xaba (L), his maize and bean trial (C), maize harvest (R)

Mbuso Mkhize

Mbuso Mkhize is a second year participant. In the current growing season, he planted both his trial and control under CA. He said he realised that CA saves money and has potential to give him higher yields compared to his old farming practices. His trial performed much better this season. The maize had 85% germination. Interestingly, he is one of the participants who's trials had not fully germinated when the team visited Cornfields a month after planting and he had started to lose hope. Mbuso Mkhize had an 80% increase in yield in the current growing season with a total yield of 3.35 t/ha this season compared to 0.872 t/ha in 2016/17.



Figure 13: Maize and beans, 26/01/18 (L), Maize and beans 10/05/18 (R)



Figure 14: Mbuso Mkhize (L), Maize from control (C), maize from trial (R)

Moses Sthomo

Moses Sthomo is a second year CA participant whose trial did not do well. In his first season he attained no yield and this season the maize trial had 41% germination and he attained a yield of 1.791 t/ha for his trial and 3.244 t/ha for his control. His soil was hard and crusted with a grey colour on the trial plot compared to a darker brown on the control plot. His maize was light green and was also damaged by hail.



Figure 15: Control Plot (L), Maize and beans, 26/01/18 (C), Maize and beans 10/05/18 (R)



Figure 16: Moses' CA Trial (left), Maize from CA plot (centre), Maize from control plot (right)

Cover Crops

Introduction

Cover crops were distributed to the group in Gobizembe and to Mrs Nxusa in Mayizekanye. Both summer cover crop (SCC) and winter cover crop (WCC) mixes were distributed as follows:

1 cup ea of millet, sunflower and sunnhemp and 2 cups of Winter Master (black oats, fodder rye, fodder radish).

Gobizembe

Out of the nine participants in Gobizembe, five planted the cover crops. Cover crops were distributed towards the end of February, which was a little late for SCCs. Nonetheless overall germination was good.

Khombisile Mncanyana

Khombisile Mncanyana planted the cover crops in rows on all four plots (400 m²) where she had planted her trial. She then flattened the maize stalks in between her cover crops to create ground cover during the winter



season. Both the WCC and SCC germinated (> 80%) and were growing well.

Khwezi Majola

Kwezi Majola did not get any yield for maize and beans this year but the cover crop germination was good. She planted the cover crops on a 100m² plot and germination was 65% and sunflower, millet and black oats seemed to be dominant.



Mthephi Chonco Mthephi Chonco had the lowest yields for beans, cowpeas and maize in Gobizembe. She planted the cover crops on a 120 m² plot and had 50% germination. There were many patches in between and the growth of the cover crops was uneven. Black oats and millet germinated well, but fodder radish was mostly absent. Sunflower flowered at a height of about 50 cm.



Ntombencane Gasa

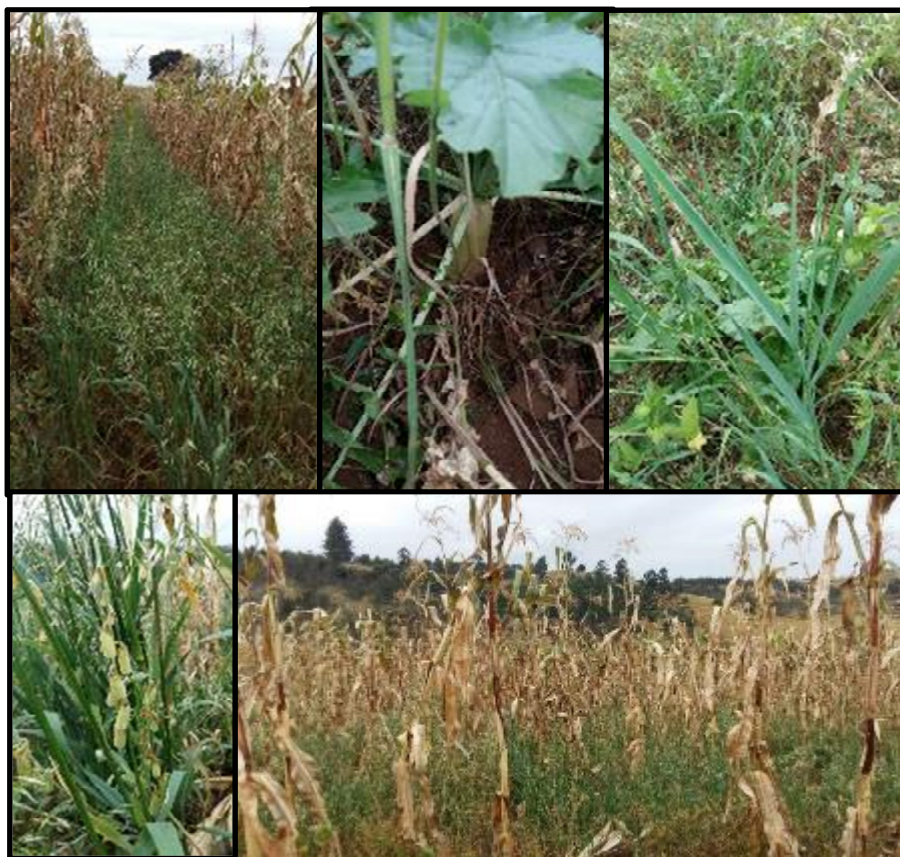
Ntombencane Gasa planted the cover crops in between the maize rows after harvesting cowpeas. Germination was very good (>85%) at the top part of the field and seemed to become patchy towards the bottom where the maize and beans were. This was interesting to see as Mrs Gasa did not get any beans this season which suggests that the soil on the bottom half of the field has nutrient deficiencies. Sunflower flowered at a height of 40 cm.



Dumazile Nxusa

Dumazile Nxusa planted the cover crops in between her maize and the germination was 85%. All the cover crops germinated and are growing well. The area planted is 1460 m².

Figure 16: Views of Mrs Nxusa's cover crops in Swayimane



Innovation Platforms

For the Swayimane groups good relationships have been built with the DARD extension officers as well as representatives from the Umswhathi LM and Umgungundlovu DM. In addition role players from UKZN and local NGOs have been involved. Through these relationships requests were made for expansion of the CA programme into others areas in the LM. An introductory meetings was held in the Appelbosch area- (between Wartburg and Tongaat). A summary report for the meeting is presented below

CA Introductory Meeting at Appelbosch:13 July 2018

On the 13th of July 2018, the MDF team undertook a field visit to Appelsboch to attend a Farmers' Day hosted by the department of Agriculture, uMgungundlovu District. The meeting was attended 140 farmers and representatives from the Department of Health and the Department of Social Development.

Appelsboch farmers are primarily potato and maize growers and work with Wiseman Ndlovu, the local Extension Officer. They farm primarily for household consumption and also sell to local traders. The farmers' day was mainly a platform to update farmers on current input prices, diseases trends and chemicals required as well as to help them plan ahead for the coming season.

Mahlathini gave a presentation on CA which focused on CA principles and practices, advantages and disadvantages of farming under CA, farming inputs, learning groups, stakeholder engagement, CA workshops, farmer centres and finally, savings groups.

Way Forward

1. Mahlathini is to work with 2 out of the 10 groups working with Wiseman Ndlovu and possibly expand from there.
2. First CA workshop is to take place in August.



Figure 17: The Appelbosch meeting

Issues, suggestions and way forward

- The season has been very productive with a number of new participants coming on board. The groups in Swayimane especially are very active and engaged in the CA learning process. They would want to expand their use of the 2-row planter considerably into the coming season and a new planter is to be procured for this area.
- Experimentation with different maize varieties for green maize, yellow maize and milling is to be introduced as the group wants to expand into other markets besides the green maize that they are used to. This market is dwindling and they are wanting to explore alternate options.
- MDF has employed more field staff to increase capacity and is also now working with 3-4 interns in a continuous basis.
- There may be a need to separate awareness raising aspects of this programme to an extent from the research aspects-
 - Further funding is required for the expansion, both in terms of resources for the inputs required for the farmer experimentation and the required logistical capacity to service many different areas
 - Research requires greater focus, time and technical expertise than some of the fieldworkers have and specific staff may need to be employed for this. Instrumentation and analysis is generally too expensive to fall within the present budgets

- Bringing other potential donors on board is important both for the research and the expansion as is the initiation of smaller, dedicated research projects within this process.
- Opportunities exist to work within the realm of climate change adaptation and payment for ecosystem services schemes, but this aspect is complex and will require focussed attention.