APPENDIX 3: EASTERN CAPE AND SOUTHERN KZN PROGRESS REPORT
CA Farmer Innovation Programme for smallholders.
Period: October 2019 - September 2020

Compiled by:

Erna Kruger, Mazwi Dlamini, Temakholo Mathebula, Nontokozo Mdletshe and Hendrik Smith

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Project implemented by:

Mahlathini Development Foundation

Promoting collaborative, pro-poor agricultural innovation.

Contact: Erna Kruger (Founder and Director)

Address: 2 Forresters Lane, Pietermaritzburg, 3201, KZN

Email: info@mahlathini.org

Cell: 0828732289

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Table of Contents

Executive Summary

Ninety-three (93) of 129 participants have planted their farmer level trials across 11 villages, with limited support for inputs form the KZN LandCare unit. Summer cover crop and livestock fodder farmer level experimentation have been included for a selection of the villages, as has planting of short season maize varieties to accommodate for late onset of summer rainfall.

Two awareness days have been run; one in Madzikane (Dec 2019) and one in Ofafa (March 2020) in association with KZNDARD, LandCare, Cedara Soils Lab and the Farming Systems unit. A stakeholder meeting with larger farmers MDF and KZNDARD was held in Ngononini to outline approaches and support for farmers and report backs of progress were provided in the Ubuhlebezwe LM Honey and Agriculture task team meetings (Nov 2019, Feb 2019). More extensive interactions have been limited by the COIV-19 pandemic.

Rain-gauges and run-off plots have been installed for a selection of participants in Madzikane and Spring Valley and soil fertility (15 repeat samples and 11 new samples) and soil health (8 participants) samples have been taken and analysed. %OM has improved by 0,1 %, from 2018/19 for the CA plots, equating to 0,6t C/ha sequestered through CA implementation.

Maize yields in CA trial plots (intercropped and rotated plots) average 3,14 t/ha and that of the CA mono-cropped maize average 2,26 t/ha this season. CA bean yields were the highest yet at 1,12 t/ha on average.

Progress with cover crops, fodder experimentation and short season maize varieties was disappointing, with very few participants focussing enough to allow for coherent monitoring of results. During the COVID-19 lockdown period all extra effort in field cropping practices was diverted to diversification into vegetable production and poultry, to accommodate for the need as well as a short-term upswing in local marketing options.

Background and Organisational Information

Mahlathini Development Foundation (2003-2019) is one of the only NGOs in South Africa focussing on promoting collaborative pro-poor agricultural innovation. As such MDF is a specialist NGO working in the fields of participatory research, training and implementation, focussing on agroecological approaches.

Introduction of CA into any farming system requires the creation of a process and environment of continuous innovation, learning and change in a number of different areas, including social, economic, environmental and agronomic considerations. In the smallholder context it requires the design, introduction and facilitation of a reasonably complex IS (innovation system) approach by the implementers, and of practice, labour and resources (including natural and financial resources) by the farmer that has system wide implications. There is an interplay of a number of different factors, all of which need to be integrated, thus requiring a well-designed and facilitated IS approach.

The IS model applies a family of approaches and methodologies, such as the Farmer Field School (FFS) approach and participatory monitoring & evaluation (PM&E), to facilitate awareness, learning, implementation and research all together. The key voluntary participants of this process are farmers from a locality or village who should be organised into learning groups (farmers generally are already organised into structures such as savings and credit groups, associations or cooperatives). A number of farmers in that group volunteer to undertake on-farm experimentation, which creates an environment where the whole group learns throughout the season by observations and reflections of the trials' implementation and results. They compare various CA treatments with their standard practices, which are planted as control plots. This provides an opportunity to explore all aspects of the cropping system, its socio-economic context and feasibility, as well as the grain and legume value chain in the area. The whole value chain is considered: input supply, production aspects, harvesting and storage, processing and marketing

Horizontal expansion (scaling out) from village nodes to surrounding farmers and villages in the area, working with organised farmer groups (or IPs) in collaboration with stakeholders in the region has shown great promise for expansion of interest in and longer term sustainability of the implementation of CA practices among smallholders. It means that a number of villages in close proximity become involved and this provides an opportunity for organising farmers around issues in the value chain such as bulk buying, transport, storage and marketing. It creates an option to set up farmer service centres at central nodes that can provide easy access to inputs and services. The model also provides for learning over a period of time, which has proven essential to allow each participant farmer to experiment with and master/adapt the CA principles for at least 4 years. The more experienced farmers become mentors to the new entrants and some undertake the role of local facilitation and support to their villages and groups. It also provides a platform where other farmers and interested parties in the area can engage and become involved. The text box below provides a stepwise description of the process.

SELECTION AND COMMUNITY LEVEL PROCESS

PRE-CONDITION; Farmers active in maize production with some level of social organisation

1. Entry into community; through word of mouth from community members (individual and group requests), government officials, other service organisations,
2. Set up introductory meetings at community level, including authorities, to introduce CA and the process:
    - Set up learning or interest group (20-30 people)
    - Members of learning group volunteer for farmer led experimentation (usually 9-12 members in the first year), while the rest of the group learns alongside them
    - These members agree to do a CA trial alongside their control (normal way of planting)
    - Trials are usually 100,400 or 1000m² (*small areas to reduce risk)*
    - The programme provides inputs for the trial, the inputs for control and all labour are provided by the farmer (the risk of implementing the new idea initially sits with the programme not the farmers. From the 2nd year onwards the farmers pay a standard 30% subsidy towards the costs of inputs for their trials)
    - Farmers are trained in the implementation of CA; pre-planting spraying (use of knapsack sprayers) and field preparation, use of herbicides, layout of plots and planting in basins and rows using a range of no-till tools (hand planters, animal drawn planters and or two row tractor-drawn planters). The choice of implements depends on the scale of farming and farmers' choice. Aspects such as top dressing, weeding and pest control are covered during the season as well.
    - The first-year trial layout is pre-determined through the programme – to include close spacing, inter cropping and different varieties of maize (choice of traditional OPV or hybrid seed- according to farmer preferences) and legumes (sugar beans, cowpeas)
    - From the 2nd year onwards, farmers start to add their own elements to the experimentation depending on their learning, questions and preferences. Cover crops (both summer and winter) and crop rotation options are introduced.
    - Researcher managed "trials" are also set up at individual homesteads, to work alongside the more enthusiastic and committed participants and to explore issues such as soil health, carbon sequestration soil fertility, water productivity, moisture retention, run-off and specific aspects of the CA system – such as seeding and seeding rates of cover crops etc.
    - As a minimum, 2-4 learning sessions per season in the learning group are held each year, building in complexity and content. 1 review session for the season and one planning session to plan experimentation for the upcoming season
    - Planters and knapsack sprayers are provided to the learning group to share, manage and maintain
    - Setting up of VLSA's (village savings and loan associations), farmer centres and joint harvesting, storage and milling options are promoted
3. Each season farmers days are organised in each area, jointly with the learning groups, CA forums and innovation platforms are promoted where all stakeholders in a region join these forums to share, discuss and plan together. This includes role players such as DARD, Social Development, Land Care, Local and District Municipalities, Agribusiness service providers and NGOs

In this season (2019-2020) we have focused on the following elements of the model, namely:

a) Support farmers who are in their 1st, 2nd, 3rd and 4th seasons of implementation,
b) Conscious inclusion of crop rotation to compare with intercropping trials
c) Inclusion of summer cover crops in the crop rotation trials
d) Introduction of short season maize varieties
e) Initiation of a livestock CA fodder strip cropping demonstration trial, for production of winter fodder and grazing and as an erosion control practice
f) Initiation of nodes for farmer centres that can offer tools, input packs and advice and
g) Initiation of a marketing Cooperative in Ngongonini.

Key activities: October 2019-September 2020

Implementation has continued in three southern KZN areas (Matatiele, Creighton, and Ixopo) in 11 villages. Plaatestat and Nokweja have been discontinued due to dwindling interest. Learning group numbers in Springvalley, Ofafa and Emazabekweni have increased by 13, 22 and 3 new participants respectively. The partnership with KZNDARD has been initiated and a fodder strip cropping CA trial has been set up in Madzikane. Support for the 3 existing VSLAs has continued and included small business development training. VSLA introductory meetings were hled in Ofafa nad Plainhill and a new VSLA was set up in Ngongonini. A marketing cooperative has been established in Ngongonini. This cooperative also plays a central role in input supply and distribution as well as management and use of shared CA equipment and is in the beginning stages of being set up as a farmer centre for the area.

The stakeholder forum in Madzikane has been continued and a farmers' day was held on the 11th of December, including stakeholders such as KZNDARD, LandCare representatives, the Farming Systems Unit at Cedara and the LED section of the Nkosazana Dlamini Zuma LM. A further farmers' day was held in Ofafa in March 2020.

Soil fertility, and soil health analyses have been done for 26 and 8 participants respectively. Soil fertility analysis indicated a reduction in acid saturation and accumulation of organic carbon and nitrogen in the CA trial plots over time. An annual increase of around 0,1% organic matter has been noted for the CA system. Rainfall and runoff summaries have again indicated a significant reduction in runoff on the CA trial plots when compared to mono-cropped CA controls: 4% and 7% of rainfall respectively. Average bulk density of CA trial plots measured was 1,12 g/cm^3, compared to 0,83 g/cm^3 for the CA control plots. Water productivity has been calculated for the first time and provided a good indication for much improved water productivity for the CA intercropped plots when compared to a single cropped maize CA control.

Progress

The project is now operational across 11 villages across Matatiele and SKZN, with a significant increase in learning groups and participants as mentioned above.

The basic experimental design was followed for all 1st year participants and most of the 2nd year participants as well. Variations for 3rd and 4th year participants have included crop rotation, intercropping, summer and winter cover crop mixes, planting of lab-lab beans, fodder crops and late season planting of beans.

The table below outlines activities related to objectives and key indicators for the period of October 2019 -September 2020.

Table 1: Summary of progress (October 2019 – September 2020) related to objectives and key activities

Objectives	Key activities	Summary of progress	% completion and comment
OBJECTIVE 1: To engage in participatory research related to the smallholder conservation agriculture farming system; including aspects of soil health, water conservation and increased productivity and diversity using a learning systems approach.	Key activity 1. Farmer level experimentation and demonstrations in fodder production systems	Planting and assessment of different fodder crops (annual and perennial) into the CA experimentation process: -Intercropping with legumes and cover crops in 11 villages -Strip cropping with perennial fodder options in 1 village	Cover crops planted by 15% of participants (100% completion)
	Key activity 2. Soil health and water conservation monitoring	Researcher managed quantitative outcomes for a number of soil health and water conservation indicators -Soil fertility samples; New (11) and repeat (15)samples across 5 villages -Soil health samples; 8 participants/ 7 villages -Run-off plots and rain gauges: 2 villages -Water productivity: 5 participants across 3 villages	Soil fertility samples results have been analysed and are included in this report Soil health sample results have been obtained and analysis is in process. (100% completion)
	Key activity 3. Stakeholder engagement in participatory research:	Articles and promotional material to engage stakeholders in the broader environment and sharing of information through various innovation platforms and processes; including the internet, social and networking platforms and conferences -Stakeholder forum in Madzikane (13th December 2020) -Open day in Ofafa (March 2020) -KZNDARD and MDF stakeholder workshop re field cropping Madzikane (March 2020) -Writing of a book chapter for CABI:CA in Africa	(100% completion)
OBJECTIVE 2: To increase the sustainability and efficiency of CA systems in the study areas giving specific attention to the value chain and incorporation into the broader	Key activity 1: Farmer-centred Innovation Systems Research: Key activity 2. Value chain and agribusiness support:	Jointly design and implement farmer-led adaptation trials and a basket of farmer level experimentation protocols from CA best practice options. -93 farmer level trials set up across 11 villages; including intercropping with legumes and cover crops options. Promotion and of VSLAs farmer centres and small business development among individual smallholder farmers -Continued support for 3 VSLAs and start up of 2 new VSLAs (Ngongonini and Ofafa) - Set up of 2 marketing cooperative sin Ngongonini and Madzikane– to take on	Spraying, planting, top dressing, pest control; growth and yield monitoring has been conducted. (100% completion)

agribusiness environment.	Key activity 3: Support Local facilitators:	role of farmer centre; proposals prepared - Small business development training and mentoring for 14 participants Training and mentoring support for at least 8 Local Facilitators to increase their capacity organise local farmers, logistics and planning for cropping options and monitoring of the farmer level experimentation. -4 Local facilitators have been capacitated to support their groups – spraying, input supply and delivery, plot layout, and crop growth monitoring	(100% completion) In a number of the villages, individuals who can fulfil the role of an LF have not come forward and this is still managed by MDF staff (100% completion)
OBJECTIVE 3: Strengthen and use different innovation platforms as avenues to scale out sustained collective action and CA practices.	Key activity 1. Further develop the Participatory Monitoring and Evaluation (PM&E) framework: Key activity 2. Facilitate innovation platforms for learning and networking: Key activity 3. Strengthen Innovation Platforms:	Experienced farmers (farmer facilitators) and the facilitation team assist in scientific, ongoing monitoring (qualitative and quantitative) and support to farmer experimenters. - Quantitative research elements conducted in partnership with 9 experienced farmers across 5 villages (incl run-off plots, rain gauges, water productivity and soil health analysis Learning group sessions for discussion and learning. -At least 3 sessions have been held with learning groups across 5-6 villages – themes have included CA principles, spraying, inclusion of fodder and cover crops, expansion into larger areas, marketing options, cooperative development and entrepreneurship Innovation platform events: -Madzikane stakeholder forum open day – 13 December 2019.; included discussions on mechanisation (2 and 4 row planters), strip cropping for perennial fodder options in a CA system, Business development support through LandCare and KZNDARD, Cooperative registration and marketing through RASET programme - Ofafa Open day 12 March 2020) _Madzikane field cropping event; KZNDARD and MDF (March 2020)	Two new interns with MSc's in Agriculture and Soil Science have been brought on board to assist. Runoff bulk density and WP sampling and analysis; mycotoxin sampling (100% completion) (50% completion) (100% completion)

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

Table 2: Performance dashboard; September 2020

Outputs	**Proposed (March 2019)**	**Actual (Feb 2020)**
Number of areas of operation	4	4
Number of villages active	13	11
No of local facilitators	8	4
No of direct beneficiaries; farmer level experimentation	140	129 (93)
Fodder trials with KZNDARD	3	1
Stakeholder Events	3	3
Value chain support	Not defined	5 VSLAs (2 new) 2 Cooperatives
Articles, conferences	1-3 of ea	1 book chapter 1 national webinar (Integra Trust)
Soil samples	40	35

The table below summarises the planned and actual farmer level experimentation implementation for the 2019-2020 planting season. A total of one hundred and twenty-nine (129) trial participants volunteered through the planning processes across 11 villages in three areas. Ninety-three (93) of these farmers planted their CA farmer level experimentation trials (around 72% of participants). For this season the weather was variable, with late-onset rains and large variability in rainfall across areas and time.

Table 3: Summary of farmer innovation number and areas planted per village in this CA process; Eastern Cape, 2019-2020

Area	Village	2019 total	2019 1st level	2018 2nd level	2017 3rd level	2016 4th level	2015 4th level	Experimenta-tion	Comments
Matatiele	Sekhutlong	4 (3)		1		1	2	Intercropping summer and winter cover crops	Bulelwa Dzingwa – local facilitator for Nkau and Sehutlong. She has continued to manage the CA experimentation in Matatiele-continuing with a smaller group of participants
	Nkau	7 (4)		4		2	1		
	Mqhobi	9 (1)				2			
	Khutsong	1 (1)					1	Intercropping summer and winter cover crops, crop rotation, fodder crops	Tsoloane Mapheele Animal drawn planters used here in larger areas
Creighton	Madzikane Farmers Assocation	10(7)			2	8		Intercropping, summer and winter cover crops. Fodder strip cropping, 2 row planter	Partnership KwaNalu. Local facilitator: Mr CD Xaba
Ixopo	Ofafa	30 (27)	22			8		Intercropping, summer and	Local facilitator; Ms Hlengiwe

								winter cover crops	Thusi .Area is hilly with variable soils
	Emazabekweni	8 (5)	3			5			Local Facilitator; Mr B Dlamini. Area is hilly with variable soils
	Springvalley	19 (18)	13			6			
	St Elois	15 (11)		3	12				Expansion area from Nokweja supported by Mr Mkhize the LF
	Plainhill	13 (8)		13					
	Ngongonini	13 (8)		13					
TOTAL	11	129 (93)	37	34	14	32	4		Total area planted to trials~ 3,72ha

Budget

A total budget of R595 527 was approved for this project by the Maize Trust. Below is a summary of invoices submitted. The project was finalised in August 2020.

Date	**Invoice No**		**Description**	**Amount (Rands)**
2019/10/31	SINV012829	GSAEC-2019-2020-2020 1	Monthly invoice	46 232,83
2019/11/29	SINV013344	GSAEC-2019-2020 2	Monthly invoice	77 230,00
2020/01/31	SINV013951	GSAEC-2019-2020-3	Monthly invoice	98 078,64
2020/02/28	SINV014496	GSAEC-2019-2020-04	Monthly invoice	100 043,09
2020/03/16	SINV014768	1102	Soil Health Solutions invoice	11 760,00
2020/03/30	SINV015020	GSAEC-2019-2020-06	Monthly invoice	55 109,25
2020/04/30	SINV015246	GSAEC-2019-2020-07	Monthly invoice	33 569,48
2020/05/30	SINV015483	GSAEC-2019-2020-08	Monthly invoice	48 681,14
2020/06/30	SINV015760	GSAEC-2019-2020-09	Monthly invoice	47 526,36
2020/07/30		GSAEC-2019-2020-10	Monthly invoice	77297,72
TOTAL				**595 528,51**

Overall trial design process

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

Year 1:

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

- Intercropping of maize, beans and cowpeas

- Introduction of OPV and hybrid varieties for comparison (1 variety of maize and beans respectively)
- Close spacing (based on Argentinean 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 or at planting
- Decis Forte used at planting and top- dressing stage for cutworm and stalk borer

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

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

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

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

Year 2:

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

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

Year 3 onwards:

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

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

Soil health

The intention is to compare the soil health characteristics for a number of cropping options within the CA trials over time and also to compare conventionally tilled mono-cropped control plots with CA trial plots over time.

The Haney soil health tests (as analysed by Soil Health Solutions in the Western Cape and Ward Laboratories in the USA) provides insight into microbial respiration and populations in the soil, organic and inorganic fractions of the main nutrients N, P and K, and assessment of organic carbon and percentage organic matter (%OM). An overall soil health score (SH) is also provided for each sample.

Method

Sampling:

Sampling is done at the same time every year; during September, after harvest and prior to start of seasonal rain, according to international conventions (Stolbovoy, et al., 2007).

- CA plots: 10x10m plots are marked and 10cm depth cores are taken (with a soil auger), taking 20 samples along a zig-zag pattern across the plot. These are combined, thoroughly mixed and then 500g is placed in a plastic bag and sealed. These bags are kept in a cool, dark place until delivery to the soil health analysis laboratory – usually within 4-6 weeks of taking the sample
- Control plots; 20 samples are taken in a zig-zag pattern across the dimension of the control plot; these vary from one participant to the next and are otherwise treated in the same manner as the CA plot samples above.
- Veld samples: This changed after the first two seasons, to reduce potential variability in the samples. A patch of undisturbed veld, as close as possible to the participant's cropping

field is chosen, to also have the same basic visual characteristics as the field in question. 4 sub-samples are taken at 10-15cm depth at the 4 compass positions adjacent to the cropping field. NOTE: It has been the team's experience that the values of the veld samples vary substantially even in the same village or the same vicinity as a field. The practise of using one veld sample for two to three different farmers in the same village was thus discontinued and a decision made to use a section of veld as close as possible to the cropping field. In addition, Veld in smallholder farming areas under communal tenure, cannot be regarded as "pristine", given heavy grazing patterns and frequent burning. It is however assumed that the soil is undisturbed in terms of tillage and gives an indication of the general conditions of the soil in the vicinity of the cropping fields.

Samples were air dried and stored for a period of 2-4 weeks at room temperature (20-24°C), prior to analysis.

Samples have been collected for the 2019/20 season in Matatiele for 3 participants across three villages: Tsoloane Mapheele (Khutsong), Bulelwa Dzingwa (Nkau) and Mamolekeng Lebuoa (Sehutlong), to be able to compare their results with previous seasons (2015-2018).
Samples were also collected in the following SKZN sites, to compare with results from 2017/18 and 2018/19:

- Spring Valley: Letha Ngubo
- Ofafa: Velaphi Hadebe
- Madzikane: Cosmos Xaba, Vakushile Gambu
- Ngongonini: Mandla Mkhize

Laboratory analysis
Laboratory analysis was undertaken by Soil Health Solutions, linked to WARD Laboratories in the USA. Each soil sample received in the lab is dried at 50°C for 24 hr and ground to pass a 4,75 mm sieve. The dried and ground samples are scooped, with the weight recorded using a Sartorius Practum 2102-1S, into two 50 ml centrifuge tubes (4 g each) and one 50 ml plastic beaker (40 g) that is perforated and has a Whatman GF/D glass microfiber filter to allow water infiltration. The two 4 g samples are extracted with 40 ml of DI water and 40 ml of H3A respectively, for a 10:1 dilution factor. The samples are shaken for 10 minutes, centrifuged for 5 minutes, and filtered through Whatman 2V filter paper. The water and H3A extracts are analysed on a Seal Analytical rapid flow analyser for NO_3-N, NH4-N, and PO_4-P. The water extract is also analysed on an Elementar TOC select C: N analyser for water-extractable organic C and total N. The H3A extract is also analysed on an Agilent MP-4200 microwave plasma for Al, Fe, P, Ca, and K.
The 40 g soil sample is analysed for CO2-C ppm after a 24- our incubation at 25o C. Initially, the sample is wetted through capillary action by adding 18 ml of DI water to an 8 oz. glass jar (ball jar with a convex bottom) and placed in the jar and then capped. Solvita paddles can be placed in the jar at this time and analysed after 24 hrs with a Solvita digital reader. Alternatively, we use a system that we call HT-1, where at the end of 24-hour incubation, the CO2 in the jar can be pulled through a LiCor 840A IRGA, which is a non-dispersive infrared (NDIR) gas analyser based upon a single path, dual wavelength infrared detection system.

SOM% is a gravimetric expression of the organic material fraction lost from combustion at 360°C for 3 hours. Also termed the loss in ignition calculation method, (LOI%).

Soil health tests parameters[1]

The method uses nature's biology and chemistry by: (1) using a soil microbial activity indicator; (2) a soil water extract (nature's solvent); and (3) the H3A extractant, which mimics the production of organic acids by living plant roots to temporarily change the soil pH thereby increasing nutrient availability.

These analyses are benchmarked against natural veld for each participant, due to high local variation in soil health properties, measured at different times. The veld scores provide for high benchmarks to compare the cropping practices against.

Soil Respiration 1-day CO2-C: This result is one of the most important numbers in this soil test procedure. This number in ppm is the amount of CO_2-C released in 24 hours from soil microbes after soil has been dried and rewetted (as occurs naturally in the field). This is a measure of the microbial biomass in the soil and is related to soil fertility and the potential for microbial activity. In most cases, the higher the number, the more fertile the soil.

Microbes exist in soil in great abundance. They are highly adaptable to their environment and their composition, adaptability, and structure are a result of the environment they inhabit. They have adapted to the temperature, moisture levels, soil structure, crop and management inputs, as well as soil nutrient content. Since soil microbes are highly adaptive and are driven by their need to reproduce and by their need for acquiring C, N, and P in a ratio of 100: 10: 1 (C:N:P), it is safe to assume that soil microbes are a dependable indicator of soil health. Carbon is the driver of the soil nutrient-microbial recycling system.

Water extractable organic C (WEOC): Consists of sugars from root exudates, plus organic matter degradation. This number (in ppm) is the amount of organic C extracted from the soil with water. This C pool is roughly 80 times smaller than the total soil organic C pool (% Organic Matter) and reflects the energy source feeding soil microbes. A soil with 3% soil organic matter when measured with the same method (combustion) at a 0-10cm sampling depth produces a 20,000 ppm C concentration. When the water extract from the same soil is analysed, the number typically ranges from 100-300 ppm C. The water extractable organic C reflects the quality of the C in the soil and is highly related to the microbial activity. On the other hand, % SOM is about the quantity of organic C. In other words, soil organic matter is the house that microbes live in, but what is being measured is the food they eat (WEOC and WEON).

If this value is low, it will reflect in the C02 evolution, which will also be low. So less organic carbon means less respiration from microorganisms, but again this relationship is unlikely to be linear. The Microbially Active Carbon (MAC = WEOC / ppm CO_2) content is an expression of this relationship. If the percentage MAC is low, it means that nutrient cycling will also be low. One needs a %MAC of at least 20% for efficient nutrient cycling.

Water extractable organic N (WEON): Consists of Atmospheric N_2 sequestration from free living N fixers, plus organic matter degradation. This number is the amount of the total water extractable N minus the inorganic N (NH_4-N + NO_3-N). This N pool is highly related to the water

[1] Haney/Soil Health Test Information Rev. 1.0 (2019). Lance Gunderson, Ward Laboratories Inc.

extractable organic C pool and will be easily broken down by soil microbes and released to the soil in inorganic N forms that are readily plant available.

Organic C: Organic N: This number is the ratio of organic C from the water extract to the amount of organic N in the water extract. This C:N ratio is a critical component of the nutrient cycle. Soil organic C and soil organic N are highly related to each other as well as the water extractable organic C and organic N pools. Therefore, we use the organic C:N ratio of the water extract since this is the ratio the soil microbes have readily available to them and is a more sensitive indicator than the soil C:N ratio. A soil C:N ratio above 20:1 generally indicates that no net N and P mineralization will occur. As the ratio decreases, more N and P are released to the soil solution which can be taken up by growing plants. This same mechanism is applied to the water extract. The lower this ratio is, the more organisms are active and the more available the food is to the plants. Good C:N ratios for plant growth are <15:1. The most ideal values for this ratio are between 8:1 and 15:1.

Soil Health Calculation: This number is calculated as 1-day CO_2-C/10 plus WEOC/50 plus WEON/10 to include a weighted contribution of water extractable organic C and organic N. It represents the overall health of the soil system. It combines 5 independent measurements of the soil's biological properties. The calculation looks at the balance of soil C and N and their relationship to microbial activity. This soil health calculation number can vary from 0 to more than 50. This number should be above 7 and increase over time.

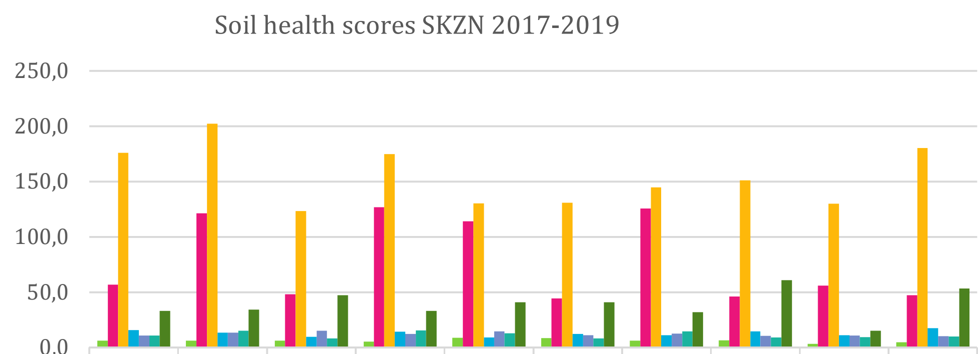
Soil health scores

Three assumptions are made regarding SH scores:

- That SH scores for the CA trial plots will be higher than for the conventionally tilled control plots
- That SH scores will increase over time for CA trial plots and
- That SH scores for different cropping combinations, such as mono cropped plots, inter cropped plots and multi cropped plot will be different

1. *SH scores over time SKZN*

Soil health scores have been calculated for 5 participants across 4 villages for three consecutive planting seasons (2017-2019) to get a sense of changes related to CA cropping in these villages. A summary of these soil health indicators is shown in the figure below.



	Madzikane 2017	Madzikane 2018	Madzikane 2019	Ngongonini 2017	Ngongonini 2018	Ngongonini 2019	Spring Valley 2018	Spring Valley 2019	Ofafa 2018	Ofafa 2019
%OM	6,0	6,1	6,2	5,4	8,95	8,6	6,3	6,5	3,4	4,8
CO2 - C(ppm)	57,0	121,4	48,3	126,9	114,0	44,4	125,7	46,0	55,8	47,2
Organic C (ppm)	176,0	202,5	123,3	175,0	130,3	131,0	144,7	151,0	130,0	180,5
Organic N (ppm)	15,8	13,4	9,8	14,2	9,0	12,5	11,4	14,5	11,4	17,5
C:N ratio	11,1	13,4	15,0	12,3	14,7	11,2	12,7	10,5	11,1	10,3
Soil health calculation	10,8	15,0	8,3	15,5	13,0	8,3	14,5	9,1	9,4	10,1
Soil aggregates	33,0	34,3	47,3	33,0	41,0	41,0	32,0	61,0	15,0	53,5

Figure 2: Summary of soil health scores for three seasons across 4 villages in SKZN

From the above figure the following can be seen:

- Soil health calculations increased from 2017 to 2018 for Madzikane and Ngongonini and decreased for all villages from 2018 to 2019, except Ofafa. This same trend was noted in both the Bergville and Midlands analyses across this time period. It is primarily due to much lower CO_2-C respiration in 2019 when compared to the previous two seasons.
- Generally the %OM in these villages is very high, except for Ofafa, where difficult soil conditions (low fertility, shallow and rocky soils) occur.
- The Organic C and % OM have increased between 2018-2019 for all areas, except Madzikane. This provides an indication that the reduction in microbial respiration is not is not directly related to a reduction in organic carbon, but is due to climatic factors; such as heat and extended dry soil conditions.
- The average increase in %OM from 2018 to 2019 was o,1% across all four villages. This equates to 0,6tC/ha sequestered in the SKZN region for this period., assuming a bulk density of 1,06 (averaged from calculations for Spring Valley and Madzikane).
- Organic N increased for all villages except Madzikane between 2018 and 2019, leading to lower C:N ratios in these three villages; a trend that is considered desirable and indicates a comparatively higher increase in organic N in the soil than organic C. The ratios are close to ideal for nutrient release and mineralization for all four areas.
- Percentage soil aggregate stability improved markedly between 2018 and 2019 for all four villages.

The general assumption here is that if the level of organic C in a plot is high, then the microbial respiration will also be high, as will the soil health score and vice versa. This is not always the case, as the relationship is not necessarily a linear one.

The CO_2-C respiration also gives an indication of the potential mineralisation of N for the soil as well as organic matter content. The small table below indicates these relationships.

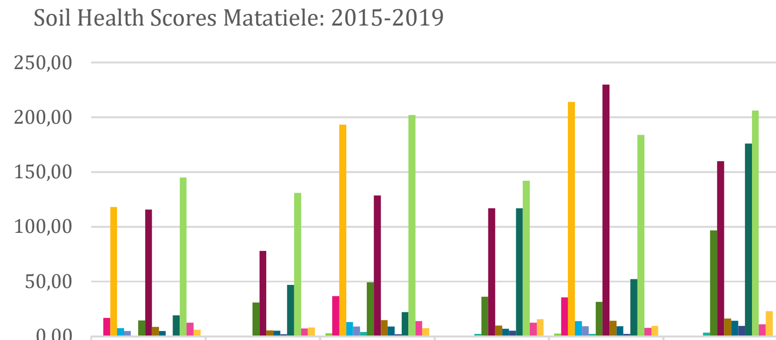
Test results ppm CO_2-C	N mineralisation potential	Biomass
>100	High-N potential soil. Likely sufficient N for most crops	Soil very well supplied with organic matter. Biomass>2500ppm
61-100	Moderately-high. This soil has limited need for N supplementation	Ideal state of biological activity and adequate organic matter
31-60	Moderate. Supplemental N required	Requires new applications of stable organic matter. Biomass <1200ppm
6-30	Moderate-low. Will not provide sufficient N for most crops	Low in organic structure and microbial activity Biomass <500ppm
0-5	Little biological activity; requires significant fertilisation	Very inactive soil. Biomass<100ppm. Consider long term care

From this table the average CO_2-C respiration of around 46ppm for all four villages, for 2019 indicates moderate N mineralization and the need for new applications of stable organic matter. It is speculated that the addition of organic matter through the diversified CA cropping system employed is not enough to provide a stable provision of nutrients under the adverse climatic conditions being experienced., despite increases in Organic C and organic N in the soil over this period. In general, these observations provide support to the management recommendations for the area, summarised below:

1. Ways in which to preserve and build soil carbon are important in this area (which has a high potential for loss of organic carbon):
   a. Mulching with weeds is very important in this system
   b. Mulching with cut grass or other organic matter if possible
   c. Ensuring canopy cover as early in the season as possible – thus close spacing
   d. Introducing a large diversity of crops as early as possible, especially legumes.
   e. Inclusion of manure in the system
2. Reduce synthetic fertilizers over time
3. Ensure legumes are a central component of cover crop and rotation options.
4. Cowpeas are an important inclusion in the intercropping process- showing ability to increase organic C and N substantially, in the short term.

2. *SH scores over time Matatiele (EC)*

In Matatiele soil health scores have been consistently calculated for 5 participants across three villages between 2014 and 2019. In this area, due to the low fertility and sandy soils, changes in soil health parameters have been slow to materialize. Below, the values for 2016 and 2019 are compared (a four year period).



	Khutsong 2016	Khutsong 2019	Nkau 2016	Nkau 2019	Sehutlong 2016	Sehutlong 2019
Cont M - Average of %OM	0,60		2,80		2,55	
Cont M - Average of CO2 - C, ppm C	16,80		36,55		35,55	
Cont M - Average of Organic C ppm C	118,00		193,50		214,00	
Cont M - Average of Organic N ppm N	7,50		13,10		13,80	
Cont M - Average of Soil health Calculation	4,79		8,84		9,22	
Trial - Average of %OM	0,70	0,80	3,95	2,30	2,35	3,40
Trial - Average of CO2 - C, ppm C	14,60	31,00	49,35	36,00	31,40	97,00
Trial - Average of Organic C ppm C	116,00	78,00	128,50	117,00	230,00	160,00
Trial - Average of Organic N ppm N	8,50	5,60	14,85	9,90	14,40	16,40
Trial - Average of Soil health Calculation	4,63	5,20	8,99	6,90	9,18	14,50
Veld - Average of %OM	1,00	1,90	2,00	5,40	2,30	9,60
Veld - Average of CO2 - C, ppm C	19,20	47,00	22,10	117,00	52,30	176,00
Veld - Average of Organic C ppm C	145,00	131,00	202,00	142,00	184,00	206,00
Veld - Average of Organic N ppm N	12,40	7,30	13,70	12,50	7,70	11,00
Veld - Average of Soil health Calculation	6,06	8,10	7,62	15,80	9,68	22,80

Figure 3: Soil health scores for 3 villages in Matatiele: 2016 and 2019

Note: As no samples were taken for the control maize plots in 2019, the CA intercropped maize and bean plots (trial) could not be compared against the CA single cropped maize plots (Cont M)

From the figure above the following trends can be seen:

- In Khutsong, for Mr Tsoloane Mapheele, there has been a slight increase in the %OM for his trial plot (0,7-0,8%), a small increase in the CO_2-C respiration (14,6-31ppm) and a small increase in the soil health score (4,6-5,6). Yield averages in this period have seen an increase in average maize yields from 0,8 to 1,1 t/ha and bean yields from 0,2 to 1 t/ha.
- In Nkau, Bulelwa Dzingwa has seen a decline in her soil health parameters in between 2016 and 2019, which is likely due to her inability to coherently implement the CA principles in her field.
- In Sehutlong, Mamelekeng Mabuoa has seen a reasonable increase in her %OM (2,4 to 3,4%), CO_2-C respiration (31,4 to 97ppm) and soil health score (9,2 to 14,5). The increase in these values for her veld samples has been even more significant, indicating that these gains are not directly related to her CA implementation.

From these results we can assume that it is possible to maintain and somewhat increase soil health parameters under CA, although increases are small and well below the values for undisturbed veld in the same areas. These analyses are to be discontinued for Matatiele going into the future.

Soil organic matter

Soil organic matter is where soil carbon is stored, and is directly derived from biomass of microbial communities in the soil (bacterial, fungal, and protozoan), as well as from plant roots and detritus, and biomass-containing amendments like manure, green manures, mulches, composts, and crop residues (Motaung, 2020). Soil Organic Carbon refers to the carbon component of soil organic matter (SOM) that is measured in mineral soil which passes through a 2mm sieve. It is the largest component of SOM (approximately 45%) and the easiest and cheapest to measure. The SOC content of agricultural soils is generally between 0.5 and 4%.

There is general consensus among researchers that CA improves soil health by increasing soil organic matter (SOM). Increased soil organic carbon (SOC) also sequestrates atmospheric carbon and thereby contributes to climate change mitigation targets (Swanepoel, Swanepoel, & Smith, 2017).

Despite this consensus, some studies in Africa and Southern Africa have reported small increases, or very slow build -up of SOC and negligible increases when compared to conventional systems. It is being argued that the build-up of SOM in CA systems, is related more to increased biomass and organic mulch than a reduction in tillage (Giller, Witter, Corbeels, & Tittonell, 2009). It has also been suggested that in drier climates with sandier soils it may take up to 10 years to detect a noticeable difference in SOC accumulation (GRDC, 2014)

In addition, it has been suggested, that to get reliable data related to changes in SOC related to land use patterns, large numbers of samples need to be taken; between 80-500 on average for croplands and undisturbed soils such as forests respectively (Stolbovoy, et al., 2007). This is not financially feasible for small, multi-faceted programmes such as the CA- SFIP.

1. *Methods*

Sampling for laboratory analysis of soil health is as described above in section 1; with 20 sub-samples making up any one sample, generally within a 100m^2 area, taken during the fallow season and air dried and stored at room temperature prior to analysis. Soil depth for samples is 0-10cm, as this is the depth of soil where the most change in SOC is likely to occur.

Percentage SOC (Kg C/Kg soil x 100) has been provided for these samples (Soil Health Solutions Laboratory, WC). A constant factor of 1,72 is used in South Africa, to convert %SOC to %SOM (GRDC, 2014)

For both the 2018/19 and 2019/20 cropping seasons, sampling was done for 5 participants, across 4 villages between their 2nd and 3rd year of CA implementation. The table below is a summary of the %OM for a combination of all CA experimentation plots (B, M, M+B, M+CP and SCC) as well as the CA control plots (Maize only), compared to veld benchmark samples.

SKZN	**%OM**		**C (t/ha)**	
	2018	**2019**	**2018**	**2019**
CA	5,7	6,4	3,7	4,2
CA-control	5,9	5,9	3,9	3,8
Veld	8,0	9,1	5,2	5,9

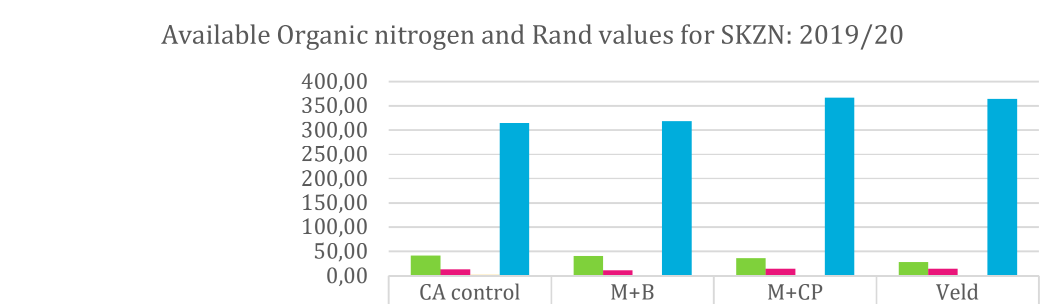
SOC and %OM derived from this, increased in the veld samples between 2018 and 2019, leading to a soil carbon density calculation of 5,2 tC/ha and 5,9 tC/ha respectively. The CA plots increased at a similar rate of 0,5 tC/ha, but as the veld samples also increased, it is considered that there has been no net gain in carbon between these seasons. The CA control plots showed a very slight reduction of 0,1 tC/ha; which would then indicate a decline in carbon for the single cropped CA maize plots during this season. This provides an indication that multi cropping in CA can allow for SOC accumulation even under adverse climatic conditions (late onset of summer rainfall, high temperatures and mid-season dry spells), although longer term averages would need to be calculated to verify this trend.

Available organic Nitrogen

In the dryland cropping system around Bergville, as in most other dryland cropping areas in South Africa, supplementation with inorganic Nitrogen is considered an important strategy for optimal crop growth. In our CA study different crop combinations and cropping options are being explored to assess the potential of providing nitrogen through improvement of natural nutrient flow cycles. Inorganic N, besides being expensive, also has been shown to dampen the natural microbial activity in the soil and can also be partially ineffective under extreme conditions of drought and heat.

An analysis of immediate release N has been done, as well as an estimation of the rand value of inorganic nitrogen saved /ha for different cropping options under CA. The immediate release N- is the water extractable organic Nitrogen, which is immediately available to the next crop, but the Rand value is calculated for the total available Nitrogen (including the short and long-term release fractions).

Samples used for this analysis are the same as for the other soil health parameters: 5 participants across 4 villages.



	CA control	M+B	M+CP	Veld
Average of N Immediate release (ppm)	41,26	40,89	36,28	28,40
Average of N Short term relsease (ppm)	13,71	11,17	14,63	14,53
Average of N Long term release (ppm)	1,71	0,74	0,00	0,00
Average of R value of N	R314,37	R318,34	R366,90	R364,47

Figure 4: Suammry of organic Nitrogen availability and rand values of inorganic nitrogen saved for SKZN:2019/20

For SKZN there has been a progression in the Rand value of inorganic nitrogen saved through accumulation of organic Nitrogen in the soil from single cropped maize (R314,37) to a maize and bean intercrop (R318,34), with the highest value being for the maize and cowpea intercropped plots (R366,90). On average the rand value of inorganic N saved in this process is R329/ha. This is however lower than the Rand value for veld and thus it can not be considered to have been a gain due to the CA cropping process. It points toward a slight loss of nitrogen in the CA system.

The small table alongside provides a summary for the Nitrogen Rand values for 2018 and 2019. The veld samples have remained stable at around R363/ha and both the CA maize plots and multi-cropped plots have increased by about 10%.

Rand value of inorganic N saved		
	2018	**2019**
Veld	R367	R365
CA control (maize only)	R279	R314
CA (multi-cropped plots with legumes)	R313	R343

Soil health considerations; PLFA SKZN 2019/20

1. *Overall distribution of microorganisms*

The term 'soil health' is widely used in reference to sustainable agriculture, especially in the context of soil as a dynamic, living organism functioning holistically rather than as an inert substrate (Frac, Hannula, Belka, & Jedryczka, 2018). Soil microorganisms are both components and producers of soil organic carbon, a substance that locks carbon into the soil for long periods. Abundant soil organic carbon improves soil fertility and water-retaining capacity. There is a growing body of research that supports the hypothesis that soil microorganisms, and fungi in particular, can be harnessed to draw carbon out of the atmosphere and sequester it in the soil. Soil microorganisms may provide a significant means of reducing atmospheric greenhouse gasses and help to limit the impact of greenhouse gas-induced climate change (Johns, 2017).

The most numerous microbes in soil are the bacteria, followed in decreasing numerical order by the actinomycetes, the fungi, soil algae and soil protozoa.

Soil microorganisms consist of bacteria, fungi, saprophytes and protozoa, the overall proportions of which provide an initial snapshot of soil health and the balance in the system. Disturbed soil, which can also be fertile and have a good soil health score, tend towards a situation where bacteria dominate the microbial population.

Bacteria

In general, most soil bacteria do better in neutral pH soils that are well oxygenated. Bacteria provide large quantities of nitrogen to plants and nitrogen is often lacking in the soil. Many bacteria secrete enzymes in the soil to makes phosphorus more soluble and plant available. In general, bacteria tend to dominate fungi in tilled or disrupted soils, with higher levels of nitrogen in the form of nitrates, because the fungi prefer more acidic environments without soil disturbance. Bacteria can survive in dry or flooded conditions due to their small size, high numbers and their ability to live in small microsites within the soil where environmental conditions may be favourable. These are perfect conditions for low successional plants such as weeds. Protozoa tend to be the biggest predators of bacteria in tilled soils. (Ingham, 2009)

As the soil is disturbed less and plant diversity increases, the soil food web becomes more balanced and diverse, making soil nutrients more available in an environment better suited to higher plants. Diverse microbial populations with fungus, protozoa and nematodes keep nutrients recycling and keep disease-causing organisms in check. (Hoorman, 2020)

Within the bacterial populations Actinomycetes and *Rhizobia* species play a crucial role in nutrient availability and cycling for plant growth. Actinomycetes have large filaments or hyphae and act in a similar way to fungus in processing soil organic residues which are hard to decompose (chitin, lignin, etc). Actinomycetes are important in forming stable humus, which enhances soil structure, improves nutrient storage, and increases water retention. Rhizobia are gram negative, nitrogen fixing bacteria that associate with a plant host, to fix atmospheric nitrogen. There are also free-living bacteria such as *Azotobacter, Azospirillum* and *Clostridium*, which fix atmpsoheric nitrogen for use by plants (Hoorman, 2020).

Fungi

The diversity and activity of fungi is regulated by various biotic (plants and other organisms) and abiotic (soil pH, moisture, salinity, structure, and temperature) factors. Fungal populations are strongly influenced by the diversity and composition of the plant community and in return affect plant growth through mutualism, pathogenicity and their effect on nutrient availability and cycling. Fungi also participate in nitrogen fixation, hormone production, biological control against root pathogens and protection against drought as well as stabilization of soil organic matter and decomposition of residues (Frac, Hannula, Belka, & Jedryczka, 2018)

All cultural practices, such as the use of cover and rotational crops, composts and tillage systems, besides their known effects on soil-borne pathogens are likely to affect also the other groups of soil fungi, especially beneficial fungal populations (Abawi & Widmer, 2000). Reduced tillage decreases the breakdown of hyphae causing fungal populations to remain more stable, retaining more nutrients and providing more suppressive effects against pathogenic microorganisms (Goss & deVarennes, 2002).

Mycorrhizal fungi improve plant growth by increasing the uptake of nutrients and protect them against pathogens (Bagyaraj and Ashwin, 2017). Arbuscular mycorrhizal fungi (the most common type), live inside and outside root cells and help them reach for nutrients by extending long threads called hyphae into the soil. The plant, in exchange, provides the fungi glucose and possibly other organic materials that they need to survive (Bagyaraj & Ashwin, 2017).

Saprophytes

Saprophytes are microorganism (bacteria, fungi and protozoa) that live on dead or decaying organic matter. Saprophytes recycle organic material in the soil, breaking it down into in simpler compounds that can be taken up by other organisms.

Protozoa and nematodes

Protozoa are single cell organisms, like bacteria but much larger. Protozoa play an important role in mineralizing nutrients, making them available for use by plants and other soil organisms. ... When they graze on bacteria, protozoa stimulate growth of the bacterial population (and, in turn, decomposition rates and soil aggregation.)

Free-living nematodes can be divided into four broad groups based on their diet. Bacterial-feeders consume bacteria. Fungal-feeders feed by puncturing the cell walls of fungi and sucking out the internal contents. Predatory nematodes eat all types of nematodes and protozoa. They eat smaller organisms whole or attach themselves to the cuticle of larger nematodes, scraping away until the prey's internal body parts can be extracted.

Like protozoa, nematodes are important in mineralising, or releasing, nutrients in plant-available forms. When nematodes eat bacteria or fungi, ammonium is released because bacteria and fungi contain much more nitrogen than the nematodes require (Johns, 2017)

2. PLFA analysis

Phospholipid fatty acids (PLFAs) are an essential structural component of all microbial cellular membranes. PLFA analysis is a technique widely used for estimation of the total biomass and to observe broad changes in the community composition of the living microbiota of soil and aqueous environments. The basic premise is that as individual organisms (especially bacteria and fungi) die, phospholipids are rapidly degraded and the remaining phospholipid content of the sample is assumed to be from living organisms. As the phospholipids of different groups of bacteria and fungi contain a variety of somewhat unusual fatty acids, they can serve as useful biomarkers for such groups (Wikipedia, 2020).

PLFA analysis has been conducted for this project by Willie Pretorius from the Soil Health Solutions laboratory in Cape Town, South Africa. For the 2019/20 cropping season the PLFA analysis was conducted for three participants; Cosmos Xaba (Madzikane), Letha Ngubo (Spring Valley) and Mandla Mkhize (Ngongonini).

	Bacteria biomass	Actinomycetes biomass	Gram (-)	Rhizobia	Fungi	Arbuscular Mycorrhizal	Saprophytes	Protozoa biomass	Gram (+)	Undifferentiated
C.D Xaba Veld	2351,1	370,9	714,0	0,0	145,1	0,0	145,1	5,7	1637,1	2624,6
C.D Xaba M+B	2692,9	407,5	1006,6	0,0	370,9	99,1	271,9	18,0	1686,3	3553,6
C.D Xaba M+CP	3763,6	711,6	1426,7	0,0	1141,8	274,8	867,0	59,6	2336,9	4562,1
C.D Xaba Control	2039,0	402,4	591,6	0,0	631,9	116,6	515,3	19,8	1447,5	3129,2
Mandla Mkhize Veld	3403,1	529,6	1136,4	0,0	860,6	131,6	728,9	12,1	2266,7	3855,9
Mandla Mkhize Control	2895,8	563,0	841,7	0,0	646,9	126,4	520,4	2,5	2054,1	3509,1
Mandla Mkhize M+B	3529,4	694,9	1366,1	0,0	1256,5	278,8	977,7	61,3	2163,2	4161,0
Letta Ngubo Veld	4860,9	852,8	1879,9	0,0	896,9	199,6	697,3	46,2	2981,0	4229,6
Letta Ngubo Control	1863,2	388,9	428,2	0,0	164,8	59,2	105,6	0,0	1435,0	2278,2
Letta Ngubo M+B	2498,8	441,4	846,5	0,0	370,1	120,1	250,0	0,0	1652,3	2339,9
Letta Ngubo M+CP	306,9	54,9	134,9	0,0	51,6	11,7	39,9	0,0	172,0	403,3

Figure 5: PLFA results for three participants in SKZN: 2019/20

Note: The fact that the values for all samples of rhizobia are zero, the AMF populations are quite low and protozoal populations are also low, indicates an imbalance in the microbial populations for the soil ins SKZN. Given that the actinomycete and Gram (-) bacterial results are reasonably high, this is not considered to be an error in sampling or handling, but an outcome of environmental conditions in the area.

Factors that suppress fungi and Arbuscular Mycorrhiza (AM) in soils include low pH, high clay content and low organic matter content (Goss & deVarennes, 2002). The soils in SKZN do not generally fall within these parameters as clay content is average, as are pH values and % OM is generally quite high. Natural suppression of microbial populations is decreased through cropping (including liming) and in particular CA (including liming and crop diversification). It has also been suggested in recent research that bacteria suppressive to AMF can be present in soil (Svenningsen, et al., 2018).

In addition, significant reductions in soil moisture, can decrease microbial populations in the soil by 50-80%. Rainfall periodicity and timing coupled to warming can have a significant impact on microbial communities, primarily on the size of the microbial communities, rather than composition. It is also possible that some populations may not recover after a significant drought period. Actinomycete bacteria in particular have been found to decrease under such conditions (Sheik, et al., 2011).

The exact reasons why these populations are low in the SKZN region are not known.

From the above figure the following can be noted:

- In both Madzikane and Ngongonini the CA intercropped plots have provided a distinct increase in beneficial microbial populations such as Actinomycetes, AMF, saprophytes and protozoa when compared to the CA control (maize only plots) In addition the Ca control plot values for these microorganisms are lower than the veld samples. Here there is a clear benefit seen in terms of promoting the presence and quantity of beneficial microorganisms in the soil through the CA intercropping options (M+B) and M+CP).
- For Spring Valley, the microbial populations for beneficial organisms are also higher in the intercropped plots (M+B) but not M+CP) when compared to the CA control maize. In this instance the microbial populations in the veld are higher than all the CA cropping options.

PLFA Matatiele

This analysis was undertaken for Matatiele for 2 participants: Tsoloane Mapheele and Mamolelekeng Mabuoa. The result are shown in the figure below

	Bacteria biomass	Actinomycetes biomass	Gram (-)	Rhizobia	Fungi	Arbuscular Mycorrhizal	Saprophytes	Protozoa biomass	Gram (+)	Undifferentiated
Tsaloane Maphelee Veld	44,2	2,1	12,2	0,0	2,0	0,0	2,0	0,0	32,0	1662,9
Tsaloane Maphelee M+B	118,8	0,0	94,3	0,0	19,5	0,0	19,5	24,5	0,6	4009,5
Mamolokeng & Matsheppo Veld	385,4	80,4	94,4	0,0	77,8	21,3	56,6	0,0	291,0	2369,3
Mamolokeng M+B	133,7	7,9	59,5	0,0	23,5	0,0	23,5	0,0	74,2	2633,8

Figure 6: PLFA analysis for Matatiele:2019

From the above figure it can be seen that the microbial populations in undisturbed veld in the area are extremely low, with few or no none of the beneficial species such as actinomycetes, Rhizobia, AMF and protozoa being present. Mr Mapheele has managed to increase the overall microbial populations in his CA plots, with some increase also in beneficial species. This has taken a concerted effort on his part implementing both multi species cropping practices and crop rotation. Microbial diversity and populations in Mamolelekeng's field are also very low, despite her ability to produce good quality crops and high yields for the area: averaging around 3t/ha for maize and 1t'ha for beans.

Bulk density

The soil bulk density (BD), also known as dry bulk density, is the weight of dry soil (mass of solids) divided by the total soil volume (Vsoil). The total soil volume is the combined volume of solids and pores which may contain air (V_{air}) or water (V_{water}), or both.

Samples were collected from the top 5cm of soil using sampling rings (7,2cm diameter) using the following procedure:

- The ring was pushed (buried) into the ground using a piece of wood and a hammer (the piece of wood was used to protect the ring)
- A spade was used to dig the ring out of the soil
- Excess soil sticking out of the ring was cut using a knife to ensure the soil fit perfectly into the ring (making sure the volume is the same for all samples).
- The soil samples (in the ring) were wrapped with aluminium foil and transported to the lab for analysis
- At the lab samples were unwrapped, placed in aluminium dishes, weighed and assigned codes and put in an oven (at 100°C) for 48 hours to dry
- After 48 hours, samples were weighed, and the masses were recorded for calculation of dry mass.

Figure 7: Above Left to Right: Sampling procedure for bulk density.

The equation used to calculate the total soil volume is as shown below.

$$Volume_{\ (soil)} = \pi r^2 \times d$$

Where, π is Pi and r is radius for the ring and d is depth of the ring and the volume was calculated in cm^3 while the mass of the sample was measured in grams (g)

Average dry mass for all samples collected in the same plot was used in calculation the bulk density and the same volume (based on the dimensions of the ring) was used. Equation 2 was used to calculate the BD

$$Bulk\ density\ (BD) = \frac{Mass\ of\ soil\ (g)}{Volume\ of\ soil\ (cm^3)}$$

Below is a summary of the results of bulk density calculations for different cropping practices within the CA system for two participants in SKZN. They were chosen from different villages (Madzikane and Spring Valley) and for inclusion of a number of practices within their CA system; namely intercropping and planting of summer cover crops (SCC).

Table 4: Bulk density calculations for two villages in SKZN, 2019-2020

Name and Surname	**Village**	**Bulk density (g/cm3)**					
CA cropping options		**CA control**	**M+B**	**M+CP**	**SCC**	**LabLab**	**Ave CA trial**
Cosmos Xaba	Madzikane	0,54	1,13	1,09	1,21	1,03	1,12
Letha Ngubo	Spring Valley	1,12	1,26	1			1,13

Note: M+B=maize and beans, M+CP= maize and cowpeas, SCC=summer cover crop mix and LabLab=Dolichos beans

For Mr Xaba in Madzikane, the bulk density for his CA control plot is substantially lower than for the multi-cropped plots. It is not possible to compare these plots directly however, as the CA control plot was not in the same area as his field where the multi-cropped plots were based. For Mrs Ngubo from Spring Valley, the bulk densities for the various crop combinations indicate similar bulk densities for her Ca control (single cropped CA maize) and her multi-cropped plots.

There is a trend towards increased bulk density for the maize and bean intercropped plots and the SCC plot for Mr Xaba and lower bulk density for plots that include legumes such as cowpea and LabLab.

These results thus indicate that multi-cropping options, such as a 3-5 crop summer cover crop mix and legumes such as cowpeas and LabLab beans, reduce bulk density of soil, which provides a significant advantage for the crops following this rotation.

This trend is similar to bulk density calculations undertaken for the Bergville site, where CA plots showed higher bulk density than conventionally tilled plots and multi-cropped plots, specifically those containing SCC show a reduction in bulk density under CA when compared to single cropped maize or maize and bean intercropping.

Although 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 allow the soil to maintain an adequate supply of moisture and air (Cavalieri, da Silva, Leão, Dexter, & Håkansson, 2009)

Crop water productivity

Crop water productivity (CWP) or water use efficiency (WUE) relates to the amount of yield per unit of water used. It is an important measure of the impact of different practices on productivity in rain fed agricultural systems. Methods for improving CWP at field level include crop selection, planting methods, minimum tillage, nutrient management and improved drainage where appropriate. Average WP for maize is 1,2-2,3 kg/m^3 (FAO, 2003).

In this research process WP has been compared for different crops and crop combinations under CA.

The main variables used in calculating water productivity (WP) are yields and volume of water used to produce that particular yield. There are standard methods used in working out the yield (e.g. putting the harvested grain or biomass on a scale and weighing it, weighing a sample of cobs for maize and estimating yield using the plant population). The challenge is in determining the volume of water used to produce the yield. There are a couple of methods (simple and more complicated) used in determining the volume of water used.

In determining the water productivity, parameters (temperature, relative humanity, solar radiation, wind speed, wind direction to calculated ET_0) are required and these parameters are gathered from automatic weather stations. This information can be used to benchmark simpler methods used in the field, that farmers can be involved in. These ET_0 values are then multiplied by the crop coefficient to find the actual evapotranspiration (Etc), which is the volume of water used to produce the yield.

To calculate the ET_0, the equation below is used. The weather station calculates the reference evaporation ET_0 using the Penman Monteith equation shown below

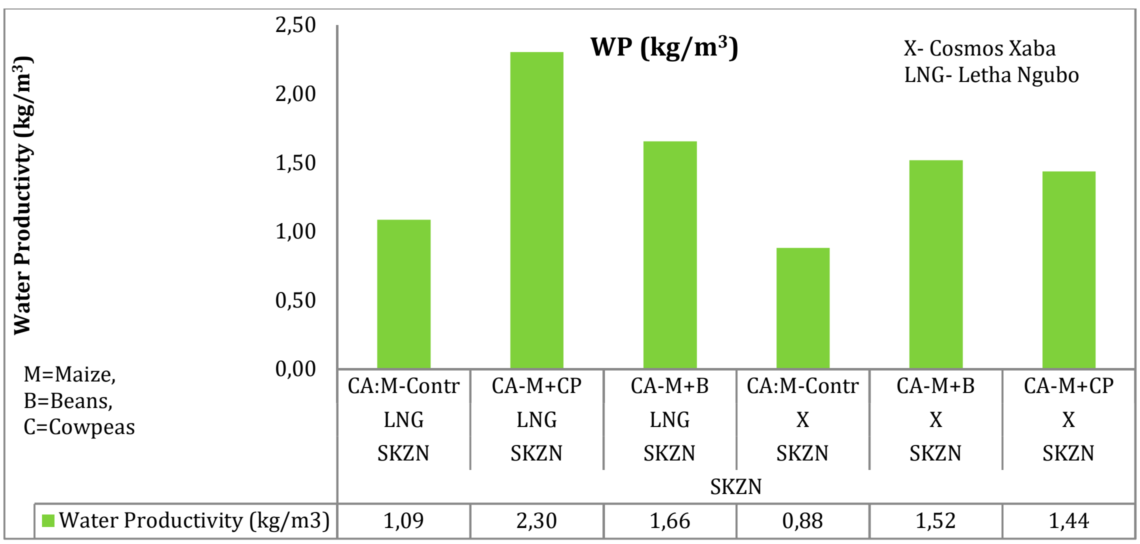
$$ET_0 = \frac{0.408\Delta(R_n - G) + \gamma\frac{900}{T+273}u_2(e_s - e_a)}{\Delta + \gamma(1 + 0.34u_2)} \quad (1)$$

Where,

ET_0 reference evapotranspiration (mm/day),
R_n net radiation at the crop surface (MJ m^{-2} day^{-1}),
G soil heat flux density (MJ m^{-2} day^{-1}),
T air temperature at 2 m height (°C),
u_2 wind speed at 2 m height (m s^{-1}),
e_s saturation vapour pressure (kPa),
D slope vapour pressure curve (kPa $°C^{-1}$),
g psychrometric constant (kPa $°C^{-1}$),

Water productivity was calculated for two participants in SKZN (2020), Cosmos Xaba and Letha Ngubo from Madzikane and Spring Valley,respectively, who have been implementing CA for a period of 2 to 3 years. Water productivity for different CA cropping options was calculated for these participants, using both grain and biomass weights.

The options were a M-CA control (consecutively mono-cropped maize); M+CP-CA trial (maize and cowpea intercropped plot in a rotation system) and CA-M+B trial (maize and bean intercropped plot in a rotation system). The aim was to ascertain whether the different cropping options within the CA system provide for different water productivity outcomes. The results are shown in the figure below.



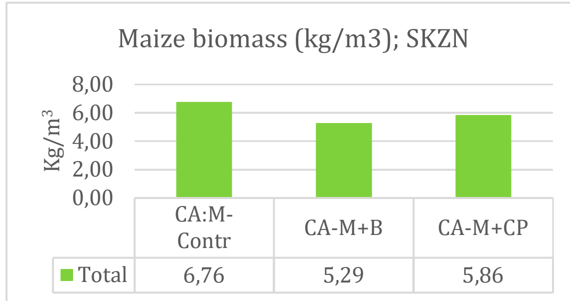
Note: CA:M-Control= maize control, CA-M+B= maize and bean intercrop and CA-M+CP =maize and cowpea intercrop

Figure 8: Water productivity calculations for two participants form SKZN: 2019-2020

From the above figure it can be seen that:

- Overall WP for Letha Ngubo's CA plots is higher than that for Mr Xaba and
- the WP for the CA intercropped plots (Ca-M+B and CA-M+CP) is substantially higher than the CA single cropped maize controls, for both participants.

This result mirrors the WP results for participants in the Midlands and Bergville sites as well, indicating the advantages of intercropping in the CA system.



The CWP was also calculated for the above ground maize plant material, (stalks and leaves). From the small figure alongside it can be seen that the single cropped maize plots (CA controls) provided for higher maize biomass than CA intercropped plots with beans and cowpeas. This result is different from that obtained in the Bergville site where intercropping with legumes improved the WP of maize biomass production. Conditions in SKZN show a higher rainfall and lower evapotranspiration rate than Bergville and lower water productivity results are more likely to be due to soil conditions or limited competition between the crops.

Progress per area of implementation

Summary of yield measurements

Yields are measured by taking samples of 3 cobs form each 50kg bag used for harvesting and averaging the cob and grain weight, multiplied with the number of cobs per bag and the number of bags per plot.

This season has seen much more intensive use of crops for household purposes and sales, due to the increased pressure of CIVOD-19 on food availability in the villages. The season, with an average annual rainfall of around 900mm for 2019-2020, was conducive to a reasonable maize yield and on average there has been a substantial increase in yields when compared to 2018-2019. Three successive hail storms in late December decimated the legumes (beans and cowpeas) for most of the participants. Those (around 32% of participants) who escaped these devastating storms have produced very high bean yields when compared to previous seasons. Yield measurements were undertaken for 30 participants (those who managed to harvest both maize and beans) across 7 villages, to provide the annual estimates of average CA yields. Separation of harvests for the different CA cropping options could not be done this season and comparisons is made between CA trial plots (inter cropped plots with maize and beans and maize and cowpeas as well as plots where crop rotation has been practiced) compared to CA control plots that have been planted to a single crop of maize for the entire period (between 2 to 4 years depending on the participant). The figure below provides a summary of all CA yields for this season

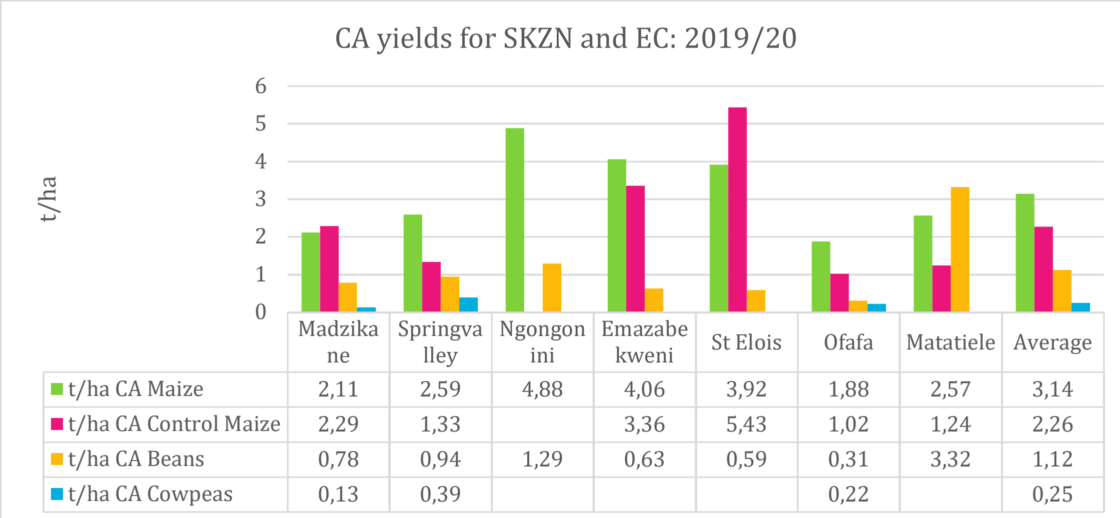


Figure 9: Maize and bean yields for CA trial and control plots for SKZN and EC:2019/20

Average CA maize and bean yields have been higher this season than any of the previous seasons for this site. In addition, this has been the first season where the CA trial plot yields have been higher than the control plot yields. Control plots for the past 4 seasons have been CA plots, but planted consistently to maize only.

Table 5: Summary of crop yields within CA trials for SKZN&EC: 2013-2020

SKZN & EC yield summaries: 2013-2020							
Season	2013	2014	2015	2016	2017	2018	**2019**
No of villages	4	10	8	8	13	13	**11**
No of trial participants	23	16	43	54	93	75	**93**
Area planted (trials) - ha	0,36	0,3	0,37	1,18	3,58	4	**3,72**
Average yield CA trial maize (t/ha)	0,95	0,7	1,37	2,52	2,17	2,6	**3,4**
Average yield control maize (t/ha	-	-	-	0,44	2,45	3,4	**2,3**
Min and max yield CA maize (t/ha)	0,3-1,7	0,3-1,8	0,5-4,4	1,1-5,2	0,2-6,7	0,2-6,9	**0,3-9,6**
Average trial quantity of maize (kg)	15	64	125	161	66	97	**78**

From the table above it can be seen that the yields for different participants, shown here as minimum and maximum CA maize yields, still vary considerably, but that the maximum yields obtained have been increasing steadily from one year to the next. In addition, the proportion of participants who are managing reasonable (2-4t/ha) and good (>4t/ha) yields, is now around 50% of the total number of participants, as shown in the small table below. This is considered a significant improvement.

Range of yields(t/ha)	**No of participants**	**% of total (N=30)**
<1	4	13%
1 to 2	11	37%
2 to 4	9	30%
>4	6	20%

Maize yields per area of implementation

There are variations in production between villages, as they are spear across quite a large area of southern KZN; from the Umkomaas valley down towards Ixopo and then further inland towards Creighton.

Springvalley

Two new participants joined this season in Springvalley; Mrs Khwela and Mrs Shoba. Mrs Khwela is an old age pensioner who stays by herself growing maize and beans for household consumption. Letta Ngubo (a 4th year participant) outperformed everyone in the trials with a yield of 9,6t/ha; twice her control at 3,5t/ha. Below is a bar graph showing yields for both trials and controls in Springvalley.

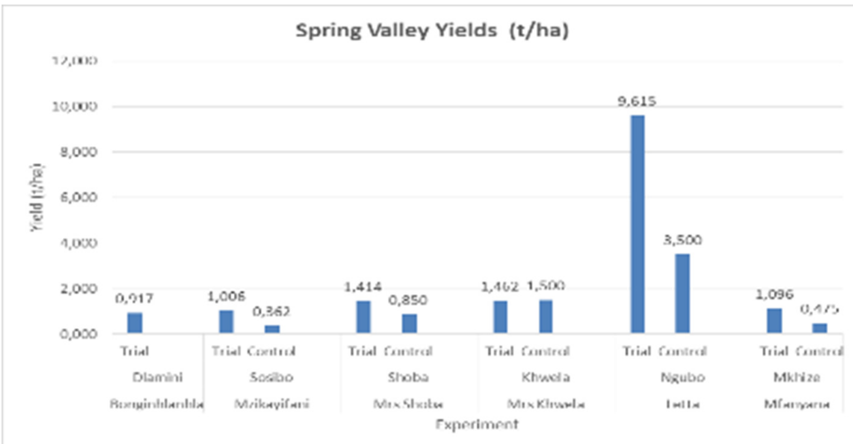


Figure 10: Bar graph showing Springvalley maize yields

Ngongonini

Mr Leonard Gamede did very well this season with 223kg of trial maize threshed and stored in a 210L plastic drum. During the season his maize was tall with thick strong stalks and roots firm in the ground as well as big cobs. Mr Gamede is now convinced that CA is the way to go for as long as he continues to grow maize. He has plans to extend his cropping area for the coming season. This season he managed an amazing 7 t/ha of maize and 1,875t/ha of beans.

Figure 11: Gamede's maize and bean harvests

Sylvina Kheswa, an old age pensioner who is in her 3rd year of participation. This year she managed to plant both PAN 6479, the white hybrid, as well as PAN 95A the short season yellow variety. The short season maize was planted as a result of livestock having invaded and destroyed half her 400m^2 plots. Mandla Mkhize, the local facilitator, helped her plant the plot once more maintaining close spacing and fertilizer micro dosing as per practise in the experiment. Mrs Kheswa managed 66,35 kg from her 200m^2 plots of PAN 6479 and 37,66 kg from the short season maize; PAN 5A 190 translating to 3,138 t/ha and 5,649 t/ha respectively, below are snapshots of her yields.

Figure 12:Left: Sylvina Kheswa's Short season maize (PAN 5A190) during the season and Right: Her maize harvest stored in 50kg bags inside one of her dwellings; here showing OPV yellow maize (Colorado) and the PAN5A190..

Maize yields in Ngongonini have been the highest for all villages, this season, averaging 4,9 t/ha. It is however unfortunate that they do not have any controls to compare against. All participants in this learning group are keen on extending their trial sizes.

Name	**Surname**	**Experiment**	**Grain weight (kg)**	**area (m2)**	**Weight (t)**	**weight (t/ha)**
Leonard	Gamede	Trial	174,220	240	0,174	7,259
Thokozani	Kheswa	Trial	83,648	240	0,084	3,485
Sylvina	Kheswa	Trial (PAN 6479)	37,660	120	0,038	3,138
		PAN 95A	67,788	120	0,068	5,649
Eunice	Nkabane	Trial	122,500	240	0,123	5,104
Total Yield Trial:			104,507			19,532
Average Yield Trial						4,883

Figure 13: Ngongonini yields sheet

Madzikane

For the Madzikane group, Mrs Gambu (a 3rd year participants) has managed the highest yields. In this area, the CA control maize outperformed the CA trial maize this season. Nombuyiselo Shozi's CA trial yields have been particularly low, mostly due to adverse weather conditions and livestock invasion into her plots.

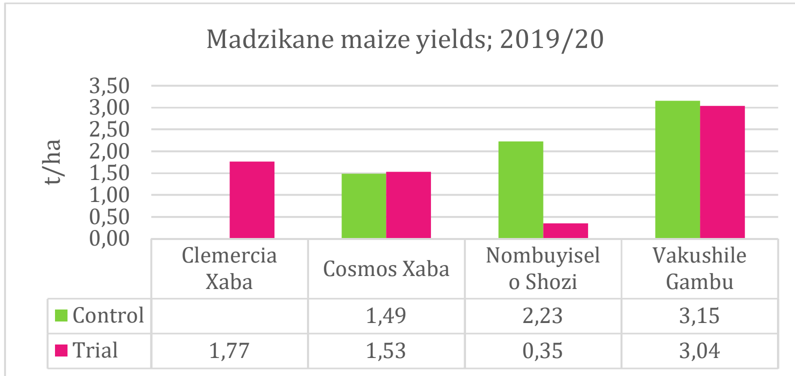


Figure 14: Madzikane trial and control yields comparison

Short Season maize

A medium early yellow maize hybrid (PAN5A 190) was planted by 3 participants, 2 in Ngongonini and 1 in Madzikane, in end January- early February 2020. Below is a small summary of yield comparisons with the standard hybrid (PAN6479) planted in the area, in late November. Although this is by no means a representative sample, it provides a good indication tht it is worth more intensive experimentation with early maturing varieties in this region.

Variety	Mr C Xaba (t/ha)	Mrs S Kheswa(t/ha)
PAN5A190	1,53	5,65
Pan 6479	1,49	3,14

Fodder production

The idea was introduced at the Mazikane stakeholder forum, with assistance from Charmain Mchunu from CEDARA. The idea is to plant strips of maize and either annual (e.g. velvet beans, oats, rye grass, kale and Japanese radish) or perennial (Lespedeza, Mooiriver mix (digiteria spp),Tall fescue (Festuca) and Bahia grass (Pensicola)) fodder crops. The farmers chose one demonstration plot within Mr Xaba's field for the planting of the maize and perennial grass strips, but due to lack of focus, weed pressure and subsequent very late planting of the grasses, the germination was limited and grasses shaded too much for subsequent growth.

Figure 15: Above Left and Right; limited germination and growth of grasses between maturing maize strips and weed infestation, which for all practical purposes reduced the growth of the planted grasses to zero.

After failing to grow cover crops in between the maize, Mr Xaba decided to sow cover crop seed on separate blocks outside the trial, in his homestead plot and those managed to germinate and grow well. He has the area fenced and will be putting in sheep when he has taken out all his maize. He aims at dedicating plots solely for cover crops in his home plot for the coming season, to ensure a supply of fodder for his livestock.

Figure 16: Above Left: Small blocks of perennial grass species planted in Mr Xaba's homestead plot and Above right: Janapese radish, also in his homestead plot

Case study: Mr Cosomos Xaba from Madzikane

Mr Xaba continued with his 10 plot CA trial, rotating a combination of single crop plots, intercropped plots, Lab-Lab/Dolichos beans and SCC (summer cover crop plots), as show in the small table below.

2018/19									
Plot 1 Maize-Beans	Plot 2 Maize	Plot 3 Maize-cowpeas	Plot 4 Lablab	Plot 5 Maize-beans	Plot 6 SCC	Plot 7 Beans	Plot 8 Maize-cowpea	Plot 9 SCC	Plot 10 Maize
2019/20									
Plot 1 Maize	Plot 2 SCC	Plot 3 Mazie-beans	Plot 4 Beans	Plot 5 SCC	Plot 6 Maize-beans	Plot 7 Lablab	Plot 8 Maize-cowpea	Plot 9 Maize	Plot 10 Maize-cowpea

From this trial maize yields (PAN5A190) were 1,53 t/ha and bean yield 0,35 t/ha. He did not manage to harvest any cowpeas, Dolichos or SCC.

From Mr Xaba's maize harvest from his fields planted earlier in the season, he has already been selling threshed maize, packaged in 50kg bags to local farmers. Having access to the thresher has meant that he can provide maize earlier than most of the other local farmers, although he has been forced to stick to the SAFFEX prices of R2 500/ton. He has thus far sold 3 tons locally as animal feed. He would prefer to be able to charge R175/50 kg bag (R3 500/ton).

Figure 17: Above Left; Threshed maize bagged and ready and Above Right: Loaded on his bakkie for delivery.

Mr Xaba also recently purchased his own tractor; a Massey Fergusson 35, as he wants to work at his own pace. In the past he has had difficulties accessing the municipal cluster tractor while it was in use by other members and where there would be breakdowns. He then decided to sell off his 1994 Toyota Hilux for the MS 35 that he will be in control of at all times. The tractor is enough to lift the two-row minimum tillage planter, this way he will be able plant whenever he wants and will earn him a bit of income when people hire it out to work on their fields as well. The tractor is old but runs well; he emphasized that it's easy to fix.

Figure 18:Mr Xaba's Massey Ferguson tractor)

Matatiele

Winter cover crops (black oats, fodder rye and fodder radish) were relay planted into the maize fields in late January for all 5 participants still active in Matatiele using a Haraka planter. Mr Mapheele from Khutsong was the only participants whose cover crops germinated and grew. These crops will be provided as extra grazing for his cows who are still suckling calves to ensure a reasonable flow of milk for them

Figure 19: Tsoloane's winter relay cover crop

This season, in Matatiele, the CA trial for Noluthando Phili (Sikhulumi) outperformed all the other participants. She has been active for around 4 years. And was a volunteer who started oding CA independently in her village.

Figure 20: Right: Noluthano Phili's CA maize and bean intercropped plot showing good growth and canopy cover.

Stakeholder forums and innovation platforms

Ofafa Land Care CA open day report

Date: Wednesday, 11 March 2020

Venue: Mrs Nyasa Ndlovu's homestead, Ofafa

Atteandance: 35 participants from Ofafa and neighbouring villages Esgedenei, Esheshe, Odangala, KZNDARD extension Officer Mr Zolani Damoyi, MDF staff and LandCare representative Thamoney Naidoo.

This was the first stakeholder event and open day held in this area. Hlengiwe Thusi, the LF assisted in setting up the day and also in informing community members of the event. The process followed for the day is similar to other events of the sort, with a plenary sessions with talks by LandCare, MDfF and CA farmers in the area, a field visit to see some of the CA trials in the area and a side venue where a power point presentation outlining CA principles, processes and progress in the area was provided. Here a focus was also provided for livestock integration into the CA process and examples shown of growing fodder and fodder supplementation.

The field site was Mrs Ndlovu's trial. She first gave history of her plot, what she grew, how and when. For the past three years she has been growing maize which she last rotated with beans three seasons ago. This led to a lot of discussion around soil fertility, trade-offs between residue retention and livestock feed and options for fodder production. Mrs Ndlovu had neglected adding fertilizer and manure to her plots and with heavy winter grazing from cattle removing all residues has seen a decline in yields and growth. Improved management options were discussed.

Figure 21: Above Left: Mazwi Dlamini providing the CA principles and soil health power point input and Above Right: A small group discussing options for improved production in Mrs Ndlovu's field

Figure 22: Above Left: Participants in the Ofafa open day and Above Right: A presentation of different CA planters and seed varieties for cover crops and crop diversification

Cooperative formation

The Masikhule Co-operative based in Madzikane; Creighton, has been successfully registered and issued a certificate. The Ngongonini co-op has struggled to finalise their registration during the COVID-19 lockdown period. The cooperatives were to supply beans, cabbage, spinach, tomatoes, butternut and other fresh produce to the Harry Gwala DM's RASET process. Due to the COVID-19 situation this process came to an abrupt halt. Both cooperatives applied for emergency relief funding through the Department and Agriculture and through Hlanganisa, but were not successful in these applications. They have focused in the meantime on local sale options.

Village Level Savings and Associations

The four VLSA's in southern KZN; Masibambane and Senzokuhle in Madzikane as well as Ikusasalethu and Masakhane in Ngongonini have continued their groups this year and have strengthened their savings and loan portfolios.

The Masibambane group (12 members); the oldest of the three groups; had their annual share out process in March 2020. And the Senzokuhle group (13 members) had their share out in April 2020.

Figure 23" The Senzokule group during their share out session in April 2020

Interest was shown to form two new VSLA's one in Ofafa and one in Plainhill and introductory meetings were held in these villages. Due to the Covid-19 pandemic however, these groups have not started as planned.

Figure 23: Above Left: The Masibambane share out meeting in march 2020 and Above right: Ofofa learning group members in an introductor sessions for VSLA with Nqe Dlamini

In Ngongonini the Ikusasalethu savings group (22 members) generated interest from the broader community and another group, Masakhane, (20 members) was formed in February 2020 and they have continued throughout lockdown with their savings and loan activities. The small table below provides a summary.

		MASAKHANE GROUP RECORDS					
	Feb-20	**Mar-20**	**Apr-20**	**May-20**	**Jun-20**	**Jul-20**	**TOTAL**
(A) total shares bought today	62	66	83	84	89	90	474
(B) total value of shares bought today	R 6 200	R 6 600	R 8 300	R 8 400	R 8 900	R 9 000	R 47 400,00
(C) total loans repaid today			R 3 440	R 4 430	R 6 210	R 12 310	R 26 390,00
(D) total loans issued today			R 5 400	R 14 800	R 2 500	R 14 500	R 37 200,00
(E) money in the box	R 2 900	R 9 660	R 4 670	R 15 060	R 15 705	R 19 765	

The Ikusasalethu group has saved R56 500 since their new cycle started in February 2020.

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