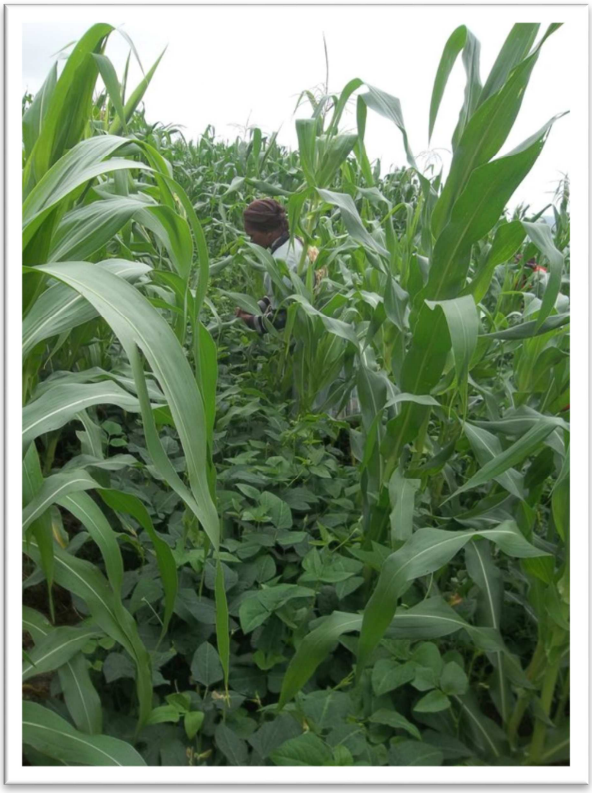
ATTACHMENT 2: ANNUAL REPORT

CA Farmer Innovation Programme (CA-FIP) for smallholders, Grain SA, October 2013 to May 2014

Farmer Centred Innovation in Conservation Agriculture in upper catchment areas of the Drakensberg, KwaZulu-Natal and Eastern Cape Provinces



Mahlathini Organics:

Promoting collaborative, pro-poor agricultural innovation.

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Time of operation: 2003-2013

Legal status: Sole proprietor (SP)

BEE: Automatic for SP - 4.

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Summary

Mahlathini Organics has implemented two pilot projects under the Grain-SA CA-FIP, for the introduction of conservation agriculture (CA) among smallholders in the upper catchment areas of the Drakensberg, Matatiele (EC) and Bergville (KZN), during the period of October 2013 to May 2014.

Through a partnership with the SaveAct Trust, the pilot was introduced to organised smallholder farmer groups. Farmers are organised into localised saving and credit groups (SCGs) and from there into commodity interest groups (CIGs) depending on their interest and focus in agricultural enterprise development. Learning groups in CA were formed from existing CIGs for maize production and within these groups volunteers undertook to do adaptive CA trials in their fields. A total of three local facilitators were brought on board in 4 of the 6 villages where the process was introduced; i.e. where individuals with the required capacity and motivation volunteered.

Farmer volunteers planted adaptive trials of between 100-1 000m² in size, with intercropped blocks of maize and beans and maize and cowpeas, using hand hoes and CA planters (Matracca [jab planter], MBLI[hand-hoe type planter], Haraka [wheel] and animal drawn planters). Herbicides were used pre and at-planting. Micro-dosing of fertilizers was done according to soil sample results and pesticides were applied for control of cutworm and stalk borer. High plant density systems (narrow rows and high plant populations)were used. Volunteers also planted control plots using their habitual (traditional) practices. Inputs were provided for the trial plots and all other inputs and labour were provided by the volunteers themselves. A total of 51 volunteers planted 3ha of trial plots and 8.4ha of control plots. Plot sizes in Matatiele were much smaller than in Bergville, as people there plant mainly in their fenced household plots, rather than in their fields, which can be quite a distance away from their homes.

During the season Farmer Field School (FFS) sessions were held for each learning group, including practical field walks and assessments and theoretical concepts around CA principles, soil fertility, soil management, soil sample analysis, soil water holding capacity, erosion control, pest control and cover crops. The Mahlathini Organics field team assisted farmers in preparation and planting, top dressing and pest control, planting cover crops, ongoing monitoring of the trial plots and harvesting and yield estimations. Towards the end of the growing season a farmers' day was held in each village to further popularise the CA concepts in those areas and to engage and share with key agricultural and development stakeholders. These days were very successful and attracted a large number of people.

Monitoring of the following aspects was done for each participant:

- Soil characteristics: crusting, hardness and run-off
- Soil cover at planting and during the season (crop canopy)
- Germination rates in trial and control plots
- Presence of weeds and pests and
- General growth of the crops: germination and growth, height and colour.

During several field site (trial) assessments, subjective scores were given jointly by the field work teams and farmers, for each of the above aspects and these were combined to give a final score for each trial and control plot out of 10. These assessment protocols and findings will be used in continuous monitoring and evaluation (M&E) processes during the lifetime of the projects.

Labour requirements for planting and maintenance of the crops were assessed. Yield data for the dry beans and cowpeas were collected where possible. Maize yield data is still outstanding as harvests are only brought in towards the end of May to early June.

Germination of crops, especially legumes was quite low. Germination of maize averaged around 50-75% and beans and cowpeas around 25-50%. The very low germination rates of legumes are attributed to rodent and bird

(including free range chickens) damage of seed and seedlings, lack of rain after planting and possible herbicide damage for both Matatiele and Bergville and soil borne bacterial pathogens in Bergville only.

Yields for legumes were comparable to commercial figures, notwithstanding late season hail and rain that destroyed some of the crops. In Bergville average yield for beans was 1.26t/ha and for cowpeas was 800kg/ha. In Matatiele the average bean yield was 1.23t/ha and cowpea yield was 750kg/ha.

Farmers' days were held for all 6 villages involved to showcase the work of the farmer participants and the commodity interest groups to the broader community and relevant stakeholders. This process has assisted in bringing agribusiness and the University of KwaZulu-Natal (UKZN) on board and in expanding the farmer innovation process into new areas.

1. Key activities: October 2013 to May 2014

The table below outlines the key activities and deliverables planned for the period of October 2013 to May 2014. The last column summarises actual achievements.

TABLE 1: KEY ACTIVITIES, OUTPUTS AND DELIVERABLE FOR OCTOBER 2013-MAY 2014; PLANNED AND ACTUAL ACHIEVEMENTS.

MONTH October 2013	**KEY ACTIVITIES**	**PLANNED OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**
R45 000 (HR) + R75 000 Materials) **R120 000**	Identify and meet key stakeholders Farmer selection; Set up groups / committees stakeholders Set up process for 1st level experimentation Set up experimentation in two study sites Reporting and admin	Meeting reports or minutes List of farmer participants Awareness & training of farmers Design farmer-led trials Procurement of production inputs	100% complete Meeting reports, farmer participants, procurement quantities for each area, trial design outlines, monthly reports, invoices and budget summaries R50 381.10 (HR) + R48 409.92 (Materials) = **R99 084.42**
MONTH November 2013	**KEY ACTIVITIES**	**OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**
R50 000 (HR) + R75 000 Materials) **R125 000.00**	Identify and meet key stakeholders Farmer selection; Set up groups / committees Set up experimentation Set up process for 1st level experimentation Social learning event in each study site Reporting and admin	Meeting reports or minutes List of farmer participants; Commodity interest group MoU's Established trials and purchase remaining inputs, equipment Awareness & training of farmers; design and signed farmer-led trials Monthly Innovation Platform Meetings – minutes Monthly report and invoice	**NOT DONE** - CIG MOUs - Monthly Innovation platform meetings **100% complete** Meeting reports, farmer participants, established trials, purchase remaining inputs, monthly reports, invoices and budget summaries R72 541.76 (HR) + R70742.73(Materials) = **R143 284.49**
MONTH December 2013	**KEY ACTIVITIES**	**OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**

R45 000(HR)	Identify and meet key stakeholders Facilitate groups / committees Facilitate process for 1st and 2nd level experimentation Reporting and admin	Meeting reports or minutes Commodity interest group meetings; Awareness & training of farmers Farmer-led experiments by selected farmers	100% complete 100% Bergville, 30% Matatiele R45 634.05 (HR) + R1 037.40 (materials) = **R46 671.45**
MONTH January 2014	**KEY ACTIVITIES**	**OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**
R41 250	Facilitate process for 1st and 2nd level experimentation Design and Participatory monitoring of 1st and 2nd level experimentation Reporting and admin	Farmer-led experiments by selected farmers;crop monitoring scores Participatory monitoring reports Baseline methodology and initial interviews Monthly report and invoice	80% Bergville, 50% Matatiele **NOT DONE-** Baseline methodology and interviews R62 356.60 (HR) + R1 694.50 = **R64 051.10**
MONTH February 2014	**KEY ACTIVITIES**	**OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**
R51 250.00	Facilitate process for 1st and 2nd level experimentation Participatory monitoring of 1st and 2nd level experimentation Facilitate focus groups Social learning event in each study site Annual reference group meeting Reporting and admin	Farmer-led experiments by selected farmers; crop monitoring scores Participatory monitoring reports Group meetings & interviews Innovation Platform Meetings - minutes Annual Innovation Platform Meetings – minutes 6-month progress report and monthly invoice	100% Bergville, 50% Matatiele Participatory monitoring reports, group meetings ,learning workshop reports **NOT DONE-** Annual innovation platform meeting, innovation platform meetings
MONTH March 2014	**KEY ACTIVITIES**	**OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**
R73 399.73	Facilitate process for 1st and 2nd level experimentation Participatory monitoring of 1st and 2nd level experimentation Social learning event in each study site Facilitate focus groups Reporting and admin	Farmer-led experiments by selected farmers – harvesting and yield calculations for legumes, planting of cover crops Participatory monitoring reports Group meetings & interviews Innovation Platform Meetings - minutes Monthly invoice and report	80% Bergville, 60% Matatiele Participatory monitoring reports, group meetings and learning workshop reports Innovation platform meetings in Bergville, **R73 399.73**
MONTH April 2014	**KEY ACTIVITIES**	**OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**
R69 064.84	Facilitate process for 1st and 2nd level experimentation Participatory monitoring of 1st and 2nd level experimentation Social learning event in each study site Facilitate focus groups Reporting and admin	Farmer-led experiments by selected farmers – harvesting and yield calculations for legumes, planting of cover crops Participatory monitoring reports Group meetings & interviews Meeting in new areas for scaling out in year 2 Monthly invoice and report	100% Bergville, 100% Matatiele Participatory monitoring reports (harvesting and cover crop planting), group meetings and learning workshop reports Innovation platform meetings in Bergville and Matatiele **R69 064.84**
MONTH May 2014	**KEY ACTIVITIES**	**OUTPUTS/ DELIVERABLES**	**ACTUAL ACHIEVEMENTS**

R74 303.38	Finalisation of 1st and 2nd level experimentation Evaluation, documentation and planning Facilitate groups to prepare for new season Reporting and admin	Farmer-led experiments by selected farmers – harvesting and yield calculations for legumes, planting of cover crops Participatory monitoring reports Group meetings & interviews Meeting in new areas for scaling out in year 2 Monthly invoice and report Yearly report finalisation	100% Bergville, 100% Matatiele Participatory monitoring reports (harvesting and cover crop planting), group meetings around budgeting, bulk buying and planning for 2nd year and learning workshop reports Meeting reports and attendance registers' for new areas. Yearly report finalisation **R85 857.26**

1.1.Expenditure statement

The budget was reworked in April 2014 to bring forward the completion period for this funding from September 2014 to End June 2014. A summary is provided below in **Table 2**. Expenditure and activities are on target.

In this way the next round of funding can start in July 2014. Work in the two areas will then be undertaken as two separate projects with their own budgets and reporting frameworks

TABLE 2: EXPENDITURE CATEGORIES; ESTIMATED BUDGETS AND ACTUAL EXPENDITURE SUMMARIES

Categories and timing of expenditure	***Estimated***	***Actual***
TOTAL TRENCHE 1: October-December 2013	***R 290 000***	***R290 735.76***
TOTAL TRENCHE Jan-April 2014	***R260 225.10***	***R260 225.10***
Subtotal: Materials expenditure	***R150 000.00***	***R124 226.18***
TOTAL expenditure end May :	***R622 381.73***	
To be claimed end June for finalisation	***R75 618.27***	

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2. Results achieved to date

This report builds on information provided in the 6 monthly report, which is not repeated here.

2.1. Summary of farmer participation and trials planted

The table below gives the final summaries for the number of farmer innovators who remained active throughout the season. The areas planted to controls are also provided as this signifies the participants' own contribution. The areas planted in Bergville were much larger than in Matatiele, which is both an indication of the general trend in the areas and the greater commitment and confidence in planting crops in Bergville as compared to Matatiele. In Matatiele, people planted in their household gardens or plots, which are quite small. Fields tend to be quite far away from the homesteads due to earlier betterment planning in the area and have been disused for some time.

TABLE 3: SUMMARY OF FARMER INNOVATION NUMBERS AND AREAS PLANTED PER VILLAGE AND REGION IN THIS CA PROCESS.

Area	Village	Learning group size	Farmers and Trials	Local facilitators	Comments; incl hand planters used.
Bergville, KZN	Stulwane	56	12 Farmer innovators Trials: 8 120m²; 1000m² average for trial plots	Mrs NM Dladla (520m²)	Local facilitator changed and 3 extra volunteers brought on board 1 animal drawn planter, 2 Matracca, 1

			Controls: 39 092m²		MBLI, 5 hand hoes only.
	Emmaus	38	9 Farmer innovators Trials: 9000m²; 1000m² average for trial plots Controls: 27 951m²	Mrs Smephi Hlatshwayo (1000m²)	Group worked well together and helped each other plant. No animal drawn planter, 2-3 MBLI planter, 5 hand hoes only
	Potshini	18	7 Farmer innovators Trials: 8 930m²; 1000m² average for trial plots Controls: 9 119m²	Mr Mduba (2 400m²)	2 animal drawn planter, 1 MBLI, 5 hand hoe only. The soil was very hard for the hand planters.
SUB TOTAL		112	28, (26 050m²)		
Matatiele	Lubisini	16	6 Farmer innovators Trials: 1200m² Controls: 2655m²	-	2 Matracca, 2 MBLI, 1 hand hoe only.
	Pontsheng	27	7 Farmer innovators Trials: 1300m² Controls: 2934m²	-	1 Matracca, 5 MBLI,
	Khaoue	18	10 Farmer innovators Trials: 1132m² Controls: 3310m²	Mr Simon Tsoloane (1200m²)	1 animal drawn planter, 2 Matracca, 2 MBLI,
SUB TOTAL		61	23, (3 632m²)		
TOTAL		**173**	**51 trials (29 8682m²)**		

2.2. Estimated duration to completion

The project is to be completed on schedule in June 2014. Between May and June, learning and evaluation workshops, and planning processes will be conducted. Harvesting and yield calculations for maize will be finalised and progress of the cover crops in the few fields where they have grown will be assessed.

2.3. Outcomes of the CA trials

Farmer-led experimentation or trials is one of the key strategies applied by the FIP to empower farmers with new knowledge and skills in CA. Summaries of observations made around the implementation of the farmer-led adaptive trials and some of the problems encountered in the two study areas are provided below. Specific summaries for each of the 6 villages involved are provided in **Attachment 1a**.

The trials themselves were designed by the facilitation team for this round of experiments to include a number of concepts and recent innovations in CA, including hand- and animal operated CA planters, high density cropping, intercropping, cool season cover crops and low-dosage fertilisers.

Based on these observations and further individual planning with each of the present farmer participants, the next round of farmer experimentation for these participants will be based on their experience and parameters. The prime outcome is farmer empowerment and improved innovation capacity, while the process gives attention to capacity building, local decision-making and organisation (of social innovation platforms). These aspects are seen as crucial in building in the elements of sustainability into the project process and for providing a basis for implementation of CA in these communities in the future, with limited intervention.

2.3.1. Intercropping

The following statements are a summary of the results achieved on the intercropping treatments of the farmer-led trials:

1. A lot of rain towards the end of the season reduced dry bean yields in the Bergville area.
2. The climbing beans planted by Mrs Hlatshwayo (Emmaus) did not show quite so much moisture damage as the intercropped dry beans and having seed pods off the ground helps. Obviously there is more biomass.

3. People have a habit of pulling out bean plants for harvesting. For some the field team did not get to them in time to ask to leave the plants in the ground and only harvest pods. Many did not feel this would work as it takes a lot longer.
4. Maize-cowpea intercrops in a few trials showed the maize taller and greener than for the Maize bean intercrop. Cowpea covers the soil a lot more quickly than beans (after 6 weeks around 90% for cowpea-maize and around 55% for beans-maize), grows in an indeterminate fashion and thus produces more biomass, but seed pods dry sequentially over a period of time – not all at the same time. This means more attention in terms of harvesting, so harvesting a couple of times. Most participants did not do this – finding time to harvest difficult, or not used to this much focus.
5. Single planted plots had a lot more trouble with weeds throughout the season. And especially mid-season. Ground cover also not as good as for intercrops – so around 15-30% after 6 weeks rather than ~82.5%. The yields for these plots have however been higher on average, than for the intercropped plots
6. In Matatiele, where farmers have flocks of free range traditional poultry in their fields, cowpeas especially were 'grazed' down to a point of zero yield. In the Bergville area, the poultry also had 'access' to other fields and crops and thus damage was not as great.
7. The legumes appear to be more sensitive to herbicides such as Round-up, showing reduced germination and initial yellowing in the plants prior to a later recovery. This was visible in trials where the two week waiting period for spraying Roundup could not be adhered to due to rain and timing (for most plots in Matatiele) and where participants sprayed Roundup at planting as well (from most trails in Bergville area).

2.3.2. Pest control and disease control

The following statements are a summary of the results achieved on the pest and disease control of the farmer-led trials:

1. Stalk borer was well controlled in some cases. In others a few participants added stalk borer granules 8-9 weeks after planting. There may be break-outs of stalk borer later in the season as population pressure might be very high. If the Decis Forte (insecticide) is not used around 6 weeks after planting the stalk borer infestation is high towards the end of the season.
2. Also, later in the season CMR beetle infestation is very high. A pesticide to deal with this may be required.
3. In some plots, notably in Potshini, bacterial diseases (transmitted through the soil) were present, such as bacterial wilt and halo blight. This could be due to previous plantings of potatoes and tomatoes in the same fields.

2.3.3. Soil fertility management

The following statements are a summary of the results achieved on the soil fertility management of the farmer-led trials:

1. MAP (5 bags ha^{-2}) and Lime (20 bags ha^{-2}) were applied at planting using micro-dosing practices and plots were top dressed with LAN (3 bags ha^{-2}). The quantities were determined by averaging soil sample recommendations from the Bergville area.
2. Organic carbon and nitrogen in the soils are extremely low, especially in Matatiele area where the soils are sandier; generally soil carbon (%C) is less than 0.5%. Growth of crops in this area was average only and lack of soil nutrients could have been a contributing factor. Potassium would have been required as well in most of the trial plots, although yield decrease due to this shortage is only around 5%. Lime was not needed for maize, but only beans.
3. In Potshini, due to the extremely high percentage clay soils (up to 50%), soil organic carbon is higher at around 0.7% and soil acidity is more pronounced. Crop growth in this area was much better with the MAP, Lime and LAN provided.

4. Top dressing with LAN was not possible in plots that were too weedy at the time. Thus many of the plots in Matatiele did not receive LAN and crop growth was hampered. In Bergville area LAN was used for both the maize and the legumes and was in fact supplied at a rate almost double the recommendation. In future the dry beans need not be top dressed (if not inoculated) as this promotes vegetative growth, potentially over seeding.
5. Addition of fertilizers to basins, rows and individual plants is done by using local measures such as bottle tops teaspoons, table spoons and handfuls. This has been a little problematic in terms of the micro dosing approach as these measures are not accurate enough, providing at times less than half and at other more than double the recommended amounts. More care needs to be taken and measuring 'tools' may need to be provided.

2.3.4. Weed control

The following statements are a summary of the results achieved on the weed control of the farmer-led trials:

1. The use of Round-up 7-14 days prior to planting and Round-up and Dual Gold at planting, provided good weed control in ideal conditions, where farmers then did not have to weed at all, or only had to weed once around 3-4 weeks after planting.
2. The suppression (control) of weeds was greatly enhanced by the crop canopy of the high density cropping system.
3. In less than ideal conditions (including faulty spraying, rain soon after spraying and lack of soil moisture for a few weeks after planting), some of the plots were extremely weedy-and grass species especially competed with crop growth.
4. Pernicious grasses such as couch grass, nut grass/sedge and kikuyu are a challenge and were not fully controlled with the herbicides chosen. In these cases and where initial cover of 2-3 year old growth of grasses is present prior to planting a different herbicide regime will need to be tried out.

2.3.5. Harvesting

The following statements are a summary of the harvesting results achieved from the farmer-led trials:

1. Harvesting of green maize in the trial plots has been almost inevitable. Farmers have been asked to keep a record of what they have consumed prior to the main harvest. This will lead to some inaccuracies in overall harvests recorded.
2. Beans are harvested by pulling out plants and laying them in the yards for further drying. Both these processes lead to some yield loss – as beans may be left until dry in the fields – a habit that lead to yield losses due to pod shattering in the fields as well as some consumption by rodents and birds. Once in the yard, the beans are trampled by livestock and eaten by poultry prior to threshing.
3. Some loss of maize yields due to rodents and birds while drying is also inevitable.
4. Storage of grain is less than ideal in most cases and attention will need to be given to safe storage and also reduction of storage pests such as weevils and rodents.

More detailed analysis of some aspects of the farmer based trials and implementation process will be provided in the section below.

3. Soil characteristics

3.1.Soil sample results

Growth of the trials in Matatiele were generally very average compared with Bergville - even though the same fertilizer recommendations were used. The table below summarizes recommendations made and used. Given the distinct differences in the soils from the two sites, notably in acidity, clay content and 'natural fertility', future recommendations will take these into account.

Generally, smallholder farmers will buy an 'average' amount of a fertilizer known to them, that may have been recommended for their soils before, or used by people they know. Even if soil sample results are available, a larger

proportion of the farmer participants are likely to try and simplify their input requirements to 1 or 2 types of fertilizer to keep matters uncomplicated for them, and/or because of a lack money to buy sufficient amounts of fertilizer.The generalised fertilizer recommendations, given to farmers for their trial plots has taken this trend into account – so that only one type of fertilizer is applied at any time. This also removes the complications of mixing fertilizers

TABLE 4: GENERALISED FERTILIZER RECOMMENDATIONS MADE FOR THE FARMER PARTICIPANT TRIAL

Amount of nutrient required	No of bags (50kg) recommended per hectare; fertilizer name	Ave recommendation from 15 soil samples (50kg bags/ha)
N (Maize): 60kg-150kg/ha (yield target: 4-7t/ha)	LAN (topdressing): 4 bags (200kg)	LAN: 2-8 bags
N (Dry Beans): 20kg-60kg/ha (yield target: 1-3t/ha)	LAN: -topdressing not required	LAN: 0-2 bags
P: 55kg-70kg/ha	MAP (at planting): 5 bags (250kgs)	MAP: 5 bags
Lime: 1ton/ha	LIME (at planting): 200 bags (1ton)	LIME: 200 bags


Above left: Mrs Hlatshwayo's field (Emmaus-Bergville) 6-7 weeks after planting and Above Right Mrs Dzingwa's field (Khauoe Matatiele) at about 6-7 weeks after planting. The general growth and canopy cover offered by the crops in the Bergville case is much better than in Matatiele.

See Attachment 2 for the soil sample results from Matatiele and Bergville

TABLE 5: SOIL SAMPLE SUMMARIES FOR MATATIELE

Soil property	Average (7 samples)	Comment	Action
% Organic carbon	<0.5%	Organic carbon is very low due to continuous tillage and sandy soil conditions. Soil cover was low in most instances and bare soil was evident even late in the season.	Building soil organic matter (SOM) is important – pursuing CA practices, including permanent organic soil cover or mulch, green manure cover crops, , manure, crop diversity and minimum mechanical soil disturbance
% clay	<9%	Soils are sandy with low fertility and have a tendency for soil crust formation leading to water runoff and erosion..	Soil cover is important to improve soil structure and/or natural soil fertility.
%N	<0.5%	'Natural' or residual N in the soil is extremely low due to low SOM levels and lack of legumes in the crop rotation.	Taking careful note of fertility requirements and making sure that top dressing is done in the initial phases (1st couple of seasons). Investigate the availability of good quality manures and compost, as well as legumes in the rotation. Nitrogen applications should be determined by yield expectations, crop type, soil

			type, rainfall, past and present management factors, etc.
Acid saturation	~9%	Acid saturation values are low.	Lime is required only for legumes, as maize is slightly acid tolerant. It would be a good idea to apply lime on all the fields as a precaution.

TABLE 6: SOIL SAMPLE SUMMARIES FOR BERGVILLE

Soil property	Average (7 soil samples)	Comment	Action
% Organic carbon	0.8 - 3.7%	Organic carbon values are fairly high resulting in higher natural fertility levels. Some of the plots have been under a natural grass ley system that resulted in a build-up of SOM.	Building and conserving SOM is important – pursuing CA practices, including permanent organic soil cover or mulch, green manure cover crops, , manure, crop diversity and minimum mechanical soil disturbance
% clay	35-50%	Soils have high clay contents resulting in high natural soil fertility (cation exchange capacity). The workability of these soils, especially under 'no-till' conditions, might be low.	Soil cover is important to continuously improve the soil structure and workability of the soils, as well as maintaining fertility levels.
%N	0.23-0.32%	Nitrogen levels are still low, primarily due to a lack of legumes in the crop rotation system.	Investigate the availability of good quality manures and compost, as well as legumes & cover crops in the rotation. Nitrogen applications should be determined by yield expectations, crop type, soil type, rainfall, past and present management factors, etc.
Acid saturation (AS) and pH	40% pH 4	AS values are moderate to high due to the natural acidic soils in the area, while pH values are very low to low.	Lime application is a prerequisite for sustainable crop production in this area and appropriate liming practices under smallholder CA systems need to be investigated.

4. Crop monitoring scores and yields

Each trial was monitored at planting, during growth (at least once) and at harvest. Monitoring was conducted jointly by the farmer participants and the field team. The aim is to create a farmer and field worker level methodology that is simple, easy to assess visually, rapid, immediate, cheap and scientifically robust. This latter criterion will still need to be thoroughly tested.

The visual Soil- Field Assessment Tool (VS-Fast), developed through the FAO for their Land Degradation Assessment in Drylands (LADA) project [1], serves as a basis for the idea. This is a soil assessment methodology using a critical set of measures – given the synergy between these measures and the links between these measures and land degradation. For this first season a few of these measures were used, including crusts (hard setting surfaces), surface run-off, the incidence and percentage of soil cover and presence of and depth of tillage pans. Measures that are to be included in the next round of farmer based trials are soil structure, texture, colour, slaking, earthworms and presence, depth and type of roots. These measures are combined with soil sample testing that includes pH and organic carbon.

Criteria were developed to score the progress of crop development, both for the CA trial and the person's control, to provide a subjective means of comparing these plots against each other and also to provide a way to compare different trial participants' plots. See the table below for a description of the criteria.

[1] McGarry, D. 2010. A methodology of a Visual Soil-Field assessment Tool - to support, enhance and contribute to the LADA program. Natural Resources Sciences, Queensland Government, Australia. FAO.

TABLE 7: RATING AND DESCRIPTIONS FOR SCORES USED IN FIELD ASSESSMENTS.

Criteria	Score rating	Description
%Cover at planting	0% – none (Completely bare soil with no organic matter evident) 100% - full cover (completely covered soil with a lot of organic matter evident)	The field team estimated the cover from organic matter (e.g. crop residues) and dead weeds at planting in a 1mx1m area.
% Weeds	0% – high weed infestation, totally outcompeted crops (Completely covered by weeds, no crops visible) 100% - no weeds, no impact on crops (completely covered by crops, no weeds visible)	The field team again looked at a representative area within the trial and compared the area covered by weeds and the area covered by the crops – so 50% would be half weeds, half crops
% pests	0% - Large numbers of pests, extreme damage, crops failed or do not yield at all. 100% – no pests, no damage, no yield loss	The field team subjectively decided upon this score after inspecting the field with the farmer, checking on pests present on the day of assessment and their severity, as well as any damage done to the crops.
% growth	0% - no germination, no growth, -crops have died 100% - full germination and stand, dark green, excellent plant development and completely healthy (germination colour height health)	The field team checked germination, colour and height of plants at the particular growth stage to decide upon a score.
Overall score (10)	The 4 criteria (cover, weeds, pests and growth) were added together and a score calculated out of 10.	

Percentage germination of seeds was also recorded - both to assess the growth, but also to compare the effectiveness of the different CA planters tested. Yields for crops are also being recorded, including comparing yields between the participant's control plots and trial plots and then within the trial plots the intercropped and single block plantings of crops.

The scores that were obtained for each of the participant farmers were averaged for each village, across each area and then for the whole group. Yield data for the legumes planted in the trials are also provided. Maize yield are not yet available. The results are shown in the table below. The summary scores for participants are shown in **Attachment 1c**. **Appendices 1-6** provide the detailed scoring information for each participant.

TABLE 8: SUMMARY OF CROP MONITORING SCORES FOR ALL PARTICIPANT FARMERS IN BERGVILLE AND MATATIELE

	Trial score (x/10)	Control score (x/10)	Ave yield beans (t/ha)	Ave yield cowpeas (t/ha)
Matatiele				
Lubisini	5.04	4.96	1.43	
Pontsheng	5.72	3.68	2.02	0.71
Khauoe	5.34	5.49	1.07	1.05
Average	**5.39**	**5.14**	**1.26**	**0.69**
Bergville				
Stulwane	6.85	5.5	0.91	1.04
Emmaus	6.54	5.85	1.27	0.53
Potshini	5.41	5.15	1.43	0.88
Average	**6.27**	**5.50**	**1.20**	**0.82**
Overall Average	**5.83**	**5.32**	**1.23**	**0.75**

From these results and general visual observations the following points can be made:

- There was a lot of variability in crop management, growth and yield between the participants. This is to be expected in farmer-led trials. These scores will be used again in the coming season to assess each farmer's improvement on their management practices.
- Although trial scores are fairly 'average', it is to be expected for the performance of farmer-led trials in their first year. Previous experiences have shown that smallholder farmers take between two and four years to develop sufficient knowledge and skills to master the new CA practices, during which there will be a steady upsurge in performance.
- Yield levels are not reflected directly by high or low crop monitoring scores. Some farmers with reasonably low scores had good yields and vice versa. This clearly indicates the need to consider both crop management factors and yield data in doing assessments and also having to consider the vagaries of weather and natural events.
- Looking at highest and lowest scores could also be useful.

	Highest score - trial	Lowest score trial	Highest yield beans (t/ha)	Lowest yield beans (t/ha)	Highest yield cowpeas (t/ha)	Lowest yield cowpeas (t/ha)
MATATIELE	6.5	4	1.84	0.6	1.54	0.3
BERGVILLE	7.5	4.5	2.1	0.2	3	0.2

- Participants in Bergville area, especially in Stulwane and Emmaus looked after their plots well. They did top-dressing and sprayed at planting and mid-season for pests. Their trials grew very well and this is reflected in the higher crop monitoring scores and high end yield data for Bergville.
- Participants in the Emmaus area were unconfident and waited for the facilitation team members to be present before doing anything in their plots. This resulted in many doing no weeding and not doing top dressing and mid-season pest spraying. The plots did remarkably well under such extreme weed pressure but the lower crop monitoring scores and lower high end yields are indicative of this situation.
- In Bergville legume yields were severely affected for some participants by bad germination, late season hail storms and continual rain causing seed to rot prior to harvesting. In Potshini in particular legumes were affected also by soil borne diseases, not present in the other areas. In Matatiele legume yields were mostly affected by bad germination, weeds and grazing pressure from free range poultry and rodents.

In Matatiele, there is a local process of piling stover after harvesting of maize and beans, to be used as feed for livestock into the winter season. Some smaller farmers who do not have their own livestock will sell this stover to others in the community. This will have implications for the required soil cover for the CA process and will need to be discussed and interrogated with the participants.

Right: An example of stover staked after harvesting(Lubisini Matatiele). This stover will be sold to farmers who own livestock

In Bergville all the processes such as harvesting dates and periods and the timing for letting cattle back down from the mountain grazing into the villages to graze on the

field residues are decided by the Nkosis' and their representatives. Again there is an issue with crop residues not being left on the fields and rather being used for livestock feed. This is a very longstanding tradition and not a process that will easily be altered.

To increase the potential for cover, crop residues nod increased organic matter in the soil, different combinations and timings of cover crops planting may be an option, as would ways to increase the amount and quality of manure used in the fields. Discussions have been started with a few individual farmers about fencing in their fields and not allowing livestock access to at least portions of their fields to observe the differences.

5. Planting Cover Crops

The following cool-season cover crop mixes were obtained from Southern African Cover Crop Solutions based at Umlaas Road in KZN:

- Winter Grazing Rye, SAISA Oats and forage peas
- SAISA oats, fodder radish, and forage peas and
- SAIA oats alone.

Participants were advised to sow the seed in between the drying maize rows as they were harvesting the legumes and doing a last late season weeding. Weeds were to be placed on the ground and in the process a mulch formed for germination of the cover crops seeds. Planting started end March to early April. Sowing of one mix per 10x10block of the trail was suggested. A few participants volunteered further to plant the cover crops mixes in their fenced vegetable garden areas, as a reserve and to keep seed for future plantings.

Below are examples of cover crop planting done by a few of the participants in Stulwane and Emmaus (Bergville).

Mrs Makethi Dladla: Her fields are unfenced, as are all fields in that community. She also sowed the crops in her small garden 10mx8m. The cattle and horses are not well controlled at this time of the year and come down from the hills earlier in the afternoons – before the boys are home from school to do the herding. They have necessitated the early harvesting of maize and have already grazed the cover crops in the field trial areas.

Clockwise from top left: Cover crop mix (rye, oats, peas) having grown and then grazed back by livestock. The same mix growing well inside the fenced garden area. Maize harvested slightly prematurely with damage from livestock evident.

Some of the participants mixed the three cover crop mixes together and sowed them as one mix. It appears in these cases and from the monitoring for all participants who actually sowed the cover crops that the Fodder radish did not really germinate or grow. The Forage peas also germinated rather sporadically and could not really be quantified.

Above Left; Cover crops growing in Mrs Dlamini's field (Stulwane)- mostly the oats are visible at around 5-6 weeks of growth . Above right; Cover crops growing in Mrs Zikode's field (Emmaus) – A similar situation of the oats being the only crop in the mix easily visible exists here as well. A few forage peas were evident but no radish. Some weed competition evident, mostly in the form of black-jacks.

Some of the participants did not plant the cover crops, considering it too late in the season to do so. Others, having never done this before elected not to try it.

6. Improved Kraal Manure

As another strategy to improve the organic matter content of the soil, as well as cover to an extent, is to include the use of kraal manure in the CA system. Participants interested in this process have volunteered to start producing improved kraal manure by laying grass and straw in the kraals and emptying the manure straw mix out from time to time, piling it up for composting.

7. Germination

For a selection of the participants percentage germination was checked for the three crops. The germination was also compared between using hand hoes and the CA planters. Four participants from Khauoe and Lubisini in the Matatiele area were monitored.

The results are shown in the two small tables below.

TABLE 8: PERCENTAGE GERMINATION OF CROPS PLANTED WITH HAND HOES AS COMPARED TO MATRACCA AND MBLI PLANTERS IN KHAUOE

Germination; KHAUOE							KHAUOE: planter/hand hoe % germination				
	Maize (plants /row)	% 20	Beans (plants /row)	% 50	Cowpea (plants /row)	% 50		Maize %	Beans %	Cowpea %	Total %
Hand (N=4)	15.25	76.25	22.875	45.75	15.75	31.50	Matracca /hoe	90.9	87.1	160.0	112.7
Matracca (N=2)	15.25	76.25	27.5	55.00	24	48.00	MBLI /hoe	108.3	90.0	118.2	105.5
MBLI (N=2)	14.25	71.25	12.75	25.50	19.5	39.00					

TABLE 9: PERCENTAGE GERMINATION OF CROPS PLANTED WITH HAND HOES AS COMPARED TO MATRACCA AND MBLI PLANTERS IN LUBISINI

Germination; LUBISINI	Maize	% 44	Beans	% 100	Cowpea	% 100	LUBISINI:planter/ hand hoe % germination	Maize %	Beans %	Cowpea %	Total %
Hand (N=4)	21	59.00	30	30.13	12	12.33	Matracca / hoe	78.1	85.6	51.5	71.7
Matracca (N=2)	21	46.59	31	31.00	5.25	5.25	MBLI /hoe	111.4	102.1	160.0	124.5
MBLI (N=2)	18	55.00	22	22.00	24	24.00					

Although the sample sizes were small and variation between values in these tables quite high the following can be confidently stated:

- Germination rates of maize, beans and cowpeas in the Matatiele area were generally quite low.
- Germination percentage of legumes was lower than for maize.
- Germination percentages of cowpeas were lower than beans
- It appears from farmers' reports and observations that the legumes did come up but were weak and yellowing and a proportion of these seedlings died.
- Germination percentages for the MBLI planter were generally higher than for both the Matracca planter and using hand hoes.

The causes suggested by the team and farmers for the low germination rates include: seed eaten by birds (including free range chickens) and rodents; a lot of rain during and directly after planting, reducing the efficacy of the herbicides applied and thus resulting in weed competition during germination; lack of rain soon after planting leading to slow and patchy germination and potential Round-up damage to the legumes more specifically leading to the initial yellowing and weak germination of the plants, but later recovery. The latter point, although controversial does have some recognition in scientific literature. Evidence suggests that glyphosate is toxic to N-fixing microbes and Mycorhizza and can thus easily affect germination and growth of legumes, within 2-3 weeks after planting[2].

[2] Don M. Huber, Emeritus Professor, Purdue University (2012). AG chemical and crop nutrient interactions – current update Proceedings Fluid Fertilizer Forum, Scottsdale, AZ February 14-16, 2010. Vol. 27. Fluid Fertilizer Foundation, Manhattan, KS.

8. Yields and Land Equivalent Ratios

Yields for the legumes grown in the intercrops and as single crop CA blocks were comparable with commercial legume yields. As expected the yields in single (sole) crop plantings were higher than for the intercropped plots. Land equivalent ratios are compared in the section below.

For maize lower yields were obtained in the control plots when compared with the CA plots. Control plots were tilled and fertilized by farmers in their habitual way- usually by ploughing either with a tractor or using animal drawn traction produced. In Potshini and Matatiele yield differences were more due to the improved (although small amounts were added to CA plots) fertilizer practices as well as lack of weeding in traditional practices, than a difference in tillage practices. The Maize yields in Potshini (Bergville) were very low and those in the neighbouring Emmaus were extremely impressive. Yields for the other areas are still being gathered as harvesting is not complete.

The table below summarises the yield results presently available.

TABLE 10 : YIELD SUMMARIES FOR BERGVILLE AND MATATIELE

Bergville							
Potshini	**Maize (T/ha)**			**Beans**		**Cowpeas**	
	CA intercrop	**CA single crop**	**Control**	**CA intercrop**	**CA single crop**	**CA intercrop**	**CA single crops**
Average	1.24 (N=7)	1.93 (N=2)	0.52 (N=6)	1.42 (N=2)		0.88	-
Range	0.491—2.31	0.1-2.31	0.1-1.7	085-1.9		0.8-0.95	-
Emmaus	**Maize (T/ha)**			**Beans**		**Cowpeas**	
	CA inter crop	**CA single crop**	**Control**	**CA intercrop**	**CA single crop**	**CA intercrop**	
Average	5.72(N=3)	4.7 (N=2)	2.06 (N=3)	1.2 (N=7)	1.6 (N=7)	0.48 (N=7)	0.89 (N=7)
Range	4.63-7.9	4.6-4.8	0.08-5.6	0.26-2.1	0.45-2.7	0.23-0.8	0.5-1.7
Stulwane	**Maize (T/ha)**			**Beans**		**Cowpeas**	
	CA inter crop	**CA single crop**	**Control**	**CA intercrop**	**CA single crop**	**CA intercrop**	
Average							
Range							
Matatiele							
Pontsheng	**Maize (T/ha)**			**Beans**		**Cowpeas**	
	CA inter crop	**Ca single crop**	**Control**	**CA intercrop**	**Ca single crop**	**CA intercrop**	
				1.43 (N=1)			
Khauoe	**Maize (T/ha)**			**Beans**		**Cowpeas**	
	CA inter crop	**Ca single crop**	**Control**	**CA intercrop**	**Ca single crop**	**CA intercrop**	
				1.07 (N=6)		1.05 (N=6)	
				0.116-1.97		0.193-1.31	
Lubisini	**Maize (T/ha)**			**Beans**		**Cowpeas**	
	CA inter crop	**Ca single crop**	**Control**	**CA intercrop**	**Ca single crop**	**CA intercrop**	
				2.02 (N=7)		0.71 (N=7)	
				0.66-4.3		0.23-1.54	

8.1.LER (Land Equivalent Ratio)

In Emmaus, Bergville it was possible to calculate the LER for the intercropped plots as compared to single block plantings of the same crops (Maize, beans and cowpeas)

The LER is the relative area of a sole crop or crops required to produce the same yield as intercrop. LERs equal to or above 1 indicate that the intercropped mixture has yield advantages. This can apply to one or both of the intercropped crops.

The LER is calculated using the formula LER= ∑ (Ypi/Ymi), where Yp is the yield of each crop or variety in the intercrop or poly-culture, and Ym is the yield of each crop or variety in the sole crop or monoculture. For each crop (i) a ratio is calculated to determine the partial LER for that crop, then the partial LERs are summed to give the total LER for the intercrop[3]

Most studies have reported larger combined yields and LERs higher than 1, showing productive advantages of the intercropping systems. This is usually explained by a more efficient use of the radiation and water/nutrient resources by the associated crops compared to each individual sole crop.[4]

A similar result has been obtained here for sugar beans intercropped with maize at plant populations of 160 000 and 64 000/ha respectively. The partial LER for the legume component only (until maize yields are available) averages 1.7 for the beans (N=7). The yield for cowpeas was reduced through the intercropping arrangement with an average LER for this legume component of 0.8 (N=7). This could also partially be due to the harvesting practises of the smallholders, who wait for the whole plant to dry prior to harvesting. As cowpeas mature and dry over a period of time, this practise will reduce the overall harvest substantially.

TABLE 11: LAND EQUIVALENT RATIOS FOR THE LEGUME PORTION OF THE INTERCROP IN EMMAUS BERGVILLE.

LERs	Beans inter crop (yield in kg)	Area (m^2)	kg/m^2	Beans sole crop (yield in kg)	Area (m^2)	kg/m^2	Ratio-Partial LER	Cow-peas inter crop (yield in kg)	Area (m^2)	kg/m^2	Cow-peas sole crop (yield in kg)	Area (m^2)	kg/m^2	Ratio – partial LER
EMMAUS														
Ntombakhe Zikode	20	100	0.2	25	250	0.1	2.0	5	100	0.05	4	100	0.04	1.3
Thabisile Mabaso	12.4	100	0.12	15	250	0.06	2.1	6	100	0.06	12	100	0.12	0.5
Simbongile Sithole	9	100	0.09	8	250	0.03	2.8	5	100	0.05	4	100	0.04	1.3
Tholwephi Mabaso	2.6	100	0.03	10	250	0.04	0.7	2.3	100	0.02	8	100	0.08	0.3
Ntombi Zikode	14	100	0.14	32	250	0.13	1.2	8	100	0.08	5.4	100	0.05	1.5
Thulisile Zikode	14	100	0.14	27	250	0.11	1.3	6	100	0.06	9.7	100	0.1	0.6
Mrs Khumalo	10	100	0.1	15	250	0.06	1.7	2	100	0.02	5	100	0.05	0.4
AVERAGE	**11.7**			**18.9**		**0.08**	**1.7**	**4.9**			**6.9**		**0.08**	**0.8**

9. Farmer Innovation Platforms

9.1. Farmers' organisation and mobilisation

The farmer based trials have generated interest from other members in the communities through observation and word of mouth. More people want to be part of the process and there is an understanding that some will do the trails and others will try out some of the ideas and principles of CA in their own fields. Expansion of involvement in

[3] Mazaheri Dariush, Madani Ahad, Oveysi Meysam. 2006. Assessing the land equivalent ratio (ler) of two corn [zea mays l.] Varieties intercropping at various nitrogen levels in Karaj, Iran. Journal of Central European Agriculture Vol 6 No2.
[4] S. Walker, C.J. Stigter, E. Ofori and N. Kyei-baffour. 2005 Intercropping and its Implications for Soil Management.University of the Free State, Bloemfontein, South Africa

each of the present sites is to be initiated, as well as moving to other areas where local community members have specifically requested this intervention.

a. BERGVILLE: Emmaus expanding into Magangangozi, Stulwane expanding into Ezibomvini and Potshini expanding into Okhombe and or Obonjaneni (through the local Farmers Forum)
b. MATATIELE: Pontsheng expanding into Nkau and Thinana, Khauoe expanding into Khutsong and Local expansion in Lubisini area.

In Bergville area there is now an increased interest in being part of SCGs and working in the SCGs to form specific groups for saving for inputs of field crop production. Two new SCGs are to be formed specifically for the purposes of saving for inputs one in Emmaus and one in Stulwane. An understanding is developing for preparing in time and starting to save earlier in the year, as well as doing soil samples in preparation for planting

Local facilitators and the field work team are very motivated by the pro-activity of the community members and the building of momentum that is community based

Learning and awareness raising workshops and farmers days were held in each of the 6 villages involved in the process. The intention was to showcase the work of the participants and the Commodity Interest Groups to the broader community and also to involve stakeholders and role players in the maize value chain. The small case study below describes and summarizes the process for Bergville.

9.2.Conservation Agriculture Case Study: Bergville: April 2014

"Take care of the land and the land will take care of you." (Hugh Hammond Bennet, 1950)

Conservation Agriculture (CA) provides an attractive alternative for smallholders where environmental and economic stresses have reduced grain production considerably. For that reason a long-term project has been launched in two smallholder pilot study areas to investigate and promote the use of CA for sustainable crop production. These smallholder projects, within the new CA Farmer Innovation Programme (FIP) at Grain South Africa and The Maize Trust, have currently been established through collaboration between four organisations: The SaveAct Trust, Mahlathini Organics, The Maize Trust and Grain SA. The projects are aimed at investigating innovation systems and processes assisting smallholder farmers in growing maize and legumes using CA practices. This article deals with the second study area in Bergville, KwaZulu-Natal Province. Similar to the project in Matatiele (see SA Grain, Volume 16, Number 8), the CA-FIP project in Bergville was formally launched in October 2013 and served the need from Grain SA to establish these projects on vibrant local farmer structures (in this case local savings and credit groups (SCG's)), supported by resourceful partners. It further fulfilled the need of the SCG members for innovative and sustainable ways of producing maize, after recognising that maize is a viable commodity. These SCG groups provide a strong organisational backbone to initiate an innovation process among the local smallholders and hence were identified as an ideal platform to launch a CA-FIP project among their members, in this case focussing on CA and agricultural enterprise development.

The Bergville study area – a 'network' of learning activities

The CA-FIP process involves volunteers within SCGs and commodity interest groups (CIGs) undertaking to do CA trials alongside their normal production practices. The CA practices introduced to them comprised planting without ploughing using specialised hand planters, retaining the crop residues on the soil surface and crop diversity, i.e. intercropping with legumes and crop rotations with winter livestock fodder mixes. A high crop density approach (i.e. narrow rows and higher plant populations) was followed to reduce soil water loss from evaporation and to suppress weed growth, whilst accelerating soil health improvement. The volunteering 'CA groups' joined in an on-going

learning process throughout the season using their trials as 'field laboratories' and their group meetings as social learning events.

Thirty-one (31) farmer-led trials have been conducted in the Bergville area between October 2013 and April 2014 as part of the smallholder CA FIP project (see **Photo 1**). These farmers are also members of CIG's, all of whom participated in the learning processes. Around hundred-and-twenty (120) farmers have been involved.

Photo 1: Thulisile Hlongwane from Stulwane in her maize and dry bean intercrop trial plot, January 2014

Participants in this project's innovation process have recognised the following outcomes and benefits:

- They have experimented with new ways of field crop production (maize, dry beans and cowpeas) that have shown good growth, increased yield, increased soil fertility, reduced soil and water erosion, reduced weed pressure and increased incomes from selling maize and beans.
- They have learnt about soil management and how to use and apply agricultural inputs such as fertiliser, pesticides and herbicides.
- They have worked together as teams to plant their plots, which have helped considerably to prepare the fields in time and reduce the burden of labour.
- They have spread the word to other members in the community and have generated a positive force towards working together and increasing production in their areas.
- They have undertaken to increase their planting areas as well as the use of CA since the benefits from this season have been obvious: saving money on hiring of tractors, saving labour after the initial planting process, less infestation of weeds, increased production and improved food security.

Yields for legumes have been exceptionally good and comparable to commercial yields, notwithstanding late season hail and rain that destroyed some of the crop. Average yields for beans have been from 720kg-1.8t/ha and for cowpeas from 400kg-1.2t/ha. Maize yields thus far have been equally good averaging around 4.2t/ha.

Considerable interest was generated through the FIP process of farmer-led trials in CA at the Bergville communities of Potshini, Emmaus and Stulwane. Farmer days were held in each of the three areas towards the end of the growing season to showcase the work being done. These were well attended by local people and stakeholders alike. The

main farmer's day was held on 25 March 2014 (see **Photos 2a to c**). People within the area and from neighbouring areas have taken proactive steps towards being included in the process in the coming year and four new CIG focus groups will be established at the communities of Magangangozi, Ezivombini, Okhombe and Nokophela.

Photo 2a: Mr Jurie Mentz from Grain SA addressing attendees at the Farmers' Day on 25 March 2014, and 2b: MBLI and Matracca CA hand planters demonstrated. 2c: Mr Nicolas Madondo, local project facilitator, explains one of the farmer-led trials

Bergville farmers gaining momentum

Groups have now been set up to facilitate bulk buying in both Emmaus and Stulwane and SCG members have planned their savings in order to buy inputs for field cropping. In addition, a process for borrowing and hiring of CA equipment for the broader community has been initiated in Stulwane and Emmaus.

Positive links were formed in the local Agribusiness community, including joining study groups set up through Grain SA, forming relationships with Afritrac for supply of CA implements, forming relationships with the KZN Department

of Agriculture and Environmental Affairs (DAEA) and Farming Systems Unit for promotion of CA in the area, and with the University of KwaZulu-Natal (UKZN) to conduct research in adoption and adaptation of CA in the area.

Looking into the future, the process will be scaled out in the Bergville area and surrounds in the next two years, linking as many villages and communities as possible and working with a model whereby more experienced farmers will each facilitate and assist five new farmers to establish CA practices in their fields. In this way around 1 000 smallholders could be on board within the next few years. In the long-term the vision is to establish an incentive scheme, such as payment for ecosystem services, to sustain and grow farmers' adoption of CA without relying on continued dedicated project funding. Already the CA-FIP project platforms among smallholders in Bergville are gearing-up to meet these challenges in view of sustainable crop production and household food security.

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10. Future

The basic process of farmer-led adaptive trials (using CA practices) linked into farmer innovation platform building is to continue in the areas where work has started and will be introduced in a number of new areas. Working with the saving and credit groups as the basis for the farmer organisation has worked well and will continue. Active learning and decision making on the side of the farmers themselves is crucial and the Farmer Field School learning approach is practical, intensive and flexible for integrating and scaling out CA within local smallholder farmer realities. Attention is to be given to the whole value chain which includes economic aspects such as input supply, budgeting and marketing.

For the next round (2nd season) of farmer experimentation the following elements have been included to ensure systematic expansion and scaling out of the innovation process:

- Two (2) new villages have been included in each area (Bergville and Matatiele), based on requests and demand from the local communities. Five (5) new farmer participants are to start trials in each of these areas, as well as in the six (6) existing villages (50 new farmer participants).
- Present participants are to design their own experimentation and adaptation process, based on their experiences in this season (40 present participants)
- A process for bulk buying is to be instituted in at least 4 of the 6 existing villages and will include inputs for the farmers' control plots.
- Soil samples are to be taken for individual existing participants who have requested this. They have undertaken to use the soil sample results to determine their soil fertility inputs, rather than using the more generalised fertilizer quantities that people habitually use.
- Attention will be given to the following technical elements in this seasons' trials: incorporating kraal manure for soil fertility and organic matter improvement, comparison of different herbicide spraying regimes, closer attention to pest control later in the season, introduction of new maize and legume varieties for comparison and cover crops and fine tuning of plant spacing.
- Each of the present participants will draw in 5 volunteers (people close to them that are interested) and will assist those people in planting their own adaptive trials. In this way the farmers themselves will be training and mentoring more farmers in the process (100 mentored farmers).
- A local store for implements and inputs for CA is to be set up and run by a local community group in each village. This will be organised through the commodity interest groups. This store/centre will provide access to implements for hire within the community, but also will provide advice and technical support to farmers wanting to try out CA. In this way the implementation of CA can be further scaled out in the communities to people not directly involved in the trials.

10.1. Things to take into account for the next round

1. It is important to know when it rained relative to planting – especially if herbicide efficacy is in question. So, measuring rainfall has to happen in both areas. Reliable weather forecasts are equally important for effective planning and response in cropping activities; at this stage this service could best be provided by the project implementers, i.e. Mahlathini Organics.
2. When comparing the different planters and their effect on germination rate of seed, we will need to ask some volunteers to do specific plots with different planters instead of comparing plots from different people.
3. When comparing hand hoe planting and CA planters we need to be much clearer with participants about seeding rates; in this round of experiments some participants placed 2 seeds/basin of maize, but only planted 1 seed per planting station with the planters- leading to different plant densities of the different plots.
4. Farmer participants and the field team will receive further training and mentoring in the monitoring of soil characteristics and crop growth – to include a wider set of parameters to monitor.
5. Plant cover crops earlier – it may be necessary to set aside areas where the crops are to be planted. Sowing in between maize in the intercrop plots may not be the most effective way due to the heavy mulch layer and presence of late season weeds. Also, a way needs to be found in the system to do the planting of the cover crops earlier- end-Feb to end March. Some attention needs to be given to planting cover crop mixes in fenced gardens for seed propagation on a local level. A system with appropriate incentives needs to be designed.
6. Interventions around harvesting and storage of the crops towards the end of the season will be important. This process is presently very inefficient and leads to considerable loss of grain yield.

Attachment 2a: Summary Observations from CA trails 2013-2014

Matatiele

	LUBISINI	PONTSHENG	KHAUOE
General info	Mt Fletcher, ~10SCGs,	Pontsheng and Nkau ~6 SCGs	Khauoe, Khutsong ~ 6 SCGs
No of initial volunteers	27	27	22
No of MoU forms filled in	20	24	16
No of people w inputs provided	14 (3 could not be found again, 5 did not plant)	23 (2 could not be found again)	15
No of people planted trials	6	8	10
No of people active throughout	4-5 Mpilo Sicwebu planted but then had to move and did not continue.	6- 7 Mr Dikotsi Tserane planted but then had to move and did not continue.	10 5 of these planted the trials in their own way and did not tend them well- so ongoing monitoring was almost impossible
Local facilitator	-	~Bulelwa Dzingwa- CBP for Nkau area	Mr Tsoloane Mapheelle (Khutsong) and Mrs Monica Dzingwa (Khauoe)
Spraying volunteers	3 Mpilo Sicwebu, Simphiwe Nduku Siphelo Siwebu 3 young men: They ended up not planting their own trials. Issues with assisting other participants (availability at the required time for both volunteers and participants) meant that some trial plots were not sprayed.	1 Thabang Monaheng. He apparently has planted, but has been unavailable and was also found out for charging for his spraying services.	-
Cover crops	1 Mrs Nobukhosibakhe Duba She did not rake the seed in or place weeds on top. Rained 2weeks after scattering of seed.	3 Mrs Bulelwa Dzingwa, Mrs Mankopane Pitso and Mrs mateboho Motsoko	3 Mrs Monica Dzingwa, Mr Tsoloane Mapheelle and Mr Monqezi Bekaphezulu.

Lubisini

Only 5 participants continued for the duration of the season. Of these, cover crops were planted in 1 plot only (the other 4 being too weedy). Generally participants waited for CA facilitators to come (and mostly do) all operations and this meant that plots were not well tended and that operations such as topdressing and spraying of pesticide mid season lagged behind.

There appears to be some issues related to entry into the community. There are 10SCGs in Lubisini. Due to the facilitation team's choice of venue at Mrs Sicwebu's homestead, only members from 3 of the SCGs have been informed of activities taking place and even then communication between participants and in the community has been patchy. Mrs Sicwebu herself was very often not available. More attention needs to be given to communication pathways.

General practice in planting maize is a type of extreme form of low input, low output farming practices. Farmers generally wait for a tractor to plough; they will spread fertilizer, if they apply it at all, before ploughing happens and just walk behind the tractor to' plant' their maize seed.

1. **Maize roots** were mostly on the surface for ploughed plots and mostly beneath the soil surface for CA plots.
2. From observations of plots in March-April 2014 **a lot of stalk borer damage** was evident. None of the participants sprayed the Decis Forte at 6 weeks after planting.

3. **Weed pressure was very high,** which meant that in quite a number of plots LAN top dressing could not be done at 6 weeks. Potentially this would only increase the weed pressure. Participants did not do weeding by themselves, electing to wait for the CA facilitators to come. By that time it was already 'too late'. Weeds were large and quite a few participants just left their plots after that. This meant that they had small harvests for beans and cowpeas and also that it was not possible to plant in the autumn cover crops between the maize rows.
4. Run off reduced substantially on trial plots with inter cropping. **Run off high on control plots.**
5. Late season hail (February and March 2014) damaged maize and beans considerably.
6. **Cowpeas generally did not do very well**. Germination was not good (60-75%) only. The reasons are unknown, but causes are most likely rodent and bird damage (including poultry) and possibly herbicide damage- as roundup was sprayed 1 day before planting in some cases.
7. Soils are hard and infertile. Soils are sandy with ~9-11% clay, but with <1% Organic carbon and about 0.05% soil Nitrogen. Acidity not a major issue.
8. Soils require around **140kg Potassium/ha**. This was not supplied through the MAP and LAN supplied.
9. Generally the crop stand for hand planting was around 20% better than for the Matracca planter. For the MBLI planter the crop stands were comparable with hand planting.
10. Common weeds in the area consist of around 70% grasses (couch grass, kikuyu and nutgrass mainly) and 30% broad leaf weeds (blackjack, khakhi bos and amaranthus mainly). The herbicide combinations will need to be adapted for this situation.

FARMERS COMMENTS

1. Want to continue
2. Saves time in terms of planting
3. Most prefer the Matracca over the MBLI planter and like the idea of the Haraka planter.
4. Beans grow and produce a lot better in this intercropping
5. Intercropping saves space – more crops on same area and the beans climb onto the maize plants which helps them to grow and seed better.
6. For CA the soil is hard and this makes planting labour intensive.

SUGGESTIONS FOR FUTURE

1. Continue with 3-4 of present participants and take on another 5 from the Lubisini community.
2. Work on a model of each existing participant choosing another 5 people that they will 'mentor' through the process. These 5 will receive limited inputs and will be asked to attend all processes, activities and meetings with their mentor...
3. Potentially set up a formal maize Commodity Interest Group to deal with budgeting and potential bulk buying of inputs. Also, the use of the CA planters can be opened to the larger community to try out, if there is a system in place for this.

Pontsheng

1. A number of the plots had been left for some time and were completely covered over with tall grass at planting. In these cases the **effectiveness of Round Up and especially Dual Gold may be reduced** – increasing the weed pressure from the onset.
2. Quite a number of the control plots were planted hastily – scattering of seed after ploughing by tractor, with no addition of fertilizer; with subsequent lack of weeding has meant very low yields. If weeding is done- yields can still be maintained to an extent.

3. Generally, **germination and growth of cowpeas especially was not good**. It appears to be a combination of potential effect of herbicide sprayed at planting and then subsequent grazing by free range poultry. Beans fared somewhat better; perhaps hte poultry prefer cowpeas!
4. **OPV maize provided has done well**. Farmers commented on the large cobs and 2 cobs per plant on occasion. It does mature later than the traditional yellow maize planted in the control plots
5. In this area **participants preferred to use the MBLI planter** over the Matracca, as it is similar to the hoes that they are used to and very easy to use. It also works slightly better if there is a lot of 'grassy' ground cover.
6. Common weeds in the area consist of around 70% grasses (couch grass, kikuyu and nutgrass mainly) and 30% broad leaf weeds (blackjack, khakhi bos and amaranthus mainly). The herbicide combinations will need to be adapted for this situation.
7. Want to continue

FARMERS COMMENTS

For Mrs Nozamile Mandlakhe and her neighbours growing food is an important livelihood activity, supplementing their roadside clearing part time work. For Mrs Mandlakhe, she wanted to see if any food would grow from her weed dominated field. Herbicides were sprayed on her 400m^2 plot and maize beans and cowpeas were sown using hand hoes and matraccas (jab planters). "At that stage people close by had come to see this nonsense; sowing seeds straight into the weeds", she said to the group. As time went on, she would get people walking into her home asking how come crops grow in such a condition; she found it difficult to answer them but tried her best. For her this was also an experience as she has never seen anything of this nature.

Maize kept on growing taller and taller, beans and cow peas also grew strong within thick grass. At the end of it all, she harvested 10.97kg beans and 3.87kg cowpeas in a 10x10m (400m^2) plot. She was amazed when we walked in with an almost full bag of beans she produced in such a small plot. "I have just grown more than 10kgs of beans that will see me through for the next four to six coming months and I have saved over R150 given that a 5kg bag of beans costs me R75 at the supermarket", she said. She stressed to the group that why not grow food together; with the SCG's there for financial back up, they could collectively buy fertilizers and eat from their own backyards.

Figure 1: Nozamile Mandlakhe's conservation tillage plot of 400m² (left) of maize and beans intercropped and (right) her bean and cowpea harvest

Khauoe

10 Participants continued for the duration of the season. 5 of these participants did not follow the layout for the CA plots and came up with their own versions for the trials, which were tricky to monitor. They did no focus well and plots were weedy and untended. Cover crops were planted in 3 plots only (the other 7 being too weedy). Generally participants waited for CA facilitators to come (and mostly do) all operations and this meant that plots were not well tended and that operations such as topdressing and spraying of pesticide mid season lagged behind.

There appears to be some issues related to entry into the community. Mrs Monica Dzingwa is a very active SCG member in the area and belongs to a number of SCGS (6 in total). She has bee instrumental in promoting enterprise development and actively seeks to agricultural support and new ideas ot introduce in her community. There is a little resistance with some community members close by given that she gets a lot more attention and support from outsiders.

Mr Mapheelle, who was appointed as the local facilitator worked more actively with a few individuals in the Khutsong part of the community and did not manage to provide support to all the participants. He is more active as a farmer and local business man than a facilitator. In future attention needs t0 be given to providing separate support to the clusters of SCGs that work together well and easily and have regular contact with each other.

General practice in planting maize is a type of extreme form of low input, low output farming practices. Farmers generally wait for a tractor to plough; they will spread fertilizer, if they apply it at all, before ploughing happens and just walk behind the tractor to' plant' their maize seed.

1. A number of the plots had been left for some time and were completely covered over with tall grass at planting. In these cases the **effectiveness of Round Up and especially Dual Gold may be reduced** – increasing the weed pressure from the onset.
2. Quite a number of the control plots were planted hastily – scattering of seed after ploughing by tractor, with no addition of fertilizer; with subsequent lack of weeding has meant very low yields. If weeding is done- yields can still be maintained to an extent.
3. Generally, **germination and growth of cowpeas especially was not good**. It appears to be a combination of potential effect of herbicide sprayed at planting and then subsequent grazing by free range poultry. Beans fared somewhat better.
4. Soils in the area are sandy and **very low in fertility and organic matter.** This has meant that the close spacing and intercropping did not have the desired effect of providing complete soil cover early in the season, or at all throughout the season.
5. From soil samples done in the area, **potassium is also required**, but not provided for this round of trials. It is however not severely limiting as a lacking nutrient. **Lime appears not to be needed** for maize, and only in a few cases for beans.
6. **Common weeds in the area** consist of around 70% grasses (couch grass, kikuyu and nutgrass mainly) and 30% broad leaf weeds (blackjack, khakhi bos and amaranthus mainly). The herbicide combinations will need to be adapted for this situation.
7. **OPV maize provided has done well**. Farmers commented on the large cobs and 2 cobs per plant on occasion. The harvests were better than for the locally grown yellow maize.

SUGGESTIONS FOR FUTURE

1. Introduce different varieties of OPV maize- including a yellow variety.
2. Introduce different options for use of herbicides- especially for grassed over fields.

3. Introduce a number of summer season cover crops of high biomass (such as lab-lab, velvet bean and other runner bean varieties awa potentially sunnhemp) to increase the organic carbon and nitrogen content of the soils
4. Work with a few volunteers in increasing quality of manure to use mixture of manure and fertilizer for soil fertility improvement.
5. Continue with 5 of present participants and take on another 5 from the Khauoe and Khutsong areas- taking care to cluster participants well according to SCGs that communicate easily and often.
6. Work on a model of each existing participant choosing another 5 people that they will 'mentor' through the process. These 5 will receive limited inputs and will be asked to attend all processes, activities and meetings with their mentor.
7. Potentially, set up a formal maize Commodity Interest Group (CIG) to deal with budgeting and potential bulk buying of inputs. Also, the use of the CA planters can be opened to the larger community through a loan and or rental process managed by the CIG.

Bergville

	EMMAUS	STULWANE	POTSHINI
General info	3 SCGs, Eqeleni area	3 SCGs, Costone area	7 SCGs
No of initial volunteers	8	~30	9
No of MoU forms filled in	8	9	9
No of people w inputs provided	9	12	9
No of people planted trials	9	12	9
No of people active throughout	9	12	7
Local facilitator	Mrs Hlatshwayo/ Nkosi	Mrs Makethi Dladla	Mr Mduba
Cover crops:	4	5	0

Emmaus, Stulwane

1. **Growth of legumes** better in intercropped trails, but harvests of legumes in single crop plots better; from 1.25-1.5 times higher yield.
2. **Bean yields generally very high** and very comparable to commercial yields of 1-2t/ha.
3. **Cowpea yields** were on average slightly lower at around 800kg/ha. Commercial yields are 1.2-1.5t/ha.

FARMERS COMMENTS

1. There is a high level of interest in continuing and a number of community members not presently linked to SCGs are coming on board. This process is working to encourage both field crop production, planning and preparation in time (budgeting, saving and soil sample) and also for individuals to link into SCGs and bulk buying for the crops.
2. A number of individuals from further afield in adjoining communities have also observed the processes and are initiating the CA in their areas.

SUGGESTIONS FOR FUTURE

1. Set up bulk buying groups for Emmaus and link this to the existing one in Potshini

2. Do budgeting exercises to work out how much to save for the field cropping
3. Do soil samples early in the season and learn how to work out fertilizer requirements from these.
4. Open the access to use of CA planters to community members outside of the immediate trial participants.

Potshini

The response in Potshini has been very lukewarm and participants and other community members have not shown much enthusiasm for the process. Meetings and workshops were very badly attended. It has thus been decided to discontinue the farmer innovation process around CA in Potshini in favour of starting up in new areas where people have shown considerable interest, namely Ezibomvini, Magangangozi and Okhombe.

Attachment 2ba: Soil sample results summary(Cedara Laboratory, KZN); Matatiele; 2013

Name	Area	Crop	Type	Nitrogen		Phosphorus		Potassium		Lime	Acid saturation	Organic carbon	N	Clay	Zn	Amount of fertilizer required (Bags/ha)				
				Yield target t/ha	Required N kg/ha	Target mg/L	Required P kg/ha	Target mg/L	Required K kg/ha	Required Lime t/ha						MAP	LAN	Urea	KCL	Single Supers
Rosina Matubatuba	Lubisini	Cabbage	Irrigated	100	200	68	185	200	140	1	2%	0.70%	0.05%	9%	No	16.8	7.7	Or 4.7	5.6	
		Maize grain	Irrigated	12	200	30	70	100	0	0	2%				No	6.4	11.8	Or 7.2	0	
		Potato	Irrigated	40	180	41	105	200	140	0	2%				No	9.5	9.1	Or 5.5	5.6	
				60	220	41	105	240	240	0	2%					9.5	12	Or 7.3	9.6	
				70	240	41	105	260	290	0	2%					9.5	13.4	Or 8.2	11.6	
Khauoe Matsoanelo	Khaoue	Dry bean	Dryland	1	40	20	20	100	0	1	9%	< 0.5	< 0.5	9%	No	1.8	2.1	Or 1.3	0	
				2	80	20	20	100	0	1	9%					1.8	5	Or 3.0	0	
				3	120	20	20	100	0	1	9%					1.8	7.9	Or 4.8	0	
		Maize grain	Dryland	4	50	25	35	120	0	0	9%			9%	No	3.2	2.3	Or 1.4	0	
				7	140	25	35	120	0	0	9%					3.2	8.8	Or 5.3	0	
				10	180	25	35	120	0	0	9%					3.2	11.6	Or 7.1	0	
		Potato	Dryland	20	90	34	70	168	160	0	9%			9%	No	6.4	3.9	Or 2.4	3.8	
				40	160	34	80	168	200	0	9%					7.3	8.6	Or 5.2	4.6	
				60	200	34	80	168	240	0	9%					7.3	11.4	Or 7.0	7.2	
Bhekaphezulu M	Khauoe	Bean	Dryland	1	40	23	25	100	5	1	13%	< 0.5		6%	No	3.2	1.6	Or 1.0	0.2	
				2	80	23	25	100	5	1	13%					3.2	4.5	Or 2.7	0.2	
				3	120	23	25	100	5	1	13%					3.2	4.5	Or 2.7	0.2	
		Maize grain	Dryland	4	70	29	55	100	5	0	13%			6%	No	5	3	Or 1.8	0.2	
				7	160	29	55	100	5	0	13%					5	9.5	Or 5.8	0.2	
				10	200	29	55	100	5	0	13%					5	12.3	Or 7.5	0.2	
		Potato	Dryland	20	90	40	90	160	155	0	13%			6%	No	8.2	8.2	Or 5	10.2	

				40	160	40	90	200	255	0	13%					8.2	8.2	Or 5	10.2	
				60	200	40	90	240	355	0	13%					8.2	11.1	Or 6.7	14.2	
Tsoloane S	Khauoe	Bean	Dryland	1	40	22	20	100	0	0	4%	< 0.5	< 0.5	6%	No	1.8	2.1	Or 1.3	0	
				2	80	22	20	100	0	0	4%					1.8	5	Or 3.0	0	
				3	120	22	20	100	0	0	4%					1.8	7.9	Or 4.8	0	
		Maize	Dryland	4	70	27	20	100	0	0	4%				No	1.8	4.3	Or 4.6	0	
				7	160	27	20	100	0	0	4%					1.8	10.7	Or 6.5	0	
				10	200	27	20	100	0	0	4%					1.8	13.6	Or 8.3	0	
		Potato	Dryland	2	90	37	48	160	85	0	4%				No	3.6	5	Or 3.0	3.4	
				4	160	37	80	200	105	0	4%					7.3	8.6	Or 5.2	4.2	
				6	200	37	80	240	125	0	4%					7.3	11.4	Or 7	5	
Monica Dzingwa	Khauoe	Cabbage	Irrigated	100	200	50	100	200	235	1	13%	< 0.5	< 0.5	21%	No	9.1	10.7	Or 6.5	9.4	
		Carrot	Irrigated	Optimum	70	50	100	200	235	1	1%	< 0.5			No	9.1	1.4	Or 0.9	9.4	
		Bean	Dryland	1	40	21	35	100	35	1	13%	< 0.5			No	3.2	1.6	Or 1.0	1.4	
				2	80	21	35	100	35	1	13%					3.2	4.5	Or 2.7	1.4	
				3	120	21	35	100	35	1	13%					3.2	7.3	Or 4.5	1.4	
		Maize	Dryland	4	70	26	50	100	35	0	13%	< 0.5			No	4.5	5	Or 3.0	1.4	
				7	160	26	50	100	35	0	13%					4.5	9.6	Or 5.9	1.4	
				10	200	26	50	100	35	0	13%					4.5	14.3	8.7	1.4	
		Potato	Dryland	20	90	36	85	160	185	0	13%	< 0.5			No	7.7	3.4	Or 2.1	7.4	
				40	160	36	85	200	285	0	13%					7.7	8.4	Or 5.1	11.4	
				60	200	36	85	240	385	0	13%					7.7	11.3	Or 6.8	15.4	
		Spinach	Irrigated	Optimum	100	50	100	200	235	0	1%	< 0.5			No	9.1	3.6	Or 2.2	9.4	
Likotsi M		Bean	Dryland	1	40	20	50	100	0	0	3%	< 0.5	< 0.5	6%	Yes		2.9	Or 1.7		9.5
				2	80	20	50	100	0	0	3%						5.7	Or 3.5		9.5
				3	120	20	50	100	0	0	3%						8.6	Or 5.2		9.5
		Maize	Dryland	4	50	25	60	120	0	0	3%	< 0.5	< 0.5	6%	Yes	5.5	1.4	Or 0.9	0	
				7	140	25	60	120	0	0	3%					5.5	7.9	Or 4.8	0	
				10	180	25	60	120	0	0	3%					5.5	10.7	Or 7.8	0	
		Potato	Dryland	20	90	34	105	160	110	0	3%	< 0.5	< 0.5	6%	Yes	9.5	2.7	Or 1.6	4.4	

				40	160	34	105	200	140	0	3%					9.5	7.7	Or 4.7	5.6	
				60	200	34	105	240	200	0	3%					9.5	10.5	Or 6.4	9.6	
Lukhozi Catherine	Khauoe	Bean	Dryland		1	40	18	20	100	0	2%	<0.5	0.6	15%	No	1.8	2.1	Or 1.3	0	
					2	80	18	20	100	0	2%					1.8	5	Or 3.0	0	
					3	120	18	20	100	0	2%					1.8	7.9	Or 4.8	0	
		Maize	Dryland		4	50	22	40	120	0	2%	<0.5	0.6	15%	No	3.6	2.1	Or 1.3	0	
					7	140	22	40	120	0	2%					3.6	8.6	Or 5.2	0	
					10	180	22	40	120	0	2%					3.6	11.4	Or 7.0	0	
		Potato	Dryland	20	90	29	75	160	40	0	2%					6.8	3.8	Or 2.4	1.6	
				40	160	29	80	200	60	0	2%					7.3	8.6	Or 5.2	2.4	
				60	200	29	80	240	80	0	2%	<0.5	0.6	15%	No	7.3	11.4	Or 7.0	3.2	

Attachment 2bb: Soil samples results summary(Cedara Laboratory,KZNDAE); Bergville

Name and surname	Area	Crop to be grown	Yield target (t/ha)	PH	Acid Saturation (%)	N Required (kg/ha)	P (Target mg/L)	P required	K (Target mg/L)	K required	Lime req t/ha	Org. C %	N %	Clay %
M Dlamini	Bergville	Maize	4.0	3,7	63	40	6	60	180	0	11.0	2.7	0.32	50
	Stulwane		7.0			120		60		0	11.0			
			10.0			160		60		0	11.0			
		beans	1.0			40		45		0	17.5			
			2.0			80		45		0	17.5			
			3.0			120		45		0	17.5			
K Sthebe	Bergville	Maize	4.0	3,59	75	40	13	20	240	0	17.0	3.7	0.3	49
	Stulwane		7.0			120		20		0	17.0			
			10.0			160		20		0	17.0			
		beans	1.0			40		20		0	26.0			
			2.0			80		20		0	26.0			
			3.0			120		20		0	26.0			
M Dladla	Bergville	Maize	4.0	4,13	5	40	17	20	400	0	0	2.0	0.23	41
	Stulwane		7.0			120		20		0	0			
			10.0			160		20		0	0			

		beans	1.0			40		20		0	0			
			2.0			80		20		0	0			
			3.0			120		20		0	0			
C Buthelezi	Bergville	Maize	4.0	3,75	59	40	5	60	54	140	8.0	2.8	0.26	44
	Stulwane		7.0			120		60		140	8.0			
			10.0			160		60		140	8.0			
		beans	1.0			40		60		90	13.5			
			2.0			80		60		90	13.5			
			3.0			120		60		90	13.5			
T Zikode	Bergville	Maize	4.0	4,29	12	50	6	60	299	0	0	1.2	0.17	35
	Emmaus		7.0			140		60		0	0			
			10.0			180		60		0	0			
		beans	1.0			40		50		0	1.5			
			2.0			80		50		0	1.5			
			3.0			120		50		0	1.5			
Name and sunrame	**Area**	**Crop to be grown**	**Yield target (t/ha)**			**N Required (kg/ha)**		**P required**		**K required**	**Lime req t/ha**	**Org. C %**	**N %**	**Clay %**
N Zikode	Bergville	maize	4.0	3,67	58	50	6	60	148	0	7.5	1.6	0.22	46
	Emmaus		7.0			140		60		0	7.5			
			10.0			180		60		0	7.5			
		beans	1.0			40		50		0	13.0			
			2.0			80		50		0	13.0			
			3.0			120		50		0	13.0			
S Nkosi	Bergville	maize	4.0	4,04	11	40	6	60	283	0	0	2.0	0.29	38
	Emmaus		7.0			120		60		0	0			
			10.0			160		60		0	0			
		beans	1.0			40		40		0	1.0			
			2.0			80		40		0	1.0			
			3.0			120		40		0	1.0			
S Mduba	Bergville	maize	4.0	4,28	8	50	6	60	94	65	0	0.8	0.17	26
	Potsini		7.0			140		60		65	0			
			10.0			180		60		65	0			

		beans	1.0			40		55		15	1.0			
			2.0			80		55		15	1.0			
			3.0			120		55		15	1.0			
T Hlatshwayo	Bergville	maize	4.0	3,66	65	40	6	60	145	0	9.5	2.4	0.25	38
	Potsini		7.0			120		60		0	9.5			
			10.0			160		60		0	9.5			
		beans	1.0			40		50		0	15.0			
			2.0			80		50		0	15.0			
			3.0			120		50		0	15.0			
L Sithole	Bergville	maize	4.0	4,36	3	40	7	55	247	0	0	3.5	0.36	≥60
	Potsini		7.0			120		55		0	0			
			10.0			160		55		0	0			
		beans	1.0			40		30		0	0			
			2.0			80		30		0	0			
			3.0			120		30		0	0			

Attachment 2c: Summary crop monitoring scores for all participants

TRIAL SUMMARIES: 2013-2014									
Matatiele									
LUBISINI		**Crop monitoring scores**				**Totals**	**Harvest figures:**		
Hh no	**Plot**	**%Cover at planting (0%) – none to 100% full cover (at planting)**	**% Weeds 0% – high weeds - 100% no weeds no impact on crops**	**% pests 0% bad- to 100% – no pests no damage no yield loss**	**% growth (germination colour height health)**	**Overall score (10)**	**Beans (1-2.5 t /ha),**	**Cowpea (1-1.2 t /ha)**	**Maize (4-10t/ha)**
1	trial	10%	70%	65%	70%	5,37	1,43		
	control	*5%*	*70%*	*65%*	*60%*	*5*			
2	trial	15%	45%	50%	50%	4			
	control	*5%*	*45%*	*50%*	*60%*	*4*			
3	trial	5%	80%	75%	75%	5,87			
	control	*5%*	*80%*	*75%*	*65%*	*5,87*			
4	trial	10%	55%	75%	60%	5			
	control	*None*							
5	trial	10%	55%	75%	60%	5			
	control	*None*							
6	trial	8%	63%	66%	63%	5,01			
	control	*None*							
	Ave trial	**10%**	**61%**	**68%**	**63%**	**5,04**	**1,43**		
	Avecontrl	***5%***	***65%***	***63%***	***62%***	***4,96***			
PONTSHENG									
1	trial	30%	45%	65%	70%	5,25	4,3	1,54	
	control	*30%*	*30%*	*65%*	*40%*	*4,12*			
2	trial	15%	70%	75%	85%	6,15	1,84		
	control	5%	50%	75%	50%	5,4			
3	trial	20%	80%	75%	85%	6,5	0,66	0,34	
	control	*5%*	*55%*	*75%*	*65%*	*5*			
4	trial	15%	85%	75%	80%	6,37	?		
	control	*5%*	*70%*	*75%*	*75%*	*5,62*			
5	trial	15%	50%	75%	50%	4,75	?		
	control	*5%*	*55%*	*75%*	*50%*	*4,62*			
6	trial	15%	60%	75%	60%	5,25	1,29	0,235	
	control								
7	trial	15%	70%	75%	70%	5,75			
	control								

	Ave trial	**18%**	**66%**	**74%**	**71%**	**5,72**	**2,02**	**0,71**	
	Avecontrl	***10%***	***52%***	***73%***	***56%***	***3,68***			
KHAUOE									
1	trial	15%	60%	85%	75%	6	0,69		
	control	*10%*	*60%*	*85%*	*75%*	*5,75*			
2	trial	15%	75%	75%	70%	5,87			
	control	*5%*	*75%*	*75%*	*60%*	*5,37*			
3	trial	15%	75%	85%	65%	6,03	0,116	0,193	
	control	*5%*	*75%*	*85%*	*75%*	*6*			
4	trial	5%	65%	75%	65%	5,26	1,52	1,65	
	control	*5%*	*50%*	*75%*	*55%*	*4,82*			
5	trial	10%	65%	75%	70%	5	1,97	1,31	
	control								
6	trial	10%	40%	65%	40%	3,87			
	control								
	Ave trial	**12%**	**63%**	**77%**	**64%**	**5,34**	**1,074**	**1,051**	
	Avecontrl	***6%***	***65%***	***80%***	***66%***	***5,49***			
TRIAL SUMMARIES: 2013-2014									
Bergville									
Stulwane		**Crop monitoring scores**				**Totals**	**Harvest figures:**		
Hh no	**Plot**	**%Cover at planting (0%) – none to 100% full cover (at planting)**	**% Weeds 0% – high weeds - 100% no weeds no impact on crops**	**% pests 0% bad- to 100% – no pests no damage no yield loss**	**% growth (germination colour height health)**	**Overall score (10)**	**Beans (1-2.5 t /ha),**	**Cowpea (1-1.2 t /ha)**	**Maize (4-10t/ha)**
1	trial	15%	90%	90%	90%	7,1	0,9	0,75	
	control	*5%*	*60%*	*90%*	*90%*	*6,4*			
2	trial	15%	90%	90%	90%	7,1	2..0	1	
	control	*15%*	*40%*	*90%*	*80%*	*5,6*			
3	trial	15%	80%	90%	90%	6,8	0,73	3	
	control	*5%*	*70%*	*90%*	*90%*	*6,3*			
4	trial	15%	90%	90%	90%	7,1	0,34	0,42	
	control	*5%*	*90%*	*90%*	*40%*	*4,1*			
5	trial	10%	75%	90%	80%	6,4	0,5	0,4	
	control	*0%*	*30%*	*90%*	*70%*	*4,7*			
6	trial	15%	90%	90%	90%	7,10	0,3	1,34	
	control	*5%*	*30%*	*90%*	*80%*	*5,1*			
7	trial	30%	70%	90%	80%	6,7	1,25	1,08	
	control	*10%*	*40%*	*90%*	*70%*	*5,2*			
8	trial	30%	80%	90%	85%	7,1	1,57	0,57	

	control	*10%*	*60%*	*90%*	*75%*	*5,9*			
9	trial	15%	60%	90%	75%	6	0,91	1,14	
	control	*5%*	*60%*	*80%*	*65%*	*5,2*			
10	trial	15%	90%	90%	90%	7,1			
	control	*5%*	*60%*	*80%*	*65%*	*4,7*			
11	trial	15%	80%	90%	90%	6,8	1,72	0,72	
	control	*5%*	*60%*	*80%*	*85%*	*7,2*			
	Ave trial	**17%**	**81%**	**90%**	**86%**	**6,85**	**0,91**	**1,04**	
	Avecontrl	***6%***	***55%***	***87%***	***74%***	***5,5***			
EMMAUS									
1	trial	10%	60%	90%	70%	5,7	2,1	0,5	
	control	*5%*	*50%*	*90%*	*60%*	*5,1*			
2	trial	10%	95%	90%	90%	7,1	1,24	0,6	
	control	*5%*	*90%*	*90%*	*85%*	*6,8*			
3	trial	10%	95%	90%	90%	7,1	1,4	0,8	
	control	*5%*	*65%*	*90%*	*70%*	*5,7*			
4	trial	30%	90%	90%	95%	7,5	0,6	0,64	
	control	*5%*	*65%*	*90%*	*90%*	*6,3*			
5	trial	15%	75%	90%	90%	6,75	1,4	0,6	
	control	*5%*	*65%*	*90%*	*70%*	*5,75*			
6	trial	15%	45%	90%	60%	5,25	1	0,2	
	control	*5%*	*65%*	*90%*	*70%*	*5,75*			
7	trial	15%	60%	90%	80%	6,1	0,8	0,4	
	control	*5%*	*50%*	*90%*	*65%*	*5,25*			
8	trial	15%	65%	90%	75%	6,1	2,6	0,8	
	control	*5%*	*65%*	*90%*	*70%*	*5,75*			
9	trial	30%	80%	90%	90%	7,25	0,26	0,23	
	control	*10%*	*65%*	*90%*	*85%*	*6,25*			
	Ave trial	**17%**	**74%**	**90%**	**82%**	**6,54**	**1,27**	**0,53**	
	Avecontrl	***6%***	***64%***	***90%***	***74%***	***5,85***			
POTSHINI									
1	trial	10%	90%	90%	70%	6,5			
	control	*20%*	*90%*	*90%*	*90%*	*7,25*			
2	trial	30%	30%	80%	75%	5,4			
	control	*15%*	*30%*	*80%*	*75%*	*5*			
3	trial	15%	35%	90%	70%	5,12	0,95	0,8	
	control	*5%*	*30%*	*90%*	*60%*	*4,92*			
4	trial	40%	30%	80%	70%	5,5			
	control	*5%*	*30%*	*70%*	*75%*	*4,5*			

5	trial	15%	40%	90%	60%	5,12			
	control	*5%*	*20%*	*90%*	*50%*	*4,12*			
6	trial	10%	20%	70%	80%	4,50	1,9	0,95	
	control	*10%*	*20%*	*70%*	*80%*	*4,5*			
7	trial	20%	40%	90%	90%	5,75			
	control	*20%*	*40%*	*90%*	*80%*	*5,75*			
	Ave trial	**20%**	**41%**	**84%**	**74%**	**5,41**	**1,43**	**0,88**	
	Avecontrl	***11%***	***37%***	***83%***	***73%***	***5,149***			

APPENDIX 1: Matatiele trial summaries – Pontsheng, Final

APPENDIX 2: Matatiele trial summaries – Khauoe, Final

APPENDIX 3: Matatiele trial summaries – Lubisini, Final

APPENDIX 4: Bergville trail summaries - Emmaus, Final

APPENDIX 5: Bergville trial summaries - Stulwane, Final

APPENDIX 6: Bergville trial summaries - Potshini, Final