ATTACHMENT 1

ANNUAL PROGRESS REPORT
Farmer innovations in Conservation Agriculture (CA) systems for sustainable crop intensification in semi-arid, sandy soil conditions, North West Province

For the period:

JULY 2013 TO JUNE 2014

Compiled by:

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JUNE 2014

Ottosdal No-till Club

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1. Coordination and management

Work Package title	**Coordination and management**
Work Package period	July 2013 to June 2014

Lead partner	Ottosdal No-till Club (Mr Hannes Otto) and Grain SA (Dr Hendrik Smith)
Involved partners	All

Objectives	Coordinate activities among all partners Ensure timely reporting to Grain SA / The Maize Trust 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	**Activity 1: Project inception workshop**. **Progress and Results achieved:** A one-day project planning and inception workshop was held on 20 August 2013 (at the Ottosdal country club) 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. **Activity 2: Frequent coordination meetings**. The purpose of these monthly or bi-monthly meetings is to establish an Innovation platform 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. **Progress and Results achieved:** Frequent monthly meetings has taken place involving all the key partners (project team members) in the project. Those include farmers, researchers, input suppliers, Grain SA/MT and manufacturers. These meetings are instrumental in the running of the project, serving as a platform for collective and adaptive project management. Some of the key project events, such as the farmer-led trials and the conference, have been planned and coordinated form this platform.

Activity 3: 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.

Progress and Results achieved: This activity is scheduled for the third or fourth quarter of the year.

Activity 4: Organise and Coordinate annual awareness event(s)

Progress and Results achieved: A highly successful CA Conference was held from 12-13 March 2014. The feedback from participants was overwhelmingly positive indicating to similar positive impacts on farmers' awareness.

The Ottosdal No-till Club in collaboration with Grain SA and The Maize trust had a very successful CA conference at Ottosdal on 13 and 14 March 2014. The conference was attended by 300 farmers and other interested people. The event also had an international flavour with the attendance of the deputy ambassador from Argentina, Mr Juan Miguel Cassissa, who was accompanied by a delegation from the National Institute of Agricultural Technology (INTA) in Argentina.

After the conference participants were welcomed by Mr Hannes Otto, the conference was opened by Mr Jannie de Villiers, CEO of Grain SA, where after presentations were delivered by Mr Carlos Galarza from INTA about successful CA practices in Argentina and Dr Tim LaSalle, CA coordinator at the Howard Buffet Foundation's farm Ukulima in Limpopo. After presentations from Mr's Jack Human (pioneer CA farmer from the Western Cape), George Steyn (CA farmer in Ottosdal) and Andre Nel, senior researcher from ARC-GCI, various field trials were visited - these trials were established by the Ottosdal No-till Club as part of the Maize Trust funded project under the CA-FIP at Grain SA.

The second day was opened by Mr Karabo Pele, chairman of The Maize Trust and was followed by various CA farmers from the Free State and North West Provinces, who shared their successes and problems in relation with CA.

After the group discussions at the end of the last day, the *Landbouweekblad* award for the best presenter was awarded to Mr Adriaan Dreyer from SGS/NVIRO Crop for his presentation of soil compaction in the Ottosdal area.

	Activity 5: Reporting. Partners will prepare a progress 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. **Progress and Results achieved:** Reporting has been done according to the standards and format required by The Maize Trust. **Activity 6: Annual progress reports.** Annual reports will be made following The 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. **Progress and Results achieved:** Annual report will be submitted in June 2014.

Deliverables	• Project actions and reporting delivered on time

Risks	None anticipated

2. Assessment of soil quality

Work Package title	**Assessment of soil quality under Conservation Agriculture (CA) systems in the semi-arid cropping areas of the North-West Province**
Work Package period	July 2013 to June 2014

Lead partner	SGS (Mr Adriaan Dreyer)
Involved partners	Ottosdal No-till Club, ARC-GCI, Grain SA,

Objectives	• To characterize the soil types and soil physical & chemical parameters, such as particle distribution, pH, Soil Organic Matter and macro-, micro-nutrients • 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

DELIVERABLES, PROGRESS AND RESULTS ACHIEVED PER ACTIVITY

Activities	**Deliverables**	**Progress and Results achieved**
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	Soil classification sampling was done for every trial. Root evaluations and root development problems in different soil profiles have been done. (see Results in **Appendix 2.1**)
2. Lab Analyses	Organic C (%) Standard soil analysis: 4 basic cations, P, pH, ratios, micro-elements Texture (once-off, top- and subsoil)	Soil chemical sampling was done for every trial. (see Results in **Appendix 2.1**)
3. Monthly meetings (project team) & Training	Participate in monthly forum meetings, discussing problems and possible solutions to that.	Participate in two meetings that were held.
4. Annual reference group meeting (advisory committee)	Report progress and findings to advisory committee; Discussion and evaluation of data. Learning from each other.	To be scheduled for fourth quarter
5. Annual reports and admin	Written technical report covering trial procedures, results and progress.	Finalised and submitted annual technical report.

(technical data)		
6. Participate in Awareness events	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits	Presented data and findings at the CA conference from 12 to 13 March. Was voted the ‘Best Presentation’ by the audience and *Landbouweekblad* sponsored the cash price.

Appendix 2.1: Soil data report, Ottosdal CA project

Progress report on soil types, chemical soil analysis and profile inspections on CA trial sites in the Ottosdal No-till Club project:

Hannes Otto

Profile inspections: Compaction occurrence is indicated in red arrows.

Glencoe soil type

- Severe compaction problems were experienced.
- Poor root development.
- Low Ca and Mg status.
- Topsoil and subsoil are sandy: 8% clay in topsoil and 10% clay in subsoil

Chemical analysis:

Hannes	pH (KCl)	P Mehlich	K	Na	Ca	Mg	UIT H+	%Ca	%Mg	%K	%Na	SUUR. V	Ca:Mg	(Ca+Mg)/K	Mg:K
Otto		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol(+)/kg	%	%	%	%	%	1.5 - 4.5	10.0 - 20.0	3.0 - 4.0
Topsoil	3.9	43	97	6	159	46	0.09	51.7	24.5	16.0	1.8	6.0	2.1	4.8	1.5
Subsoil	4.0	6	40	7	257	49	0.10	67.1	20.9	5.3	1.7	5.0	3.2	16.6	3.9

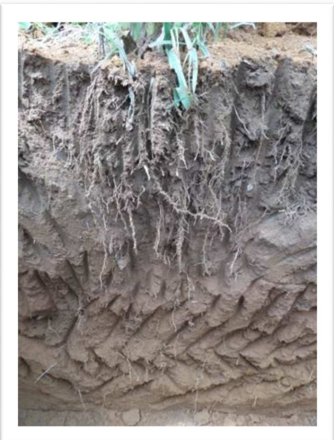
Hannes	S-Waarde	Na:K	CEC	Digtheid	Fe	Mn	Cu	Zn	S	B	C	P (Bray1)	Klei	Slik	Sand
Otto	cmol(+)/kg			g/cm3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	%	%	%
Topsoil	1.5	0.1	1.54	1.420	51.1	51.1	0.92	2.84	7.5	0.07	0.52	40	8	11	81
Subsoil	1.8	0.3	1.91	1.260	43.9	63.0	0.99	0.98	15.5	0.06	0.28	5	10	13	77

Tobie Martin

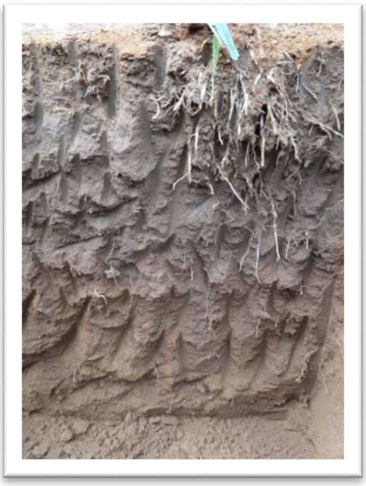
Profile inspections

Two cultivation practises were trialled namely a strip till practise versus a no till system.

Strip till:



No till:



- Good root development in both cases.
- High Ca /Mg status

Chemical analysis:

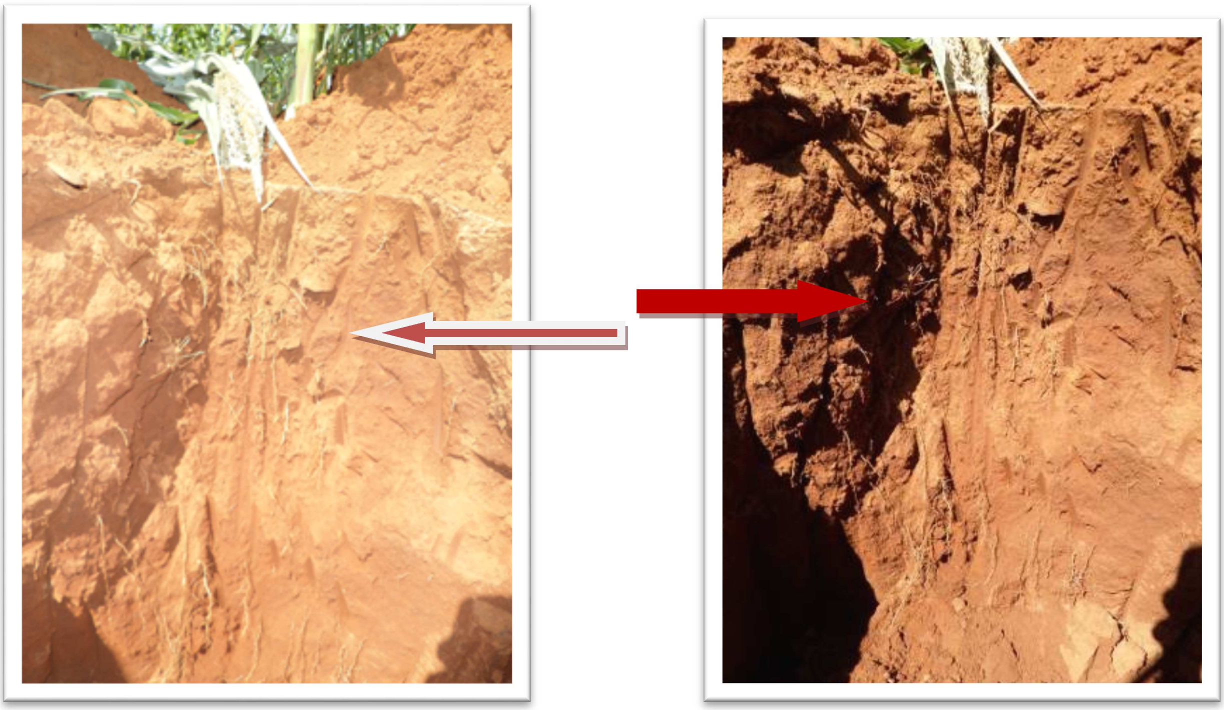
Tobie	pH (KCl)	P Mehlich	**K**	**Na**	**Ca**	**Mg**	**%Ca**	**%Mg**	**%K**	**%Na**	**SUUR. V**	Ca:Mg	(Ca+Mg)/ K	Mg:K	**S-Waarde**
Martin		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	**%**	**%**	**%**	**%**	**%**	1.5 - 4.5	10.0 - 20.0	3.0 - 4.0	**cmol(+)/ kg**
Topsoil	5.6	21	134	8	586	119	68.4	22.8	8.0	0.8	0.0	3.0	11.4	2.8	4.3
Subsoil	5.9	5	46	8	636	94	77.5	18.7	2.9	0.9	0.0	4.1	33.5	6.5	4.1

Tobie	**S-Waarde**	Na:K	**CEC**	Digtheid	Fe	Mn	Cu	Zn	S	B	C	P (Bray1)	Klei	Slik	Sand
Martin	**cmol(+)/kg**			g/cm3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	%	%	%
Topsoil	4.3	0.1	4.29	1.264	38.8	148.9	1.70	4.00	5.3	0.08	0.36	18	14	12	74
Subsoil	4.1	0.3	4.10	1.179	32.8	95.6	1.48	0.87	4.9	0.08	0.60	4	20	15	65

Dirk Laas

Profile inspections: Compaction occurs throughout the profile and is indicated by the red arrows below.

Hutton soil type



- Severe compaction problems were experienced.
- Poor root development.
- Low Ca and Mg status.
- Top soil and subsoil are sandy: 4% clay in topsoil and 12 % clay in subsoil

Chemical analysis:

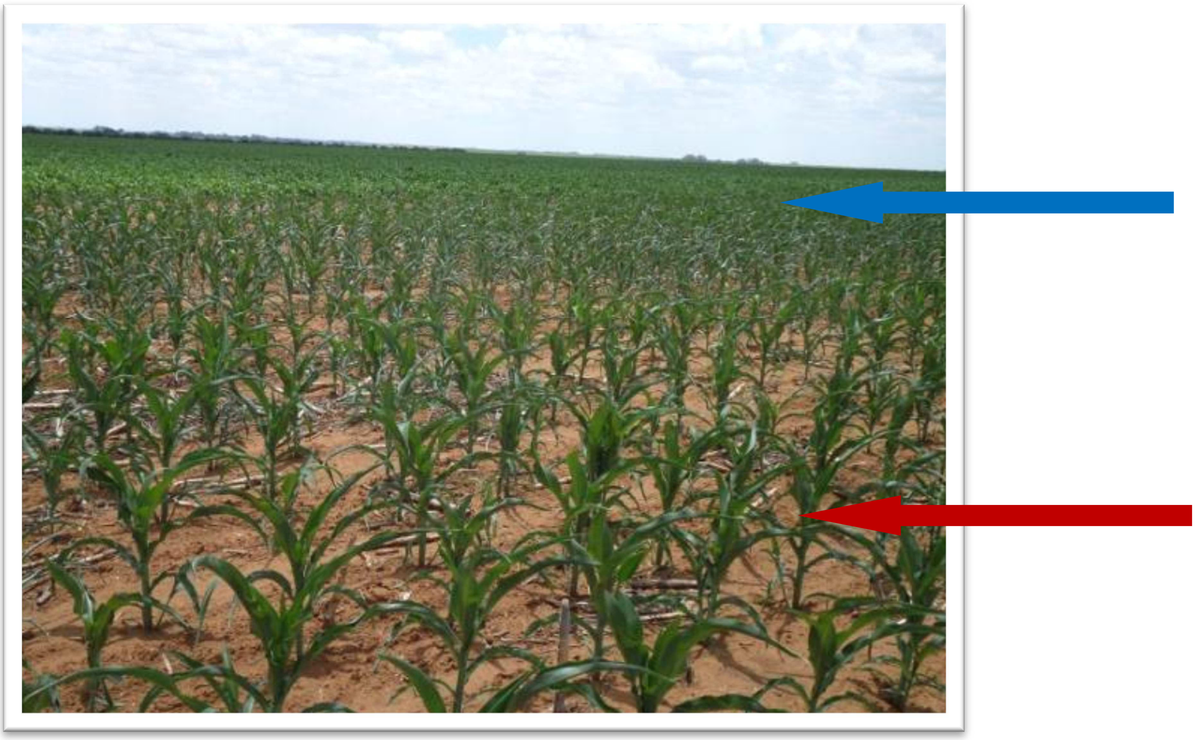
Dirk	pH (KCl)	P Mehlich	K	Na	Ca	Mg	UIT H+	%Ca	%Mg	%K	%Na	SUUR. V	Ca:Mg	(Ca+Mg)/K	Mg:K
Laas		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol(+)/kg	%	%	%	%	%	1.5 - 4.5	10.0 - 20.0	3.0 - 4.0
Topsoil	5.4	20	79	6	231	51	0.00	64.0	23.3	11.2	1.5	0.0	2.7	7.8	2.1
Subsoil	4.8	5	85	8	332	64	0.01	67.7	21.5	8.9	1.4	0.6	3.1	10.0	2.4

Dirk	S-Waarde	Na:K	CEC	Digtheid	Fe	Mn	Cu	Zn	S	B	C	P (Bray1)	Klei	Slik	Sand
Laas	cmol(+)/kg			g/cm3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	%	%	%
Topsoil	1.8	0.1	1.81	1.535	33.4	57.6	0.69	2.67	3.1	0.05	0.12	16	4	11	85
Subsoil	2.4	0.2	2.46	1.280	32.3	55.0	0.96	1.14	7.6	0.06	0.32	5	12	12	76

George Steyn

Profile inspections: Clovelly soil type

Tyne (Red arrow) vs Coulter(Blue arrow) :



Coulter – good root development. Tyne – also good root develepment

No difference could be seen between the coulter and tyne in root develpment and physical observations.

No difference between the root development of the Hutton(Hu) and Clovelly(Cv) soils. Both were excellent.

Chemical analysis:

George	pH (KCl)	P Mehlich	**K**	**Na**	**Ca**	**Mg**	UIT H+	**%Ca**	**%Mg**	**%K**	**%Na**	**SUUR. V**	Ca:Mg	(Ca+Mg)/K	Mg:K
Steyn		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol(+)/kg	**%**	**%**	**%**	**%**	**%**	1.5 - 4.5	10.0 - 20.0	3.0 - 4.0
Hu topsoil	5.6	17	144	7	439	128	0.00	60.3	28.8	10.1	0.8	0.0	2.1	8.8	2.9
Hu subdoil	4.9	4	79	8	692	195	0.01	65.2	30.1	3.8	0.7	0.2	2.2	25.1	7.9

George	**S-Waarde**	Na:K	**CEC**	Digtheid	Fe	Mn	Cu	Zn	S	B	C	P (Bray1)	Klei	Slik	Sand
Steyn	**cmol(+)/kg**			g/cm3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	%	%	%
Hu topsoil	3.6	0.1	3.64	1.437	29.5	104.4	1.29	2.19	4.0	0.07	0.28	15	10	12	78
Hu subdoil	5.3	0.2	5.30	1.242	34.7	89.5	2.25	0.44	8.4	0.07	0.56	4	20	13	67

George	pH (KCl)	P Mehlich	**K**	**Na**	**Ca**	**Mg**	UIT H+	**%Ca**	**%Mg**	**%K**	**%Na**	**SUUR. V**	Ca:Mg	(Ca+Mg)/K	Mg:K
Steyn		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol(+)/kg	**%**	**%**	**%**	**%**	**%**	1.5 - 4.5	10.0 - 20.0	3.0 - 4.0
Cv topsoil	5.4	31	229	7	382	100	0.00	57.1	24.5	17.5	0.9	0.0	2.3	4.7	1.4
Cv subsoil	4.2	5	79	8	347	88	0.21	59.6	24.9	6.9	1.2	7.3	2.4	12.2	3.6

George	**S-Waarde**	Na:K	**CEC**	Digtheid	Fe	Mn	Cu	Zn	S	B	C	P (Bray1)	Klei	Slik	Sand
Steyn	**cmol(+)/kg**			g/cm3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	%	%	%
Cv topsoil	3.3	0.0	3.35	1.426	42.1	101.2	1.19	2.90	3.8	0.08	0.44	23	8	14	78
Cv subsoil	2.7	0.2	2.91	1.235	34.1	79.6	1.27	0.87	11.2	0.10	0.20	4	12	13	75

Jerry Basson

Profile inspections:

Samples were taken on three different soil types namely Avalon, Pinedene and Oakleaf.

Soil samples were taken on all three and are given in the sheets below.

Root development was good on all the trials.

Avalon soil type - good root development.

Pinedene soil type - good root development on the tine.

Pinedene soil type - poor root development on the coulter.

Chemical analysis:

Jerry	pH (KCl)	P Mehlich	**K**	**Na**	**Ca**	**Mg**	UIT H+	**%Ca**	**%Mg**	**%K**	**%Na**	**SUUR. V**	Ca:Mg	(Ca+Mg)/K	Mg:K
Basson		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol(+)/kg	**%**	**%**	**%**	**%**	**%**	1.5 - 4.5	10.0 - 20.0	3.0 - 4.0
Av topsoil	4.2	10	225	8	449	96	0.16	59.0	20.7	15.1	0.9	4.2	2.8	5.3	1.4
Av subsoil	4.6	4	159	9	691	227	0.03	59.6	32.1	7.0	0.7	0.5	1.9	13.1	4.6
Pn topsoil	4.4	8	199	7	389	98	0.07	57.8	23.9	15.1	0.9	2.1	2.4	5.4	1.6
Pn subsoil	4.7	6	166	10	537	157	0.02	60.2	28.8	9.5	0.9	0.5	2.1	9.3	3.0
Oa topsoil	5.2	15	256	8	646	142	0.00	63.5	23.0	12.9	0.7	0.0	2.8	6.7	1.8
Oa subsoil	4.5	9	174	9	743	161	0.05	66.7	23.7	8.0	0.7	1.0	2.8	11.3	3.0

Jerry	**S-Waarde**	Na:K	**CEC**	Digtheid	Fe	Mn	Cu	Zn	S	B	C	P (Bray1)	Klei	Slik	Sand
Basson	**cmol(+)/kg**			g/cm3	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	%	%	%
Av topsoil	3.6	0.1	3.80	1.270	46.7	82.7	0.89	0.97	7.8	0.08	0.08	9	12	8	80
Av subsoil	5.8	0.1	5.80	1.148	36.4	71.5	1.43	0.36	13.8	0.09	0.16	4	24	9	67
Pn topsoil	3.3	0.1	3.36	1.257	48.8	93.1	0.85	0.80	6.1	0.08	0.44	7	16	11	73
Pn subsoil	4.4	0.1	4.46	1.176	49.4	88.8	0.97	0.57	11.3	0.08	0.72	5	22	10	68
Oa topsoil	5.1	0.1	5.09	1.260	69.3	119.7	1.74	2.10	3.5	0.11	0.12	14	18	12	70
Oa subsoil	5.5	0.1	5.57	1.355	75.9	104.2	1.72	0.83	5.4	0.10	0.28	8	10	20	70

3. Assessment of cover crop adaptability and suitability

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

Work Package period	July 2013 to June 2014
Lead partner	ARC-API (Mr. Gerrie Trytsman)
Involved partners	Grain SA, Ottosdal no-till club, ARC-GCI

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	1. Land preparation (finding a suitable location, sourcing materials) 2. Purchase Materials & Equipment 3. Establishing and Planting of trials 4. Seasonal management and maintenance of trials 5. Monitoring and Sampling (including harvesting, biomass and yield determination, nutrient analysis) 6. Lab Analyses 7. Monthly meetings (project team) & Training 8. Annual reference group meeting (advisory committee) 9. Harvesting, biomass and yield determination, nutrient analysis 10. Annual report and admin (production & technical data) 11. 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.)

DELIVERABLES, PROGRESS AND RESULTS ACHIEVED PER ACTIVITY

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 every party involved.	With the cooperation with the farmers a suitable site was identified. • Previously use as a no-till production field • Homogeneous (physically, chemically and biologically) Seed was purchase with the appropriate inoculums for the legumes. An action plan was drawn up with the roles of the different stakeholders clearly explained
2. Purchase Materials & Equipment	Acquisition of seed, inoculum, stickers, implements, chemical inputs.	Contact the seed company and making sure that farmers received the seed. Some seed that was not available were sourced from companies such as Agricol (e.g. *Vicia dasycarpa*).

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.	The trial design was discussed with biometry unit of the ARC. Liesl Morey did the randomization for the trial. This was necessary for statistical analysis. Trials were established at the different locations.
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	A field form was drawn up to collect valuable data with trial visits, which incudes. • Agronomic evaluation • Soil condition data • Nitrogen fixation • Other comments Photos and height (cm) measurements of the accessions were taken
5. 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 6. Root evaluation:	See Results in the sections following below
6. Lab Analyses	C:N content of plant material	Sample of DM will be dried and delivered to ISCW for analysis (see Results below)
7. Monthly meetings (project team) & Training	Partake in monthly forum meetings, discussing problems and possible solutions to that.	Partake in meetings. Three visits discussing and giving feedback was undertaken. 7/5/14: Feedback at Ottosdal No-till club meeting
8. Annual reference group meeting (advisory committee)	Report progress and findings to advisory committee; Discussion and evaluation of trials. Learning from previous mistakes.	Scheduled in fourth quarter.
9. Annual report and admin (production &	Written technical report covering trial procedures, results and progress.	On-going process. Annual technical report completed by 6/6/14.

technical data)		
10. Participate in Awareness events	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits	Took part in CA Conference at Ottosdal on 12-13/3/14

3.1 Results and discussion - Agronomic measurements of cover crops

Table: 3.1 Agronomic measurements from emergence to harvesting for Humanskraal, Springboklaagte and Huntersvlei of different summer annuals.

Agronomic evaluation	Planting: Recording: Last	Date: 9/12/13 Date: 20/2/14	Date: 13&20/12/13 Date: 21/2/14	Date: 23/12/13 Date: 20/2/14
Crops		**Humanskraal**	**Springboklaagte**	**Huntersvlei**
Mucuna pruriens **Velvetbean**	Emergence:	70%	80%	Not establish, seed too big
	Plant height:	110cm	80cm	
	Population:	60 000	24 000	
	Weeds:	0	0	
	Insects:	0	0	
	Diseases:	0	0	
	Pest:	0	Buck damage	
Helianthus annuus **Sunflower**	Emergence:	Fair 60%	Good 90%	Good 90%
	Plant height:	2.2m	2m	2.3m
	Population:	45 000	24 000	41 000
	Weeds:	0	0	*Portulaca oleracea* (porselein) and *Leusine coracana* (jongos gras). No herbicides used
	Insects:	0	spotted maize beetle	spotted maize beetle
	Diseases:	Sclerotinia	0	0
	Pest:	0	0	0
Crotalaria juncea **Sunnhemp**	Emergence:	60%	80%	60%
	Plant height:	1.4m	1.7m	1.7m
	Population:	135 000	300 000	100 000
	Weeds:	0	0	Same
	Insects:	0	0	0
	Diseases:	0	0	0
	Pest:	0	0	0
Zea mays **Maize**	Emergence:	good 95%	good 80%	good 95%
	Plant height:	2.2m	2.2m	2.1 m
	Population:	35 000	24 000	44 000
	Weeds:	0	0	Same
	Insects:	10%	10%	5% buckshot
	Diseases:	0	0	0

	Pest:	0	0	0
Sorghum bicolor Sorghum	Emergence:	poor re-plant, too deep	100%	100%
	Plant height:	5-30cm	2.2m	2.2m
	Population:	still emerging	90 000	230 000
	Weeds:	0	0	Not much
	Insects:	10%	10%	20% buckshot
	Diseases:	0	0	0
	Pest:	0	*Busseola fusca*	0
Lablab purpureus Dolichos	Emergence: 90%	90%	95%	90%
	Plant height	1m	1.1m	1m
	Population	95 000	31 000	220 000
	Weeds:	Atrazine damage	0	0
	Insects:	5%	5%	0%
	Diseases:	0	0	0
	Pest:	0	0	0
Pennisetum glaucum Millet	Emergence:	poor re-plant, too deep	95%	80%
	Plant height	20cm	2m	2.2cm
	Population:	Still emerging	92 000	230 000
	Weeds:	0	0	0
	Insects:	20%	10%	20%
	Diseases:	0	0	0
	Pest:	0	0	0
Vigna unguiculata Cowpea	Emergence:	95%	95%	95%
	Plant height:	90 cm	90 cm	90cm
	Population:	275 000	60 000	150 000
	Weeds:	0	0	Same
	Insects:	5%	0%	5%
	Diseases	0	0	0
	Pest	0	Root knot nematode	0
Glycine max Soybean	Emergence:	80%	95%	80%
	Plant height:	45cm	70cm	80cm
	Population:	190 000	150 000	440 000
	Weeds:	0	0	Same
	Insects	0%	0%	Green worms
	Diseases:	0	0	0
	Pest	0	0	0
Mixture summer Dolichos Sorghum Sunnhemp	Emergence:	80%		Planted sunflower
	Plant height	1.4m		
	Population			
	Weeds:	0		
	Insects 0%	Insects 0%		
	Diseases:	0		
	Pest:	0		

3.2 Discussion and description of different cover crops

3.2.1 Velvetbean *(Mucuna pruriens)* - Velvetbean is a vigorously growing, warm-season annual legume native to the tropics but well adapted to sub-tropical conditions. It performs well in sandy and infertile soils. Most cultivars are viney and some can attain a stem length of 10m. The leaves of Velvetbean are trifoliate with large ovate leaflets. Velvetbean is an excellent green manure crop, producing high amounts of biomass that decompose readily to provide nitrogen for subsequent crops. Velvetbean should be seeded into warm soils. Velvetbean seed should not be drilled because the very large seed can be damaged in conventional drills. Planting at Huntersvlei was unsuccessful. When grown for seed production, Velvetbean should be sown in a mixture with an upright crop like Sorghum-Sudangrass or Millet in order to make production and harvesting more successful.

3.2.2 Cowpea *(Vigna unguiculata)* - Other common names for this plant include black-eye pea and southern pea. Cowpea is a fast growing, summer cover crop that is adapted to a wide range of soil conditions. Having a taproot that can obtain moisture from deep in the soil profile, it does well under drought conditions. Vigorous Cowpea varieties compete well against weeds. A high nitrogen producer, Cowpea yields average 3000 to 4000 kg/ha of dry biomass containing 3 to 4% nitrogen. Maximum biomass is achieved in 60 to 90 days. Residues are succulent and decompose readily when incorporated into the soil. Cowpea can be planted after first significant rain in summer. Cowpea seed can be drilled in rows 15-20cm apart at 40-50 kg/ha or broadcasted at 70-120 kg/ha. However, higher seeding rates are necessary if soil moisture is likely to be limiting. Plants normally grow up to 80-100 cm tall, but some cultivars can climb when planted in mixtures with other species. Good mixture options are Sorghum-Sudangrass and Millet. When killed mechanically, Cowpeas can have considerable regrowth after mowing; but was killed with a roller at Humanskraal no burn-off herbicide was needed.

3.2.3 Sunnhemp *(Crotalaria juncea)* - Sunnhemp is a tall, herbaceous, warm-season annual legume that has been used extensively for soil improvement. The erect fibrous stems competes well with weeds. It grows rapidly and can reach a height of 2.2m in 60 days. It can tolerate poor, sandy, droughty soils but requires good drainage. Sunnhemp tolerates moderate alkalinity and a soil pH below 5 reduces growth. Sunnhemp should be broadcasted or seeded in rows. Higher seeding rates will lead to prolonged succulence of the stems and are recommended if the crop will only be grown for 4 to 5 weeks. Sunnhemp becomes fibrous with age, but the plants will remain succulent for about 8 weeks after seeding. It will produce high biomass yields and N in the months before frost. Residues left on the soil surface over the winter months will facilitate no-till crop production the following season. Seed is not currently readily available, but if the demand is increased, seed availability would most likely respond. While forage of some *Crotalaria* species is toxic to animals, Sunnhemp forage is not. The growing season in the North West and Free State provinces might not be long enough for Sunnhemp to produce viable seed.

3.2.4 Soybean *(Glycine max)* - Soybean is one of the best economic choices for a summer legume cover crop. It is an erect, bushy plant that grows 1m tall, establishes quickly, and competes well with weeds. When grown as a cover crop (forage type) these are late maturing varieties usually give the highest biomass yield and fixes the most nitrogen. While most of the roots are in the top 20 cm of the soil, some roots can penetrate up to 2m deep. Soybean will withstand short periods of drought if they are well-established. Soybean will grow on nearly all types of soils, but are most productive on loam soils. Soybean planted as cover crops should be broadcast or closely drilled. Some new viney forage types are available or are being developed that have the potential to produce more biomass than traditional soybean varieties.

3.2.5 Lab-Lab (*Lablab purpureus*) is a popular choice as a cover crop on infertile, acidic soils, and it is drought tolerant once established. Like other legumes, it can be incorporated into a grazing rotation. Be aware of one important limitation: lablab is susceptible to root-knot nematode infection. Lab-lab is a climbing or erect perennial herbaceous crop often grown as an annual. It grows up to 1 m tall, with long stems in climbing types extending as much as 6 m from the base of the plant. The leaves are trifoliate, and the flowers are purple or white. It has a strong taproot with many lateral and adventitious roots. It grows rapidly in fertile soil. Both determinate (bush) and indeterminate (vining) varieties exist. It has an approximate growing cycle of 60 days.

Lab-lab can grow in a wide range of soil textures, from heavy clays, if well drained, to sandy soils. It is normally adapted to the same areas as Cowpeas. It tolerates acidic soils better than most legumes, growing well when soil pH is 4.5–6.5 and it does well in low fertility soils. Like most legumes, it is intolerant of waterlogged or flooded conditions. Once established, it is fairly drought tolerant and can be grown in rain fed conditions or with minimal irrigation. It is reportedly more drought tolerant than the jack bean (*Canavalia ensiformis*). Lablab is also shade tolerant. Lab-lab and Soybean was however herbicide (atrazine) damaged, whilst Cowpea and Velvetbean were not, and had to be replanted at Humanskraal.

3.2.6 Millet *(Pennisetum glaucum)* - Pearl millet is a tall summer annual bunchgrass that grows 2-2.5m tall. It is also often referred to as cattail millet because its long dense spike-like inflorescences resemble cattails. The mature panicle is brown. Though it performs best in sandy loam soils, Pearl millet is well adapted to sandy and/or infertile soils. Pearl millet can be planted from November-December at a rate of 5 to 20 kg/ha. Pearl millet matures in 60 to 70 days. As a forage crop, no prussic acid are produced and the prolific roots penetrate deep into the soil profile.

3.2.7 Sorghum-sudangrass *(Sorghum bicolor x S. sudanense)* - Sorghum-sudangrass is a cross between forage or grain sorghum and sudangrass. It is a warm-season annual grass that grows well in hot, dry conditions and produces a large amount of biomass. Often reaching 2m in height, it can be mowed to enhance biomass production and root development. Sorghum-sudangrass is very effective at suppressing weeds and has been shown to have allelopathic properties. The roots of Sorghum-sudangrass are good foragers for nutrients (especially nitrogen) and help control erosion. Research on nematode suppression by Sorghum-sudangrass is not conclusive. Some studies have shown that nematode populations have been higher in vegetables following Sorghum-sudangrass, while other studies have shown that Sudangrass suppresses nematode levels.

3.2.8 Single species vs. mixtures: Mixtures of cover crop species can be planted to optimize the benefits associated with cover crop use. Mixtures which include species that establish quickly can reduce soil erosion. Above-ground biomass, and consequently N in the above-ground biomass, can be increased by a mixture that can utilize more below-ground and above-ground niches for nutrients, water, and light. For example, a deep rooted cover crop can be combined with a shallow rooted cover crop to utilize water and resources in more of the soil profile.

Competition for soil N in mixed stands results in increased biological nitrogen fixation by the legume. Cereal crops usually germinate and establish effective root systems more rapidly than legumes and effectively lower soil N concentration in the soil. Since nodulation of legume roots and fixation of atmospheric N_2 by legumes is generally greater when soil N concentration is low, nodulation and nitrogen fixation is increased in mixtures.

Nitrogen cycling can also be manipulated with mixed cover crop species. Combining plants with high C:N ratios (mature cereals) with plants that have low C:N ratios (legumes) can influence mineralization of cover crop residues. The release of nitrogen from residues can be more properly timed with subsequent crop uptake, i.e. both nitrogen immobilization and large flushes of nitrate can be moderated. This can help to optimize the efficiency with which fixed nitrogen is used by subsequent crops.

Planting mixtures of cover crops enhance the advantage of the allelopathic potential of the cover crops to suppress weeds. Allelopathic suppression of weeds has been shown to be a species specific phenomenon; therefore a broader spectrum of weed control may be possible by growing a mixture of cover crop species, each contributing allelopathic activity towards specific weed species.

Mixtures can also be planted to influence insect populations. Cover crop species, regardless of biomass or biomass-N production potential, could be included in a mixture if they were known to attract important beneficial insects into the cropping system. Cowpea is a farmer favourite if the aim is to attract beneficial insects.

3.2.9 Other crops: Maize, Sunflower and Grain-sorghum are regarded as cash crops and will not be discussed.

3.3 Ground cover (%) of different cover crops

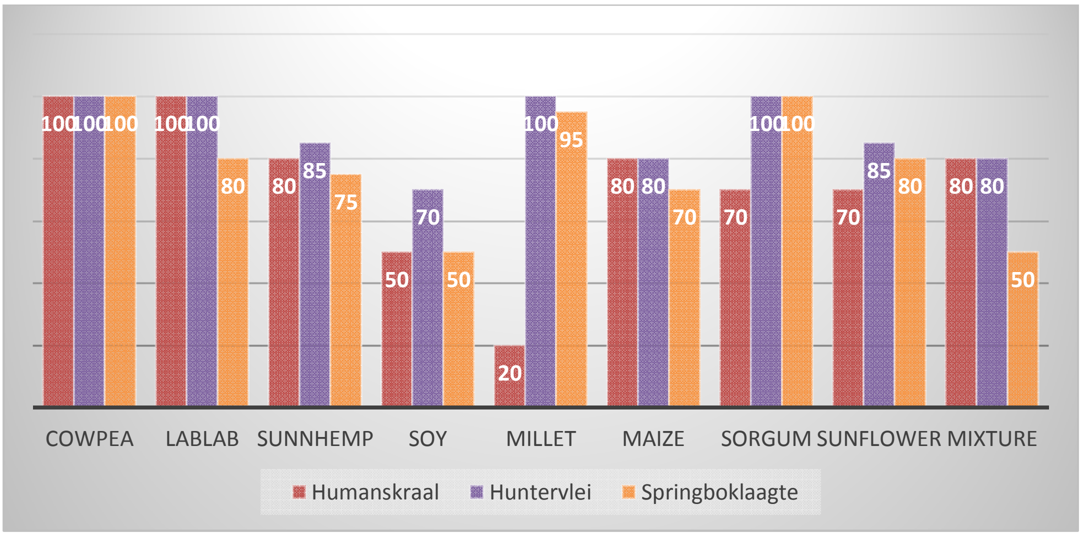


Figure: 3.1 Ground cover % for crops at different locations (20/02/2014)

In Figure 3.1 it is clear that legumes such as Cowpea, Lab-lab and Sunnhemp have the ability to cover the soil in 60 DAP (days after planting), whilst Soybean struggles to cover the soil surface. The annual grasses such as Millet and Sorghum are also capable of reaching 100% cover in 60 DAP. The tall crops' ability are, however, reduced when it comes to erosion control by as much as 25%. Run-off can still occur during heavy storms because water accumulates at the base of the plants. The same observation for cash crops such as maize and sunflower are true.

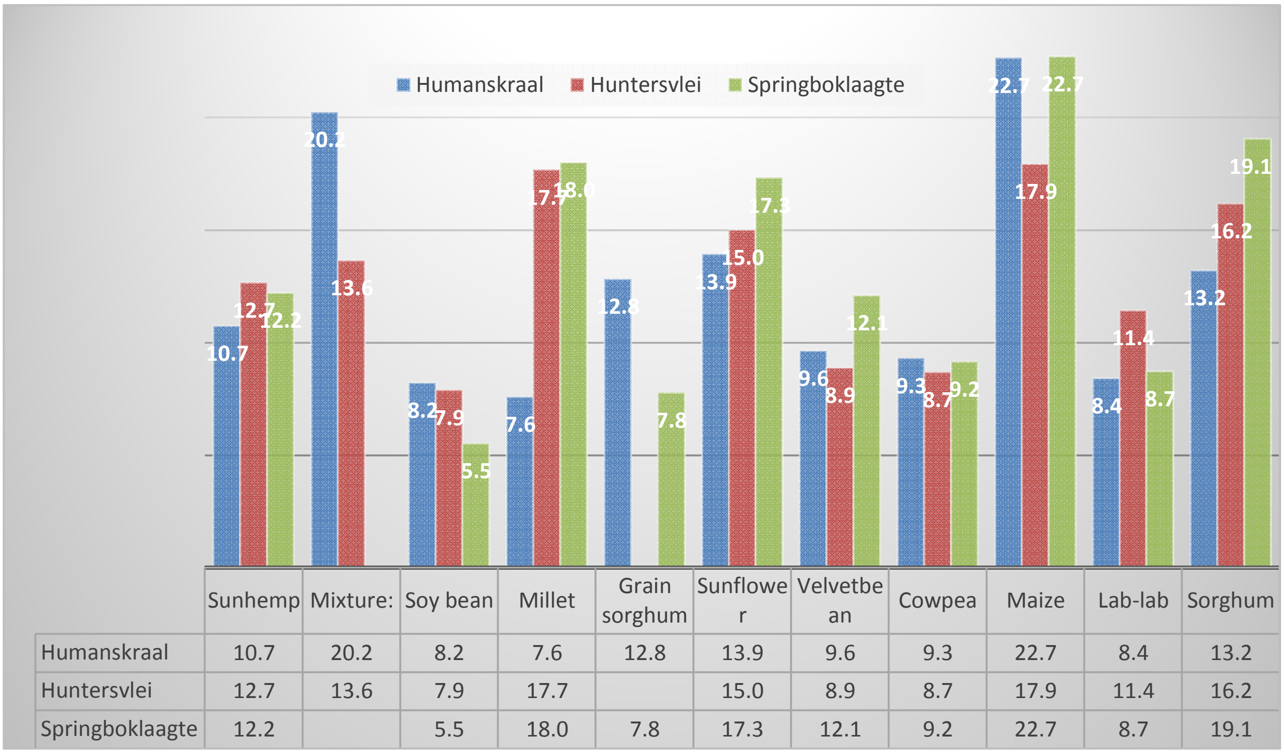
All crops that were planted covered the soil well and it seems that anthropogenic issues such as carry over herbicides and bad planting practises had a more profound impact on cover as a principal issue for erosion control. In Figure 3.2 it is also clear that tractor wheel compaction played a role in infiltration of rainwater during intensive thunderstorm activity and this also hampers the crop to cover the soil. The trial at Huntersvlei however was mechanically weeded and no herbicides were used.

Figure 3.2 Compaction from tractor wheels

3.4 Dry Matter (DM) production of different cover crops

In Figure 3.3 DM yield of accession were determined at Humanskraal near Ottosdal, Huntersvlei near Viljoenskroon and Springboklaagte in the Welkom area. A predetermined area was used for sampling. The wet material was weight and subsamples taken for the different treatment. These samples were oven dried at 70^{o}C. This was necessary because at high temperatures N % can be influence. After calculating the DM/ha the samples were taken to ISCW (Institute Soil Climate and Water). Whole plants were dry and technicians were asked to mill the plants before taken a sample to determine N %. This was to ensure that the ratio of components was reflected in the analysis.

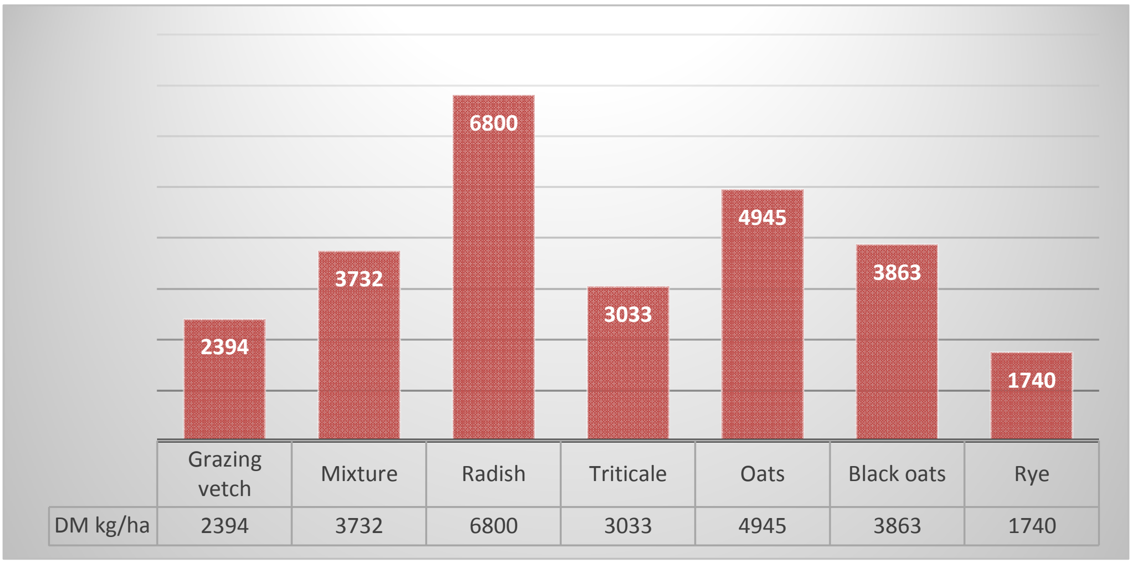
At this early stage of the investigation it is concluded that for the different legume species, Sunnhemp outperform Cowpea and Lab-lab. The mixture (Sorghum, Sunnhemp and Lab-lab) produced 20 DM t/ha. This tri-culture seems to have great promise with regards to soil protection, N fixation and supplying energy and nitrogen to micro-organisms.



	Sunhemp	Mixture:	Soy bean	Millet	Grain sorghum	Sunflower	Velvetbean	Cowpea	Maize	Lab-lab	Sorghum
Humanskraal	10.7	20.2	8.2	7.6	12.8	13.9	9.6	9.3	22.7	8.4	13.2
Huntersvlei	12.7	13.6	7.9	17.7		15.0	8.9	8.7	17.9	11.4	16.2
Springboklaagte	12.2		5.5	18.0	7.8	17.3	12.1	9.2	22.7	8.7	19.1

Figure: 3.3 DM production (t/ha) for warm season crops at different locations (March – April 2014).

Crops such as Millet and Sorghum also seems to do well at the different locations. Millet was planted too deep at Humanskraal. Sorghum-Sudangrass, especially Sugar graze, seems to do well at Huntersvlei where it is also the preferred silage crop.



	Grazing vetch	Mixture	Radish	Triticale	Oats	Black oats	Rye
DM kg/ha	2394	3732	6800	3033	4945	3863	1740

Figure: 3.4 DM production (kg/ha) of Cool season crops at Humanskraal; North West

In Figure 3.4 the same procedure was used to determine the DM of cool season crops. These crops were establish late February at Humanskraal, after a raining event. Germination and emergence were close to 100 % as can be seen in figure 3.5. *Avena sativa* (white oats) outperformed the other small grain accessions. Figure 3.6 shows sampling of cool season crop *Vicia dasycarpa* and *Raphanus sativus* showing promise.

Figure: 3.5 Emergence of the cool season crops.

Figure: 3.5 Grazing vetch and radish

Dry matter samples were delivered to ISCW but we have not receive the results of the analysis yet. Crop characteristics for cool season crops will be discussed in the next report.

Table: 3.2 Nitrogen studies for warm season crops.

Crops	N (%)	CP (%)	C:N RATIO	DM (t/ha)	Total (kg N/ha)	Estimated (PAN)*
Soy	2.22	13.9	18.02	8.2	182	45
Sunnhemp	2.16	13.5	18.55	10.7	231	57
Millet	1.62	10.1	24.68	7.6	123	30
Maize	1.63	10.2	24.60	22.7	368	92
Cowpea	3.29	20.6	12.15	9.3	306	76
Sunflower	1.76	11	22.77	13.9	244	6
Grain sorghum	1.78	11.2	22.42	12.8	228	57
Mucuna	3.37	21.1	11.87	9.6	324	81
Mixture; Sorghum, Lab-lab, Sunnhemp	2.17	13.6	18.44	20.2	439	109
Lab-Lab	4.13	25.8	9.69	8.4	347	86

*PAN (Plant available nitrogen); DM data for Humanskraal was used in calculating the values in table.

In many applications, the carbon content of vegetation may be estimated by simply taking a fraction of the biomass, say C = 40*B.

- Where C is carbon content by mass, and B is oven-dry biomass
- C: N ration can be calculated by dividing 40 by N %
- Total kg N/ha = DM/ha x N% X 10
- Estimated PAN in dry region are calculated = N/ha /4
- CP is calculated by = N % x 6.25.

Scientists have determined four conditions that are constant for all residue decomposition:

1. A maximum of 35% of the carbon in fresh organic material will be converted into soil humus if there is sufficient nitrogen present.
2. A minimum of 65% of the carbon in fresh organic material will be given off to the atmosphere as carbon dioxide due to microbial respiration.
3. The humus formed from the decomposition of fresh organic material will contain approximately 50% carbon and 5% nitrogen. In other words, the C:N ratio of the humus is 10:1.
4. Most fresh plant material contains 40% carbon. The C:N ratio varies because of differences in nitrogen content, not carbon content. (Note: Dry materials are generally in the range of 40 to 50% carbon, and sloppy, wet materials are generally 10 to 20% carbon. Therefore, the most important factor in estimating the carbon-to-nitrogen ratio of plant is the N content).

For maintenance, animals need fodder with 7-8% crude protein. Growing animals and lactating cows will benefit from forage with higher indices of crude protein. Integration might be the only way we can make cover crops a viable option for farmers in dry regions. Utilization however should be monitored closely to allow enough biomass for soil protection. Grazing when the surface is dry and removing animals after rain will positively curb surface compaction due to hoof action.

3.5 Root evaluations of different cover crops

ROOT GROWTH: The cover crop should be adjusted to the specific conditions and characteristics encountered on sandy soils. Quick surface cover and strong root development into the sub soil layers are preferable. So is resistance against the pests and diseases which could threaten the main crop. Root evaluations were done on all the cover crops in the trial at Springboklaagte (Kroonstad) on two rows per plot (crop) to identify possible restriction of root distribution by compacted layers. Row direction is approximately 15˚ diagonally across the plant rows of the previous year, when Rip-on-Row (RoR) was practiced.

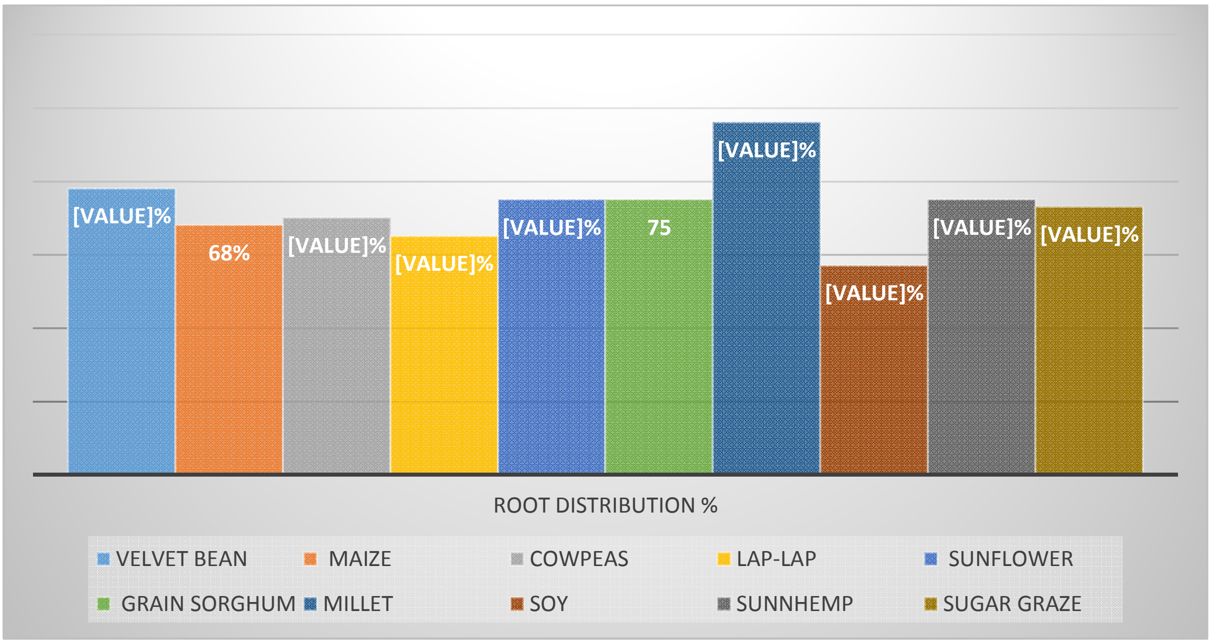


Figure 3.7 Root evaluations at Springboklaagte

Summary of root evaluation results done at Springboklaagte, 2013/2014 season:

- **Velvetbean:** Topsoil partly compacted, roots well distributed below 45cm.
- **Maize:** Compact layer 30-45cm restricted root penetration.
- **Cowpea:** Deep sand reasonable root distribution, severe eelworm infection.
- **Lab-Lab:** Uncompact passage down the left side increased root penetration.
- **Sunflower:** The clay increased from 45cm and improved root penetration. Subsoil was dried out and hard.
- **Grain sorghum:** Fairly poor root distribution, plants infested with stalk borer in one cultivar. The other cultivar good root distribution
- **Millet:** Sand become deeper but the root penetration values are good except for restrictions in the top soil. Very promising crop as has been proved over years. Low cost to establish, produces high amounts of roughage and seems to control eelworm.
- **Soy:** Soybeans affected by residual herbicide. In most profiles at other evaluations Soy had better root distribution than maize for the same tillage.
- **Sunnhemp**: Vigorous plants with good root growth in subsoil. Compaction restricted roots in the topsoil.

- **Sugar graze**: Severely restricted root growth due to compaction. Sorghums do not like sandy soils.

Values for the different crops were determined by using making use of a grid. We thank Mr Carel Koch for his inputs.

3.6 Problems encountered with the project

As a researcher, an ideal situation will be one where you are capable to visit trials on a regular basis. Distance in this instance is the biggest problem. Farmers involved in programme are willing and able to help but communication with farmers also remains a problem during planting and harvesting.

3.7 Milestones that have not been achieved and the reasons for that:

None.

An assessment of the adequacy of the funding to complete the execution of the project in the form of an expenditure statement:

Budget		**R 86 200**
Claimed (January)	**Manpower** **Travel by car**	R 31 500 R 5 180 **R 36 680**
Claimed (March)	**Manpower** **Travel by car**	R25 800 R 8 288 **R34 088**
Committed (must be claimed)	**25-26/3/14 Harvest Warm Cc 22 hours** **7-8/5/14 Harvest Cool Cc 22 hours** **Gathering data 8 hours** **Kilometres 759+921+200** **Writing report 32 hours**	R 6 600 R 6 600 R 2 400 R 7 520 R 9 600 **R 32 720**

3.8 The estimated duration of the project until completion:

Funds were made available for next year. Winter annual crops still have to be analysed and interpreted. Winter annuals at Springboklaagte and Huntersvlei have been planted and still needs to be harvested at the correct stage. The investigation and integration of cover crops in CA grain production systems are still in an infant stage in South Africa and a long term vision is required to achieve any success.

4. Weed survey of field trials: planning and analyses

Work Package title	**Weed survey of field trials: planning and analyses**
Work Package period	July 2013 to June 2014

Lead partner	ARC-GCI (Dr E Hugo)
Involved partners	Ottosdal No-till club members, SGS

Objectives	• To plan the on-farm maize weed survey trials • To analyse and report the results of the weed survey trials

Justification	Knowledge of the long-term effect of tillage or reduced-tillage practices on weed diversity and species composition will provide information necessary for improving weed management in agro-ecosystems. The constant use of certain active ingredients of herbicides such as glyphosate in a monoculture-maize production system also raises a concern for development of resistant weed populations. Most research to date on weed control in reduced tillage practices have shown clearly that tillage has a profound effect on the species composition and subsequent shift in the weed spectrum. The absence of soil disturbance and presence of crop residue cover in CA systems will generally lead to an increase over seasons in organic matter content of the soil, soil moisture, temperature and microbial activity. These factors may have a direct or indirect effect on weed control efficacy, including weed species present, time of weed seed germination and emergence, weed-crop interference, competition between weed species, effective herbicide application and residual efficacy of herbicides as well as waiting period of herbicides on follow-up crops.

Description of work	**Planning of trials in collaboration with participating farmers. 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 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	Deliverables	Progress and Results achieved
Attendance of meetings, planning, analyses and reporting	Trial plans and reports on the analyses of results	**No actions were performed in this financial year as there were no actual requests received and/or formulated from the project team to perform a proper inquiry under this work package.**

5. Agronomic field trial planning and analyses

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

Work Package period	April 2013 to March 2014
Lead partner	ARC-GCI (Dr. A. A. Nel)
Involved partners	Ottosdal No-till club members, SGS

Objectives	• To plan the on-farm maize plant population density trials • To plan the on farm crop rotation trials • To analyse and report the results of the maize plant population density trials • To 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 of trials in collaboration with participating farmers. 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 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	Deliverables	Progress and Results achieved
Attendance of meetings, planning, analyses and reporting	Trial plans and reports on the analyses of results	See progress report attached below

The following field trials were designed and implemented in terms of its objective, extend, statistical layout, and field data required. The trial plans were supplied to and discussed with the Ottosdal No-Till Club:

1. **Investigating plant population densities of crops in CA in North West**
   The objective is to determine if currently used plant population densities in conventional crop systems should be lowered or increased for CA systems. Three or four plant densities, ranging from below to above the optimum for conventional crop systems were selected for maize, soybean, sunflower and sorghum. Several farms were selected for these trials, each representing a single replicate.

2. **Investigating crop rotation in CA in North West**
   The objective is to determine over a number of seasons the effect of crop rotation on the performance of five crops. The five crops are cowpeas, sorghum, maize, sunflower and soybean. Crops were planted in strips next to each other on three farms, each representing a single replicate. In the follow-up 2014/15 season strips of these crops will be planted transverse to the direction of the 2013/14 season creating a series of plots where each crop is grown in rotation with the other crops and in monoculture with itself.

3. **A comparison of local row widths and plant population densities of maize in CA systems with Argentinian recommendations**
   The objective is to compare the yield performance of CA grown maize over a number of seasons and farms between currently used practices of 0.9 m row widths and plant populations of below 24 000 plants ha^{-1} with the Argentinian recommendations of widths of 0.5 m spaced rows and plant population densities of more than 40 000 ha^{-1}.

4. **The effect of tines versus coulters for planting on the performance of different crops**
   The objective is to compare the yield performance of crops planted in adjacent strips when a tine is fitted to the no-till planter with that of a coulter. Trials on different farms serve as replications.

5. **Investigating the performance of maize cultivars in Conservation Agriculture systems**
   The objective is to compare the performance of a number of maize cultivars grown in a CA system at the increased plant population density of about 40 000 ha^{-1}. Again, trials on different farms will each serving as a single replicate.

As this is the first progress report and no results are available yet and consequently no analyses could be done.

6. Coordination and facilitation of project activities among farmer participants

Work Package title	**Coordination and facilitation of project activities among farmer participants**
Work Package period	July 2013 to June 2014
Lead partner	Local facilitator (Coert Coetzee)
Involved partners	Ottosdal No-till Club, ARC-GCI, ARC-API, 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 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. Lab Analyses 6. Monthly meetings (project team) 7. Annual reference group meeting (advisory committee) 8. Annual report and admin 9. 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

DELIVERABLES, PROGRESS AND RESULTS ACHIEVED PER ACTIVITY

Activities	**Deliverables**	**Progress and Results achieved**
1. Land preparation (10 visits)	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	Assisted to prepare land on 12 farmers' fields
2. Planting (10 visits)	Prepare planter for planting Move planter between farmers for timely planting Make sure farmers plant according to standard treatment specifications	Assisted to establish trials on 12 farmers' fields See list of trials in **Table 6.1** below.

3. Seasonal management (30 visits)	Assist farmers in weeding and pest/disease management	Currently on-going
4. Monitoring and Sampling (Done with activity 3 above)	Assist farmers to complete field forms Assist to collect soil samples Monitor the farmer-led actions	Currently on-going
5. Lab Analyses	Assist Omnia for OmniBio analysis – payment to Omnia via farmer facilitator	NA
6. Monthly meetings (project team) & Training (9 meetings)	Participate in monthly forum meetings, discussing problems and possible solutions to that.	Participated in 12 project meetings
7. Annual reference group meeting (advisory committee) (1 meeting)	Report progress and findings to advisory committee; Discussion and evaluation of data. Learning from each other.	Scheduled for final quarter of year
8. Annual report and admin (2 days)	Written report covering trial implementation, results and progress.	Participated in writing of 6-monthly and annual report
9. Participate in Awareness events (2 days)	Trial visits with stakeholders; participate in awareness events, such as information day and/or cross-visits	Participated in the organisation and coordination of the CA conference in Ottosdal that took place from 12-13 March

Table 6.1: List of location and type of trials established in Ottosdal area, 2013/14 season

Trial Number:	**1**	**2**	**3**	**4**	**5**
Farmer co-worker:	**Plant pop (own planter)**	**Crop Rotation**	**Local vs Argentina**	**Tine vs Disc**	**Cultivars**
Hannes Otto	Soya	√	Maize		√
			Sorghum		
			Soya		
George Steyn	Maize	√	Maize	√	√
	Soya		Soya		
	Graansorghum		Sorghum		
Philip v.d Berg	Maize	√	Maize		√
Dirk Laas	Maize	√	Maize		√
Koos Voorendyk	Maize (2)		Maize		
Tobie Martin			Maize		
Jaco Pienaar			Maize		√
Niel Rossouw			Maize		

Nico de Bruyn			Maize		
Uys Schikherling	Maize		Maize		
	Soya				
Pieter Breedt	Sunflower		Sunflower		
	50,000/ 60,000/ 40,000				
Hannes Steyn			Maize		
Jerry Basson	Maize		Maize		
Jacques Voster			Maize		
			Sunflower		
Buks Hartzenberg	Maize (2)				
Dirk Sitterd					
Deon Van Vuuren					√ Soya
Willem Weldhagen	Maize				
Japie & Tom Fousche	Maize				
Magnus Theunissen	Sunflower				
Wiekus Blom	Maize				
	18,000 & 22,000				
Koos Bezuidenhout					Soya
Total Farmers	**13**	**4**	**14**	**1**	**8**

7. Summary of expenses from July 2013 to June 2014

PROJECTS	YTD TOT	BUDGET	VARIANCE
Commercial Farming CA project in NW (Ottosdal) *	447 909	700 000	252 091

*** Expenses and invoices still expected which will affect the final amount.**