APPENDIX 4:

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

For period:

July 2015 to September 2015

Compiled by:

HJ Smith, Grain SA

In collaboration with:

Riemland (Reitz) and Ascent (Vrede) study groups

GRAIN SA
GRAAN SA

September 2015

1. Background and Problem statement

1.1. General Background

Worldwide there is consensus that intensive tillage-based farming, still widely practised, has unsustainable elements, whose continued promotion and application endangers global capacities to respond to the food security concerns. Intensive tillage and removal of crop residues after harvest leave soil naked and vulnerable to wind and rain, resulting in gradual, often unnoticed degradation and erosion of soil. This is like tire wear on your car — unless given the attention and respect it deserves, catastrophe is only a matter of time. Soil degradation also puts carbon into the air where it contributes to climate change.

In virtually all South African arable land, crop production systems based on intensive and continuous soil tillage of over many decades, have led to an accelerated loss of soil organic matter (SOM), reduction of vital biological activity and destruction of soil structure, which, in turn, resulted in severe levels of soil degradation such as soil erosion and a considerable decrease in soil health. South Africa's soils have, over the last 60 years, been over-exploited to the point where about 70% of the country's food-producing lands are critically and severely degraded. According to a recent study by the Agricultural Research Council (ARC) in South Africa (Le Roux, 2008), **the average soil loss under annual grain crops in the country is 13 ton $ha^{-1}yr^{-1}$**, which is much higher than the natural soil formation rate. This adds to the growing problems with profitability and poverty in some of the rural areas. If we have to offer farmers a better chance to survive on the farm and if sustainable and economically viable agriculture and food security is to be achieved, then the paradigms of agriculture production and management must be changed.

There is general agreement among key role players, such as government, research institutions and producer's organisations (such as Grain SA), that these outcomes will be achieved through the adoption and implementation of CA. CA is seen as an ideal system for sustainable and climate-smart agricultural intensification, through which farmers can attain higher levels of productivity and profitability (i.e. 'green prosperity') while improving soil health and the environment.

The National Development Plan (Vision 2030) recommended the following on the rural economy: *"To deal with the consequences of industrialised agriculture and unique country ecosystems also demand that serious attention is paid to advances in ecological approaches to sustainable agriculture. This includes greater attention to alternative energy, soil quality, minimum tillage and other forms of conservation farming."* The DAFF Strategic Plan for 2011-2015 provides firm commitment that a climate smart agro-ecological approach to agriculture will be the key area of focus for implementation.

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

Photo 1: Participants during the planning session of the Riemland study group

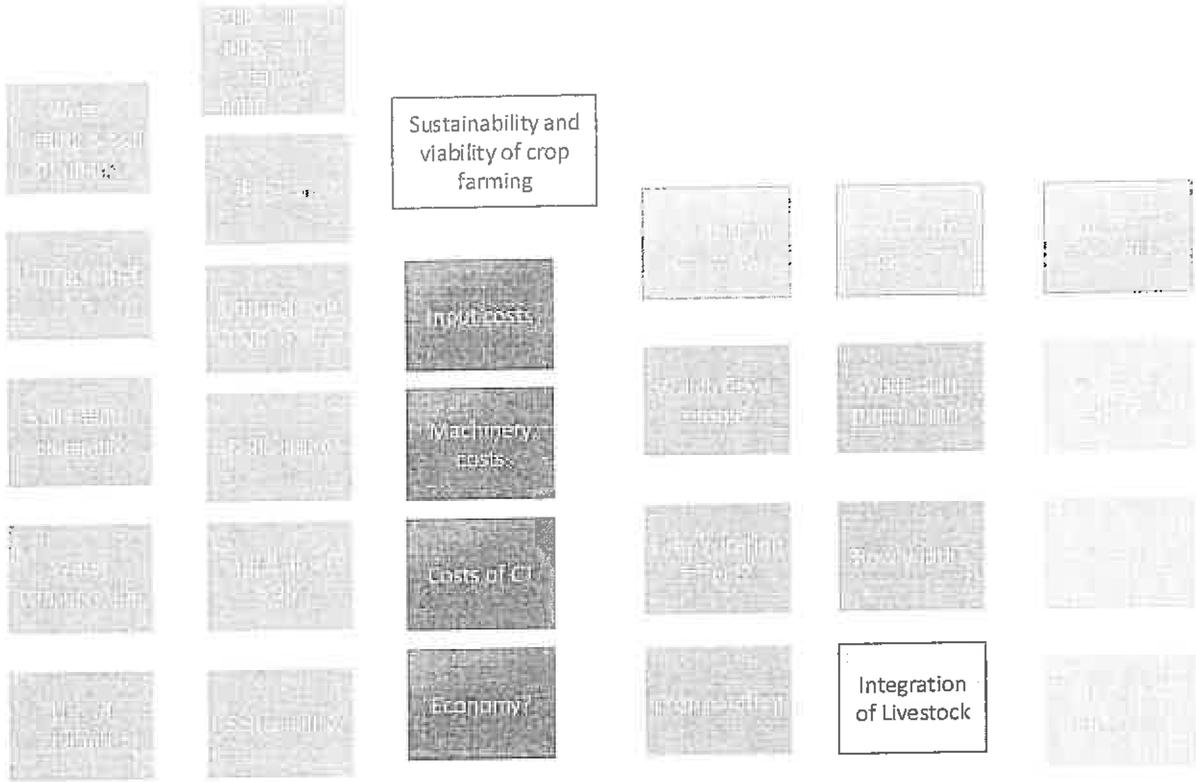


Figure 2: Problem tree of the Riemland study group.

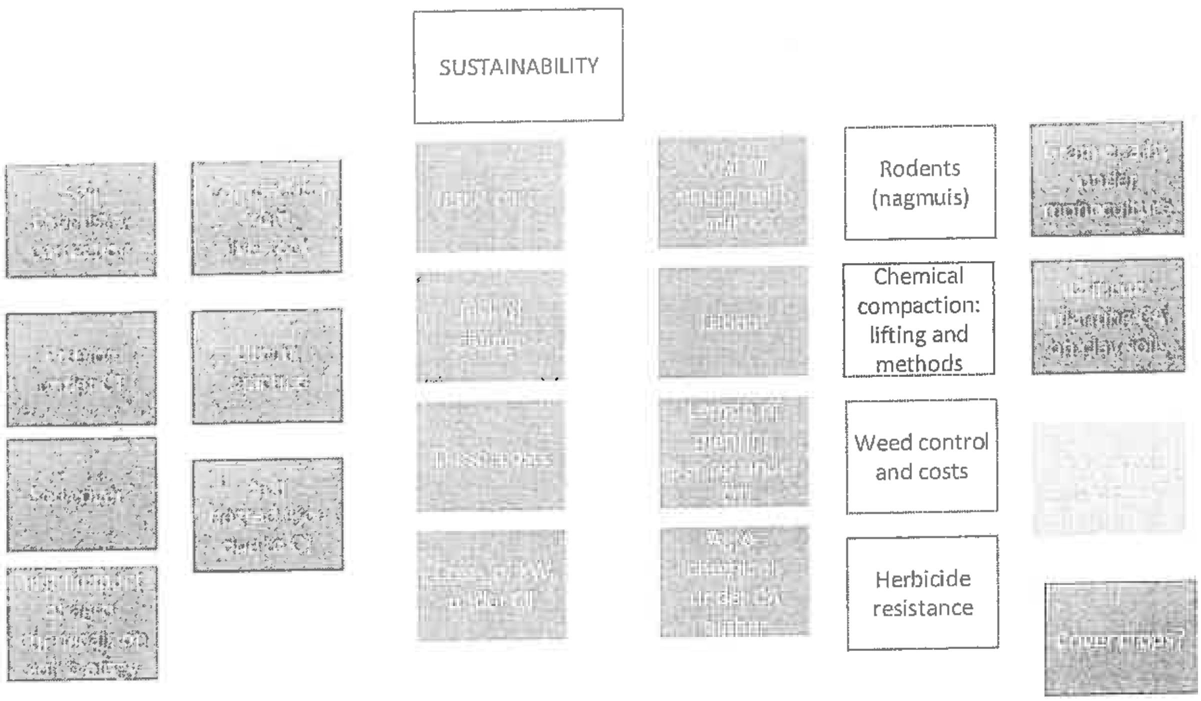


Figure 3: Problem tree of the Ascent study group.

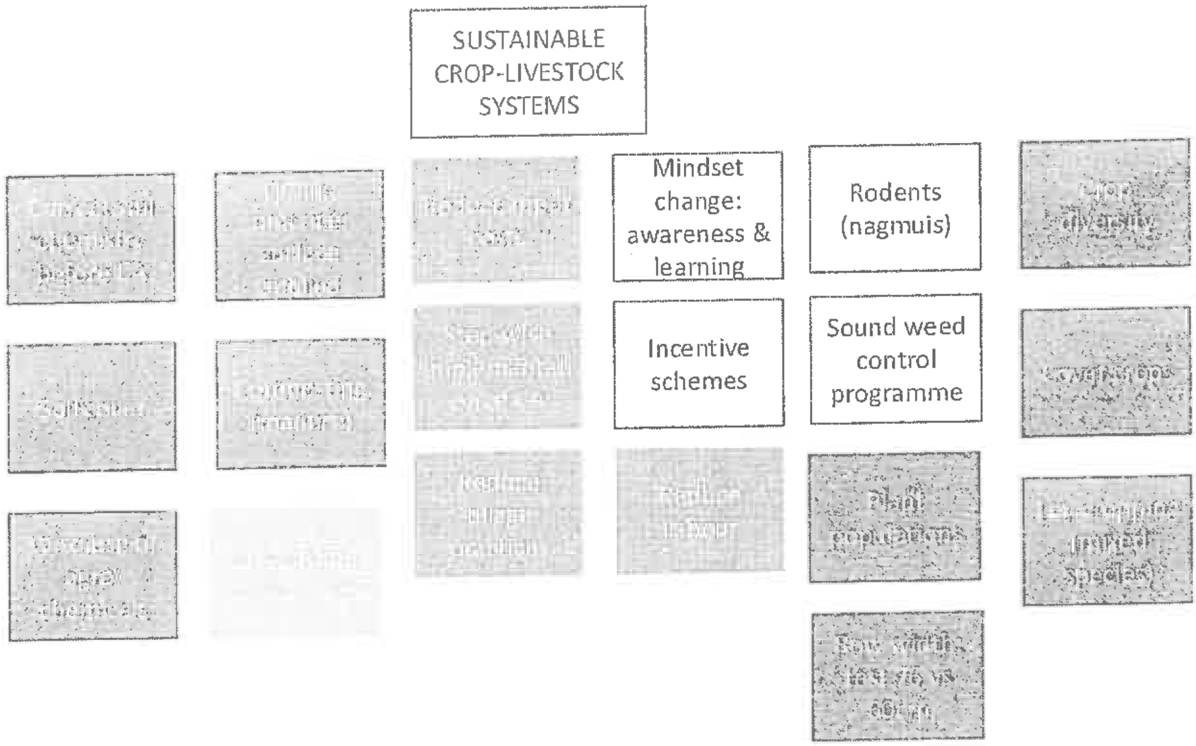


Figure 5: Solution tree of the Ascent study group

The trials and treatments identified for the Ascent study area:

A. Plant density:

2 x row widths x 4 plant pop – maize x soya rotations every year; 4 repetitions on each locality. Soya plant population = 360,000

a) 0.6m: 30,000; 40,000; 60,000 (Jaco)
b) 0.76m: 30,000; 40,000; 60,000 (Izak, DC)
(Argentina collaboration should be considered in future)

B. Cover crop trial:

4 sites – Izak, DC, Paul,

Paul du Plessis will provide a no-till planter for winter crops

Ascent Project Manager: Stephan Fourie / Paul Zietsman

2. Description of the targeted study area(s)

According to the Land Type Survey Staff ( ), the area can be divided into two broad physiographic zones:

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.

2.1. Soils of the Reitz study area

Soils in this area are dominantly not well drained but rather, at present or in the past, have been associated with fluctuating groundwater tables. The effect of groundwater or stagnating surface water is that iron is segregated to such an extent that a layer with mottles and/or concretions (nodules) is formed, which is called a 'plinthic layer'. This layer is invariably underlain by a slowly permeable layer (Samadi, 2005). The presence of a soft or hard plinthic B horizon defines the plinthic soil group. The distribution and abundance of plinthic soils across South Africa seems to confirm the general observation that they are largely absent from regions of extremely low or high rainfall (Fey, 2010).

2.2. Soils of the Vrede study area

This area is dominated by soils with high base status, dark coloured and/or red soils, usually clayey, associated with basic parent materials. The Land Type Survey indicates that more than half of the Vrede area is covered by soil forms with **melanic and vertic diagnostic horizons**.

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, Omnia, Willie Pretorius (Soil Health Solutions)
3. Assessment of cover crop	Gerrie Trytsman (ARC-API)	Gerrie Trytsman (ARC-

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 (see treatments in **Section 5** above). Experiments have been well designed with appropriate treatments and sufficient replications spread over the entire agro-ecological zone and/or on a sufficient number of farms. Data from these properly designed experiments will provide a much stronger starting point for discussion and investigation of a farmer's claims or problems. Furthermore, scientifically valid data will be generated which provides incentives for bringing people together in groups or networks across boundaries and on different levels. It is the potential for getting real answers that makes the group(s) hopeful that working together will be worthwhile; it makes all parties interested in how the experiment is conducted. Involving agricultural scientists in group problem solving and on-farm research (through the different work packages) is also much easier if valid data and results are important outcomes.

8.2. 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.

8.3. Reference Group

A Reference Group will be appointed for the project by the CA-FIP at 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.

It should be noted that, in exceptional cases, projects are not assigned a Reference Group.

Reference Group meetings are scheduled annually (or more frequently, if required) with the Project Leader in attendance and the CA-FIP facilitator fulfilling the role of Chairperson. Progress reports for the preceding period and work programmes for the following cycle are tabled at these meetings.

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 – Progress to date (July to September 2015)

KEY ACTIVITY	TIMELINE	INDICATOR OF SUCCESS	PROGRESS TO DATE (for interim period Jul-Sep'15)
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)	July to June (Continuous)	Statistically designed trials established and managed on selected trial sites	Trial design workshops were held on 13 and 14 August with the Riemland and Ascent project teams respectively. Rough trial designs were agreed on. The ARC-SGI developed detailed trial designs and protocols from these – see Appendix 4.1.
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	Responsibilities were allocated to specific role-players to collect benchmark data or indicators, specifically soil samples, on the on-farm trial plots.
b) Farmer participatory M&E and discovery learning	January to June	Completion of Field monitoring form with farmers	The field form was discussed at the design workshops and will be refined and used by the farmer facilitators, in collaboration with farmer co-workers and researchers.
c) Data Analysis and Evaluation	June to August	Analysis of data collected from on-farm trials and field forms	None
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	None
b) Exposing on-farm trials to	Continuous	Trial visits by interested people	None

FS, Reitz: Farmer Facilitation	-	-	18 192	18 192	18 192
Total	-	-	**152 152**	**152 152**	**152 152**
Plus: Management fee (5%)			**7 608**	**7 608**	**7 608**
Grand Total	-	-	**159 760**	**159 760**	**159 760**

	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

Assessment of soil quality under CA systems

Work Package title	**Assessment of soil quality under Conservation Agriculture (CA) systems**
Work Package period	July 2015 to June 2016
Lead partners	AgriSol (Mr. GP Schoeman), 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

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

16. Participate in Awareness events	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits

Agronomic field trial planning and analyses

Work Package title	**Agronomic field trial planning, design and analyses**

Work Package period	July 2015 to June 2016
Lead partner	ARC-SGI (Mr W Killian)
Involved partners	Riemland & Ascent study groups 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

	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
1. 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
2. Planting	Prepare planter for planting Move planter between farmers for timely planting, where necessary Make sure farmers plant according to standard treatment specifications

An evaluation of different crop rotation systems in the Eastern Free State

1. Background

Crop rotation is one of three pillars on which conservation agriculture (CA) are build. Research in the Western Cape, as well as overseas, indicated that adoption of CA practices increased when data regarding successful rotation crops and -systems became available in a region. The Riemland study group in Reitz are being used as platform to launch a series of on-farm trials on this topic as part of The Maize- and Winter Cereal Trust project with Grain SA and the ARC to evaluate different crop rotations in their existing CA systems.

2. Purpose of trial

To evaluate the potential and success of six crop rotation systems, which was identified by the study group, in the Eastern Free State, namely:

- Soy beans : Maize
- Soy bean : (Wheat and, or Sunflower) (sunflower will be planted directly after wheat if soil moisture is enough) : Maize
- Soy bean : Wheat : Maize
- Soy bean : Sunflower : Maize
- Soy bean : Winter cover crop : Maize
- Soybean : (Wheat and, or Sugar bean) - (sugar bean will be planted directly after wheat if soil moisture is enough) : Maize

3. Objectives of the trial

- To evaluate the impact of crops on the growth, development, yield and quality on the follow-up crop.
- To establish any negative impacts (diseases, weeds and pests) specific crops may have on the follow-up crop.
- To establish any beneficial effects a crop may have on the next crop in the sequence (disease breaks, elevation of compaction, availability of nutrients, fixation of nitrogen).
- To establish the effect crops may have on nutrient availability of subsequent crops.
- To determine most profitable sequences of crops.

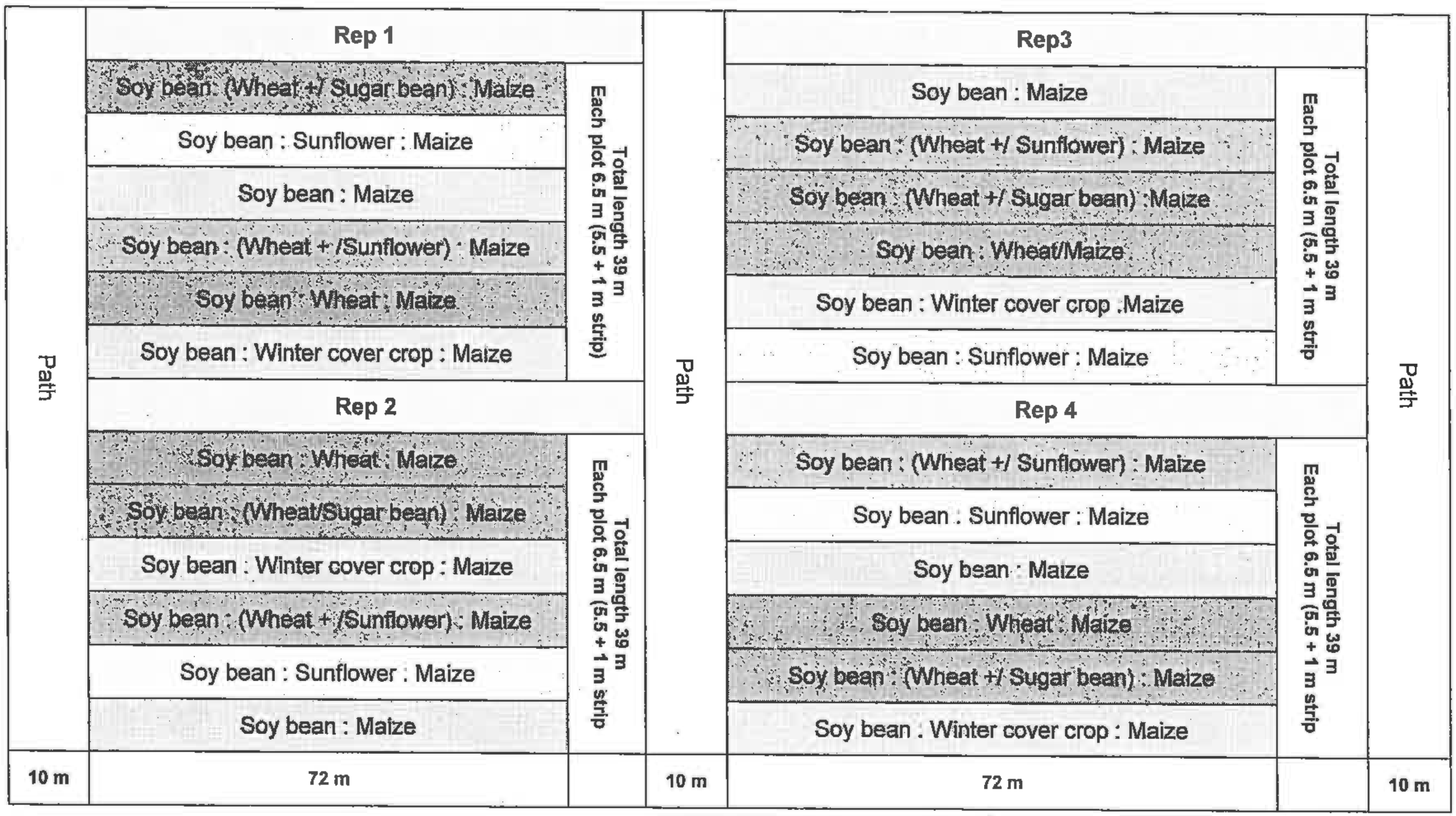
4. Method

The trial will be replicated on two localities on the farms of Danie Slabbert and Armand Muller. Both trials will be planted as randomised blocks with four replicates of the six crop rotation treatments. Each rotation will be planted on the same plot every year to measure the effect of the crop sequence on the specific plot. Plots will be 72 m in length and the row widths will be 50 cm. Total plot width will be 39 m, which includes 1 m strips between each treatment.

4.1 Planting times

Year	Month	Sequence 1	Sequence 2	Sequence 3	Sequence 4	Sequence 5	Sequence 6
2015	Nov	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean
	Dec	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean
2016	Jan	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean
	Feb	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean
	Mar	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean
	Apr	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean
	May						
	Jun						
	Jul		Wheat	Wheat		Cover crop (W)	Wheat
	Aug		Wheat	Wheat		Cover crop (W)	Wheat
	Sep		Wheat	Wheat		Cover crop (W)	Wheat
	Oct	Maize	Wheat	Wheat	Sunflower	Cover crop (W)	Wheat
	Nov	Maize	Wheat	Wheat	Sunflower	Cover crop (W)	Wheat
	Dec	Maize	Wheat	Wheat	Sunflower	Cover crop (W)	Wheat
2017	Jan	Maize	Sunflower		Sunflower		Sugar bean
	Feb	Maize	Sunflower		Sunflower		Sugar bean
	Mar	Maize	Sunflower		Sunflower		Sugar bean
	Apr	Maize	Sunflower				Sugar bean
	May	Maize	Sunflower				Sugar bean
	Jun	Maize					
	Jul	Maize					
	Aug						
	Sep						
	Oct		Maize	Maize	Maize	Maize	Maize
	Nov	Soy bean	Maize	Maize	Maize	Maize	Maize
	Dec	Soy bean	Maize	Maize	Maize	Maize	Maize
2018	Jan	Soy bean	Maize	Maize	Maize	Maize	Maize
	Feb	Soy bean	Maize	Maize	Maize	Maize	Maize
	Mar	Soy bean	Maize	Maize	Maize	Maize	Maize
	Apr	Soy bean	Maize	Maize	Maize	Maize	Maize
	May		Maize	Maize	Maize	Maize	Maize
	Jun		Maize	Maize	Maize	Maize	Maize
	Jul		Maize	Maize	Maize	Maize	Maize
	Aug						
	Sep						
	Oct	Maize					
	Nov	Maize	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean
	Dec	Maize	Soy bean	Soy bean	Soy bean	Soy bean	Soy bean

4.4 Trial plan



Protocol for research on planting densities of crops produced in conservation agriculture systems in the Eastern Free State

1 Background

Adoption of conservation practices (CA) in the Eastern Free State is much slower than expected. Grain SA has partnered with two farmer study groups (Ascent in Vrede and Riemland in Reitz) to identify research needs and to implement various activities, of which on-farm trials are the main one, in the identified two project sites. Both groups saw plant density in CA systems as a high priority research need. Plant population play an important role in optimising grain production and in other regions research indicated that planting densities needed to be adapted for CA practises. It is expected that this research might lead to the adaptation of new planting densities in the Eastern Free State as well.

2 Purpose of trial

The standard planting densities of conventional systems in the area will be tested at lower, as well as higher levels, to determine the effect thereof on the crop yield in conventional systems. The influence of two treatments, namely plant rows and plant density, as well as the interaction between the two treatments on crop yield will be determined. Blocks planted at nine different localities will serve as replicates. The nine localities will include four replicates of 0.50 m row widths planted with an Argentine planter; five replicates of the 0.72 m row width – two in no-till systems, two in strip-till systems, one in a conventional and three replicates of 0.90 row widths in conventional systems.

3 Method – Ascent Study group

3.1 Localities

A) Row width 0.50 m – Argentine planter
Paul, Izak, Stephan, Danie (?).

B) Row width 0.72 m
No-till – Izak, DD
Strip-till – Christo, Pienaar
Conventional – Paul

C) Row width 0.90 m
Conventional – Willie, Helgaard Stephan

Each farmer use his own cultivar of choice for maize, as well as soy bean.
Own planters will be used at different locations, except for the localities where the Argentine planter will be used.

3.6 Trial plans for different row widths

A) **<u>Row widhth0.50 m – Argentine planter</u>**

Paul, Izak, Stephan, Danie (?).

Plot length at least 50 m	**MAIZE**				
	0.50 m x **40** k	0.50 m x **30** k	0.50 M **60** K	0.50 m x **100** k	0.50 m x **80** k
10 m	**PATH**				
Plot length at least 50 m	**SOY BEAN**				
	0.50 m x **300** k	0.50 m x **300** k	0.50 m x **300** k	0.50 m x **300** k	0.50 m x **300** k

C) Row width 0.90 m

Conventional – Willie, Helgaard Stephan

	MAIZE				
Plot length at least 50 m	0.90 m x 30 k	0.90 m x 80 k	0.90 m x 60 k	0.90 m x 40 k	0.90 m x 100 k
10 m	PATH				
	SOY BEAN				
Plot length at least 50 m	0.90 m x 300 k	0.90 m x 300 k	0.90 m x 300 k	0.90 m x 300 k	0.90 m x 300 k

Protocol for research on planting densities of crops produced in conservation agriculture systems in the Eastern Free State

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3 Method – Riemland Study group

3.1 Localities

Locality one – Danie Slabbert
Locality two – Armand Muller
Maize cultivar – 774 (Monsanto) RR
Soy bean cultivar year 1 – 1664, year 2 - 1545
Planters at both localities – Jemil with cutting wheels - plant 12 rows.

3.2 Fertiliser programme

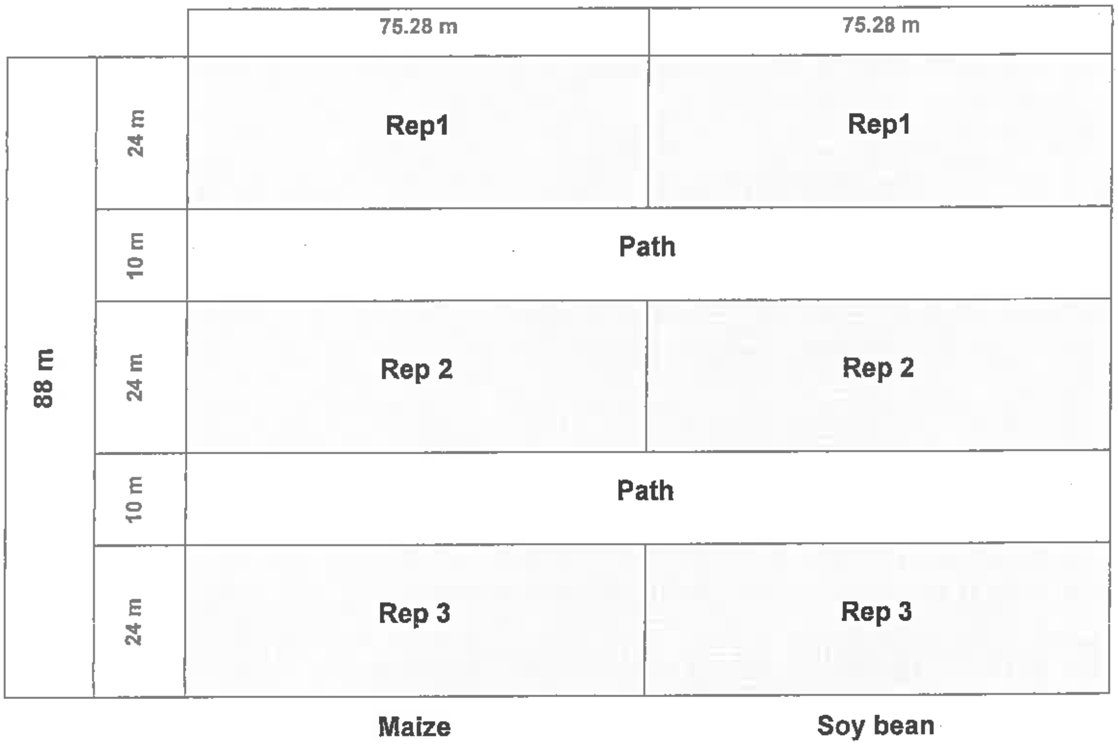
Fertiliser will be applied according to recommendations.

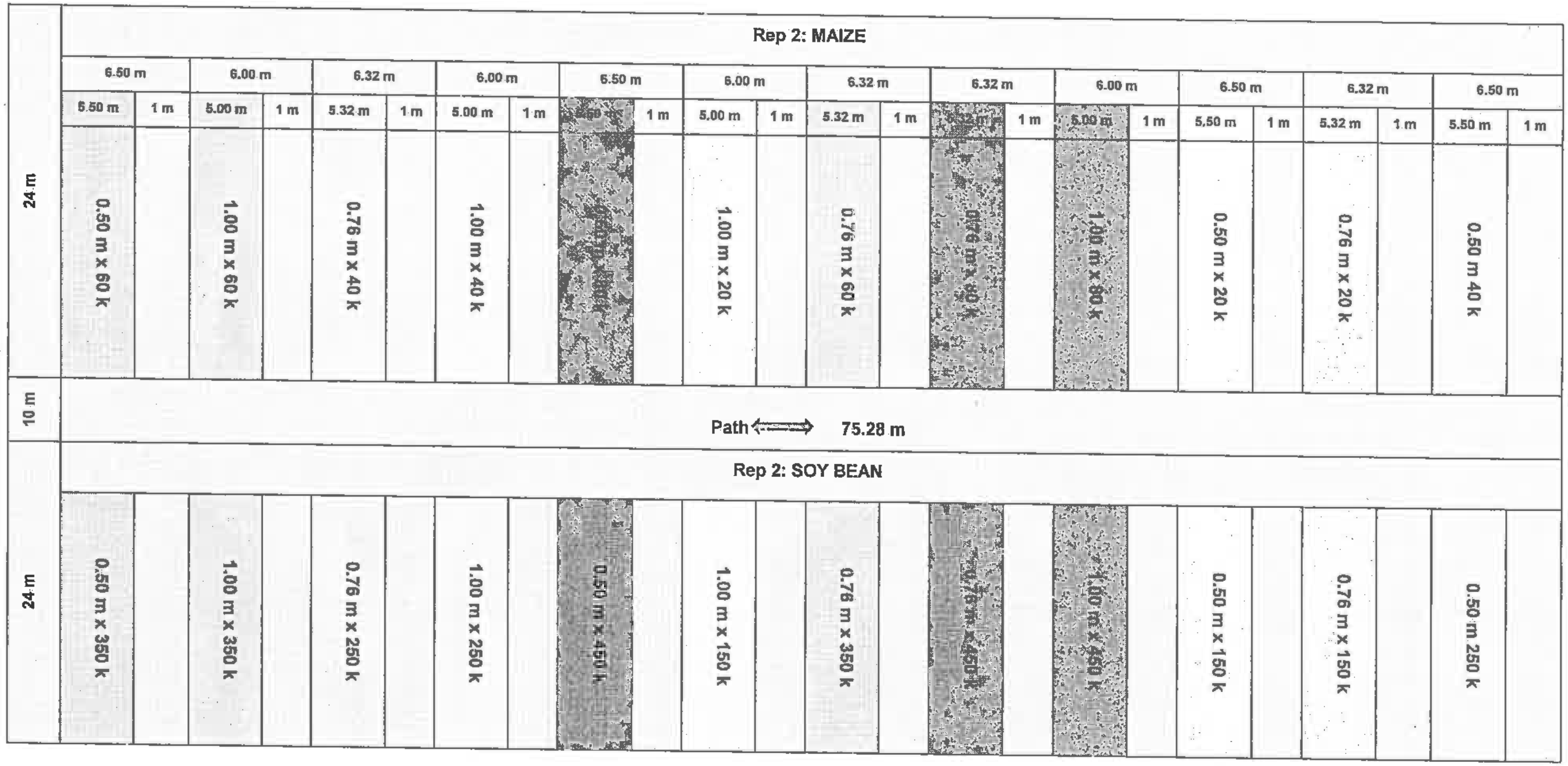
3.3 Weed and disease control

Will be managed according to seasonal needs.

3.4 Harvest

B Vertical – 1 m paths between plots




Rep 2: MAIZE
6.50 m
6.00 m
6.32 m
6.00 m
6.50 m
6.00 m
6.32 m
6.32 m
6.00 m
6.50 m
6.32 m
6.50 m
5.50 m
1 m
5.00 m
5.32 m
24 m
0.50 m x 60 k
1.00 m x 60 k
0.76 m x 40 k
1.00 m x 40 k
1.00 m x 20 k
0.76 m x 60 k
0.76 m x 80 k
1.00 m x 80 k
0.50 m x 20 k
0.76 m x 20 k
0.50 m 40 k
10 m
Path
75.28 m
Rep 2: SOY BEAN
24 m
0.50 m x 350 k
1.00 m x 350 k
0.76 m x 250 k
1.00 m x 250 k
0.50 m x 450 k
1.00 m x 150 k
0.76 m x 350 k
0.76 m x 450 k
1.00 m x 450 k
0.50 m x 150 k
0.76 m x 150 k
0.50 m 250 k