APPENDIX 4:
PROGRESS REPORT
THE PROMOTION OF CONSERVATION AGRICULTURE IN THE NORTH-EASTERN FREE STATE – PHASE 1 (TWO STUDY AREAS)

For the period:
October 2017 to February 2018

Compiled by:
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In collaboration with:
Riemland (Reitz) and Ascent (Vrede) study groups

March 2018

GRAIN SA
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The Maize Trust

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1. Introduction

This progress report covers the period of October 2017 to February 2018 of the implementation of a project funded by The Maize Trust (MT), which will assist to scale out Conservation Agriculture (CA) to grain farmers in the north-eastern Free State Province. The north-eastern and eastern parts of the Free State are seen as key grain producing areas and have very suitable conditions (soil and climate) to practice CA, however, the area still has a very low adoption percentage of farmers practising CA. Consequently, this area has been identified by Grain SA's CA Farmer Innovation Programme (CA-FIP) as a target area to promote CA among farmers in order to improve their sustainability and profitability. The Grain SA CA-FIP uses innovative, well organised and interested farmers and/or their structures (e.g. study groups, clubs, associations, etc.) as platform to launch projects and scale out CA to the surrounding farming communities. In this respect two active study groups, namely Ascent (Vrede district) and Riemland (Reitz district) have agreed to serve as platforms to launch projects in these two study areas. The study groups have consequently been engaged in various planning and implementation activities for the 2015/16 season, which have all been included in various work packages that serve as the framework for this proposal.

Central to the CA-FIP philosophy and approach, farmers' resource-base, experiences, practices, problems, fears, perceptions and needs form the basis of any proposed or intended (project) intervention to promote CA in a specific area. The 'learning process starts from what they know and where they are'. As a first step a 'diagnosis' of the situation was needed. The **aim of the diagnostic phase** was to assist stakeholders to analyse, describe and understand the current [farming] system or situation in need of change (to 'build a picture or model' of and to 'get a handle' on their situation in order to formulate effective solutions). There after a participatory planning session took place aiming to identify solutions or treatments to the problems, work packages and an immediate action plan. **Figure 1** below indicates the participatory diagnosis and planning process followed with the Riemland study group (on 18 August 2014 at the Mooigelegen farm, Reitz district) and the Ascent study group (on 19 August 2014 at the Ascent grain silo, Vrede district). These events were facilitated by Dr Hendrik Smith (CA Facilitator at Grain SA), assisted by Dr Sybrand Engelbrecht (CA research coordinator, The Maize Trust). Mr Willem Killian and Ms Lientjie Visser from the ARC-SGI at Bethlehem also participated in both events.

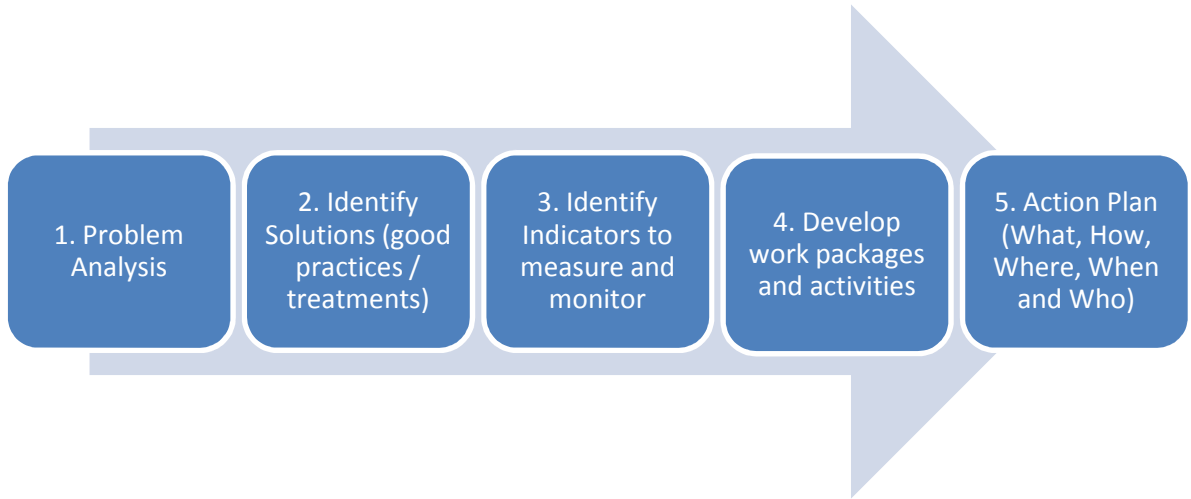

Figure 1: The participatory diagnosis and planning process followed with the Riemland and Ascent study groups

2. Description of the targeted study area(s)

The two study areas identified (listed below) were described in detail (Grain SA, March 2015).

The Frankfort-Vrede Plain occupies most of the northern half of the study area, south of the Vaal River. The underlying geology is mainly mudstone and sandstone of the Adelaide Formation, Beaufort Group with, in the north-east, shale of the Volksrust formation, Ecca Group. Dolerite intrusions occur frequently. The soils are mainly dark, swelling clays of the Arcadia form along with duplex soils (sandy, often bleached topsoil abruptly overlying gleyed clay) of the Estcourt and Kroonstad forms, especially in the north-west.

The Bethlehem-Reitz Basin, in the west of the area, is underlain mainly by mudstone and sandstone of the Tarkastad Formation, Beaufort Group. The soils here are mainly grey and yellow, sandy loam to sandy clay loam soils with grey, mottled plinthic subsoils, belonging to the Avalon, Westleigh and Longlands forms. Duplex soils, as well as shallow, rocky soils of the Mispah form, are also present.

3. Targeted beneficiaries or key project participants

Two separate farmer-centred Innovation Platforms (IP's) have been established around the Ascent and Riemland farmer study groups, which will target farming communities in the following Grain SA regions (and districts): Region 15 (Heilbron, Frankfort and Vrede) and Region 18 (Reitz and Lindley). Each of these two regions constitute fairly homogeneous agro-ecological conditions, which will facilitate the scaling out of CA practices from the representative project sites and trials on selected (or volunteering) farmers' fields (in the Vrede and Reitz districts).

It is envisaged that the IP's will be able to create a general awareness and innovation capacity among the farming communities in these regions and even beyond their borders. The official number of Grain SA members (grain producers) in these regions are 583 (region 15) and 371 (region 18), which have direct communication channels through the Grain SA structures and processes. Added to this is approximately the same number of non-member producers in these regions who are also seen as potential primary beneficiaries. Very few of these grain producers (<5%) follow CA practices, although a substantial (but unknown) percentage do follow some form of reduced tillage practice. The reasons for the poor adoption of CA is not well-understood, but are most probably and primarily due to a lack of information and awareness of the long term benefits of CA on farming and the environment. It is of utmost importance to break this cycle of ignorance and empower farmers with a truly sustainable farming system.

4. Project aim

The aim of the project is:
To promote conservation agriculture in key grain producing areas of the North-eastern Free State through a farmer-centred innovation process.

4.1. Objectives

The following short-term objectives will assist the project in achieving its aim:

a) To establish and facilitate on-farm trials around two local farmer structures (i.e. the Ascent and Riemland study groups)
b) To monitor and analyse a series of on-farm, farmer-led trials on selected farmers' fields
c) To create wider awareness and innovation capacity in local farming communities on the practices and benefits of locally adapted CA systems.

d) To support farmer facilitation, administration and reporting processes.

In order to effectively implement the above short-term objectives, a number of cross-cutting **work packages** were designed with each having a designated person or institution to implement and manage the specific activities and budget (see Section 11 below for detailed discussion of work packages). **Table 1** shows the different work packages and responsible champions in each project:

Table 1: Work packages and lead partners in Riemland and Ascent projects

Work Package	Lead partner - Riemland	Lead partner - Ascent
1. Coordination and management	Danie Slabbert (Riemland study group)	Paul Zietsman (Ascent study group)
2. Assessment of soil quality under CA systems	GP Schoeman (AgriSol); Willie Pretorius (Soil Health Solutions)	Paula Lourens (Vermi Solutions), Willie Pretorius (Soil Health Solutions)
3. Assessment of cover crop adaptability and suitability	Gerrie Trytsman (ARC-API)	Gerrie Trytsman (ARC-API)
4. Agronomic field trial planning, analyses and reporting	Willem Killian (ARC-SG)	Willem Killian (ARC-SG)
5. Coordination and facilitation of project activities among farmer participants	Suzette Smalberger (VKB)	Suzette Smalberger (VKB)

5. Project approach and rationale

In the original Grain SA proposal submitted in March 2015, the development and implementation of *Innovation Systems (IS)* to adapt CA principles to local (farmer) conditions has been well motivated and approved. Accordingly, and at the very least, the emphasis has to be on on-farm research and the inescapable experiential learning that this generates; both of which critically place the farmer in the central role.

Since the commencement of the implementation process in 2015, several 'actors' that influence the 'working' of the innovation process around the two project study areas, *have been 'formally' and effectively integrated with the IP's in the form of work packages and related responsibilities*. The CA FIP is confident that these two local IP's have their focus on **farmer empowerment**, i.e. ensuring that farmers are recognised, accepted, rewarded and used as independent innovators (or researchers). Proper facilitation and coordination of this farmer-led innovation process and its various activities is crucial and in the light of this IS philosophy, local resources (people) took up these responsibilities quite effectively. The CA facilitator at Grain SA (Dr Hendrik Smith), who manages and implements the CA-FIP, fulfils an overarching role in this respect. Another prominent local stakeholder, namely VKB, is playing a vital role at both sites as project or farmer facilitators, as well as implementing and monitoring field trials and other activities.

The key elements of the CA-FIP project approach are as follows:

5.1. Farmer-centred Innovation Systems Research

CA is defined by three key principles that have to be applied simultaneously and adapted to each farm ecosystem, namely minimal mechanical soil disturbance, permanent organic soil cover and crop diversity. The inescapable consequence of this is that farmers have to function as applied ecologists who have to fine-tune (adapt) universal principles to their own social, economic and ecological circumstances. As mentioned above, farmers are the adopters, the adapters and often the innovators of new farming techniques through an **on-farm, farmer-led research** process.

A series of selected on-farm, farmer-led trials, where farmers are lead or equal partners (in identifying research needs, designing, implementing and evaluating experiments), will give farmers independence, ownership and control. Experiments were well designed with appropriate treatments and sufficient replications spread over the entire agro-ecological zone and/or on a sufficient number of farms (see trial designs and layouts attached). Data from properly designed experiments will provide a much stronger starting point for discussion and investigation of a farmer's claims or problems. Hence, scientifically valid data are being generated and strengthened through the involvement of agricultural scientists in group problem solving and on-farm research (through the different work packages).

5.2. Participatory monitoring, evaluation and adaptive management

There are several purposes in the use of PM&E within the CA FIP, for example to enhance shared understandings (i.e. to offer a forum that allows different stakeholders to articulate their perspectives); to increase participants' engagement, sense of ownership, and self-determination; to strengthen organizations and promote institutional learning; to encourage institutional reform towards more participatory structures; etc. In this context PM&E is regarded less as an instrument of reporting and auditing, and more as a means of *enabling organizations and groups to keep track of their progress, build on their successes, and enhance their capacities for self-reflection, learning, and social responsiveness (or adaptability)*. Thus, PM&E is used in a more transformative / empowerment way to support learning and adaptive management among those involved.

The following indicators were identified and are being measured and monitored by and through the different work packages:

INDICATOR	YES / NO	MEASUREMENT	WHO (Ascent)	WHO (Riemland)
Compaction	Y	Root evaluation; bulk density; penetration resistance	Facilitator	Facilitator
Wind erosion	Y	Ground cover after plant (per Monitoring form)	Farmers & Facilitator	Farmers & Facilitator
Soil fertility	Y	Macro and micro nutrients – on row and in-between	Vermi Solutions	Agrisol
Soil biology / Soil structure	Y	%C / SOM / MO/ C02 soil respiration – different depths every 3-4 yrs	VS & Soil Health Solutions	Agrisol / Soil Health Solutions
Rainfall	Y	Per event / 24 hour	Rain gauge	Rain gauge
Pests	Y	Monitoring form	Farmers & Facilitator	Farmers & Facilitator
Diseases (soil-borne)	N	Monitoring form	NA	NA
Nematodes	N	Nematode counts	NA	NA
Production	Y	Yield; kg/mm; kg/kg NPK; biomass	Farmers & Facilitator	Farmers & Facilitator

Weeds	Y	Weed counts; keep plots clear of weeds; weed control / herbicide programme	Farmers & Facilitator	Farmers & Facilitator
Mico-toxins	N			
Economy	Y	Gross margin / savings of treatments / systems economy	Farmers & Facilitator	Farmers & Facilitator
Grain quality	Y	Grading	VKB	VKB
Record keeping	Y	Description of all physical and chemical practices on treatments	Farmers	Farmers
Water content	Y	Soil moisture probes	Facilitator	Facilitator

5.3. Reference Group

A Reference Group will be coordinated for the project by Grain SA. The Reference Group (comprising key, concerned and capable persons) is tasked to provide the project team with guidance and to assist the CA-FIP in monitoring progress and evaluating deliverables. The Reference Group is only required to act in an advisory capacity. At this stage the Grain SA CA working group fulfils this role.

Reference Group (or CA working group) meetings are scheduled twice a year (February and August). Progress reports for the preceding period and work programmes for the following cycle are tabled and discussed at these meetings.

5.6. Awareness and marketing

General awareness (or sensitisation) has been experienced as particularly important to stimulate farmers getting involved with further learning activities, such as experimentation. The whole CA farmer innovation process usually needs an 'impulse' or an injection of energy (knowledge) to start or to speed-up the momentum and mostly it is a specific awareness event or sensitisation that achieves that. The CA-FIP sees three distinct awareness raising activities as key events during the entire CA innovation process:

- Organise cross-visits or Look & Learn visits to other successful CA communities or farmers
- Develop/distribute posters, pamphlets, videos/dvd's and other material to support the awareness raising events/campaign.
- Organise/support major or annual information days, workshops or conferences.

6. Work packages

As discussed above, a number of key stakeholders, who could play a role in the implementation of the project, were identified and involved at the start of the project. These stakeholders were invited to a planning workshop where they took part in a participatory brainstorm, identifying and prioritizing problems and solutions, consequently leading to the design of a number of Work Packages (WPs) to be implemented by selected stakeholders who were identified through these meetings. The project budget was consequently developed around these WPs, linked to various activities and deliverables. The implementation of these WPs is collectively monitored and managed through the project team, especially during site visits and monthly meetings. The on-farm trials form the basis of all the other activities in the project and will run through a number of seasons. Emphasis will be placed on data collection, interpretation, reporting and awareness.

7. Implementation of work plan from October 2017 to February 2018 – summary

KEY ACTIVITY	TIMELINE	INDICATOR OF SUCCESS	PROGRESS TO DATE
Objective 1: To establish and facilitate on-farm trials around two local farmer structures (i.e. study groups)			
a) Prepare, establish and manage on-farm trials on selected sites (farms)	Continuous	Statistically designed trials established and managed on selected trial sites	Statistically designed trials were designed, established and managed on selected trial sites. ARC SG helped the Riemland group to measure and prepare the trial sites. Assistance was also given with the planting of the row width trial. – see trial layouts attached to previous reports
Objective 2: To monitor and analyse a series of on-farm, farmer-led trials on selected (volunteering) farmers' fields			
a) Participatory monitoring / data collection	January to June	Collection of a range of selected indicators from trials, especially soil samples	Collection of a range of selected indicators from trials, especially soil samples.
b) Farmer participatory M&E and discovery learning	January to June	Completion of Field monitoring form with farmers	Completion of Field monitoring form with farmers.
c) Data Analysis and Evaluation	June to August	Analysis of data collected from on-farm trials and field forms	Analysis of data collected from on-farm trials and field forms.
Objective 3: To create wider awareness and innovation capacity in local farming communities on the practices and benefits of locally adapted CA systems.			
a) Annual farmers day or conference	February to March	A well organised and -attended awareness event	A CA conference was successfully held in Reitz on 19-20 March, which was attended by 620 participants. The event was held in collaboration with *Landbouweekblad* and Riemland study group, with main sponsors VKB, Standard bank, DeKalb and Grain SA.
b) Exposing on-farm trials to interested farmers and other	Continuous	Trial visits by interested people	A number of interested people (mostly farmers) have been visiting the on-farm trials through the season and had

			discussions with participating farmers.
Objective 4: To support social learning, farmer facilitation, administration and reporting processes.			
a) Project meetings	Bi-monthly meetings	At least six project meetings per year	A number of project meetings were held at each of the project sites to monitor and manage planned activities.
b) Farmer facilitation	Continuous	Effective deployment of a local farmer facilitation to assist implementation and M&E with farmers	Currently this role is performed by Jacques van Zyl (VKB).
c) Reference Group	August	A well organised annual reference group meeting	A number of feedback and planning meetings were held in From October 2017.
d) Reporting	March and September	Six-monthly and annual reports according to specifications	Completed 6-monthly report for period October 2017 to February 2018.

8. Implementation of work packages from October 2017 to February 2018

8.1. Coordination and management

Work Package title	**Coordination and management**
Work Package period	October 2017 to February 2018

Lead partner	Riemland and Ascent study groups
Involved partners	All

Objectives	Coordinate activities among all partners Ensure timely reporting to Grain SA Promote synergy among project activities

Justification	Project size, complexity and level of integration/interdependency among different project actions require strict delivery and adherence to project timelines as essential. Partners must often work together to achieve specific project outputs.

Description of work	**Project inception workshop**. A one-day project planning and inception workshop was held at the beginning of the project to enable all project partners

	to define work packages and procedures to achieve the project outputs and objectives. These WP's are used for the financial control and payment of the project and for the monitoring of the agreed tasks and deliverables. Work package managers were identified at this meeting and will present/follow strategies and protocols which are frequently monitored by all partners. **Frequent coordination meetings**. The purpose of these monthly or bi-monthly meetings is to establish and manage an Innovation Platform (IP) for improved communication, integration and sharing. The essence or key action in these meetings will be social learning, characterised by feedback, reflection, planning and coordination between different work packages and stakeholders. A secondary activity is the creation of a wider network in support of communication, sharing, learning and scaling out. **Annual Reference Group Meetings.** Formal reference group meetings will be organised each year with representation from each work package. In order to provide the project with independent monitoring, advice and support and to ensure communication with key stakeholders, a group of experts and end users (reference group) will be formed and invited to participate. Presentations from each work package leader will summarise achievements. Discussions about progress, potential deviations from the work plan and forward planning will be standing items at each meeting. **Activity reporting.** Partners will prepare a two-page activity report *every six months*. The lead applicant and work package managers will use these to assess whether work progresses to plan and take action to minimise the effects of delays on other project activities. **Annual progress reports.** Annual reports will be made following Maize Trust / CA-FIP instructions. Work package managers will be responsible for collating information and making a single work page report. The lead applicant will be responsible for integrating these into a single full report. A similar approach will be used to prepare the final project report covering information from all project years.

Deliverables	• Project actions and reporting delivered on time

Risks	None anticipated

8.2. Assessment of soil quality under CA systems

Work Package title	**Assessment of soil quality under Conservation Agriculture (CA) systems**
Work Package period	October 2017 to February 2018

Lead partners	AgriSol (Mr. GP Schoeman), VermiSolutions (Ms. Paula Lourens) and Soil Health Solutions (Mr Willie Pretorius)
Involved partners	Riemland & Ascent study groups, ARC-SGI, Grain SA,

Objectives	• To characterize the soil types and soil physical & chemical parameters, such as particle distribution, pH, Soil Organic Matter (SOM), macro-, micro-nutrients, and soil biology • To compare the effect of different CA treatments on soil quality • To establish relationships between different soil parameters, yield and atmospheric elements

Justification	A number of studies suggest that a soil and nutrient management strategy based on a broader range of ecosystems processes is worth further investigation. The approach shifts the emphasis of soil nutrient (fertility) management away from soluble, inorganic plant-available pools to organic and mineral reservoirs that can be accessed through microbial and plant mediated processes. However, a relatively poor understanding and capacity exist among the local research fraternity to investigate these crucially important subjects.

Description of work	Characterise the effects of different CA practices (treatments) on soil nutrient and physical dynamics as well as crop growth and yield, will involve regular field visits, sampling of soil on selected transects / sites and time intervals, laboratory analyses of the samples, data processing, statistical analyses and report writing.

Activities	1. Monitoring and Sampling 2. Lab Analyses 3. Monthly meetings (project team) 4. Annual reference group meeting (advisory committee) 5. Annual report and admin (technical data) 6. Participate in Awareness events

Risks	• Being a dryland experiment, low and erratic rainfall may compromise crop yields; • Wild animals and birds may jeopardise crop performance and yields; • Instrumental failure can result in incomplete data results

ACTIVITIES AND DELIVERABLES

Activities	**Deliverables**
1. Monitoring and Sampling	Soil classification (types and depths) Detailed sampling of each trial site; Selected samples in surrounding landscape Root evaluations in soil profiles
2. Lab Analyses	Organic C (%) Standard soil analysis: 4 basic cations, P, pH, ratios, micro-elements Texture (once-off, top- and subsoil) Soil biology (Solvita and others)
3. Monthly meetings (project team) & Training	Participate in monthly forum meetings, discussing problems and possible solutions to that.
4. Annual reference group meeting (advisory committee)	Report progress and findings to advisory committee; Discussion and evaluation of data. Learning from each other.

5. Annual report and admin (technical data)	Written technical report covering trial procedures, results and progress.
6. Participate in Awareness events	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits

DELIVERABLES, PROGRESS AND RESULTS ACHIEVED PER ACTIVITY

Activities	**Progress and Results achieved**
1. Monitoring and Sampling (Done with activity 3 above)	Monitoring to be done in September 2018
2. Lab Analyses	To be done.
3. Monthly meetings (project team) & Training	Participated in planning meetings.
4. Annual reference group meeting (advisory committee)	Scheduled for August and September 2018.
5. Annual report and admin	Submitted 6-monthly report in February 2018 Contribute to comprehensive annual report in September 2018.
6. Participate in Awareness events	Participated in CA conference on 19-20 March 2018.

8.3. Assessment of cover crop adaptability and suitability

Work Package title	**Assessment of cover crop adaptability and suitability**

Work Package period	October 2017 to February 2018
Lead partner	ARC-AP (Mr. Gerrie Trytsman)
Involved partners	Grain SA, Riemland & Ascent study groups / IP's

Objectives	• To establish and maintain an on-farm screening trials • Determining the biological production of different cover crops • Measuring the production of crop residues of each cover cropping system • Measure the adaptability of cover crops in different agro-ecological regions

Justification	Cover crops offer many benefits for agriculture productivity and sustainability while reducing off farm environmental effects. For agricultural productivity, sustainability and soil health these include: erosion control, compaction remediation, increased water infiltration and storage, improved soil biodiversity, increased organic matter, nitrogen fixation, and improved nutrient recycling and retention of macro and micro nutrients. Environmental benefits include: reduced

	nutrient leaching, reduced sediment and phosphorus deposition, reduced runoff, and increased carbon sequestration; while suppression of weeds, diseases and nematodes and improved beneficial insect habitat results in reduced pesticide use. Other conservation benefits include: pollinator enhancement, wildlife enhancement as well as aesthetic value (Stivers-Young and Tucker, 1999; and Snapp *et al.,* 2005). The use of no-tillage systems greatly increases the benefits of cover crops and vice versa. No-till systems increases water conservation by maintaining cover crop residues on the surface. No-till systems reduce the disruption of the soil reducing: soil erosion, water runoff, organic matter oxidation and increases; infiltration and all of the benefits of improved organic matter accumulation. Stratification of the soil profile as result of no-till is important for macro invertebrates and soil micro-organisms. Tillage leads to unfavorable effects such as: soil erosion, soil compaction, loss of organic matter, degradation of soil aggregates, death or disruption of soil microbes and other organisms including; mycorrhizae, arthropods, and earthworms. Continuous no-till needs to be managed very differently in order to maintain or increase crop yields. Residue, weeds, equipment, crop rotations, water, disease, pests, and fertilizer management are just some of the many details of farming that change when switching to no-till. Tillage generally increases the amount and speed of nitrogen mineralization of soil organic matter which may increase or decrease synchrony of nitrogen release depending on the timing of the subsequent crop's nitrogen needs.

Description of work	**On-farm, farmer-led screening trials: around 10 potential cover crops**

Activities	7. Land preparation (finding a suitable location, sourcing materials) 8. Purchase Materials & Equipment 9. Establishing and Planting of trials 10. Seasonal management and maintenance of trials 11. Monitoring and Sampling (including harvesting, biomass and yield determination, nutrient analysis) 12. Lab Analyses 13. Monthly meetings (project team) & Training 14. Annual reference group meeting (advisory committee) 15. Harvesting, biomass and yield determination, nutrient analysis 16. Annual report and admin (production & technical data) 17. Participate in Awareness events

Risks	Finding a suitable site for a trial of this magnitude Getting the right equipment and seed to do the job well Acts of God (drought, hail, etc.) Labour (weed control, harvesting, etc.)

ACTIVITIES AND DELIVERABLES

Activities	**Deliverables**
7. Land preparation	Weeding and management of cover crops prior to planting.
8. Purchase Materials & Equipment	Acquisition of seed, inoculum, stickers, implements, chemical inputs.

9. Establishing and Planting of trials	Established trial according to the field plan.
10. Seasonal management and maintenance of trials	Regular visits to the trial site for inspection of weeds and insect damage and control if needed. Top dressing of grass cover crops. Treatment of cover crop at appropriate time (usually before seed set) using appropriate equipment. Submission of technical report after each visit. Photos from trial during visits
11. Monitoring and Sampling	Completed data sheets for 1. Input cost 2. Germination 3. Cover % 4. Height of cover of each addition 5. Biological productivity t/ha^{-1}
12. Lab Analyses	C:N content of plant material
13. Monthly meetings (project team) & Training	Partake in monthly forum meetings, discussing problems and possible solutions to that.
14. Annual reference group meeting (advisory committee)	Report progress and findings to advisory committee; Discussion and evaluation of trials. Learning from previous mistakes.
15. Annual report and admin (production & technical data)	Written technical report covering trial procedures, results and progress.
16. Participate in Awareness events	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits

DELIVERABLES, PROGRESS AND RESULTS ACHIEVED PER ACTIVITY

Background

Suzette Smallberger was appointed by VKB in the place of Dr Robert Steinberg who retired. She also found greener pastures in the meantime, this left a void in so far the continuity to the farmer's innovation project goes. Fortunately Mr Jacques van Zyl, junior agronomist at VKB, has been tasked to support the project and offered to help us in distributing seed to farmers, as well as monitoring, analyses and reporting.

The following cover crop mixtures were distributed to Ascent and Riemland famers:

Early summer mixture (Reitz)

- A. Visser x 17 ha
- D. Slabbert x 1ha

Early summer mixture (Vrede)

- W. Cilliers X 5ha
- P. Zietsman X 2ha
- P. Du Plessis X 2ha
- DD Roets X 1ha

Late summer mixture (Reitz)

- D. Slabbert X 4 ha
- Rautenbach X 14 ha

Late summer mixture (Vrede)

- W. Cilliers X 5 ha
- P. Zietsman X 2 ha
- P. Du Plessis X 2 ha

Seed were package, mixed and delivered to VKB by Douw Steyn at Barenbrug.

At Reitz, Callie Meintjies planted an early summer cover crop mixture after harvesting soybeans. This year he decided that planting maize is not an option and also planted 200 ha of a late summer cover crop mixture on his farm. His plan is to buy weaners for grazing. Grazing the cover crop he believe will be more financially viable than producing maize.

At Ascent, Vrede, on the farm Skulpspruit, Izak Dreyer grazed his winter cover crop, which was planted after the harvesting of soya bean, and he calculated a net return of R4 500/ha from meat production. The maize he planted after chemically killing the cover crop looks good. He was adamant that on this land he could finish the planting of the maize very fast, because of the condition of the soil. The soil was moist and workable, which improved the emergence of the maize immensely. The only way to describe this farmer is that he is real pioneer in the field of CA and that he thinks holistically about the system. For him this is a process and not just planting with a no-till planter.

At Reitz, Danie Slabbert bought about 320 young Drakenberger cows, with the intention of starting an ultra-high utilization grazing system of his veld. He moves the livestock every hour by opening up a new 300 m^2 area to them. He invested in a water system, an electrical wire system and also build a brand new reservoir. He also practices CA on the rest of his farm.

According to Paul Zietsman at Ascent, Vrede, the mixtures this year was dominated by oats and the millets and sorghums did not germinate and grow satisfactory. Planted in November he really thought that the contribution that the two warm season annuals would make will be meaningful. He grazed the cover crops with milking cows. This winter he wants to plant bulb crops such as radish at a rate of 3kg/ha, mixed with oats.

Ad hoc events that took place was the monitoring and description of the veld at Danie Slabbert. Jacques van Zyl received 20 ha winter annual seed to distribute to farmers. Again the seed and the delivery of it to VKB was handled by Barenbrug. We also visited A. Visser while he was busy utilizing the cover crop with livestock. After pulling out a plant we witness the biological activity in his soil.

Activities	Deliverables	Progress and Results achieved
1. Land preparation (finding a suitable location, sourcing materials, action planning)	Description of natural resources. This will include positive and negative factors that can impact on plant growth. Selection of suitable site(s). Action plan that will include acquisition of seed, inoculum, stickers, implements, chemical inputs, monitoring and evaluation of trial, harvesting, collecting and interpretation of data. The action plan should clarify the roll of all parties involved.	Chemical land preparation is done by all farmers at the moment. If bloadleave is part of the mixture then spraying a round-up, 2-4D mixture is recommended. Grazing vetch would not easy kil using Round-up alone. Grasses are easyly killed though.
2. Purchase Materials & Equipment	Acquisition of seed, inoculum, stickers, implements, chemical inputs.	See Background
3. Establishing and Planting of trials	Drawing up a field plan Experimental design discussed with ARC Biometric Unit. Established trial according to the field plan.	All farmers use commercial planters. Both vacuum and finger planters are used. If not available fertilizer spreader can also be used for broadcasting. Good seed to soil contact will increase success.
4. Seasonal management and maintenance of trials	Regular visits to the trial site for inspection of weeds and insect damage and control if needed. Top dressing of grass cover crops. Treatment of cover crop at appropriate time (usually before seed set) using appropriate equipment. Submission of technical report after each visit. Photos from trial during visits	Trials at Izak were visit on 11/09. Proposals were made how to improve system. We also visited Sklupspuit on the 10/1/2018 and Danie Slabbert, Abe and Callie on the 29/1/2018. A survey was done at Danie's grazing system, which will be included into the report. Photo's was taken when visiting the trials to monitor progress
5. Monitoring and Sampling	Completed data sheets for: • Input cost • Germination • Cover % • Height of cover of each addition • Biological productivity tha^{-1} (Dry Matter, DM)	DM will be determined at a later stage. At the same time cover %, height of the cover and actual stand will be determine.
6. Lab Analyses	C:N content of plant material	Veld samples was dried to detemine DM for the veld grazing at Danie
7. Monthly meetings (project team) & Training	Partake in monthly forum meetings, discussing problems and possible solutions to that.	On the 11/09 a report back meeting was attended and ideas exchaned.

		A meeting was held on 30/01/2018 with the Riemland study group, VKB and *Landbouweekblad* and the involvement of the different roleplayers in the CA conference was discussed.
8. Annual reference group meeting (advisory committee)	Report progress and findings to advisory committee; Discussion and evaluation of trials. Learning from previous mistakes.	On-going process.
9. Annual report and admin (production & technical data)	Written technical report covering trial procedures, results and progress.	Technical progress report was submitted by middle March. Technical annual report will be submitted in September
10. Participate in Awareness events	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits.	Participated in the conference on 19-20 March.

The progress that has been made with the project

Photo 8.3.1 shows a good example of a summer cover crop mixture, taken at Callie Meintjies, Reitz. Allthough cool season crops such as sweet clower and radish form part of this mixture, it is dominated by summer legumes and grasses. The color of the sward surgest that nitrogen is needed; the biomass production can be increased by the application of N (40-60N/ha) fertilizer. This will also improve root developmet. Increasing the roots in the soil profile will help to build soi aggregates. Sandy soils are dependant on roots and micro-organism to develop structure, whiles clay soil are more dependeant on weather patterns such as drying and wetting.

Photo 8.3.1: Summer annual cover crop mixture at Callie Meintjies, Reitz

Photo 8.3.2 shows an attempt to lengthen the grazing period, where Callie Mreintjies planted a mixture late in the summer to have good grazing during the lean winter months. This mixture contains more cool season crops that the mixture used in photo 8.3.1.

Photo 8.3.2: Late planting of a cover crop mixture into the mulch of black oats

Visits to Izak Dreyer at Ascent, Vrede were fruitfull and interesting. Photo 8.3.3 shows Izak standing in front of the cover crop seed he bought for the season. According to him he feels vulnarable if he do not have seed ready.

Photo 8.3.3: Cover crop seed delivered to Izak Dreyer, Ascent, Vrede

Photo 8.3.4 give us an indication of the ability of the cool season cover crop's regrowth after grazing. The sward produced enough for a second grazing and had to be terminated using herbicides.

Photo 8.3.4: Regrowth of winter cover crops after the first round of grazing

Although it might seem a bit over-grazed, the soil surface was trampled by cattle leaving the soil loose and completely covered with dung and residues. After moving the herd within a week of grazing, new growth could be seen.

Photo 8.3.5: Weaners on cover crops before they were moved

Photo 8.3.6 shows the same young bulls on summer annuals. The size of the camps is very small so they sleep in the kraal. A cover crop mixture was planted too early and due to above normal cold temperature, summer annual legumes such as cowpeas and lablab failed to germinate and grow. The same happened with the babala and sorghums, which did not do well at all. Livestock is weight on a regular basis and a control group on the veld is also being monitored.

Photo 8.3.6: The same weaners on cover crops.

Photo 8.3.7 shows an example of a good mulch. Dung beetles are now seen on a regular basis and Izak is very excited about this. He wants to use less toxic poison in the future for tick control to make sure that the eco function of the dung beetles are restored.

Photo 8.3.7: A good mulch left after a grazing cycle

At Danie Slabbert we did a preliminary veld survey for future reference:

Baseline study of veld condition at Danie Slabbert on 29/01/2018

The introduction of a systems approach (ultra-high utilization grazing) at Danie Slabbert's at the start of January on his farm outside Reitz needed to be surveyed to assess the current veld condition. This was necessary for future references and to monitor changes in parameters such as basal cover, specie composition and soil health.

1) Basal cover was assessment

Basal cover is a good indicator to show the relationship of the plants contact with the soil. This indicator not only has an influence on the long term biological production of the sward but also have an influence on the erosion of an area. Living plants dissipates the energy of falling raindrops render it less vulnerable to erosion. A high value for this indicator "soil plant interface" at this stage is regarded as high with a value of approximately between 30-40%. The method that was use is simply a piece of rope with knots in every 0.5 m. If one of the knots were in contact with a tuff of grass it was regarded as a hit. The ratio of hit to misses can then be calculated into a percentage as show in photo 8.3.8.

Photo 8.3.8: Assessment of the basal cover of the veld.

2) Biological productivity of un-grazed areas

A small quadrant of 0.25 m^2 was used to cut grass samples in order to determine the biological productivity of the area, as shown with the blue arrow in Photo 8.3.9. These samples were numbered and placed into a brown paper bag. Samples were dried in an oven at 60^0C. These samples contained the green growing parts of the plants as well as some dried grass materials on the soil surface. The DM average of the sample were calculated and a total of 4.2 t/ha was measured at the site.

Photo 8.3.9: The quadrant and tape to determine veld condition

3) Species composition.

Line transects using a measuring tape was rolled out on the ungrazed areas. At every meter increment (1m, 2m, 3m etc.) species were identified and noted. The amount of hits was determined. The amount of points was then divided into the number of hits to determine the % of each individual species.

ECOLOGICAL STATUS	BOERENAAM	SCIENTIFIC NAME	% CONTRIBUTION
INCREASER (11B)	Koperdraadgras	*Elionorus muticus*	23
INCREASER 1	Terpentyngras	*Cymbopogon plurinodus*	29
INCREASER (11C)	Katstertsteekgras	*Aristida congesta*	20
DEGREASER	Rooigras	*Themidia triandra*	6
INCREASER 1	Ruspergras	*Harpochloa flax*	3
VARIANT	Kruimannagras	*Setaria Sphacelata*	3
INCREASES (11B)	Oulandsgras	*Eragrostis curvula*	6

Assessing the ecological status of the veld at this moment, an increaser 1 species dominates the veld, which is an indication that the veld was previously under-utilized.

8.4. Agronomic field trial results in Riemland study area

Work period	October 2017 to February 2018
Lead partners	ARC-SG (W Killian, L Visser) and VKB (J van Zyl)
Involved partners	Riemland study group and other Innovation Platform (IP) partners

Objectives	• To plan and design the on-farm maize plant population density trials • To plan and design the on farm crop rotation trials • To (statistically) analyse and report the results of the maize plant population density trials • To (statistically) analyse and report on the results of the crop rotation trials

Justification	Plant population density is one of relatively few variables that farmers can manage easily. Current recommendations for maize plant population were derived from trials under conventional tillage. Physically, the soil is very different in no-tillage than in tilled soil. This might require an adjustment in the plant population density of crops. Recommendations from elsewhere in the world is that plant population densities should be increased and row width should be decreased for no-till cropping. Crop rotation, another easily manageable variable, is one of the principles of conservation agriculture. No information on how crops respond to rotation in conservation agriculture systems in this semi-arid environment is available. Crop responses to changes in management and the environment is usually liable to interactions resulting in variation of the results, which might lead to wrong conclusions and recommendations. In order to generate scientifically sound recommendations on these two agronomical variables, proper planning and analyses of the results is needed.

Description of work	**Planning and designing of trials in collaboration with participating farmers and partners. Analyses of farmer collected results and reporting of findings.**

Activities	Planning of trials through the attendance of the frequent coordination meetings where aims and procedures will be discussed with farmers. Planning of trial layout and compiling of data sheets to be completed by participating farmers. Collection of data from farmers at the after harvest of the trials. Statistical analyses, interpretation, discussion and drawing of conclusions from the results. Presentation and reporting of the results to participants and MT as required.

Deliverables	• Annual trial plans and analysis report • Regular attendance of meetings • Reporting as required • Popular article once enough results have been acquired.

Risks	Adequate involvement and participation of farmers

DELIVERABLES, PROGRESS AND RESULTS ACHIEVED PER ACTIVITY

Activities *(as specified in Work Package or project proposal)*	**Deliverables or Milestones***(as specified in Work Package or project proposal)*	**Progress and Results achieved;** and/or **Problems and Milestones <u>not</u> achieved**(in report period)
1. Planning of trials	Farmer participation in meetings.	A meeting was held on 18 October 2017 to discuss the new planting season with Abé Visser and Danie Slabbert. Armand Muller withdraw from the project. The row width and plant population trial will continue only on Danie Slabbert's farm. The long-term trial of the study group, which is planted on Abé Visser's farm, will be included in the project. The initial purpose of the trial was to compare no-till with conventional tillage. The aim was however changed and no-till, with two crop rotation treatments will be applied in future.
2. Land preparation and planting of trials	Trials planted on time.	Planting dates: Crop rotation – 18 October 2017 No-till/Conventional : rotation with cover crops – 19 October 2017 Row width and plant population – 4 December 2017
3. Seasonal management and monitoring	Soil probes and weather station.	• Water probes were installed on all three trials • VKB sponsored a new weather station • Data captured: weather data water probe data crop growth data
4. Monthly meetings (project team) & Training	Participate in monthly forum meetings, discussing problems and possible solutions.	Active discussions on a Whats App group. Farmer visits • 18 October 2017 • 19 October 2017 • 4 December 2018

		• 29 January 2018 • 8 February 2018 Project team meetings and discussion sessions between farmer co-workers.
5. Awareness events	Create awareness of CA farming practices through events and reporting.	Trial inspections were done on 29 January 2018 by Dr Hendrik Smith.
6. Reporting	Reporting as required and popular article once enough results have been acquired.	A popular article was written and submitted in February 2018 to SA Grain.

The long term trial on Abé Visser's farm

Year	Month	Rotation 1 on previously no-till strips	Rotation 2 on previously conventional strips
2017	Oct	Cover crop mix	Cover crop mix
	Nov	Cover crop mix	Cover crop mix
	Dec	Cover crop mix	Cover crop mix
2018	Jan	Cover crop mix	Cover crop mix
	Feb	Cover crop mix	Cover crop mix
	March	Cover crop mix	Cover crop mix
	April	Cover crop mix	Cover crop mix
	May	Cover crop mix	Cover crop mix
	June	Cover crop mix	Cover crop mix
	July	Wheat	Wheat
	Aug	Wheat	Wheat
	Sept	Wheat	Wheat
	Oct	Wheat	Wheat
	Nov	Wheat	Wheat
	Dec	Wheat	Wheat
2019	Jan	Cover crop mix	Sunflower
	Feb	Cover crop mix	Sunflower
	March	Cover crop mix	Sunflower
	April	Cover crop mix	Sunflower
	May	Cover crop mix	Sunflower
	June	Cover crop mix	
	July	Cover crop mix	
	Aug	Cover crop mix	
	Sept	Cover crop mix	
	Oct	Maize	Maize
	Nov	Maize	Maize
	Dec	Maize	Maize
2020	Jan	Maize	Maize
	Feb	Maize	Maize
	March	Maize	Maize
	April	Maize	Maize
	May	Maize	Maize

	June	Maize	Maize
	July	Maize	Maize
	Aug		
	Sept		
	Oct	Soybean	Soybean
	Nov	Soybean	Soybean
	Dec	Soybean	Soybean
2021	Jan	Soybean	Soybean
	Feb	Soybean	Soybean
	March	Soybean	Soybean
	April		
	May		
	June		
	July	Wheat	Wheat
	Aug	Wheat	Wheat
	Sept	Wheat	Wheat

8.5. Agronomic field trial results in Ascent study area

Work period	October 2017 to February 2018

Lead partner	VKB (Jacques van Zyl) and ARC (Willem Killian, Lientjie Visser)
Involved partners	Ascent study groups and other Innovation Platform (IP) partners Willem Killian, Lientjie Visser (ARC), Gerrie Trytsman (ARC), Paula Lourens (Vermi Solutions), Hendrik Smith (Grain SA)

Objectives	• Coordinate on-farm experimentation activities among all participating farmers • Ensure timely and correct implementation of relevant activities and treatments • Assist with the use of specialised implements for trial purposes • Promote synergy among farmer participants • Monitor selected indicators (through field form, sampling & visits) and report on project activities and progress related to farmer involvement.

Justification	On-farm experimentation involving farmers as 'researchers' are seen as central to research projects under the banner of the CA-Farmer Innovation Programme at Grain SA. This implies that trial treatments or replications are implemented on the farm by the respective farmer participants. A range of support measures are needed to ensure the success and quality of these farmer-led actions, including the engagement of relevant research and technical team members around these farmers**. A particular role and function identified by the project team is that of a local farmer facilitator, primarily assisting, guiding, calibrating and coordinating the participating farmers to implement the experimental designs (treatments) correctly.** This person also has to manage and move specific specialised implements (e.g. a no-till planter) between the farmers, allowing timely and correct use of it. The person selected should be locally based and should have an intimate knowledge of the local natural resources and stakeholders, especially the farmers. Expected result of this function is the

	elimination of undesirable variables and the increased quality of the trials and data.

Description of work	Prepare farmers and implement on-farm trials. Manage, maintain and move specialised implements to be used by the various farmers involved in the trials. Making sure that farmers understand the treatments and what is expected from them. Calibrate or train farmers on specific implements / practices where necessary. Conduct regular field/farm visits, monitor and coordinate relevant activities, assist with sampling of soil where necessary. Attend regular project meetings and assist with report writing.

Activities	1. Land preparation 2. Planting 3. Seasonal management 4. Monitoring and Sampling 5. Monthly meetings (project team) 6. Annual reference group meeting (advisory committee) 7. Annual report and admin 8. Participate in Awareness events

Risks	• Being a dryland experiment, low and erratic rainfall may compromise crop yields; • Wild animals and birds may jeopardise crop performance and yields; • Instrumental and logistical failure can result in incomplete activities and results

ACTIVITIES AND DELIVERABLES

Activities	**Deliverables**
7. Land preparation	Assist farmers to lay out their trial plots Prepare (calibrate and train) farmers on the trial treatments Make sure land preparation (e.g. weeding) is done according to specifications Make sure the correct type and quantity of production inputs are ready and used
8. Planting	Prepare planter for planting Move planter between farmers for timely planting, where necessary Make sure farmers plant according to standard treatment specifications
9. Seasonal management	Assist farmers in weeding and pest/disease management
10. Monitoring and Sampling (Done with activity 3 above)	Assist farmers to complete field forms Assist to collect soil samples Monitor the farmer-led actions
11. Monthly meetings (project team) & Training	Participate in monthly forum meetings, discussing problems and possible solutions to that.

12. Annual reference group meeting (advisory committee)	Report progress and findings to advisory committee; Discussion and evaluation of data. Learning from each other.
13. Annual report and admin	Written report covering trial implementation, results and progress.
14. Participate in Awareness events	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits

DELIVERABLES, PROGRESS AND RESULTS ACHIEVED PER ACTIVITY

Activities *(as specified in Work Package or project proposal)*	**Deliverables or Milestones** *(as specified in Work Package or project proposal)*	**Progress and Results achieved;** and/or **Problems and Milestones <u>not</u> achieved** (in report period)
1. Planning of trials.	Farmer participation in meetings.	Reporting and planning meetings were held at Ascent on 12 September 2017 where farmer participants were confirmed.
2. Land preparation and planting of trials.	Trials were planted as planned during October-November 2017 period.	Assistance was given with the planting of trials where possible. Trials had established very satisfactory due to good rains.
3. Seasonal management and monitoring.	* Yields and yield components will be measured after harvesting. * Soil probe data are monitored on a continuous basis. * Photos and videos were taken of cover crops and animal grazing on cover crops	Proper reporting follows in the technical annual reports below.
4. Awareness events.	Create awareness of CA farming practices through events and publications.	Cover crop seed were handed out to farmers.
5. Statistically analyse and report the results	Annual report Reporting as required and popular article once enough results have been acquired	Two articles were written in the Die Pad Saam

ACTIONS TAKEN – ASCENT, VREDE

The following trials were planted:

- Maize – rotation with soya beans; **Plant population and row width trials**
  Tillage practices:
  - No till with winter cover crops; I Dreyer – 3 trials
  - Strip till; C Cronje; P Zietsman
  - Conventional; D Portwig

  Row Width:
  - 91cm; D Portwig;
  - 76cm; I Dreyer; C Cronje; P Zietsman

  - Plant population; 30; 40; 60; 80; 100 (thousand/ha) per trial
    - **Total**: 7 Trials

- Maize – No till following soya beans and a **winter cover crop**
  - I Dreyer;
    - **Total**: 1 Trial

- Maize – **Fertilizer pilot trials**
  - I Dreyer (3 trials); P Zietsman; C Cronje
    - **Total**: 5 Trials

- Soya bean – rotation with maize; **Planting date, row width, plant population**
  Row width:
  - 76cm and 38cm; I Dreyer – 2 trials
  - 76cm; S Fourie, J v Dyk
  - 60cm; J v Dyk

  Planting date
  - Varied from farmer to farmer starting 7 November 2017 and ending 29 November 2017

  Plant population
  - Consisted of at least 4 increments starting with roughly 100 000 plants per ha and ending at 400 000 to 600 000 depending on farmer participant.
    - **Total**: 4 Trials

- Summer cover crop
  - I Dreyer; P Zietsman, P du Plessis, W Cilliers, DD Roets, J van Dyk
    - **Total**: 6 Trials

PROBLEMS THUS FAR

No problems. The planted trials are however, more than enough to achieve our research objectives.

GOALS FOR THE REMAINDER OF THE YEAR – ASCENT, VREDE

1. To organise a study group visit to various farms to jointly estimate yield potentials.
2. To harvest and determine trial yields.
3. To present a farmers day in August to share information and let participants experience practical on farm demonstrations of certain aspects of CA farming.

9. Summary of expenses on February 2018

Description of Reitz and Vrede CA project work packages	Total Actual YTD Feb 17	Total Budget YTD	Available to use
Reitz: Soil	-	83 200	83 200
Vrede: Soil	-	76 800	76 800
Cover crops	1 850	141 600	139 750
Reitz: Agronomy	12 249	84 800	72 551
Vrede: Agronomy	16 044	53 920	37 876
Reitz: Grain SA	-	145 000	145 000
Vrede: Grain SA	-	68 000	68 000
Total	**30 143**	**653 320**	**623 177**

*** Expenses and invoices still expected which will affect the final amount until 30 March 2018.**