APPENDIX 2: BERGVILLE ANNUAL PROGRESS REPORT

CA Farmer Innovation Programme for smallholders in Bergville

Period: October 2017 – September 2018

Farmer Centred Innovation in Conservation Agriculture in upper catchment areas of the Drakensberg in the Bergville region of KwaZulu-Natal

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GRAAN SA

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Identification of the project

Description and selection of study areas

Work in the Bergville (KwaZulu-Natal) site continued with the 17 village learning groups brought on board in the 2016-2017 season. Attention has been given to consolidating and expanding the learning groups within each village. In this way the numbers of farmer participants in farmer level trials have increased from 263 in the 2016-2017 season to 322 this season. The overall area for trials has increased from 13ha to 17 ha.

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 methodologies are used within the group to focus the learning on the actual growth and development of the crops throughout the season. New ideas 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 (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) the project has continued to focus on the following elements of the model, namely:

a) Support farmers who are in their 1st, 2nd , 3rd , 4th and 5th seasons,

b) Conscious inclusion of crop rotation to compare with inter cropping trials,
c) Inclusion of summer cover crops in the crop rotation trials,
d) Continuation with experimentation with winter cover crops, but planted in separate plots rather than in-between maize,
e) Planting of late season beans,
f) More focussed introduction of lab-lab beans and,
g) Initiation of nodes for farmer centres that can offer tools, input packs and advice,
h) Support for existing VSLAs and initiation of new savings groups where requested,
i) Conscious inclusion of the local facilitators in the crop and progress monitoring processes,
j) Further supply of tools (MBLI planters, animal drawn planters and knapsack sprayers) to learning groups.

Key activities: October 2017-September 2018

For this season a process of consolidation of existing learning groups has been the focus, along with implementation of the co-funded process from LandCare. Support here has primarily been in the form of implements, but also some seed and for hosting of farmers' days.

Researcher-managed trial plots have now been set up in Ezibomvini, Eqeleni and Mhlwazini to work on quantitative benchmarking of some of the visual CA indicators being used in this process. This includes rain gauges, run-off plots, a weather station, gravimetric soil sampling and use of infiltrometers for measurement of water infiltration; with the intention of comparing water balances across control and CA trial plots. In addition, visual soil assessments have been conducted for 15 selected participants and soil health samples have been taken for 9 participants across four villages, along with 42 soil fertility samples for new participants and 30 repeat samples for existing participants to build a body of information about the soil fertility and soil health status of the CA trial participants.

A survey has been conducted for 4th and 5th year participants to gauge the implementation and adaptation of CA in their farming systems and to ascertain potential sustainability going forward. As in previous years intensive growth monitoring has been done for a selection of trials and yield measurements taken for as many of the participants as possible.

Two stakeholder innovation platform events/ farmers' days have been conducted in Emmaus and Ndunwana respectively. Three cross visits have been hosted; one for the Growing Nations team from Lesotho in collaboration with KZN DARD, one for the mentors and coordinators for the Grain SA FDP and one for a team of researchers from the ARC SGI in Potchefstroom. CA participants have been included in a cover crop learning event hosted jointly between KZN DARD and the No-till Club. A number of awareness days were held in the villages of Ezibomvini, Eqeleni and Thamela. These proved to be fruitful as the importance of practices undertaken were emphasized. These were not only attended by farmers who are participants of the programme but various stakeholders including the local and provincial departments of agriculture, various NGO's and local traditional authority leadership.

Three articles have been written for the SA Grain magazine and papers have been written and accepted for presentation at two conferences: 2nd Africa Congress on Conservation Agriculture

(9-12 Oct2018) and the 8th Biennial LandCare Conference (25-27 Sept 2018). In addition, co-facilitated and presented at a workshop; Conservation Agriculture-Principles in Land Rehabilitation for the 2018 conference of the Land rehabilitation Society of Southern Africa (13-16 Aug 2018).

Village Savings and Loan Associations (VSLAs) have increased from 12 to 16 groups, with 208 of the participants involved. A total of R335 664.00 has been saved by these groups in this year.

Progress for the farmer centre in Ezibomvini has been monitored. The centre now operates independently of support.

Financial reporting

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

Table 1: Bergville SFIP budget outline for 2017-2018

Bergville Milestones: Farmer Centred Innovation in CA. October 2017- November 2018			
Milestones/ Outputs	**Key activities**	**OUTCOMES/ DELIVERABLES**	**Budgets**
	Capital Equipment	Incl soil samples, knapsack sprayers and planters	R38 752,00
Farmer experimentation Bergville	Administration and sundries	Travel ,accommodation, admin, manuals etc	R94 160,00
	Farmer centred innovation systems	Farmer experimentation, savings groups, monitoring, review	R525 898,00
	Innovation platforms	Stakeholder meetings, platform building and events	R15 000,00
Sub - TOTAL: Oct2016-Sept2017			**R673 810,00**

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 (R245 750) and the payment of subsidies by farmers (R23 865). This provided for increased budgetary allowances and thus also meant savings on capital equipment of around R10 000, which has been used within the Farmer centred innovations systems key activity area.

Expenditure on capital equipment and farmer experiments is detailed below.

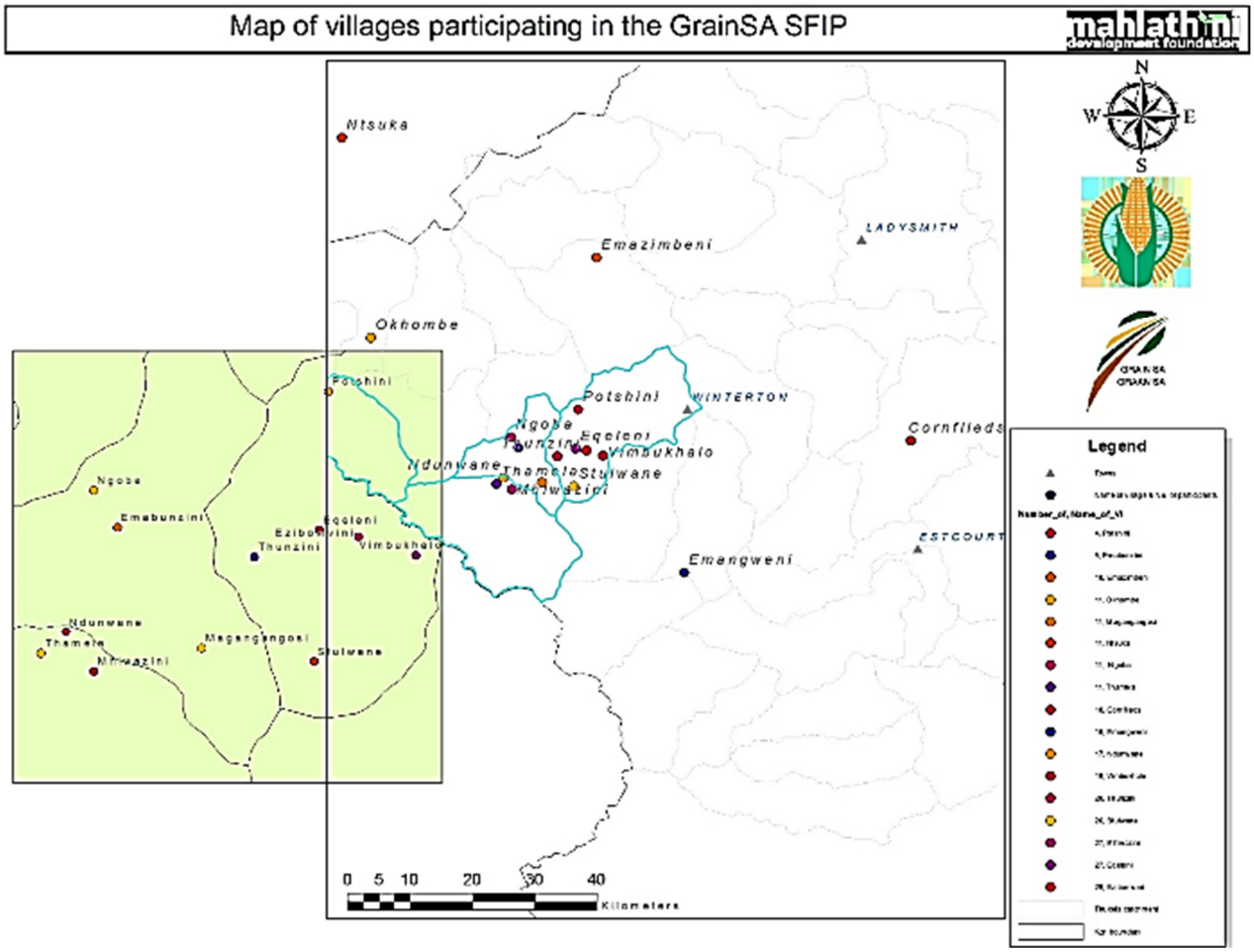
Table 2: Expenditure on the Capital Items and farmer Experimentation portions of the budget; 2017-2018

Date	**Inputs**	**Capital equipment**	**Farmer Experiments**	**Subsidies paid by farmers**
2017/10/25	Cedara Soil samples x 140	R 12 600,00		
2017/10/24	TWK Agri-Winterton		R 81 410,75	

2017/10/24	TWK Agri-Winterton		R23 654,91	R 900,00
2017/10/27	Farmsave: Roundup		R2 795,00	R 10 140,00
2017/11/03	Cedara Soil samples	R 12,60		R 5 000,00
2017/10/20	Victoria Packaging; bags for input distribution	R 755,03		R 3 000,00
2017/11/15	TWK Maize seed white		R1 701,20	R 4 000,00
2017/11/17	Build It Winterton; rain gauges	R 322,60		R 825,00
2017/11/17	TWK Winterton; poles for raingauges	R 78,50		
2017/11/25	TWK Maize seed white		R548,60	
2017/12/13	TWK Maize seed, RoundUp		R885,40	
2018/01/15	Victoria packaging; packets	R 172,00		
2018/01/24	Farmsave Bgvl Kemprin		R462,00	
2018/02/06	Farmsave Bgvl Kemprin		R308,00	
2018/02/06	TWK Agri; materials for run-off plots	R 237,40		
2018/03/06	TWK Agri - bags	R 37,20		
2018/02/09	Food pack distributors- foil	R 339,72		
218/04/04	Food pack distributors- buckets	R 190,67		
2018/04/04	Victoria Packaging-bucket	R 37,98		
2018/05/10	Victoria Packaging; mini grips	R 75,66		
2018/05/14	Victoria Packaging; drums- VSAs	R 440,00		
		R 15 299,36	R 111 765,86	R 23 865,00
	Total	**R103,300,22**		
Budget _MT	**Description**	**Amount**	**Budget - KZNDARD Land Care**	**Amount**
Capital equipment	Soil samples, tools, quantitative measurements	R 38 752,00	Co funding farmer experiments, capital expenditure	R245 750,00
Farmer experiments	Seed, herbicide, fertilizer	R 75 000,00		
	Total	**R113 752,00**		**R245 750,00**

Progress

The project is now operational across 17 villages in the Bergville area, with a total of 322 learning group participants and 226 farmer-level trials.



The basic experimental design was followed for all 1st year participants and most of the 2nd year participants as well. Variations have included crop rotation, intercropping, summer and winter cover crop mixes, planting of lab-lab beans and late season planting of beans.

The table below outlines activities related to objectives and key indicators for the period of October 2017 -September 2018.

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	- Manuals, promotional and learning materials - Sharing of information through innovation platforms processes	- Grain SA promotional DVD used in learning sessions and events. - Shooting of CA implementation DVDs with Bergville CA participants

		- Articles and promotional material	- 5 farmers days, 3 cross visit learning events with further meetings and workshops - 3 articles in the *SA Grain* magazine, incl a case study for Phumelele Hlongwane (Dec2017, Jan 2018, Feb 2018), one article in the Adaptation Network newsletter (Jan 2018) - 3 Papers for conferences **(100% completion)**
	Final report	-	- Annual report finalised. **(100% completion)**
2. Increase the sustainability and efficiency of CA systems	1st level experimentation: farmers sue their own practice as a control – size 400m² ha exp, 400m² control, Control. farmers	- 12 villages, 56 farmers	- Basic CA design- intercropping with maize beans and cowpeas on a 400m² 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. **(100% completion)**
	2nd level experimentation: existing farmers use their own practice as a control – size: size 400m² ha exp, 400m²	- 14 villages, 118 farmers	- Adaptation trials included late season planting of beans with a mixture of winter and summer cover crops. Most participants opted to continue with intercropping practice from their 1st year. **(100% completion)**
	3rd level experimentation; own contribution, larger plots, own ideas	- 9 villages, 59 farmers	- Larger level plantings using oxen drawn planters and including cover crops. Intercropping still practised. Awa crop rotation and summer and winter cover crops. **(100% completion)**
	4th level experimentation (inc also participants from 5th year); own contribution, larger plots, own ideas	- 8 villages, 26 farmers	-Participants undertake their own combination of experimental plots that include intercropping, crop rotation and cover crops (summer awa winter). **(100% completion)**
	Develop and manage PM&E framework; – weekly and monthly M&E visits	- M&E forms redesigned and used - Digital monitoring system piloted	- Crop growth monitoring, VSA's, 4th and 5th year participants surveys and final reviews finalised **(100% completion)**
	Facilitation of innovation platforms	- Co- facilitation of information sharing and action planning with stakeholders and role players	- 5 Farmers days, 3 cross visits, numerous meetings and workshops **(100% completion)**
	CA working group, and reference group	- Attended in August 2018	- Maize trust presentation – July 2018 **(50% completion)**

	Sharing of information using a range of innovation platforms	-Attendance of a range of meetings, workshops, networking events and planning processes	- CCA processes linked to UKZN and the WRC - Meetings with DEA re CA adaptation and mitigation potential - Networking meetings; Prolinnova, Green fund, -Student thesis inputs- Khethiwe Mthethwa – UKZN RRM Honours, Mazwi Dlamini – UWC PLAAS Masters - Making of participatory videos – short videos detailing farmers' perspectives and success stories **(100% completion)**

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	2	2
Number of villages active	17	18
No of 1st level farmer experiments	27	82
No of 2nd level farmer experiments	80	125
No of 3rd level experiments	125	59
No of 4th level experiments	17	15
No of local facilitators	12	6
No of direct beneficiaries	270	322
VSLAs	11	14
Participatory monitoring and evaluation process (farmer level)	Yes	Yes

The process of focusing on the existing villages has bolstered the learning group numbers and most of the participants from last season (2016-2017) continued with their CA process. There has been some attrition for the 3rd level experiments; some reasons given by participants include inability to pay the subsidies and a wish to continue with CA without the intercropping experimentation.

Local Facilitators

The involvement and responsibilities of the local facilitators are expanded upon each year and this year saw substantial assistance in monitoring and yield measurements from the facilitators. The two tables below summarises the facilitators involved and their activities.

Table 5: Bergville CA programme local facilitators

Village name	Name of local facilitator	Activities
1. Ezibomvini	Phumelele Hlongwane	Planting, mobilization of group, collecting of yield data

2. Eqeleni (lower) Eqeleni (upper)	Simephi Hlatshwayo & Ntombakhe Zikode	Planting, mobilization of group Newly appointed-Planting, mobilization of group
3. Stulwane	Nelisiwe Msele	Newly appointed-Planting, planting & crop growth monitoring, weighing, group mobilization
4. Okhombe	Nkosithandile Ndlovu	Planting, group mobilization
5. Vimbukhalo	Sbongile Mpulo	Planting, group mobilization
6. Emabunzini	Valindaba Khumalo	Planting, group mobilization
7. Mhlwazini	Mathula Mdladla	Planting, group mobilization
8. Ndunwane	Boniwe Hlatshwayo	Planting, group mobilization, planting & crop growth monitoring, yield data collection
9. Thamela	Constance Hlongwane	Planting, group mobilization, yield data collection
10. Ngoba	Thembelani Hlongwane	Planting, group mobilization
11. Emazimbeni	Valindaba Khumalo	Planting, group mobilization
12. Magangangozi	Thulile Zondo	Planting, group mobilization
13. Emangweni-Emaqeleni	Nkanyiso Hadebe	Planting, group mobilization
14. Thunzini	Nikiwe Hadebe	Planting, group mobilization
15. Nsuka	Busisiwe Khoza	Planting, group mobilization

Table 6: Description of activities

Activities	**Description of activity**
Planting	Assist learning group members with trial layout, fertilizer and herbicide dosages and general planting duties.
Group mobilization	Organizing people for meetings or farmers days and general logistics
Yield collection	Assist with maize weighing, beans, cowpeas and cover crops (scc and wcc)
Monitoring	Completion of forms for planting and crop growth monitoring

Results achieved to date

The framework for scaling out implementation included: Continuation with existing farmer experimentation options for 1st, 2nd and 3rd level participants and mentoring and monitoring for 4th and 5th year participants. This includes intercropping, crop rotation, late season planting of beans and combinations of summer and winter cover crop mixes.

The table below outlines the villages, numbers of participants and experimentation processes for the present learning groups in the Bergville area.

Table 7: Activities and numbers of farmers involved, per village for October 2017-September 2018.

BERGVILLE	**Year started with CA**							**COMMENTS**
Villages	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**	**trials**	
Emabunzini				9		9	9	Intercropping with hand hoes and MBLI planters; Maize, beans, cowpeas
Emangweni-Engodini			14	3	3	20	10	1st and 2nd level experimentation; intercropping
Emangweni-Emaqeleni				8	6	14	11	1st level experimentation; intercropping
Eqeleni	7	3	4	4	5	23	20	1st, 2nd and 3rd level experimentation; MBLI's hand hoes and animal drawn planters; intercropping crop rotation summer and winter cover crops, late season beans
Ezimbovini		6	4	10	6	26	24	1st, 2nd and 3rd level experimentation; MBLI's hand hoes and animal drawn planters; intercropping crop rotation summer and winter cover crops, late season beans
Magangangozi		9	1	2	4	16	7	1st and 2nd level experimentation; intercropping
Mhlwazini		6	10	7		23	16	1st, 2nd and 3rd level experimentation; MBLI's hand hoes, intercropping crop rotation summer and winter cover crops, late season beans
Ngoba			6	5	3	14	9	1st, 2nd and 3rd level experimentation; MBLI's hand hoes and animal drawn planters; intercropping crop rotation summer and winter cover crops, late season beans
Nsuka-Zwelisha				11		11	9	Intercropping with hand hoes and MBLI planters; Maize, beans, cowpeas
Okhombe		5		6	6	17	8	1st and 2nd level experimentation; intercropping
Potshini	1					1	0	3rd level experimentation
Stulwane	7	4	2	3	5	21	20	1st, 2nd and 3rd level experimentation; MBLI's hand hoes and animal drawn planters; intercropping crop rotation summer and winter cover crops, late season beans
Thamela				11	6	17	13	Intercropping with hand hoes and MBLI planters; Maize, beans, cowpeas
Thunzini				21	5	26	6	Intercropping with hand hoes and MBLI planters; Maize, beans, cowpeas
Vimbukhalo		8	4	10	6	28	17	1st and 2nd level experimentation; intercropping
Ndunwana			14	5	6	25	21	1st and 2nd level experimentation; intercropping
Emahlathini					12	12	12	Intercropping with hand hoes and MBLI planters; Maize, beans, cowpeas

Emazimbeni				10	9	19	14	Intercropping with hand hoes and MBLI planters; Maize, beans, cowpeas
Grand Total	**15**	**41**	**59**	**125**	**82**	**322**	**226**	**17,4 ha trials; 13,4ha controls**

322 Participants across 17 villages are still registered and have been implementing the CA trials for between 1-5 seasons. This year 226 trials have been planted of whom 82 participants started this season for the first time.

CA practice

Going into the 3rd year, the farmer experimentation protocols for each level of farmer participants has been more clearly defined, given that those farmers with more experience can now incorporate some of their own learnings and preferences in the trials, but the 1st level trial participants still need to get used to the overall CA planting process and thus the close spacing intercropping trial plots are 'prescribed' for them.

The protocols are outlined below:

Year 1(1st level) trial outlines

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

Experimental design includes 2 treatments; planter type (2) and intercrop (2)

Year 2 (2nd level) trial outlines

Based on evaluation of experiment progress for year 1, this 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 inter cropping planting methods
- Use of specific soil sample results for fertilizer recommendations
- Early planting and

- Own choices.

Year 3 (3rd level) trial outlines

Based on evaluation of the experimentation process to date this protocol includes 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, or singly.
- 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 and
- Farmer level monitoring of trials for selected individuals.

Rainfall data

Rain gauges have been installed across 5 villages. The rain gauges installed in Okhombe and Emangweni were moved to other villages, as the participants there were not meticulous about taking the rainfall records. Below is a small table that summarises the information. The cumulative average rainfall for the area as recorded by the farmers was 563 mm between December2017-May 2018.

Averages for Ezibomvini, Eqeleni, Stulwane, Thamela and Ndunwana	Dec	Jan	Feb	March	April	May
Monthly rainfall (mm)	185	72,25	169,2	114,7	17	5
Mean (mm) per rainfall event	7,9	5,8	8,2	7,6	2,1	0,4
Max (mm) per rainfall event	60	30	30	20	1	3,5

An analysis of the rainfall patterns for January-February 2018 were done for Ndunwana as an example of the rainfall distribution in these months.

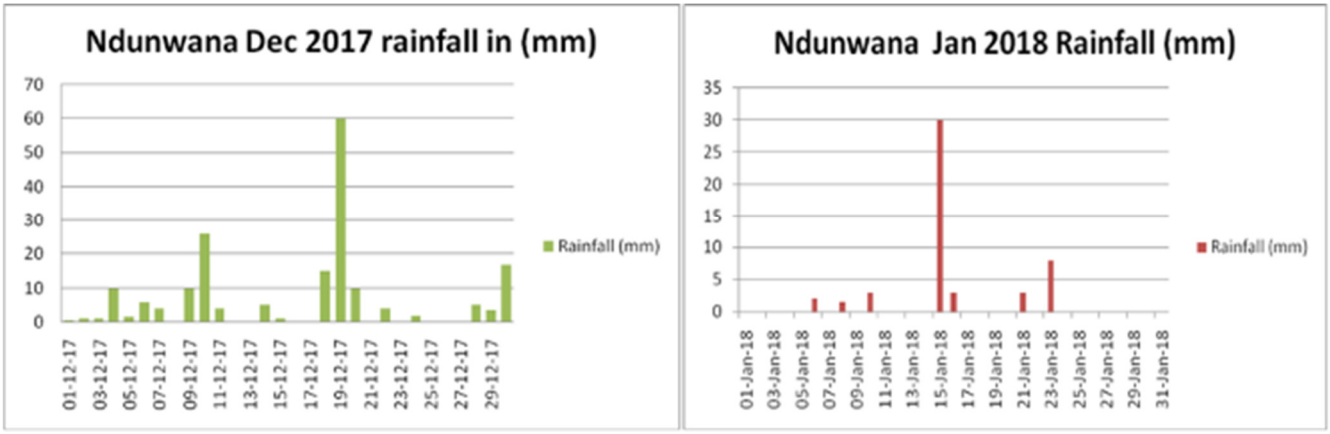


Figure 1: rainfall data for Ndunwana for December 2017-January 2018

A few observations can be made from the two small graphs above

- The number of rainfall events in December was 13 and in January 7
- In each month one large rainfall event occurred; 60mm in December and 30mm in January
- The average rainfall per event for December was 6mm and for January was 2,2mm

This indicates a high variability in rainfall with extreme events punctuated by small amounts of rain which is unevenly distributed. This dry spell in the period of maturation of beans and maize have had a detrimental effect on yields – more specifically for the beans.

Infiltration

Content for this section was supplied by the MDF intern Nonkhanyiso Zondi, who did the infiltration tests, analysis and reporting.

Infiltration rates of water into the soil are expected to increase for the CA trial plots over time. The assumption is that the pore continuity and pore size distribution are improved due to greater structural stability and biological activity and thus saturated hydraulic conductivity and the plant available water are greater under CA than conventional tillage.

The infiltration tests were done to assess the impact of CA on water infiltration in the soil.

Results from infiltrometer tests (single ring) from 2016-2017 season for 16 participants were extremely varied and appeared unreliable. They were not reported on. For the 2017-2018 a double ring infiltrometer was acquired and readings were taken for 13 participants. The comparison of control and trial plots is somewhat artificial, given that a number of participants have been practising CA on their control plots as well.

The results are presented below.

Table 8: Summary of water infiltration results for 13 participants in Bergville; 2017-2018

Village	Name and Surname	Yrs under CA	infiltration rate (mm/hr) control	infiltration rate (mm/hr) trial
Stulwane	Khulekani Dladla	5	587,4	531,4

	Dlezakhe Hlongwane	5	226,2	423,8
	Thulani Dlamini	5	422,7	450,0
	Makhethi Dladla	5	226,6	587,4
	Pasazile Sithebe	5	544,4	478,3
	Cuphile Buthelezi	5	429,2	637,7
Ezibomvini	Phumelele Hlongwane	4	455,5	282,5
	Cabangile Hlongwane	3	183,0	133,9
Eqeleni	Tholwephi Mabaso	5	218,8	250,8
	Tombi Zikode	5	618,1	177,1
	Smephi Hlatshwayo	5	434,8	218,8

In summary, infiltration results were higher and thus faster for the CA plots for only 5 of the 13 participants. Generally soils are hard, with high clay content and a lot of compaction and soil crusting is still visible, in both the control and CA plots. Structural improvements in the soil cannot be gauged using water infiltration as a proxy.

Below are some comments for a selection of the participants on the infiltration tests.

Stulwane

Phasazile Sthebe

Phasazile is on her 5th year under the CA programme. Her soils contain around 46-49% clay and are acidic with some addition of lime in the CA plots, but not the control plots. Her soil pH is around 4 for both control and trial plots, but acid striation for the trial plots (32%) is lower than the controls (44%. She has experienced unsatisfactory, stunted and variable growth, although in this past season growth in her trial plots has visibly improved.

Figure 2: Stunted maize in Phasaziles' control plot.

The infiltration tests showed higher infiltration in her control plots, which have been under CA for 3 years, than her trial plots. The soils were similar with the only visible difference being that of crop growth.

Makhethi Dladla

Makhethi is on her 5th year under the CA implementation. She has hard soils, with visible crusting. When her trial was monitored earlier on in the year, her field was suffering from stunted growth and large patches of yellowing maize at an early stage of growth.

Khulekani Dladla, Thulani Dlamini, Dlezakhe Hlongwane

Reasonably high water infiltration rates were recorded for these three participants. Their soils however are similar to the other participants in Stulwane showing very high clay percentages; around (35-55%) and soil crusting

Figure 3: Right: Crusting and cracking in the soil shown in Dlezakhe Holngwane's field and Far Right: A soil sausage made from his soil indicting the high clay content.

Eqeleni

Simephi Hlatshwayo is on her 5th year of CA implementation. She is now focussing mainly on crop rotation also using a number of different types of traditional beans. She has not planted cover crops this season. It is not clear whether this way of planting has impacted negatively on her soil quality. When comparing Simephi's VSA results in 2016-2017 and 2017-2018, the soils haven't not improved and the indicators and scores have remained the same. Her soils have not improved, showing shallow rooting (~12cm) and compaction.

Figure 4: The hard, compacted soils in Smephi Hlatswhayo's CA trial plots

Ntombakhe Zikode

Ntombakhe is also on her 5th year of participation and she has 1000m^2 trials intercropped with maize, beans and cowpea and she also has cover crops. Ntombakhe has also undertaken a liming experiment.

Her soils are extremely shallow with an effective depth of around 30cm only, before hitting the shale below. Ntombakhe also stated that her yield for this year has somewhat decreased in comparison to the previous year. She holds the dry weather accountable for such a poor yield.

Figure 5: A gravimetric soil simple taken at Ntombakhe's trial plot, showing the clay and shale parent material in this 30cm depth sample

Ezibomvini

Phumelele Hlongwane is one of the best CA farmers in the Bergville area. She has used all cropping practices including intercropping, rotation and summer and winter cover crops and has consistently achieved very high yields. Here soils however are not good structurally and the implementation of CA for the last 4 years has not changed the water infiltration rate of her soil. Soils are also variable across her field with some parts being shallow and rocky and other less clayey with deeper soil. Generally, her infiltration rates are slow.

Figure 6: From Left to Right: A spade of her soil graded to show large clods but little structural integrity; An example of root size and depth of one of her maize plant - showing quite shallow rooting and the double ring infiltrometer set up for readings. The walls of the rings are quite battered due to extreme difficulty of getting the rings into the soil

Challenges and Solutions

One of the biggest challenges in doing the infiltrometer readings was accessing enough water. Each site would take on average around 100 lit of water. The households had not access to water and thus this had to be found and brought to site, usually from a nearby stream or spring -which was extremely time consuming. The doulbe ring as well was construted locally in Pietermatizburg and was not of a high enough quality to withstand the strain of being hammered into extremely hard soils. It is likely that the project will discontinue these efforts in the future and rely more heavily on gravimetric water soil sampling and analysis.

Visual Soil Assessments

This methodology has been tried each year in the Bergville area, as a potential peer review system for assessing soil quality. Below is the scoring sheet that has been designed for this assessment. This assessment has been altered slightly in terms of indicators used when compared to similar processes employed[1][2], to accommodate for tests that are seen to be very similar in the original forms. An example is surface ponding and infiltration, which in our version has been changed to infiltration only.

Visual indicator of Soil Quality	**Visual Score (VS)** 0 = Poor conditions 1 = Moderate conditions 2 = Good conditions	**Weight**	**Comments**
Soil Structure (aggregates)		× 3	Shatter test and assessment of clods for distribution of aggregated 0=many large clods, few smaller ones, 1=equal proportions of large and finer aggregates, 2= larger proportion of friable soil and fine aggregated
Soil porosity		× 3	0=hard compact clods, 1= breakable clods, 2= easily breakable with organic matter and some roots
Soil colour and organic matter		× 2	Here the organic matter is what counts. 0=none,1=little, 2=Some to lots
Number and colour of soil mottles		× 1	0= many mottles, 1=some mottles, 2= no mottles
Earthworm counts		× 2	As per manual
Soil cover (residue cover)		× 2	As per manual
Soil depth (presence of a tillage pan), depth of rod into soil		× 2	0=0-10cm, 1=10-15cm, 2=>15cm
Run-off		× 2	As per manual
Infiltration (surface ponding)		x 2	0= evidence of ponding (yellowing plants, standing water after rain), 1= some ponding (water takes a while to infiltrate) 2=no ponding
TOTAL		**37**	

VSAs were conducted for 13 of the longer term participants this season. Soil from the CA trial plots were compared with the control plots. As is the case with a number of other indicators, the value of comparing trials and controls has been minimised due to the fact that all these participants started using CA in their control plots as well. There are however still marked differences in crop diversification between the trial and control plots, as all participants plant only maize in their controls.

Below is a summary table for the soil based indicators of the VSAs for the 13 participants.

[1] Sheperd G. 2010. Visual Soil Assessment Field Guide: Part 1: Maize. FAO, Rome

[2] Sheperd G, Bailey J, Johnson P. 2012. Visual Soil Assessment. SMI and Vaderstad. New Zealand.

Table 9: Visual Soil Assessments for 4th and 5th year CA participants in Bergville:2017-2018

May-18																										
Visual soil Indicators	Stulwane												Eqeleni										Ezibomvini			
NAME OF PARTICIPANT	K Dladla(T)	K Dladla(C)	D Hlongwane(T)	D Hlongwane(C)	T Dlamini (T)	T Dlamini (C)	M Dladla(T)	M Dladla(C)	C Buthelezi(T)	C Buthelezi(C)	P Sthebe(T)	P Sthebe(C)	ThZikode (T)	ThZikode (C)	T Zikode (T)	T Zikode (C)	T Mabaso (T)	T Mabaso (C)	N Zikode (T)	N Zikode (C)	S Hlatshwayo (T)	S Hlatshwayo (C)	C Hlongwane (T)	C Hlongwane (C)	P Hlongwane (T)	P Hlongwane (C)
SOIL TEXTURE	6	6	6	6	6	6	6	3	6	6	3	6	3	6	3	6	3	3	3	3	3	3	6	6	6	3
SOIL STRUCTURE(AGGR)	6	6	6	6	6	3	6	3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
SOIL POROSITY	6	3	3	3	6	3	6	0	3	3	3	3	6	6	3	3	3	6	3	3	3	0	3	3	6	3
SOIL COLOUR	2	2	2	2	2	2	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2
NO. OF SOIL MOTTLES AND COLOUR	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	0	0	0	1	2	1	1	1	0
EARTHWORM COUNTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOIL COVER (RESIDUE)	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
SOIL DEPTH(CM)	4	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	2	2	2	2	4	2	2	2	2
RUN-OFF	4	4	0	2	2	4	0	0	2	2	2	2	2	2	2	4	2	2	2	0	2	2	0	2	2	2
INFILTRATION	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
TOTALS	**33**	**30**	**24**	**26**	**31**	**25**	**28**	**18**	**27**	**23**	**20**	**23**	**23**	**26**	**20**	**25**	**20**	**20**	**17**	**15**	**18**	**18**	**19**	**21**	**27**	**17**

The VSA scores for 6 of the 13 participants are higher for their CA trial plots (T) when compared with their control plots (C), the scores for 2 participants are the same and the scores for 5 of the participants are lower. As this is the fourth year that these scores have been used and the results are still very inconclusive in terms of a methodology to assess improvement under CA, the tests are to be discontinued in the future as a CA assessment methodology. While VSAs provide a good set of visual indicators for testing soil quality, some of the indicators are not directly related to short term management benefits and changes in the soil. A selection of these indicators, notably soil structure, run-off and soil cover are however to be continued, as they do provide visible differences in the shorter term (4-5years).

Some interesting points however can be made from the table above

- Even after 5 years of implementation there are no earthworms counted in the soil across all the villages.
- The only indicator that shows either a positive change for the CA trial plots, or where soils remain similar for that indicator across the trial and control plots is Soil Structure (aggregates).

Soil Fertility and soil health

Soil samples are taken annually, both for new participants and also a selection of participants in their 4th and 5th year of participation. These results are used to be able to give participants a specific fertilizer recommendation, check the "generic" recommendation used and also to observe any changes in soil fertility status over time.

In addition, soil health status is tested for a selection of the longer-term participants to ascertain levels of and changes in; microbial activity, percentage soil organic carbon, percentage organic nitrogen, upstream availability of nutrients to follow-on crops and aggregate stability.

This season an additional measurement has been included, that of soil bulk density (ρb). This measurement is needed for the calculation of water productivity. Bulk density is directly related

to soil porosity and indicates the degree of soil compaction (Assouline, 2006[3]). Consequently, ρbis considered a good measure of soil quality as it affects other soil physical parameters such as water holding capacity and ease at which roots can penetrate the soil.

Soil fertility

The following generic fertilizer recommendation has been used for all farmer led trials in the Bergville area:

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

These amounts have been checked yearly against the soil sample results and thus far have provided a good average.

Soil samples were taken for most of the new entrant farmers (42 of the 56 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 200kg/ha or (4x50kg bags/ha). The LAN recommendation will remain 3x50kg bags/ha

Table 10: A summary of soil fertility recommendations for 8 villages across Bergville area, 2017-2018

No of samples	Village	Crop	Yield target (t/ha)	pH	Acid sat (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Lime (t/ha)	MAP (50kg bags/ha)	KCL (50kg bags/ha)	LAN (50kg bags/ha)	Org. C %	N %	Clay %
10	EMAQALENI	Maize	4	4,2	11,4	72	43	1	0,5	3,9	0,4	3,6	1,7	0,2	23,8
		Beans	1	4,2	11,4	40	33	0	2,0	2,1	0,4	2,0	1,7	0,2	23,8
7	MAGANGANGOZI	Maize	4	4,2	9,9	73	47	2	0,2	4,2	0,4	3,6	1,6	0,2	21,5
		Beans	1	4,1	35,3	45	36	0	1,2	2,4	2,1	2,3	2,6	0,2	40,2
6	VIMBUKHALO	Maize	4	4,1	12,1	40	36	0	1,9	2,2	0,0	2,0	1,7	0,2	23,8
		Beans	1	4,4	17,0	76	50	1	0,4	4,5	0,0	3,7	2,0	0,2	28,7
6	EZIBOMVINI	Maize	4	4,1	17,5	39	28	0	2,2	2,0	0,0	2,2	0,9	20,2	23,8
		Beans	1	4,4	6,5	66	44	1	0,9	3,7	0,0	3,3	1,3	3,6	33,4
3	EQELENI	Maize	4	4,2	17,2	54	40	0	1,2	3,0	0,0	2,7	2,1	0,2	30,9
		Beans	1	3,8	48,0	51	37	1	1,4	5,5	2,0	2,1	2,5	0,2	51,7
6	NDUNWANA	Maize	4	4,2	18,6	56	39	1	1,2	3,1	0,0	2,8	1,6	4,2	24,8
		Beans	1	3,9	38,3	56	40	0	1,2	3,6	0,0	2,7	2,1	0,2	37,3
1	STULWANE	Maize	4	3,8	31,0	80	60	0	2,5	5,5	0,0	3,6	1,7	0,1	28,0
		Beans	1	3,8	31,0	40	60	0	7,5	5,5	0,0	3,6	1,7	0,1	28,0
3	EMAZIMBENI	Maize	4	4,0	27,2	58	40	1	1,2	4,3	0,7	2,7	2,0	1,3	40,8
		Beans	1	4,1	16,3	63	46	0	1,6	5,5	5,2	3,1	1,9	0,2	18,5
42				**4,1**	**21,8**	**57**	**42**	**0**	**1,7**	**3,8**	**0,7**	**2,9**	**1,8**	**2,0**	**29,9**

Soil fertility results for the repeat samples of longer term participants will be presented within that case study within this document

Bulk density

Soil tillage has been a popular agricultural practise throughout the world due to the initial improvement of crop productivity, control of weeds and ease with which crops can be planted.

[3] Assouline S., 2006. Modelling the relationship between soil bulk density and the water retention curve. Vadose Zone Journal, 5 (554-563).

However, it has been recognised in many regions that this improved productivity is temporary and overall, soil organic matter (SOM) content decreases under conventional tillage (CT).

This decrease in SOM results in a decline of soil quality as SOM plays a major role in the soil's structural and pore characteristics by influencing aggregate stability.

Bulk density samples were taken for three participants, towards the end of the cropping season (early May 2018). Samples were taken this late in the season as many authors report greater porosity, lower ρb and reduced soil strength under CT than under (no-till) NT due to the creation of macro-pores during ploughing. These provide for a lower ρb reading early in the season, as during the course of the season the soil settles again and the readings increase (Basset, 2010)[4].

Below is a summary of the results of the bulk density calculations for different cropping practices within the CA system of the three participants. They were chosen for having differing period of cropping under CA and for inclusion of a number of practices within their CA system; namely intercropping and planting of summer cover crops (SCC).

Table 11: Bulk density results for three CA participants

Village	Period undue CA	Name and Surname	Control CT	Control CA	M	M+B	M+CP	SCC	Average
Ezibomvini	4	Phumelele Hlongwane	1,30	1,36	1,38	1,33	1,38	1,28	**1,34**
Eqeleni	5	Ntombakhe Zikode		1,35		1,49	1,37	1,32	**1,38**
Thamela	1	Mkhuliseni Zwane			1,14	1,08	1,09	1,07	**1,10**
Average bulk density									**1,27**

These results indicate an increase in ρb over period of involvement in CA. There is little to no difference between the CA practices, although in all three cases the planting of SCC has reduced the ρb fractionally.

An explanation for this trend is that ploughing increases the presence of macro-pores in the short term but, less structural stability under CT can lead to lower porosity, higher bulk densities and greater soil strength with time, as tillage-induced pores readily collapse. Although initial conversion from CT to CA usually results in higher bulk densities it is unlikely that plant growth will suffer markedly as a consequence of insufficient moisture and poor aeration status. Improved aggregation and pore connectivity under CA allows the soil to maintain an adequate supply of moisture and air (Cavalieri et al., 2009)[5].

The average ρb of 1,3g/cm^3 is to be used for the water productivity calculations

[4] Basset, T.S. 2010. A comparison of the effects of tillage on Soil physical properties and microbial Activity at different levels of nitrogen Fertilizer at Gourton farm, Loskop, Kwazulu-Natal. MSC thesis. Dept of Soil Science, UKZN.

[5] Cavalieri K.M.V., da Silva A.P., Tormena C.A., Leão T.P., Dexter A.R. and Håkansson I., 2009. Long-term effects of no-tillage on soil physical properties in a Rhodic Ferrasol in Paraná, Brazil. Soil and Tillage Research, 103 (158-164).

Soil health test results

In the interim report an analysis was done for soil health test results over 2-3 years for a selection of participants to analyse the changes in soil health due to specific CA practices in each year. Below an analysis has been done to ascertain soil health changes dependant on length of CA practice. Results from Ezibomvini (three 4th year participants) are compared to Mhlwazini (two 2nd year participants). These results are qualitative and give an indication of trends only.

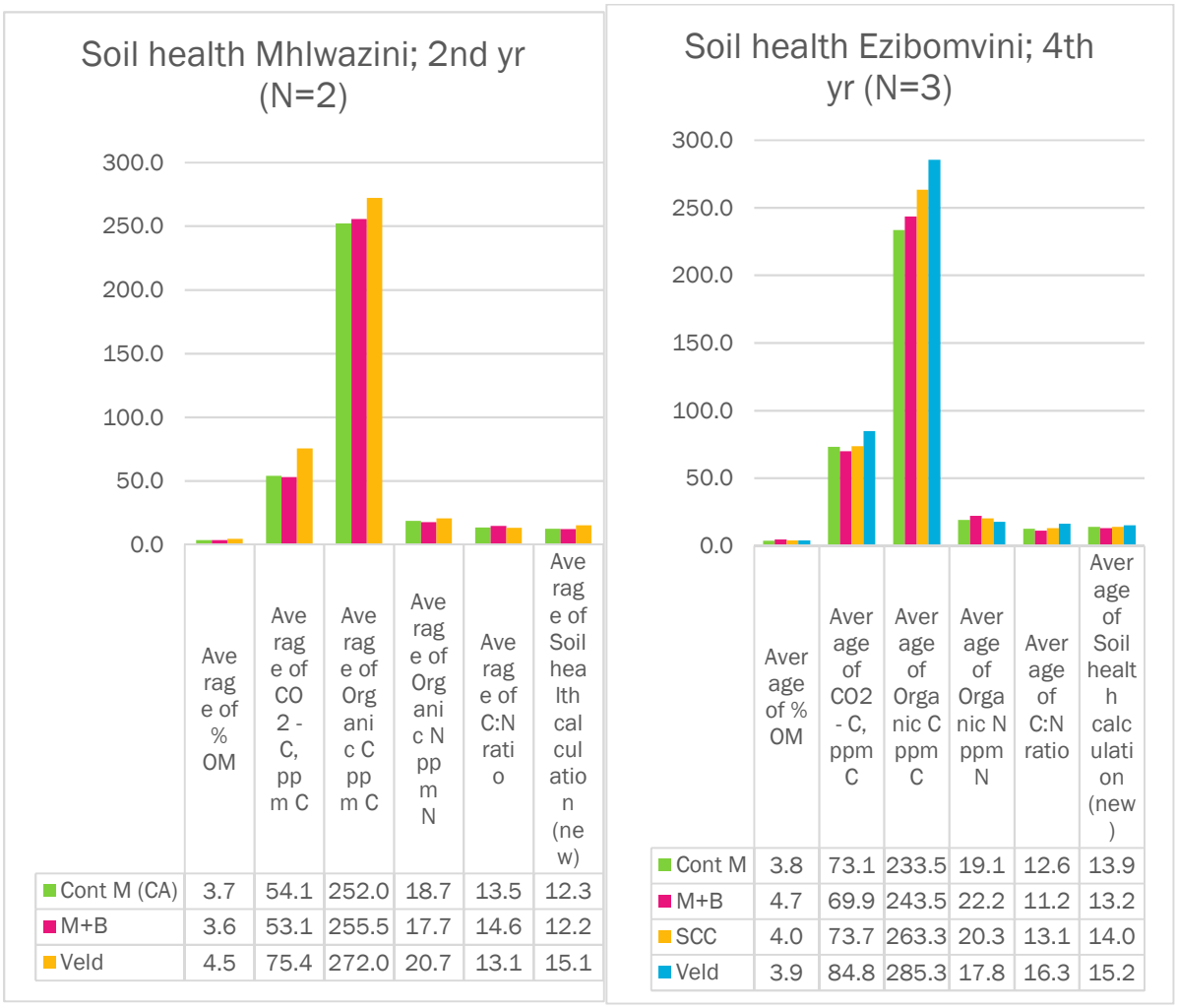


Figure 7: Comparison of soil health test results for 2nd and 4th year CA participants

From the above figures the following comments can be made:

- After 4 years the % OM accumulation for the CA plots (M+B and SCC) is higher than the veld benchmark. This indicates good accumulation of organic matter in the intercropped and summer cover crop plots of the CA trials over time. The maize only plots do not accumulate organic matter to the same extent. For the 2nd year participants the % OM is lower than the veld benchmark and there is as yet no distinction between the maize only and maize and bean plots.
- There is an increase in the average organic C from the maize(M) only plots, to the maize and bean intercrops (M+B) to the summer cover crops (SCC), indicating an accumulation

of Organic C for the M+B plots from the 2nd year onwards. Use of SCC over a period of time provides for the highest increase in Organic C.

- The largest accumulation of Organic N is for the 4th year M+B plots, when compared to M and SCC plots. This indicates a cumulative effect of increased Organic N when intercropping is used and the effect becomes more visible over time.
- This links to the lower C:N ratio for M+B plots for 4th year participants.
- C:N ratios for the CA plots (M, M+B and SCC) for the 4th year participants are lower than the veld benchmarks. This is not the case for the 2nd year participants. This indicates the lowering of C:N ratios over time for the CA practices.

In summary, the use of CA practices and especially including intercropping and summer cover crops in the cropping system increases % soil organic matter and the accumulation of organic C and Organic N over time. C:N ratios decrease. These trends become more clear after a period of 4-5 years of implementation of CA.

The savings in R for inorganic N that needs to be applied is also cumulative. For Mhlwazini (2nd year) this value is R374,50/ha and for Ezibomvini (4th year) the value is R437,13. These values are equivalent to 12% and 14% of total fertilizer costs respectively.

Farmer Centres

Thus far only one farmer centre has grown up from the learning groups, with two others not lasting more than one season. This is directly linked to the commitment and entrepreneurial spirit of those who volunteered for the task.

Now in its second year of operation the farmer centre in Eizbomvini has been running quite well and is seen to have played a pivotal role in the upkeep of agricultural production in the village. More and more people, including those from neighbouring villages such as Vimbukhalo also get their inputs of seed, fertilizer and herbicide from the Ezibomvini farmer centre.

Products available at the farmer centre still include seed, fertilizer, herbicide and the preservative pill, but maize ready for milling, beans and sweet potatoes are now up for sale as well. These are products which Phumelele grows and are a surplus from her yields.

Figure 8: Above Left: Seed available at the farmer centre now includes the commercial hybrids as well as locally grown OPV yellow maize seed and Right; traditional white maize is sol for milling in small quantities.

The small table below gives a summary of income made through the farmer centre.

Date	Description of products sold	Total	Mark- up (20-25%) Profit
February 2018	Brought forward		R3092.14
March 2018	Quickphos preservative pill Bulala Zonke	R 46.72 R 100	
March – July 2018	Maize 30*20 l @ R 50.00 each Beans 06* 5l @ R90. 00 each 02* 20l @ R 300 each Sweetpotato 20* 5l @ R25.00 5* 20l @ R 100	R 1 500 R 450 R 600 R 500 R 500	
Sub Total			R 3 550.00
Total profit			**R 6 642.14**

VSLAs

In Bergville 16 VSLAs are now active. The groups consist predominantly of middle aged to elderly women majority who are unemployed and depend on social and pension grants in order to survive.

The VSL groups were established with the aim to support CA learning groups to save money for agricultural inputs. The groups however, have come to have broader functions where the members save for household needs, to pay back loans, pay for school fees and to buy merchandise for their businesses among other things. A VSL group operates for 12 months and on the thirteenth month the group has a share out of "profits" (interest gained) and thereafter begins another cycle. During these twelve months group members take out loans which they repay with a 10% interest fee added monthly which is how the groups generate income.

Progress of VLS Groups

The groups are all functioning and are doing well except for uMhlathuze group in Bergville, Emmaus area that is no longer under MDF due to non-compliance with the non-negotiable rules. Out of the four new groups that were established this year, there are two groups in Vimbukhalo, one in Ngoba and one in Nokopela. This report will focus on the 9 groups that were visited during the month of June in the following villages; Ezibomvini, Eqeleni, Vimbukhalo, Ngoba, Stulwane and Ndunwana

In the month of June, the groups saved a combined sum of R 59 700 and the total value of their shares for the year is R 403 964. Loans repayments add up to R 53 240, existing loans were R 297 190 and new loans were R 69 500. This money is counted and kept by the groups themselves. Table 1 on the following page gives a breakdown of the VLS transactions for each group. When looking at the loans versus shares, one will notice that the existing loans are generally lower than the total number of cumulative shares, which is the case for most of the groups. The two groups in Stulwane have existing loans that are higher than the cumulative number of shares, which suggests that they are in the negative i.e. some people are still adding new loans on existing ones.

Table 12: Summary of VLS Groups for the month of June

GRP NO	Area	Village	GROUP NAME	YRS ACTIVE	NO. OF MEMBERS	# SHARES BOUGHT TODAY	VALUE OF SHARES (TODAY)	CUM # OF SHARES	VALUE OF TOTAL SHARES	LOAN REPAID TODAY	LOAN	NEW LOAN TAKEN	AMOUNT DUE NEXT MONTH
1	Bergville	Vimbukhalo	Inyonyana	1	20	20	R2,000.00	260	R26,000.00	R2 540	R13,100.00		R14,410.00
2	Bergville	Eqeleni	Masibambisane	4	20	54	R5,400.00	442	R43,210.00	R5 190	R22,600.00	R500.00	R26,310.00
3	Bergville	Eqeleni	Masithuthuke	5	20	48	R4,800.00	354	R35,100.00	R4 910	R20,700.00	R4,000.00	R27,570.00
4	Bergville	Stulwane	uMntwana	5	35	70	R7,000.00	507	R50,332.00	R4 900	R57,550.00	R12,300.00	R78,250.00
5	Bergville	Stulwane	Mbalenhle	3	20	56	R5,600.00	400	R40,000.00	R4 490	R43,600.00	R3,000.00	R52,030.00
6	Bergville	Ngoba	Sakhokuhle	2	23	38	R3,800.00	399	R37,722.00	R8 570	R30,600.00	R5,200.00	R39,480.00
7	Bergville	Ngoba	Isibonelo	1	30	82	R8,200.00	537	R53,700.00	R9 350	R32,500.00	R13,600.00	R42,870.00
8	Bergville	Ezibomvini	uKuzama	2	21	56	R5,600.00	317	R31,700.00	R3 530	R18,800.00	R6,000.00	R27,130.00
9	Bergville	Ndunwana	Mphelandaba	2	19	17	R1,700.00	179	R17,900.00	R2 110	R16,600.00	R1,500.00	R18,260.00
	TOTAL				**208**	**441**	**R44,100**	**3395**	**R335,714**	**R45 590**	**R256,050**	**R46,100**	**R326,310**

Mphelandaba VSL Group, Ndunwana

The Mphelandaba group from Ndunwana Village in Bergville is in its second year of operation. It has a total membership of 19 people who are all female. The group saves for household needs but do occasionally use the money for inputs. This year is going well so far, the group has learned from the mistake of the first year where some people took out loans but failed to pay back because they did not follow the principle of not lending more than twice the cumulative number of shares. The table below gives a summary of the group's savings for June.

NO.	SURNAME	INITIALS	# SHARES BOUGHT TODAY	VALUE OF SHARES (TODAY)	CUM # OF SHARES	VALUE OF TOTAL SHARES	LOAN REPAID TODAY	LOAN	NEW LOAN TAKEN	AMOUNT DUE NEXT MONTH
1	Zondo	SN	1	100	9	900	50	500		550
2	Hlatshwayo	BS	0	0	10	1000	150	1500		1650
3	Hlongwane	AM	1	100	12	1200	20	200		220
4	Hlongwane	PL	1	100	8	800	50	500		550
5	Mazibuko	N	1	100	10	1000	20	200		220

6	Zimba	LL	2	200	14	1400	300	3000		3300
7	Mdluli	K	1	100	10	1000	50	500		550
8	Hlongwane	Z	2	200	17	1700	100	1000		1100
9	Khumalo	ZJ	1	100	9	900	100	1000		1100
10	Hlatshwayo	NE	1	100	12	1200	180	1800		1980
11	Vilakazi	Z	0	0	5	500	0	600		660
12	Hlongwane	D	1	100	9	900	50	500		550
13	Zondo	T	0	0	9	900	230	2300		2530
14	Nkala	T	0	0	6	600	50	500		550
15	Mazibuko	S	1	100	5	500	60	600		660
16	Hlongwane	N	1	100	9	900	330	0	1500	0
17	Mkhonza	SI	2	200	14	1400	50	500		550
18	Zondo	G	0	0	3	300	270	900		990
19	Zimba	LL	1	100	8	800	50	500		550
	Total	**19**	**17**	**1700**	**179**	**17900**	**2110**	**16600**	**1500**	**18260**

Mbalenhle Group: Stulwane

The Mbalenhle Group consists of 20 members and is based in Stulwane. The table below shows their transactions for the month of June. In terms of savings, value of shares bought came to R 5600.00, total amount repaid was R 4490.00, exiting loans were R 47 960 and new loans came to R 3000.00. The group is similar to uMntwana group in that they also borrow money on top of existing loans. The biggest challenge with Stulwane is that the groups are comprised of young as well as old women, who also happen to be in laws of some of the younger women. When the older, more knowledgeable break the rules it is difficult for those deemed as inferior to rectify them.

NO.	SURNAME	INITIALS	# SHARES BOUGHT TODAY	VALUE OF SHARES (TODAY)	CUM # OF SHARES	VALUE OF TOTAL SHARES	LOAN REPAID TODAY	LOAN	AMOUNT DUE NEXT MONTH	NEW LOAN TAKEN	NEW BALANCE
1	Duma	H	5	500	35	3500	300	3000	3300	0	3300
2	Msele	N	5	500	32	3200	500	5000	5500	0	5500
3	Mpinga	T	5	500	31	3100	300	3000	3300	0	3300
4	Dubazana	N	4	400	17	1700	330	3000	3300	0	3630

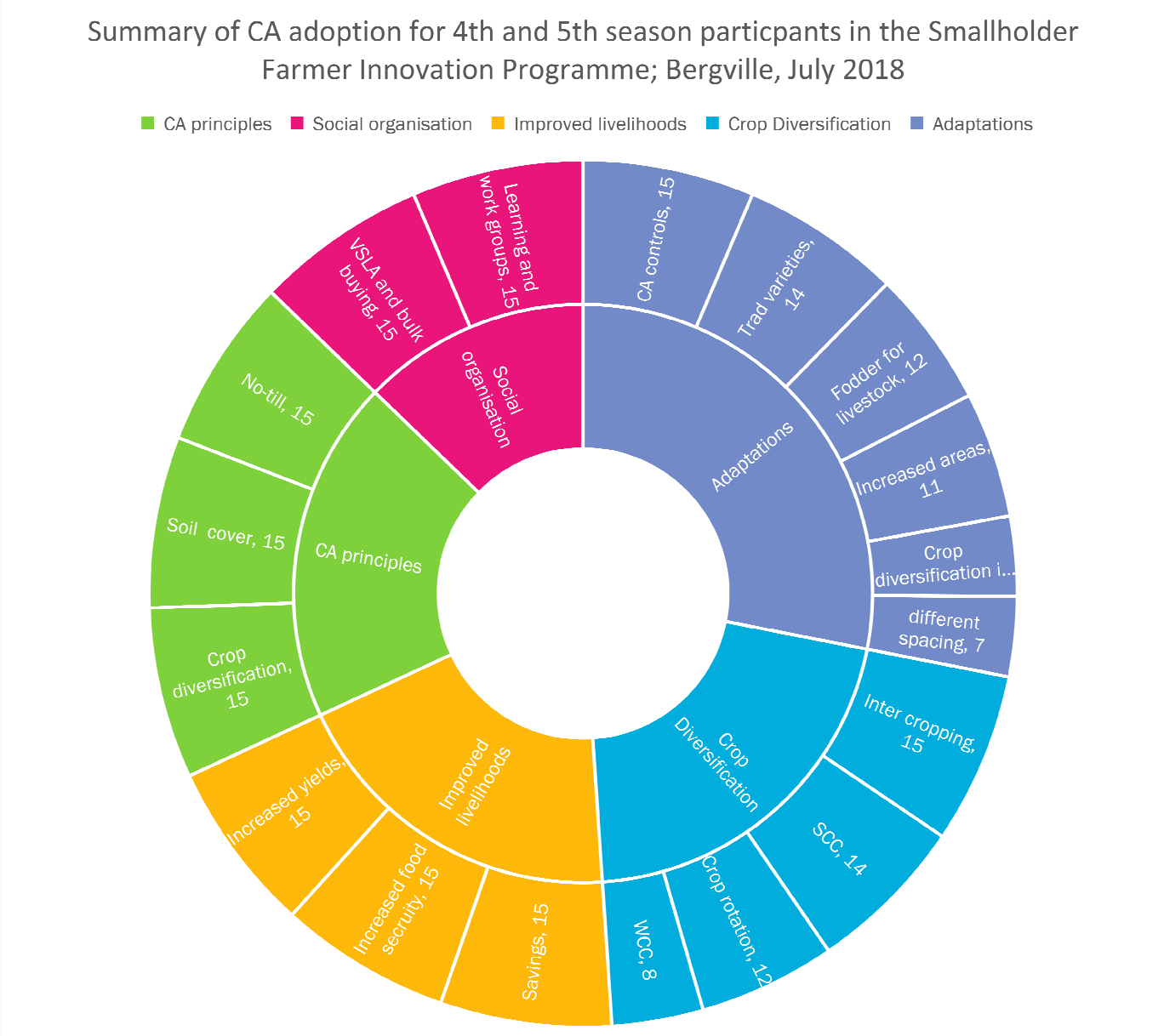
5	Sishi	H	4	400	19	1900	150	1500	1650	0	1650
6	Mkhize	T	3	300	23	2300	200	2000	2200	0	2200
7	Skhosana	N	2	200	23	2300	220	2200	2420	1800	4620
8	Nyoka	Z	0	0	3	300	100	1000	1100	0	1100
9	Mkhize	S	5	500	34	3400	200	2000	2200		2200
10	Mvelase	M	2	200	14	1400	150	1500	1650	0	1650
11	Mkhize	E	4	400	31	3100	150	1500	1650	0	1650
12	Mhlanga	N	0	0	16	1600	200	2000	2200	0	2200
13	Mazibuko	N	1	100	9	900	300	2000	2200	0	2200
14	Zimba	N	2	200	13	1300	270	2700	2970	0	2970
15	Mkhize	N	2	200	29	2900	300	3000	3300	0	3300
16	Mpinga	N	2	200	11	1100	150	1500	1650	700	2420
17	Dlamini	N	2	200	12	1200	150	1500	1650	0	1650
18	Ndlovu	N	2	200	9	900	200	2000	2200	0	2200
19	Nene	M	5	500	31	3100	200	2000	2200	500	2970
20	Msele	M	1	100	8	800	120	1200	1320	0	1320
TOTAL			**56**	**5600**	**400**	**40000**	**4490**	**43600**	**47960**	**3000**	**52030**

Trends for longer term smallholder participants in the CA FIP

A specific survey was conducted this season (2017/18), with smallholder participants who have now cropped for 4 (5th year) and 5 (6th year) seasons respectively to ascertain their uptake, adaptation of the CA systems introduced as well as aspects of sustainability, including – increased cropping area, use of CA principles in all their fields (thus including the control plots), increased yields, increased food security and increased incomes/savings.

A total of 15 case studies with 5 participants in each of three villages (Eqeleni, Ezibomvini and Stulwane) in the Bergville area, were conducted between January-March 2018.. (This is a sub-sample of the total number of participants (27) who started CA in 2013 and 2014).

Below is a summary for the 15 participants interviewed. The values in the graph represent the number of participants for that indicator



Summary of results:
All these participants are implementing all three principles of CA, are involved in intercropping and have included CA into their overall farming practices. They will now use CA as their farming approach going into the future. All participants agree that this approach has saved them money and increased food security considerably and all are involved in local VSLAs (Village savings and loan associations). All participants also use traditional seed varieties alongside the more modern OPVs, hybrids and GM varieties promoted.

There are some individual variations and adaptations in terms of crop rotation systems, spacing, use of cover crops and use of fodder for livestock. Around 73% of these respondents have already increased their area of cropping and feel that with the introduction of the animal drawn and tractor drawn implements, they will be able to expand even further.

This summary provides a very clear indication that after around 5 years of experimentation with CA, the farmers are now willing and able to implement CA without any further external mentoring. Support in the form of farmer centres that can assist in the provision of access to implements and inputs as well as the small subsidies for continued experimentation is however still important.

Present challenges are primarily around storage systems and capacity as all are producing more maize than they can easily harvest and store. Stray livestock provide a challenge for many participants and some still have some challenges around weeding and pest incidence (such as cutworms and bagrada beetles). In addition, we have as yet been unable to come up with a satisfactory process of inclusion of winter cover crops (WCC's) in this CA farming system. Relay cropping and broadcasting of WCC's have been largely unsuccessful in this system.

A few other comments of interest are:

1. A proportion of participants have included the broadcasting of kraal manure into their cropping system, along with the micro-dosing of fertilizer and believe this works well. This is a practice that warrants further attention and experimentation
2. Around 36% of these participants have also been involved in the Grain SA Farmer Development Programme's Job Funds project. They have now all withdrawn given that the inputs provided through this programme have become unaffordable. Most of these participants have also kept the seed they obtained through that process for more than one season as their cropping areas are in fact smaller than 1ha.

Below is a summary of comments made by the interviewees.

The Conservation Agriculture system

"I am very happy with my current method of farming (CA) and I try by all means to recruit people into CA as it breaks the strong boundaries of poverty and food insecurity" (Ntombakhe Zikode)

"We really appreciate having Mahlathini as a stepping stone towards poverty alleviation in our village. The learning groups and farmer's day have played a huge role in enhancing our knowledge and learning. It has taught me to experiment with the skills that I have picked up. Phumzile and her team encourage us to keep our plots looking good. When they do monitoring rounds, we are able to ask more questions and share new ideas and in turn acquire more skills." (Khulekani Dladla)

"The workshops that were given in the introductory phase of the programme led me to believe that this system can be a very useful tool to solve our production problem of obtaining poor yields and also at the same time contribute to better food security in my homestead. Soils that we worked were tired after numerous years of tillage and had very little potential and the CA principles presented helped to form a more complete picture of the factors influencing good productivity of the soil which includes the combined use of practices such as intercropping, crop rotation and cover cropping and how these can assist in terms of building up the nutrients in the soil and also increase moisture retention capacity of the soils when practicing CA. I have now seen a drastic improvement in my fields with increased yields and soils are always workable as they are moist (cover)". (Thulani Dlamini)

- CA helps to save money and improves yields

- CA reduces water erosion and run-off in the fields
- CA reduces wind damage to crops as maize is not blown over, as it is under conventional tillage
- CA increases soil fertility and soil health
- CA increase soil moisture and makes the soil soft and more workable

Crop rotation

"Crop rotations helps most when it comes to disease control and balancing the way nutrients are taken from the soil as well as putting them back into the soil. This includes planting maize for one season then changing in the following season and planting cover crops, which are ideal for soil health". (Khulekani Dladla)

Below is a summary of some of the observations related to crop rotation:

- Maize-beans-beans-maize. This rotation has been introduced as maize grows a lot better after the bean rotations than without
- Maize-SCC-maize; this rotation provides the best growth of maize when compared to other intercropped and rotated plots.
- Rotations after planting Lab-Lab beans grow very well

Intercropping

Below is a summary of some of the observations made related to intercropping:

- Intercropping assists with weeding and keeping the soil soft and moist
- Intercropping also assists in boosting the fertility of the soil and helps with good growth in follow-on crops. It improves the yield of maize
- Intercropping helps with weeding
- Cowpeas provide for excellent soil cover due to its vigorous growth and thus also helps with weeding, containing soil moisture and soil fertility. Participants are no longer used to eating cowpeas and for this reason it is not preferred.
- There can be problems with bean yields in intercropped plots due to shading and excessive moisture where the pods rot prior to harvest.
- It also assists in providing different food sources over a longer period of time
- In maize and cowpea intercrops, the maize grows and yields better than in the maize and bean intercropped plots.
- Cowpeas provide more nutrients for follow-on crops.
- The yields of the mono cropped maize in the CA control plots varies a lot from year to year, while the maize yields in the trail plots where intercropping and cover crops have been used increase every year.

Cover crops

Below is a summary of observations related to cover crops:

- Planting of millet improves soil quality (making it soft and easy to work with) and soil health. It assists the follow-on crop substantially in terms of growth and yield
- Millet is eaten by birds and thus harvesting the grain has been impossible for most participants.
- Sunflowers grow well and most participants have harvested the seed to feed to their chickens. Some participants prepare a feed of crushed maize and sunflower for their poultry and have found this to greatly increase their survival rate.

- SCC's are cut and dried as a fodder for livestock – both goats and cattle.
- Cover crops increase the fertility of the soil; especially cowpeas and millet.
- Lab-Lab beans also have medicinal properties in assisting to regulate blood pressure. This is preferred over the modern medications as it is more natural. It also provides for much increased soil fertility and improved soil health.
- Cover crops help keeping the soil moist and in a good condition during the off season
- Cover crops help in providing fodder for livestock in winter when they do not have enough food.

Crop varieties

"I like the modern cultivars, such as PAN6479 as they have the capacity to produce more as compared to the traditional maize which I used in my control plot. The traditional maize is good when it comes to disease resistance and adaptation to weather changes; however, it does not have the best yield" (Smephi Hlatshwayo)

"The Gadra beans are more susceptible to pests and diseases as well as poor adaptation to weather changes, which makes it better to plant this bean late in the planting season. Usuthu (a traditional cultivar of climbing bean) is much more disease resistant and can adapt to weather changes, which is why I have both these cultivars in my trial and control plots" (Smephi Hlatshwayo).

Traditional varieties are used as it is possible to keep seed for following seasons and this is seen as important. Participants also prefer the taste of the traditional maize.

Below is a small table put together from comments made by Khulekani Dladla on comparing different seed types.

Hybrid seed Pro's	**Hybrid seed cons**
Yields big cobs with multiple lines	Sometimes it is too sensitive to chemicals
Produces quality maize	
GM seeds Pro	**GM seeds cons**
Persistent and not too sensitive to weather and chemicals	Has many bad weather hazards
Easy to work with because they don't require labour when it comes to weeding (chemically friendly)	Has many bad health hazards
Traditional seeds Pro	**Traditional seeds cons**
Resistant to many diseases	Yield is too small (the traditional seed cob has fewer lines of seeds/pips).
It is filling	

Plot layout and spacing

Overall the standard design of the experimental plots has been adapted by the whole group in Eqeleni under the direction of the local facilitator in the area. They have altered plant spacing from the recommended 50 cmx50 cm for maize to 70 cmx70 cm. They share that this solves the problem of ease of weeding as with the close spacing the feeling was that the growing bean plants intercropped with the maize cannot escape damage from human traffic and implements used. Apart from this, increased competition between growing plants was observed and for this reason spacing altered.

Their 1000 m^2 trials (50 m*20 m) are divided into5 plots (20 m*10 m). The last crop rotation plot is split into two to allow for 2x (10 m* 10 m) plots, planted to sole Maize crop and summer cover crop mix of sunflower, sunn-hemp and millet respectively.

M+B+WCC	**M+B+WCC**	**M+C**	**M+B**	**M SCC**

In the other two villages the decisions have been based a lot more on individual observations. For the control plots, which are the 'rest' of the field crop plantings for each individual, most of the participants have now included elements of the CA system, including no till and micro dosing fertilizer. For the most part however, they have continued with a maize monocropping system in their control plots.

Below are some descriptive photographs.

Eqeleni	**Ezibomvini**	**Stulwane**
Smephi Hlatshwayo	Phumelele Hlongwane	Khulekani Dladla
Ntombakhe Zikode	Phumelele Gumede	Dlezakhe Hlongwane
Thulile Zikode	Cabangani Hlongwane	Thulani Dlamini
Tombi Zikode	Alfred Gumede	Makhethi Dladla
Tholwephi Mabaso	Velephi Zimba	Phasazile Sthebe

Eqeleni

Eqeleni village is one of the pioneer villages of CA in the Bergville. The group currently comprises of a total 21 participants 6 of which are new entrants into the programme having joined in the current 2017/2018 growing season. This group has really taken on the CA principles and made these their own by modifying certain aspects of the model but also sticking to basic concepts of CA. There are 2 VSLAs in the village

Figure 9: Tholwephi Mabaso stands in front of her mono-cropped maize trial plot.

Figure 10 (below: Close-up mono cropped maize from Smephi Hlatshwayo's trial.

Figure 11 (right): control maize (CA) – Her trial maize performs better than her continually mono-cropped control

Figure 12 (left): Ntombakhe's trial plot, early stages of the summer cover crops in the foreground. Behind that and to the right are her inter cropped plots and on the left at the back her mono-cropped maize plots.

Figure 13: Thulile Zikode. below – a view of her late bean planting with her maize and bean intercropped plot behind her and Right – her SCC plot with millet, sunflower and sunn-hemp mix

Ezibomvini

This village started the CA process in the 2015-2015 season. There are presently 26 participants, of whom 6 are new entrants into the programme. Ezibomvini hosts a farmer centre and 2 VSLA groups.

Figure 14: right: Alfred Gumede standing next to a plot of Lab-lab beans planted in the 2015-2016 season. Towards the back of the picture are the millet stalks from a SCC plot. Right below: A view of one of his CA mono cropped maize plots.

Figure 15: Above- Velephi Zimba standing in her SCC plot (sunn-hemp, millet and sunflower)

Figure 16: Right- a view of Phumelele's maize and cowpea intercropped plot and Far Right - A view of Phumelele's Lab-Lab plot in the 2017-2018 season. She rotates these plots in her intercropping and rotation system. Behind the visitors is a plot of inter cropped maize and sunflower.

Stulwane

This village started their CA process in 2013. There are presently 19 participants. A new group has been started in another part of this village this past season, with 12 members

Figure 17: Left above: A view of Khulekani Dladla's field showing maize and bean and maize and cowpea intercropped plot. Left below – he stands in front of a plot of sunflowers and Right – he indicates yields form different types of beans planted in his fields.

Figure 18: Thulani Dlamini stands in a single crop bean plot, ready for harvest and in front of a plot of single cropped sunflower that he planted in the 2016-2017 season.

Figure 19: Right above: A view of Makhethi Dladla's field with a mono-cropped bean plot in view and towards the back of that is maize and SCC intercropped plot. Right below: Makhethi stands in a maize and bean intercropped plot.

Soil fertility analysis

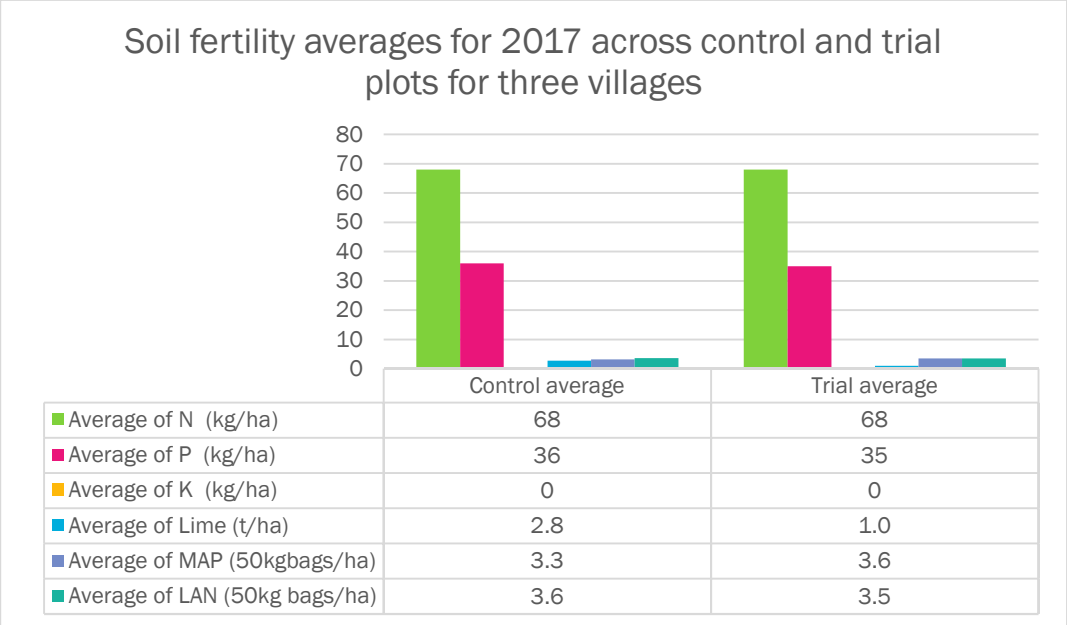
Soil samples are taken for every participant at the start of their experimentation and then again 2-3 years later. The idea has been to gauge the difference between soil fertility and nutrient requirements for the control and trial plots. Below is a summary of the soil fertility requirements analysis for 12 of the 15 participants interviewed.

Table 13: Averages for soil fertility requirements across three villages, for control and trial plots; 2017-2018

Average of soil fertility requirements and indicators for repeat samples across three villages (Eqeleni, Stulwane, Ezibomvini)									
Plot	**Village**	**N (kg/ha)**	**P (kg/ha)**	**K (kg/ha)**	**Lime (t/ha)**	**MAP (kg/ha)**	**LAN (kg/ha)**	**Org C %**	**N %**
Control	Stulwane	63	41	0	4,4	3,7	3	2,4	0,2
Trial	Stulwane	63	29	0	1,7	3,4	3,2	2,6	0,2
Control	Eqeleni	73	31	0	1,2	2,8	4,2	1,8	0,2
Trial	Eqeleni	73	41	0	0,3	3,7	3,8	1,6	0,1
Control	Ezibomvini	80	60	0	0	3,6	4,3	1,2	0,1
Trial	Ezibomvini	80	40	0	0	5,5	3,6	1,2	0,12

The table indicates broadly that the differences between control and trial plots are quite small. P requirements are on average lower for the trial plots than the control as are the Lime requirements. %C and %N are on average the same across trial and control plots.

It is assumed from these results that the use of CA in both control and trial plots have evened out any differences in the soil fertility status between the plots.



	Control average	Trial average
Average of N (kg/ha)	68	68
Average of P (kg/ha)	36	35
Average of K (kg/ha)	0	0
Average of Lime (t/ha)	2.8	1.0
Average of MAP (50kgbags/ha)	3.3	3.6
Average of LAN (50kg bags/ha)	3.6	3.5

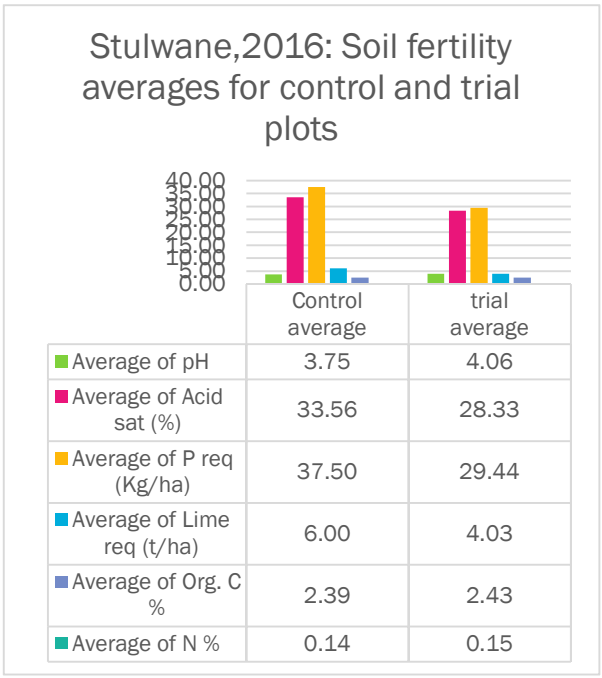
Figure 20: Soil fertility requirements and fertiliser recommendations across three villages for control and trial plots; 2017-2018

The figure above provides for the fertilizer recommendations now required across these areas. The generic recommendation of 5 bags (50kg)/ha MAP and 3 bags (50kg)/ha LAN, along with 1t/ha of lime, can now be reduced to 3,5 bags of MAP/ha and 1 bag/ha of LAN. This indicates a 30% reduction in the need for MAP and phosphate and points towards the provision of this nutrient through the CA practices. For LAN the reduction is even more significant at around 48%.

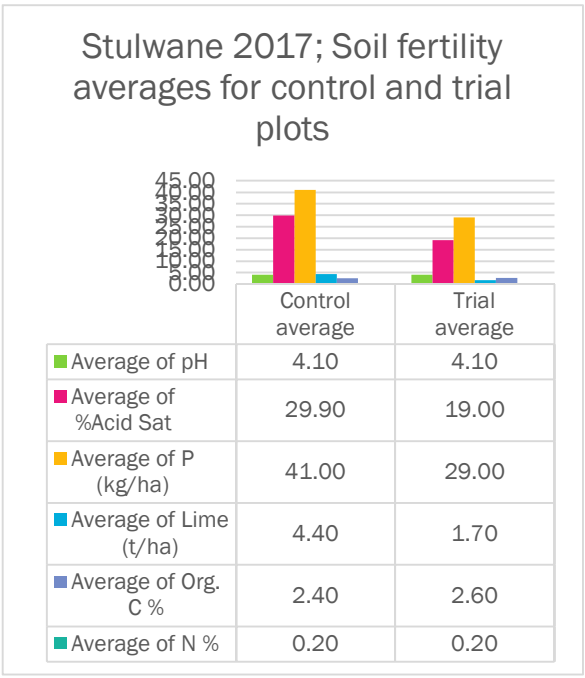
A practice that participants have not included in their application of CA to their control plots is the addition of lime. This can be seen in the higher average lime requirement across the control plots. A recommendation of addition of 3 t/ha of lime to the control plots is to be made in these areas.

As the N recommendation for soil fertility analysis is based on crop requirements, rather than N present in the soil, these are predictably similar for the control and trial plots. The savings in N are however calculated through the Haney soil health test process. For these participants the combined average of savings in inorganic N fertilizer amount to R401,82/ha. This is equivalent to roughly 35kg/ha of N. the reduction in MAP suggested will already reduce the application of inorganic N by around 9 kg /ha. This suggests a reduction also in the LAN requirement of 26 kg. This is equivalent to a reduction of roughly 2x50kg bags and means the recommendation can be brought down from 3 to 1x50kg bags of LAN/ha.

A further analysis of the changes in soil fertility status over time has been made for the Stulwane participants as an example. The two small figures below represent the results for 2016 and 2017 respectively.



	Control average	trial average
Average of pH	3.75	4.06
Average of Acid sat (%)	33.56	28.33
Average of P req (Kg/ha)	37.50	29.44
Average of Lime req (t/ha)	6.00	4.03
Average of Org. C %	2.39	2.43
Average of N %	0.14	0.15



	Control average	Trial average
Average of pH	4.10	4.10
Average of %Acid Sat	29.90	19.00
Average of P (kg/ha)	41.00	29.00
Average of Lime (t/ha)	4.40	1.70
Average of Org. C %	2.40	2.60
Average of N %	0.20	0.20

Figure 21: Soil fertility requirements for Stulwane 4th and 5th year participants for 2016 and 2017

From the figures above the following observations can be made:

- Average pH has increased for control plots and remained similar for the trial plots
- Average % acid saturation has decreased for both the control and trial plots
- Avera P required (kg/ha) has increased for the control plots, but remained constant for the trial plots
- Average lime requirement (9t/ha) has decreased for both control and trial plots. The decrease for the trial plots is significant
- Average % organic carbon has increased slightly for the control plots and increased more significantly for the trial plots, by an amount of 0,17%. This is equivalent to around 2tC/ha (using the calculation %C x BD (g/cm^3) x SD(cm)x 10 – the assumption here is 10 cm sampling depth and around 1,3 g/cm^3 bulk density.
- Average % nitrogen in the soil has increased slightly for both control and trial plots.

Given these results, it can be seen that the CA process is improving soil fertility status in the soil; increasing pH, reducing acid saturation and the consequent need for lime applications. There is a visible reduction in the need for externally applied P, while organic carbon is sequestered in the soil at a rate of around 2 t/ha.

The Haney Soil health tests for 9 of these 15 participants have also been done for this season. Averaging the % soil organic matter (SOM) (LOI) from those tests leads to a value of around 3,5 t/ha sequestered carbon. This value is equivalent to the Cedara % soil organic carbon (SOC) (Walkley Black) test, given different procedures used, as SOM~ 1,72 x SOC. The tests from the two laboratories are thus providing the same results.

Case study_Nelisiwe Msele; Stulwane

Nelisiwe is in her 5th year of programme participation and has in the past two seasons taken over the administrative role of her villages learning group acting as Local Facilitator. Nelisiwe has shown signs of great initiative and has contributed tremendously in data collection in her village having collected all data related to planting, crop growth monitoring, yield data for beans and maize, cover crop information, rainfall data and photographs.

Figure 22: Nelisiwe working with Phumzile and Nonkanyiso in filling in the crop growth monitoring forms

She is also a member of a new savings group in her village Eqaqaneni savings group, which is in its second year of operation.

In the past years of her programme participation her yields have been good showing progressive increase, but there has always been cobs characterized by discoloration and of no use for milling except for making of brewing malt. Due to this the initial thought was that her field might be infected by a kind of soil borne disease, but this is slowly disappearing from her fields, with her current season's yield at a record 10.27 t/ha for maize and 1.26 t/ha for beans.

Figure 23: Far right; a view of one of Nelisiwe's maize only trial plots

She has been actively experimenting both with inter cropping and crop rotation and has included summer and winter cover crops in her plots as well.

1 **M+B**	**2** **M+C**	**3** **M+C**	**4** **M+B**	**5** **B**
6 **M**	**7** **M**	**8** **B**	**9** **SCC**	**10** **M**

Figure 24: Nelisiwe's trial plot layout.

Figure 25: Far right; a view of Nelisiwe's SCC trial plot

In addition, she has planted a late season bean trial. She has done this alongside two other participants in the Stulwane group- Makehti Dladla

and Mthuleni Dlamini assessing not only the yields but also the effectiveness of different treatment when planting (kraal manure versus conventional fertilizer MAP). Both Nelisiwe and Makhethi used animal traction. The layout sketched below was used. Plot size was 100 m^2.

1	2	3	4
Beans (Fert)	**Beans (Fert)**	**WCC + SCC (Fert)**	**Beans (kraal manure)**

Below is a table outlining the yields obtained for this experiment.

Table 14: Late bean experiment yields comparing use of fertilizer with kraal manure (Stulwane)

Participant name	**Treatment**			
	Fertilizer Yield (Kg)	t/ha	Kraal Manure (Kg)	t/ha
Nelisiwe Msele	18.12 kg	0,9	9.06 kg	0,9
Makhethi Dladla	4.53 kg	0,23	0 kg	0
Mtholeni Dlamini	4.53 kg	0,23	4.53 kg	0,23

Figure 26: (Left) Neliwise's late bean yield and (Right) a view of her maize and cowpea intercropped plot.

Case study Phasazile Sithebe: Stulwane

During the initial stages of her participation, Mam Phasazile Sithebe was experiencing serious acidity problems in her fields with stunted yellowing plants and poor yields. In the 2016/2017 season she conducted one of three liming experiments in the Bergville area. Her lime recommendation was 11 t/ha and in the 2016-2017 planting season 22 x 50kg bags of lime was added to her ploughed and CA plots. Her yields in the 2016/2017 season after the application of lime were 2.08 t/ha maize and 0.12

t/ha beans. This has more than doubled in the 2017/2018 season with her obtaining 4.75 t/ha maize and 1.087 t/ha beans.

Trial Layout 2017/2018 – Mam Phasazile Sithebe, with maize yields 2017-2018

1 **M+C** **17.342kg**	**2** **M+C** **26.441kg**	**3** **M+B** **43.651kg**	**4** **M+B** **32.272kg**	**5** **M** **63.972kg**
6 **B**	**7** **SCC**	**8** **M** **31.313kg**	**9** **B**	**10** **M** **26,665kg**

The yields for maize, having been collected for each plot, show quite a high variation.

Averages are as follows and indicates her best yields to be in the maize and bean intercropped plots.

Plot	Average yield (kg/plot)
M – maize only	32,32
M+B- maize and bean intercrop	37,96
M+C – maize and cowpea intercrop	21,89

Figure 27Above left: Phasazile Sithebe's trial plots with beans only in the foreground and a maize only plot behind that. Above right: her SCC plot

Case study Letiwe Zimba: Ndunwana

Lethiwe Zimba, a mother of two, is one of the younger participants in the programme, at 30yrs old. This is her 4th year of programme participation in the Ndunwana learning group. She reports that her

yields have been increasing every year and that she received good yields this season 2017-2017. She harvested around 10,3 t/ha of maize (a total of around 620 kgs from her trial plot) and around 0,3 t/ha of beans.

Yields obtained from her trial are enough to satisfy the needs of her family of 6 for at least 9 months and she is confident that this year's yields will be able to keep her family going until the next harvesting season set to begin in May - June 2019.

She is a member of the Mphelandaba VSLA and one of the book-keepers of her village. She has been saving in this group for the past 3 years and saves at least R 100.00 per month.

Figure 28: *Centre with purple pinafore and book on lap. Lethiwe attending a savings group meeting in her village*

She states that the share out from this association not only assists her in satisfying household necessities but also helps her to be ready for the upcoming planting season as the share out for her group is in October of every year. This means she is able to contribute toward input subsidies and buy other inputs such as fertilizer for her control plots

She has nothing but praises for intercropping, especially that of maize and cowpea, which she has seen to have a significant effect on the subsequent maize crop that is characterized by good crop growth and good cob formation.

Figure 29: *A view of Lethiwe Zimba's trial plot showing stunted cover crop growth_ the plot with yellow flowers on the right- hand side of the maize planting*

Although she has learnt about the benefits of including cover crops in the CA system, especially regarding the benefits they have for the soils, she shares that she prefers the intercrop more because of already limited access to agricultural land. She does not want to relinquish land for crops other than food crops

She commented that while this year was her first year of experimentation with cover crops, their growth was unpleasing; although the germination was, the subsequent growth was stunted and seeding unsuccessful.

Figure 30: Lethiwe Zimba's maize yields for the 2017/2018 season

Yields in intercropped and rotated plots

Maize yields for different plots within the experimentation regime were taken for a few of the longer term participants.

Table 15: Maize yields calculated for each plot in a few longer participant trials

Yields per plot for a selection of participants: 2017-2018			Yield of Maize (kg)											
Area	Name and Surname	Trial description	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot7	Plot 8	Plot 9	Plot 10	Total Kg	Ton/ha
Eqeleni	Ntombakhe Zikode	Plt 1-4: M+B (20*20), Plt 5-8: M+B (20*20),Plt 9 M+C (10*10)	150,86				142, 45				38,54		331,86	4,92
	Tholwhephi Mabaso	M only(10*20), Bonly,M only, M only, M+C, Scc, M+B, M only, M only	167,32	B only	83,24	115,75	102,55	Scc	67,64	50,62	58,47	B only	645,59	8,90
Ezibomvini	Phumelele Hlongwane	Plt 1(m only), Plt 2 (m+b), Plt 3 (M only),Plt 4 (m only) Plt 5 (lab lab), Plt 6 (m+c), Plt 7(m+b), Plt 8 (b only), Plt 9 (Scc), Plt 10 (M only)	89,78	84,99	110,22	103,07	lab- lab	74,68	98,07	B only	Scc	115,23	676,05	10,82
	Cabangani Hlongwane	Plt 1(m only), Plt 2 (m+c), Plt 3 (m+b),Plt 4 (m+ c) Plt 5 (m only), Plt 6 (m only), Plt 7(lab lab), Plt 8 (m only), Plt 9 (b only), Plt 10 (Scc)	28,99	60,24	64,84	34,21	33,89	42,42	lab- lab	45,15	b only	Scc	309,74	4,95
Stulwane	Nelisiwe Msele	plot 1(m+b), plot 2(m+cp), plot 3(m+cp), plot 4(m+b),plot 5(b only), plot 6(m only), plot 7(m only),plot 8(b only),plot 9(scc), plot 10(m only)	77,21	80,87	60,81	86,11	B only	95,98	114,29	B only	Scc	101,03	616,29	10,27
	Khulekani Dladla	Plt 1(m+cp), Plt 2(m+cp), Plt3 (m+b), Plt 4 (m+b), Plt 5 (m+b), Plt 6 (m only), Plt 7 (b only), Plt 8 (m only), Plt 9 (Sunflower) Plt 10 (Sunhemp and Millet)	22,02	24,90	28,69	27,35	32,10	b only	b only	39,41	Sunflower	Millet and sunhemp	174,47	3,49
	Phasazile Sthebe	Plt 1(m+cp), Plt 2(m+cp), Plt3 (m+b), Plt 4 (m+b), Plt 5 (M only), Plt 6 (B only), Plt 7 (Scc), Plt 8 (M only), Plt 9 (b only) Plt 10 (M only)	17,34	26,44	43,65	33,08	68,57	b only	Scc	31,31	b only	22,67	243,07	4,75
Ndunwana	Boniwe Hlatshwayo/ Mthembu	Plt 1: M+C , Plt 2: M+B,Plt 3 M+C, Plt 4: M+B	74,49	85,81	80,17	84,97							325,44	10,85

The yields across the plots vary considerably for all eight participants. The expectation is that after a number of years, the mixture of intercropping and crop rotation would mean that the soil builds up across the plots and that the yields would even out as they increase. This is as yet not happening.

A more in-depth look at the actual rotations and yields for one of the participants, Phumelele Hlongwane, are presented in the table below.

Table 16: Maize yields per plot in Phumelele Hlongwanes rotation system:2015-2017

Phumelele Hlongwane: Comparison of maize yields per plot:2015-2017							
Plots	**2015/2016 season**		**2016/2017 Season**		**2017/2018 Season**		
	Crops Planted	**Yields (t/ha)**	**Crops planted**	**Yields (t/ha)**	**Crops planted**	**Yields (t/ha)**	**Change in yield (t/ha)**
Plot 10	Maize +Beans	8,3	Maize + Beans	8,8	Maize	11,5	2,8
Plot 9	Maize +Cowpea	8,7	Maize + Beans	8,9	SCC		
Plot 8	Maize + Beans	10,4	Maize + Cowpea	7,7	Beans		
Plot 7	Maize +Cowpea	6,9	Maize	6,5	Maize + Beans	16,3	9,8
Plot 6	Maize +Lab-lab	3,4	SCC		Maize + Cowpea	12,4	
Plot 5	Lab-Lab	NA	Maize	8,8	Lab-Lab	NA	

Plot 4	Maize+ Beans	8,7	Lab-lab		Maize	10,3	
Plot 3	M +SCC+WCC	8,7	Maize + Beans	10,1	Maize	11,0	0,9
Plot 2	SCC		Maize	10,0	Maize + Beans	14,2	4,2
Plot 1	Maize +Beans	6,9	Maize	6,2	Maize	8,9	2,7

This season (2017-2018) has seen a remarkable increase in yield across all the plots where maize has been grown, with yields that seem to be almost unheard of. These calculations and yields have been checked and re-checked given this near impossible outcome and appear to be correct as far as the team can tell. The variety of maize planted was PAN6479.

Rainfall as recorded by the farmers has averaged around 563mm this season as compared to an average of around 527mm for last season. These amounts are considered similar enough to not have a major influence on yield differences noticed.

The difference in maize yield from one plot to another does not appear to be directly related to the previous rotations, although in general those that include legumes and summer cover crops in a three year rotation prior to planting a monocrop of maize, are higher than the plots where maize has followed on maize.

Cover crops

The inclusion of summer cover crops in the plantings were expanded from 4 to 8 villages in this season; Ezibomvini (11), Eqeleni (9), Stulwane (14), Vimbukhalo (6), Ngoba (6), Ndunwana (4), Thamela (8) and Emabunzini (6). A total of 65 particpants thus planted SCC (summer cover crops

Each participant received three cups with the following seeds: 1 cup sunflower, 1 cup sunhemp and 1 cup millet (enough for 100 m^2). These were planted in rows and a number of variations were practiced in the different villages. Ezibomvini, Eqeleni and Stulwane practiced the following planting system:

- 2 rows of a mix of sunhemp and millet
- 2 rows ofsunflower

This was done because past experience has taught the participants that when the cover crops are mixed together the sunflower does not do well in terms of overall growth and seeding.

While the germination of the cover crops was reasonably good this season, the subsequent growth and seeding for all was unpleasing, Very few participants obtained yields. Participants attribute this to a significant dry spell that took place in the critical growth stages of the plants. No seed was harvested for either millet or sunnhemp. For sunflower around 30% of the participants harvested an average of 5 kg seed each (~0,4 t/ha).

Figure 31: Above right- SCC planting for Zodwa Zikode in Ezibomvini – And Below right; SCC planting for Valindaba Khumalo from Vimbukhalo

In Stulwane, all participants in their 2nd - 5th years of implementation planted SCCs. This can be attributed to the fact that this village has a very active interest in livestock, as they use animal traction and are also interested in producing fodder at a larger scale. However out of the 15 participants who planted cover crops more than half (53%) reported issues of either birds feeding on the seeding cover crops or interference by stray livestock. Only four participants recorded any yield. Thulani Dlamini and Khulekani Dladla recorded the highest yields in all villages of 4.805 kg and 9.61 kg respectively, but also kept seed of winter cover crop oats with yields of 5 litres each. In previous years participants have always recorded yields for sunflower but seldom for millet as birds have always fed on this, but this season birds seemed to attack the sunflowers as well.

Yields (Kg) of SCC			
Ezibomvini	Sunflower	Millet	Sunnhemp
Phumelele Hlongwane	5.76 kg	-	-
Zodwa Zikode	0.823 kg	-	-
Fikile Zikode	0.653 kg	-	0.07 kg
Gcinekile Zikode	0.961 kg	-	-
Eqeleni			
Smephi Nkosi	4.805 kg	-	-

Ngoba			
Thembelani Hlongwane	0.961 kg	-	-
Vimbephi Dladla	2.403 kg	-	-
Ntombenhle Hlongwane	2.403 kg	-	-
Stulwane			
Khulekani Dladla	9.61 kg	-	-
Thulani Dlamini	4.805kg	-	-
Mtholeni Dlamini	4.805 kg	-	-
Cuphile Buthelezi	4.805 kg	-	-

Winter cover crops

A mixed cover crop combination of five crops was distributed to participants in the Bergville area who wanted to experiment with WCC (winter cover crops). This included Sunnhemp, millet, Saia oats, fodder radish and fodder rye. The mix of both summer and winter cover crop species is made as these are planted during February. Planting later has given very low germination and growth results. As February is still quite warm, it is considered that a good over can be achieved by mixing both summer and winter cover crops together. Experimentation with a range of other cover crops would also make sense. In the past two seasons that this 5 species mix has been used, all 5 crops have germinated reasonably well on grown to provide good vegetative cover.

The table below indicates the participants who received WCC for experimentation.

Ezibomvini	Eqeleni	Stulwane
Gcinekile Zikode	Ntombakhe Zikode	Khulekani Dladla
Nombono Dladla	Thulile Zikode	Thulani Dlamini
Phumelele Hlongwane	Sbongile Mkhonza	Makhethi Dladla
	Smephi Hlatshwayo	Nelisiwe Msele

These WCC's were broadcasted onto beans only plots after harvested and raked in. For the relay-cropping they were broadcasted once beans were harvested in between the maize rows. Germination and growth has been reasonable this season. The green tops of the radishes are used as 'imifino" or spinach in the households. WCC were grazed by livestock once the maize was harvested and cattle let back into the village. Phumelele Hlongwane from Ezibomvini has fenced her field plots and can now manage the grazing in her field. For other participants cattle feed until they have finished the fodder.

Figure 32: Ntombakhe Zikode's field planted to winter cover crops (Oats seen clearly)

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Figure 33: Pictures above show winter cover crops "Winter master- Oat, fodder radish, & fodder peas" planted by Phumelele Hlongwane, in a plot that was planted to beans only.

In Stulwane both Khulekani Dladla and Dlezakhe Hlongwane harvested seed from their Saia oats. Both reported harvesting around 5 kg of seed (~0,4 t/ha). They kept the WCC until they had seeded and provided cut and carry fodder to their livestock in their kraals.

Figure 34:: Above left; Khulekani Dladla'ss summer cover crop "Sunflower yield" . Above right; Nelisiwe Msele's sunflower yield.

Figure 35: Above left & right shows Thulani Dlamini & Khulekani Dladla's winter cover crop" oat yield"

Yield summaries

Below is a summary table for maize and bean yields obtained and measured in the Bergville area. There were a number of participants who did not obtain any yields due to crop failure and livestock invasions. Some participants however did really well. So, the trend of vastly different yields between participants even within the same learning group has continued.

Table 17: Yield summaries for maize and beans for Bergville viallges;2017-2018

Village	Maize (Trial) t/ha	Maize (Control) t/ha	Maize (min-max) t/ha	Beans (t/ha)	Beans (min-max) t/ha
Stulwane (older)	3,8	-	0,6-10,3	0,84	0,5-1,9
Stulwane (new)	2,3	-	0,4-5,7	1,75	0,7-2,7
Ndunwana (older)	5,3	3,8	1,7-10,8	1,46	0,3-1,8
Ndunwana (new)	2,2	1,5	0,8-6,0	0,47	0,3-0,9
Ezibomvini	8,1	7,5	4,4-13,5	1,62	0,5-2,2
Eqeleni (older)	7,8	3,7	0,9-9,4	1,37	0,3-2,2
Eqeleni (new)	1,0		0,96-1,1	0,26	0,2-0,3
Thamela	4,5	1,8	1,6-7,3	0,51	0,0-1,3
Emabunzini	4,6	-	2,7-10,2	0,94	0,0-2,7
Emazimbeni	7,9	-	3,2-10,6	1,28	0,2-2,1
Vimbukhalo	7,9	-	3,5-10,3	1,29	0,04-2,1
Emangweni- Emaqeleni	5,9	-	0,7-7,9	1,80	

Okhombe	3,5	-	1,4-9,6	-	
Magangangozi	2,8	2,5	0,5-6,7	0,5	0,5
Nsuka	2,8	-	0,0-8,3	-	
Thunzini	3,6	-	0,4-9,5	1,2	0,7-2,0
Ngoba	4,2	-	0,8-10,9	0,5	0,2-0,9
Mhlwazini	6,6		2,7-10,9		
Emahlathini (new)	5,9		3,8-9,6	1,09	0,5-1,4
AVERAGE (older)	**5,7 t/ha**	**3,4 t/ha**		**1,22 t/ha**	

The average yield for the maize CA trials has increased slightly from the 2016/2017 season from 5,03 t/ha to 5,7 t/ha. The maximum yield was recorded at 13,5 t/ha this season. Average bean yields for the trials have also improved slightly from 1,05 t/ha to 1,22 t/ha.

Measurement of control yields has been a problem this season. A new procedure where participants were meant to harvest form a proportion of their control plots, the same size as their trials were tried out. Very few participants actually did this. Control yields were generally just big piles and it was not possible to estimate the harvest. In the cases where participants have now fully incorporated CA into their original control plots, these were no longer measured as controls.

In addition some yields were not monitored; specifically in Emangweni where violence in the community meant the field team could not gain access.

Progress per area of implementation

A few of the learning groups in the Bergville area are also supported through the KZN DARD. This has mostly occurred in Ezibomvini, which is presently the most organised and active learning group. They have received support in planting orange fleshed sweet potatoes and also now have a registered Co-operative - the Gcinekile Primary Co- Operative established in the year 2016. This Co-op consists of 12 members and is headed by Phumelele Hlongwane. These Co-ops are supported with all inputs required for planting, including seed, fertilizer, as well as planting and in the 2017/2018 planting season the group has been assisted to plant 3 ha of dry beans. Yields obtained here are shared equally among participating members and in this past season 08 x 50 kg bags of dry beans were obtained as yield. This translated to at least 2 x 20 litres of dry beans for each registered member. Other villages receiving limited support from DARD include Eqeleni and Ngoba.

Stulwane

Stulwane is one of the oldest villages in the programme having joined in the 2013/2014 season. They are situated in the Emmaus central area of Bergville with neighbouring villages such as Ezibomvini, Eqeleni and Thunzini. To date the group has a total membership of 19 members, with 5 of these members having joined in the 2017/2018 season. A new group has been established as an extension of this area in the 2017/2018 season and this group has 12 members who are in their first year of programme participation.

The following experiments are being run in this village:

- Collecting village weather data i.e rainfall
- Late bean planting using different treatments
- Liming experiment to rectify excessive soil acidity issues

Livestock has presented a major challenge to this year's yields in the village with numerous farmers reporting invasion of stray livestock either early season or late season, which led to farmers with good management practices of trials in terms cropping practice and general maintenance obtaining relatively lesser yields than previously recorded.

Khulekani Dladla and Mtholeni Dlamini of Stulwane were among the best performers in the 2016/2017 season with yields of 7.16 t/ha and 3.85 t/ha of maize respectively. Their bean yields showed signs of slight decreases, not as a matter of mismanagement but due to the invasion of stray livestock into their fields. Drybean yields were recorded at 0.63 t/ha and 1.81 t/ha for dry beans in the previous season and in the current season 2017/2018 season their yields have been recorded at 0.54 t/ha and 1.08 t/ha showing decreases of 0.09 t/ha and 0.73 t/ha respectively.

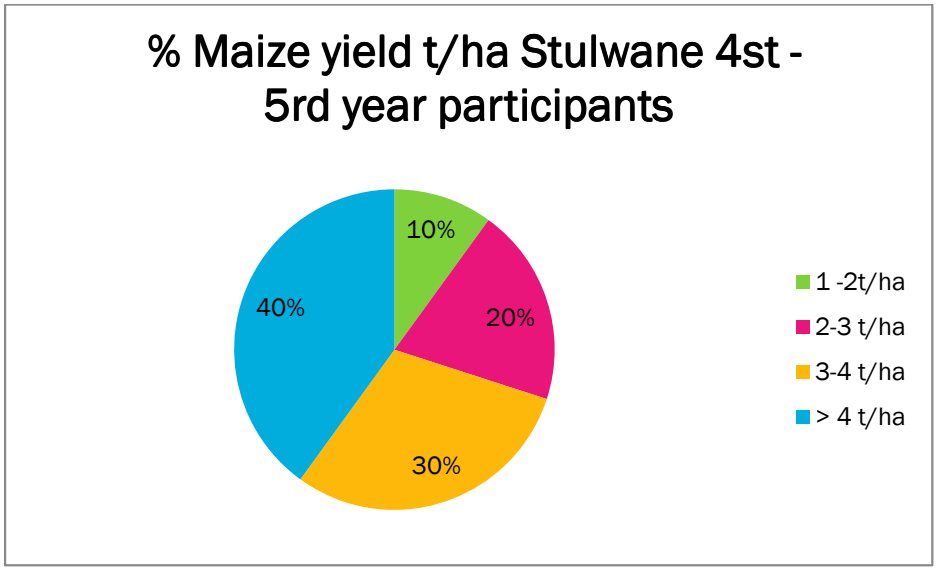
Yields

Table 12 shows the yields of the 2017-18 season in Stulwane.

Table 18: Stulwane maize yields 2017-2018

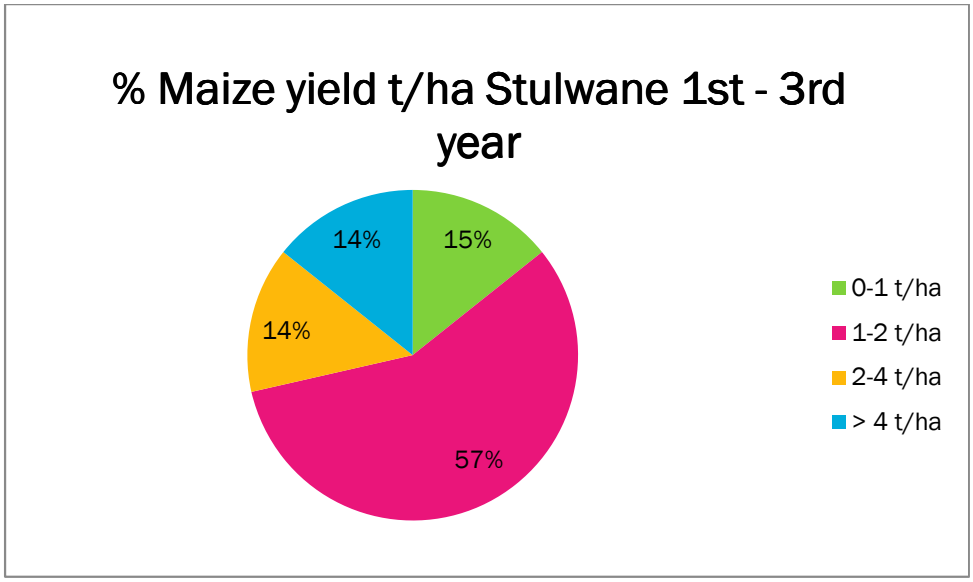
Surname	Name	Trial size (m^2)	Yield t/ha	
			Maize	**Beans**
Buthelezi	Cuphile	1000	2.909	0.724
Dladla	Khulekane	1000	3.489	0.543
Dladla	Makethi	1000	1.581	0.494
Dlamini	Mthuleni	1000	0.654	1.087
Dlamini	Bangeni	1000	3.882	1.268
Dlamini	Thulani	1000	2.292	0.724
Hlongwane	Dlezakhe	1000	4.24	0.181
Hlongwane	Nokwaliwa	1000	9.058	1.977
Miya	Kethabahle/Getty	1000	1.785	0.164
Sithebe	Phasazile	1000	4. 753	1.087
Zondi/buthelezi	Nothile	1000	2.125	0.181
Msele	Nelisiwe	1000	10.27	1.268
Zondo	Hluphizwe	1000	1.899	1.087
Gumbi	Matolozane	1000	4.504	0.906
New Participants 2017/2018				
Dlamini	Dombi	400	1.202	0.776
Zikode	Mantombi	400	1.894	2.718
Mthembu	Hlaleni/flaurence	400	0.497	0.724
Hlatshwayo	Fikile	400		1.812
Dlamini	Dombolo	400	5.699	2.718
Average			**3.48 t/ha**	

An analysis of maize yields for newer and older participants in the village follows.



From the above chart we can see that 40% of the participants in their 4th- 5th year of programme participants in the 2017/2018 season obtained more than 4t/ha while 30% obtained between 3-4 t/ha of maize yield. The effects of stray livestock is evident in this as 10% of these participants obtained yields between 1– 2t/ha of maize yield. The average yield for the 4th -5th year participants is 4.30 t/ha

When comparing the yields of the newer participants to these, it can be seen that a larger proportion of the longer term participants (40%), versus 14% of the new entrant participants have managed to obtain yields higher then 4t/ha.



The newer entrants into the programme are seen to be making good progress as a combined 28% of these participants obtained yields of more than 2 t/ha and 14 percent of these with yields of > 4t/ha.

Figure 36: Top left picture: show Mrs. Phasazile Sthebe's maize yield, Middle centre: Mtholeni Dlamini's maize yield & Top right: Thulani Dlamini's maize yield.

Figure 37:Top left: shows Gogo Nokwaliwa Hlongwane's maize yield and Top right: Mrs. Makhethi Dladla's maize yield.

Ndunwana

This village is situated in the upper Drakensberg towards Cathedral peak and has Thamela as one of its extension villages. This village is in its third year of programme participation and has 25 members in its learning group, 6 more members than they had in the 2016/2017 season. This is one of the fastest growing groups which is also showing signs of good uptake of CA practice. This is evident in this year's initiation of experimentation with cover crops (summer cover crops).

One of this season's awareness days was held in this village on the 15 March 2018 themed *CA practice and the importance of cover crops* and here a total 87 farmers and stakeholders attended, the highest attendance of all three farmers' days that were held t in the Bergville area this season.

Boniwe Mthembu is the local facilitator of the group and because of her literacy has shown signs of good administration of the group, this pertaining to assisting with the monitoring, the collections of yield data and also the upkeep of the installed rain gauge in the village, which is set up in her household.

Some of the highest yields recorded in the 2016/2017 season were those of Elizabeth Hlatshwayo and Shongani Zondo who both had trials planted to intercrops of maize and beans, plus maize and cowpeas at a trial size of 1000 m^2 . They obtained yields of 6.3t/ha and 7.52 t/ha respectively. However this season their yields decreased to 2.815 t/ha and 5.188t/ha respectively. Mam Hlatshwayo's yield decrease was attributed to water shortage across the growing season and she is also of the view that the rotation contributed to this as a smaller area was planted to maize with inclusion of cover crops and legumes in the form of lab-lab in her trials.

Mam Zondo decreased her trial size from 1000 m^2 to 400 m^2 this season because in the previous season she really struggled with the weeding sighting that the chemical was ineffective in managing her weed problem, but apart from this she had obtained good yields from both her trial and control, which meant she had more than enough maize to keep her family going for the year.

Yields

Ndunwana Maize yields 2017/2018

Surname	Name	Trial size (m^2)	Yield t/ha	
			Maize	Beans
Hlatshwayo	Elizabeth/Nomgqibelo	1000	2.8152	1.208
Hlatshwayo/Mthembu	Boniwe	400	10.848	2.718
Hlongwane	Alexina	400	5.7363	0.906
Hlongwane	Nombuso	400	5.430	0.906
Khumalo	Zandile	400		0.906
Mafokeng	David/Bonani/lethiwe	1000	10.362	1.812
Manatha	Gcineni Mavis	400	1.0793	0.906

Zondo/Mazibuko	Shiyiwe	400	2.480	1.812
Mdluli	Makhu	1000	3.957	1.208
Nkala	Tholiwe	400		0.906
Zondo	Matozo	400	9.653	2.718
Zwane	MkhiPheni	Deceased		
Zondo	Shongani	400	5.188	1.812
Hlongwane	Phendukile	400	0	0.362
Mdluli	Khipha/Khosi	400	1.734	1.812
Sithole	Lihle/Hilda	400		0.362
Mkhonza	Sbongile	400	4.649	3.624
Vilakazi	Zabi	400	was absent	0.906
Zondo	Thoko	400	6	0.906
Zimba	Phetheni	400	2.263	0.362
Zondo	Gcwalisile	400	0.038	0.362
Nxumalo	Nomfundo/khosi	400	2.036	0.362
Shabalala	Thembeka	400	0.75	0.362
Average			**3.74 t/ha**	**1.19 t/ha**

Figure 38: Left- Mrs. Elizabeth Hlatshwayo'ss yield, Middle - Shongani Zondo and Right MDF field team counting Mam Nombuso Hlongwane's maize yield.

Magangangozi

Magangangozi village is situated between Mhlwazini and Ngoba villages and they joined the CA programme- in 2014. This village has a total number of 8 participants for the 2017/2018 season. The progress has been slow due to lack of commitment of participants and poor maintenance of the trials. The present participants all joined as new participants in this season. A training workshop was held on the 4th of December 2017 before their planting season. The agenda included herbicide and pesticide application, planting of the trial following CA principles and trial maintenance including good timing of weeding management. Trial management was better for this season when compared to the old participants.

Table 19: Magangangozi maize yields:2017-2018

Surname & Names	Trial description	Maize(t/ha)
1. Hlongwane Buselaphi	2(m+b), 2(m+cp)	4.12
2. Zondo Thulile	2(m+b), 2(m+cp)	6.71
3. Mdakane Buselaphi	2(m+b), 2(m+cp)	0.50
4. Dubazane Shonisile	2(m+b), 2(m+cp)	0
5. Mdakane Bongile	2(m+b), 2(m+cp)	2.68

Thulile Zondo is 42 years old; she was a part of learning group in 2016/2017 season and is the only older participant who joined in the CA programme in 2017/2018 season. She is a mother of 4 children and she is unemployed. Mrs. Zikode planted a 400m^2 trial"2(m+b), 2(m+cp)" and had her own field of maize intercropped with pumpkins as a control. Monitoring was done and % germination was very average; maize was 60-70%, beans was 40-50% and cowpeas was 50-60%. The problem we noticed was that her beans were showing signs of yellowing of leaves which led to crop failure. She took good care of her trial as she weeded on time, starting two weeks after planting. Mrs. Zondo harvested maize weighed 201.404kg, which is equivalent to 6.71t/ha.

Figure 39:Left- Mrs.Thulile Zondo in her trial with (MDF) Field officer Phumzile Ngcobo & Right - Beans showing signs of yellowing leaves.

Eqeleni

Eqeleni village is situated in Emmaus, Bergville under the Okhahlamba municipality. Nearby villages include Ezibomvini, Stulwane and Thunzini. This village has a total number of 22 participants recorded for the 2017/2018 planting season.

Eqeleni is one of the first villages where MDF implemented their CA programme, but the process has not been without challenges. The group is presently split into two sub-groups, due to conflict between some of the members; Smephi Hlatshwayo is leading the one sub-group and Ntombakhe Zikode the other. This has in fact been beneficial as Ntombakhe has taken upon herself to organise the members closer to her, which were in fact too far for Smephi to include properly. Ntombakhe is also a great motivator for planting cover crops and has introduced the new participants in 'her' area to this practice.

A farmer's day was held in Eqeleni (at Ntombakhe's homestead) with a purpose of educating farmers about CA. This was a huge success because more and more people were encouraged to plant cover

crops just by seeing how this group at Eqeleni had planted these cover crops. As a result of such news, we have the village of Vimbukhalo who have planted cover crops for the very first time, through the success of the farmer's day held at Eqeleni.

Figure 40: Eqeleni community group gathered for Farmer's day

One of the issues that these farmers have in common is the problem of stray livestock, which tends to damage their crops. This has had a negative effect on the yields of most of the participants in terms of yield percentages.

Ntobakhe's homestead is also a site for one of the rain gauges and a set of run-off plots. The collection of data here was however very tricky as her daughter was meant to take most of these measurements, being the literate member of the household. She was not committed to this process.

Figure 41: Left-MDF team installing rain gauge at Mam Ntombakhe Zikode's homestead and Right- MDF team installing Run-off plots in Mrs. Zikode's trial.

Eqeleni yields

The 2017/2018 season has been challenging for the Eqeleni farmers, due to the extremely late onset of rains and dry, hot weather throughout the season. Stray livestock also found their way to the fields, damaging the crops that had survived the harsh conditions. This has caused a lot of conflict within the community and has left most people weary.

Besides all these issues, the farmers were able to get some yields, even though most of them were not impressed with what they were able to harvest.

Figure 42: Left and centre-Maize yields for Mrs. Sbongile Zikode and Right- maize yields for Ntombakhe Zikode

The chart below indicates that despite the harsh conditions, 67% of the participants were able to achieve a yield higher than 4 t/ha, with one participant by the name of Smephi Hlatshwayo achieving remarkable yields of of 13.5 t/ha. 22% had a yield between 3-4 t/ha and 11% had a yield between 0-1 t/ha..

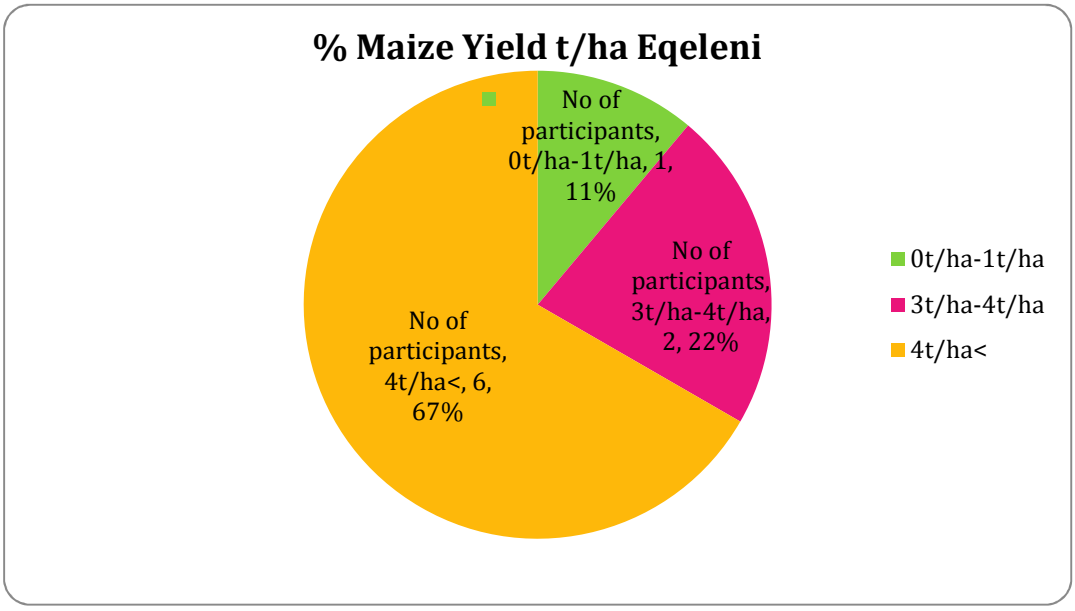


Figure 43: A summary of maize yields achieved in Eqeleni;2017-2018

Issues, comments and suggestions

1. Measuring yields of control plots has been a difficult process form the start. This season a new approach was attempted where participants were to separate yields in their control plots on a small section marked out to be an equivalent size to their trial plots. A lot of time was spent helping participants mark out these sections, but very, very few participants remembered to separate out these yields at the end of the season. It was then too late to estimate these yields. A new process will need to be designed for next season
2. The maintenance quantities of lime of 1 t/ha were supplied for all trial participants. The field team is aware that there are individual participants who require much larger quantities of lime, but the programme is unable to assist in this regard due to budget and resource constraints. Options for ordering bulk quantities of lime, which should be cheaper, will be explored in the coming season as it is also very labour intensive to move around the quantities of 50 kg bags of lime required.
3. This season trucks will be hired to deliver the trial inputs to farmers to reduce the need for the MDF field team to make numerous return trips in their vehicles. A greater reliance will be placed on the local facilitators to manage the distribution of these inputs to their learning group members.
4. Working with infiltrometers, both the single and double ring versions, has proven to be extremely frustrating. Infiltration rates in these high clay compacted soils is very slow and the interns involved literally spent weeks and weeks waiting for water to infiltrate. This is in addition to the difficulties of getting the rings into the soil and finding water to do these measurements. A decision has been taken to remove this measurement, as the results obtained are very inconclusive in terms of improved soil structure.
5. This season, due to the long periods between rainfall events and the sometimes very small rainfall amounts of between 1-10mm, the rain gauges and run-off plots have not been well tended by the participants involved. Readings have been very patchy and consequently the results have been unusable in most cases. Going into the next season, interns will be given the responsibility for collecting this data and ensuring in an ongoing way that participants are up to date with their readings.
6. Consolidation of the 17 existing villages has been a good idea, as the team is at the limit of their implementation capacity. This does mean that bringing new villages on board – of which there are a number, will be a huge challenge going into the next season. Joint learning sessions across 3-4 villages will need to be organised and in the older groups Local facilitators are to do the planting demonstrations for the new participants.
7. The review of 4th and 5th year participants' farmer led experimentation has been very successful and a similar process will be undertaken in the coming season.
8. With respect to the payment of subsidies for the trials, this year's payment in some of the groups has been very promising. We have however seen a bit of attrition in the older groups as some participants have fallen away through not being able to pay for their trial inputs. This is not a problem in and of itself, but it does mean that the poorer participants, or those less

organised are being excluded. Overall not enough is being recouped from these subsidies to cover the trial input costs for such a large group of participants. Further financial support for this process will need to be found.

9. Monitoring has been streamlined in the present season, with different field team members being responsible for certain aspects such as the visual soil assessments, the soil fertility sampling and analysis, and the quantitative measurements. There has however been a bit of a lack of communication between the team members and so not all the data has been coherently recorded. The issue was picked up mid-season and has been rectified, but some of the early season data is now unavailable.
10. Not much progress is being made with the PES system development. It has however been decided to work primarily from the 3 major CA principles instead of the more detailed indicators that have been used previously.