

ANNUAL PROGRESS REPORT

DETAILS

PROJECT NUMBER	P05000011 (102160)
PROJECT TITLE	Promotion of conservation agriculture (CA) among selected farmer groups in the North-West Province
PROJECT MANAGER	APN du Toit
CO-WORKER(S)	Internal Messrs MA Prinsloo, EA Nemadodzi, and TA Masiha External North-West Department of Agriculture, Land Care Unit, ARC-Institute for Agricultural Engineering (IAE), Grain SA, NWK Development Programme
PROJECT STATUS	Continue
DURATION	01/04/2017 to 31/03/2022
REPORT PERIOD	01 Oct 2020 to 30 Sep 2021

ACTIONS TAKEN TO DATE

The Lareystryd experimental plot:

Due to the removal of the crop residue of the previous season (2019/20) by livestock accessing the plot, no crop cover remained. As a result of this event, no soil cover was left. In view of this, the focus was on the effect of crop rotation (one of the principles of CA) on yield and specific soil chemical characteristics namely nitrate (NO_3^-), ammonium (NH_4^+) and organic carbon (C) among four crops namely maize, sunflower, cowpea and soybean. The trial at Lareystryd was planted on 18 December using a no-till planter (see Figures 2a, b, and c).

The following agronomic practices were applied:

Cultivars selected:

Maize - DKC 77 77 BR (Roundup ready)

Sunflower - Agsun 8251

Cowpea - Agrinawa

Soybean - DM 6.8li RR (Don Mario cultivar by Agricol-Roundup ready)

Fertilization program:

Maize:

Mixture at planting – 250 kg of 3:2:1 (25)

Top dressing N - 200 kg of LAN (28)

Sunflower:

Mixture at planting - 150 kg of 3:2:1 (25)

Top dressing N - 100 kg of LAN (28)

Cowpea - 100 Kg of Super Phosphate (10.5) at planting

Soybean - Prior to planting - Surface spreading of 50 kg of Potassium chloride (K=50 %)

100 Kg of Super Phosphate (10.5%) at planting

Weed control (Herbicides applied):

Maize and soybean (Roundup Ready cultivars)

Pre emergence application of Frontier Optima @ 0, 75 liter per hectare

Roundup application at 40 days after planting @1, 5 liter per hectare

Sunflower and Cowpea (Non-GMO's) - Pre emergence application of Dual Gold @ 0, 75 l/ha

Soybean and cowpea were harvested in May (11-13 May) while sunflower and maize later in June (21 - 24 June).

Variation in harvesting period was due to the short growing period of the two legumes cultivars. After harvesting soil samples were taken (4 and 5 August) to determine the nitrate (NO_3^-), ammonium (NH_4^+) contents as well as the carbon percentage (C %).

The trial at Brooksby:

Due to theft of maize at the Brooksby plot during the growth period in 2020, as indicated in previous report, the trial plot at Brooksby was planned to be planted on 20 January 2021 following several delays. In the morning of 20 January I, the project manager (APN du Toit), was admitted to hospital and the plot at Brooksby was planted in my absence. This, unfortunately, resulted in a failure of the trial at Brooksby. As alternative, an excursion to the Agricol research farm near Potchefstroom (attended by 18 farmers of the Brooksby study group, was undertaken on 29 April, to compensate farmers for this unfortunate outcome at the Brooksby trial plot.

Training, planning sessions and in-field interaction:

Through specific training events e.g. on 13 & 14 August 2020 at Ganalaagte study group, 21st October 2020 with

the Mahikeng CA study group and on 27 October 2020 with the Brooksby group, various production related matters were discussed and elaborated on, including practical exercises on the following topics:

- CA principles emphasised
- Local soil characteristics and their effect on the production potential of local fields
- The nutrient status of local soils and its implications for fertilization programs
- Chemical weed control practices and strategies
- Planter and boom sprayer calibration skills
- Mechanization planning

On 17 March, a farmer's day was presented and attended by 26 farmers (Figure 1).

Strategic workshop in planning:

In a joint venture with the Provincial Department of Agriculture and Rural Development, a workshop, to be facilitated by Dr. Hendrik Smith, is organized for 9 September 2021. The purpose of the workshop is to revisit the project thoroughly and to develop a more coordinated approach for the development and implementation of a more appropriate CA strategies among participating farmers. Forty farmers and selected role players have already been invited.

PROGRESS MADE

An important indicator of progress in the project was the invitation extended by the Ottosdal No-till club to invite farmers participating in the project to visit their local research work on CA. This invitation and response by the farmers participating in the project made a significant contribution to spark the enthusiasm among the study group members. On 12 March 2020, a special visit by the invited farmer groups (40 farmers), had a significant impact on the farmers in general. A loaded and meaningful program organized by the Ottosdal Club contributed to stimulate the visitors and convinced the visitors greatly to embark on the first steps needed to change to CA. Most importantly and meaningful is the great stride made to build the bridge between the commercial CA practitioners and the developing farmers

Results achieved to date

Effect of crop rotation on maize grain yield

In season two, crop rotation had a significant effect on maize grain yield at the Lareystryd site with plots of maize following cowpea giving lowest yield than other treatments (Table 1). Plots of continuous maize had the highest grain yield, which, however did not significantly differ from that of plots with maize following sunflower. Grain yield in plots of maize following cowpea were more depressed. No significant rotation effect was observed on leaf area and plant height (data not shown).

Table 1: Effect of crop rotation on maize grain yield (kg ha⁻¹) in Season 2 at Lareystryd

Factor	Treatment	Season 2
Crop rotation	Cowpea-Maize	4110b
	Soybean-Maize	4974ab
	Sunflower-Maize	5018a
	Maize-Maize	5460a
	Pr. value	0.044
	CV (%)	6.2
	LSD(0.05)	866.650

Means followed by different letters within a column are significantly different at P < 0.05

Effect of crop rotation on legumes and sunflower yield

No significant crop rotation effect was observed on legumes and sunflower yield (data not shown). Similarly, no significant crop rotation effect was observed on leaf area and plant height (data not shown).

Effect of crop rotation on NO⁻³ and NH⁺⁴ and C % in all crops

In Season two, crop rotation had a significant effect on NO⁻³ content at Lareystryd site with plots of maize following a legume and following a sunflower giving higher NO⁻³ content (Table 2). Plots of soybean following other crops and those of continuous soybean gave the lowest NO⁻³ content than other treatments. Crop rotation also had a significant effect on NH⁺⁴ content with plots of cowpea following sunflower giving higher NH⁺⁴ content than other

treatments. NH^{+4} content on plots of soybean following other crops was more depressed. No significant crop rotation effect was observed on C % in all crops in this study (data not given).

Table 2: Effect of crop rotation on NO^{-3} and NH^{+4} (mg kg^{-1}) content and C % in Season 2 at Larestryd

Factor	Treatment	NO^{-3}	NH^{+4}
		Season 2	
Crop rotation	Cowpea-Maize	5.203a	1.653bcdef
	Soybean-Maize	7.037a	2.373abc
	Sunflower-Maize	3.223abcd	2.233bcde
	Maize-Maize	4.673abc	3.110ab
	Sunflower-Cowpea	6.730a	3.830a
	Soybean-Cowpea	5.050ab	2.275abcd
	Maize-Cowpea	4.650abc	1.887bcdef
	Continuous Cowpea	3.330abcd	1.317cdef
	Cowpea-Soybean	0.167d	0.670f
	Maize-Soybean	0.120d	0.792def
	Sunflower-Soybean	0.010d	0.675f
	Continuous Soybean	0.426d	0.707ef
	Soybean-sunflower	1.057bcd	1.070cdef
	Maize-Sunflower	0.868cd	1.677bcdef
	Cowpea-Sunflower	0.328d	1.283cdef
Continuous Sunflower	1.147bcd	1.087cdef	
	Pr. value	0.003	0.006
	CV (%)	52.4	32.7
	LSD(0.05)	4.045	1.556

Means followed by different letters within a column are significantly different at $P < 0.05$

Effect of crop rotation on NH^{+4} in cowpea

In Season 2, crop rotation had a significant effect on NH^{+4} content on cowpea following other crops with plots of cowpea following sunflower giving higher NH^{+4} content than other treatments (Table 3). NH^{+4} content under continuous cowpea plots was more depressed. Under plots of soybean-cowpea rotation, NH^{+4} content gave intermediate results. No significant crop rotation effect was observed on NO^{-3} content and C % in cowpea plots in this study (data not given).

Table 3: Effect of crop rotation on NH^{+4} (mg kg^{-1}) content in Season 2 at Larestryd

Factor	Treatment	Season 2
Crop rotation	Maize-Cowpea	1.887b
	Soybean-Cowpea	2.275ab
	Sunflower-Cowpea	3.830a
	Continuous Cowpea	1.317b
	Pr. value	0.045

CV (%) 40.7

LSD(0.05) 1.661

Means followed by different letters within a column are significantly different at $P < 0.05$

Effect of crop rotation on NO_3^- in soybean

In Season 2, crop rotation had a significant effect on NO_3^- content on soybean following other crops with plots of continuous soybean giving higher NO_3^- content than other treatments (Table 4). No significant NO_3^- content effects were observed amongst plots of maize-soybean, cowpea-soybean and sunflower-soybean rotation. However, plots of sunflower-soybean rotation on NO_3^- content was more depressed. No significant crop rotation effect was observed on NH_4^+ content and C % in soybean plots in this study (data not given).

Table 4: Effect of crop rotation on NO_3^- (mg kg^{-1}) in soybean in Season 2 at Lareystryd

Factor	Treatment	Season 2
Crop rotation	Maize-Soybean	0.1200b
	Cowpea-Soybean	0.1670b
	Sunflower-Soybean	0.0100b
	Continuous Soybean	0.4260a
	Pr. value	0.014
	CV (%)	37.1
	LSD(0.05)	0.2084

Means followed by different letters within a column are significantly different at $P < 0.05$

PROBLEMS ENCOUNTERED

The study group at Brooksby remains to be a difficult group to participate in a project of this nature. The experimental plot remains threatened by both livestock owners and thieves. The very dry season of 2018/19 was a great setback to the farmers of Brooksby and only a small number in this area was able to plant their crops in the season of 2019/20. This contributed to a great loss of enthusiasm and interest by members to participate in the project.

At Lareystryd, the farm owner Mr. Vuyani Lolwane and chairperson of the Mahikeng CA study group passed away recently. This unfortunate occurrence will require various re-arrangements in the project.



Handtekening van Snr Navorsingsbestuurder
Signature of Senior Manager Research

3 September 2021

Datum/
Date



Figure 1: Farmers day field visit at Lareystryd on 17 March 2021 (the rain giving us a short gap)



Figure 2a



Figure 2b



Figure 2c

Figure 2a, 2b, and 2c show the four crops on the experimental plot at Larestryd in February 2021.