



Western Cape
Government

Agriculture

BETTER TOGETHER.

Evaluation of the Impact of the Long-Term Crop Rotation Trails at Langgewens

Annexure A

Urban-Econ Development Economists

in collaboration with Social Systems Scanners (SOSSCA) & Agronomist, Christopher Yohane

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Table of Contents

List of Maps	3
List of Tables.....	3
Annexure A: Survey Questionnaire Analysis.....	5
A1. Introduction	5
A2. Farm Details.....	7
A2.1. Farm Size	7
A2.2. Practice Crop Rotation?	9
A3. Crop Rotation System & Types of Planters Used	10
A3.1. Crop Rotation System Used on the Farm.....	10
A3.2. Types of Planters Used	11
A4. Awareness of Trials at Langgewens	12
A4.1. Awareness of Trials at Langgewens.....	13
A4.2. Is Langgewens Information Easily Accessible?	14
A4.3. Attendance at Farmer's Days	15
A5. Effect of Crop Rotation on Farming Inputs	15
A5.1. Effect on Yields	15
A5.2. Effect on Seeds.....	16
A5.3. Effect on Weed Control	16
A5.4. Lowering of the Weed Seed Bank	17
A5.5. Effect on Diseases	18
A5.6. Effect on Pesticide Inputs.....	19
A5.7. Effect on Mechanisation Costs	19
A6. Animal Production.....	20
A6.1. Animals on Medics, Stubble or Other Feed.....	20
A6.2. Animal Production & Crop Residues	20
A7. Effect on Soil.....	21

A7.1.	Soil Improvement	21
A7.2.	Effect on Fertiliser Inputs	22
A7.3.	Organic Fertiliser	23
A8.	Economic Outcomes	23
A8.1.	Economic Viability of Crop Rotation	23
A8.2.	Effect on the Cost of Production	24
A8.3.	Effect on Farm Income	24
A9.	Recommendations	25

List of Maps

Map 1.2.1:	Study Area	5
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List of Tables

Table A1.1:	Number of Survey Questionnaires Completed	6
Table A2.1.1:	Farm Sizes	7
Table A2.1.2:	How Much Farm Is In Production Before & After The Implementation of Crop Rotation.....	7
Table A2.1.3:	Produce Being Produced	8
Table A2.2.1:	Does The Farmer Practice Crop Rotation?	9
Table A2.2.2:	When Farmers Started Implementing Crop Rotation	9
Table A3.1:	Crop Rotation Systems Implemented	10
Table A3.2.1:	Types of Planters Used	11
Table A3.2.2:	When the Farmer Bought The Planter	11
Table A3.2.3:	Plant or Sow on Farms	12
Table A4.1.1:	Awareness of 20 year Crop Rotation Trial on Langgewens Farm	13
Table A4.2.1:	Is Langgewens Information Easily Accessible?	14
Table A4.2.2:	Recommend a Friend Farmer to Start Crop Rotation?	14
Table A4.3.1:	Attendance at Farmer's Days.....	15
Table A5.1.1:	Crop Rotation Effect on Yields	15

Table A5.2.1: Crop Rotation Effect on Seeds	16
Table A5.3.1: Crop Rotation Effect on Weed Control	16
A5.4.1: Lowering of the Weed Seed Bank	17
Table A5.4.2: When a Lowering of the Weed Seed Bank was Noticed.....	17
Table A5.4.3: Lowering of the Weed Seed Bank Effect on Yields.....	18
Table A5.5.1: Crop Rotation Effect on Diseases	18
Table A5.6.1: Crop Rotation Effect on Pesticides.....	19
Table A5.7.1: Crop Rotation Effect on Mechanisation Costs	19
Table A6.1.1: Difference in Sheep/Cattle Grazing on Medics, Stubble or Other Feed at Slaughter Time.....	20
Table A6.2.1: Whether Animal Production is Affected by the Availability of Crop Residues	21
Table A7.1.1: Soil Improvement Due to Crop Rotation	21
Table A7.2.1: Crop Rotation Effect on Fertiliser Inputs	22
Table A7.3.1: Application of Organic Fertiliser on the Farm	23
Table A8.1.1: Is Crop Rotation Economically Viable?	23
Table A8.2.1: Effect of Crop Rotation on the Cost of Production.....	24
Table A8.3.1: Effect on Farm Income	24
Table A9.1.1: Research Needs / Recommendations of the Various Stakeholders	25

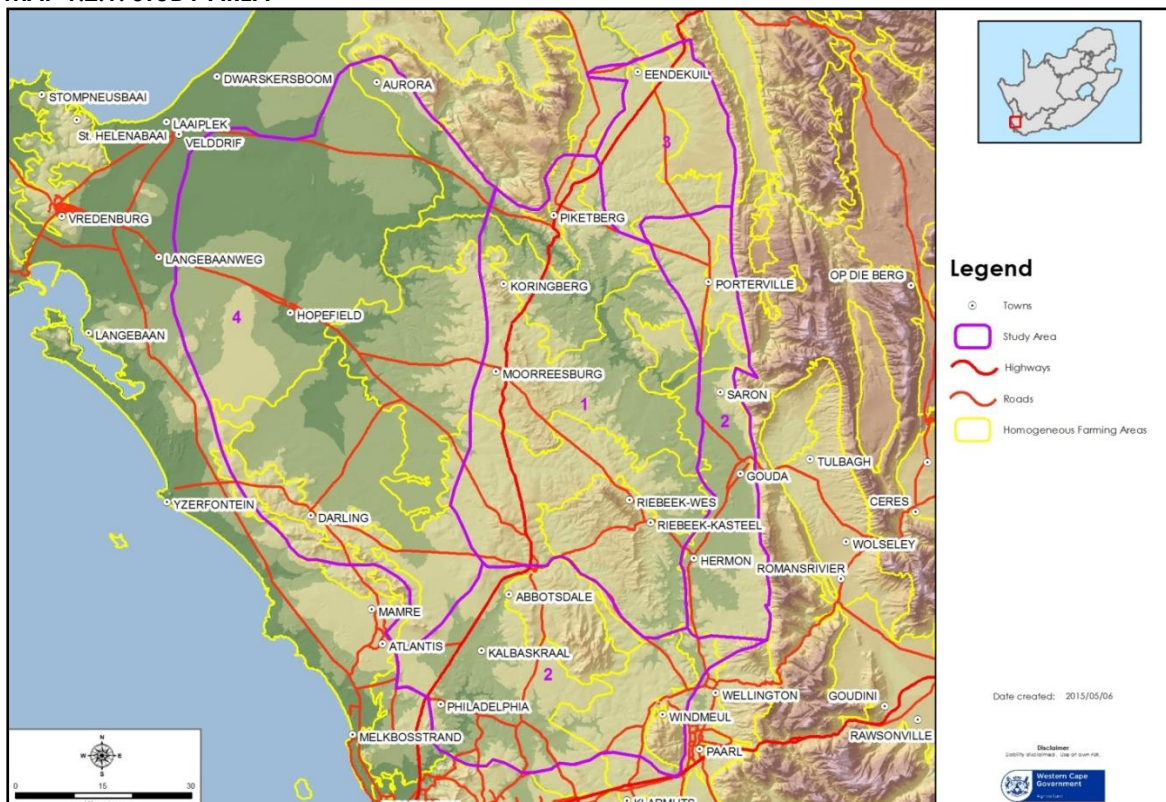
Annexure A: Survey Questionnaire Analysis

A1. Introduction

Urban-Econ, in collaboration with Social Systems Scanners (SOSSCA) and Agronomist, Christopher Yohane, has been appointed by the Western Cape Department of Agriculture to undertake an impact evaluation of the Swartland Community Crop Rotation project on Langgewens farm near Malmesbury. The purpose of the study is to determine what impact the study on Langgewens has had on the greater Swartland region. The project on Langgewens started in 1996 and the project will turn twenty in 2016. This annexure includes the analysis of the survey questionnaire that was used when interviewing farmers.

The study was focused on the greater Swartland region (Map 1.2.1). The areas within the Swartland identified are: (1) Middle Swartland (med-high potential for agriculture); (2) High Rainfall (high agriculture potential); (3) Rooi Karoo (low potential for agriculture); and (4) Sandveld (only wheat and lupin have potential).

MAP 1.2.1: STUDY AREA



The sample size for this study was to be between 20 and 25 farmers per region (i.e. Rooi Karoo, Middle Swartland, Sandveld and High Rainfall area). In total 85 farmers were interviewed in the greater Swartland. The sample was used to determine the adoption rate of crop rotation in the study area and the financial and economic impact crop rotation had on the farms. Table A1.1 indicates the number of survey questionnaires completed per region and the reasons why the target of 20 to 25 farmers was not reached in some regions.

TABLE A1.1: NUMBER OF SURVEY QUESTIONNAIRES COMPLETED

Region	Number of Survey Questionnaires Completed	Reasons for not reaching the target of 20 to 25 farmers per region
Rooi Karoo	6	The Farmers Association in this area did not want to disclose farmers contact details, but the Association did email the survey questionnaire to all of its members. GrainSA provided a few extra contact details.
Middle Swartland	43	The Farmers Association in these areas provided all the contact details of farmers in the area. All the farmers were contacted and all the farmers interested in taking part in the study were either interviewed or filled in the survey questionnaire electronically.
Sandveld	27	
High Rainfall	9	The Farmers Association in this area did not want to disclose farmers contact details, but the Association did email the survey questionnaire to all of its members. GrainSA provided a few extra contact details.
Total	85	

As with any research or study, limitations can be expected. Below is a summary of limitations experienced during the data collection:

- ❑ Some respondents' contact details were not made available to the research team (as mentioned above). The research team had to rely on farmers responding to the emails without being able to phone the farmers personally.
- ❑ Some respondents' were not willing to take part in the survey questionnaire. Reasons being lack of time, not interested in contributing towards the study, etc.
- ❑ Many of the farmers were planting during this time and even though they were interested in taking part they did not have the time to do so. That said, some farmers found the time during planting even when it meant the research team had to interview the farmer in their field.

A2. Farm Details

A2.1. Farm Size

Table A2.1.1 indicates the various sizes of farms in the study area.

TABLE A2.1.1: FARM SIZES

Region	200 ha or less	201 - 400 ha	401 - 600 ha	601 - 800 ha	801 – 1,000 ha	1,001 ha or more	NA
High Rainfall	0%	0%	11.1%	0%	22.2%	66.7%	0%
Middle Swartland	0%	4.7%	11.6%	11.6%	25.6%	41.9%	4.7%
Rooi Karoo	0%	0%	0%	33.3%	0%	66.7%	0%
Sandveld	0%	3.7%	0%	3.7%	7.4%	85.2%	0%
Entire Study Area	0%	3.5%	7.1%	9.4%	17.6%	60.0%	2.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of the farms in the study area (60%) are larger than 1,000 hectares in size; while almost 20% are 801 to 1,000 hectares in size. Farms need to be large for economies of scale, and in the Sandveld for example farms are mostly between 1,200 hectares to 1,500 hectares in size, some reaching as large as 5,000 hectares. The farm size can be attributed to the types of soil and climate conditions.

Table A2.1.2 indicates how much of the farms are in production before and after the implementation of crop rotation.

TABLE A2.1.2: HOW MUCH FARM IS IN PRODUCTION BEFORE & AFTER THE IMPLEMENTATION OF CROP ROTATION

Region	20% Decrease	No Change	20% Increase
High Rainfall	0%	88.9%	11.1%
Middle Swartland	4.7%	95.3%	0%
Rooi Karoo	0%	83.3%	16.7%
Sandveld	3.7%	92.6%	3.7%

Region	20% Decrease	No Change	20% Increase
Entire Study Area	3.5%	92.9%	3.5%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of the farms in the study area (92.9%) did not have a change in the size of the farm that was under production before and after implementing crop rotation. The same amount of land is under production, but the amount of a certain crop planted has changed to make way for crop rotation systems.

Table A2.1.3 indicates what produce is currently produced on the farm within the study area.

TABLE A2.1.3: PRODUCE BEING PRODUCED

Region	Produce	
High Rainfall	<input type="checkbox"/> Wheat <input type="checkbox"/> Canola <input type="checkbox"/> Lupin <input type="checkbox"/> Medics <input type="checkbox"/> Oats	<input type="checkbox"/> Potatoes <input type="checkbox"/> Barley <input type="checkbox"/> Vineyards <input type="checkbox"/> Sheep (pastures) <input type="checkbox"/> Cattle
Middle Swartland	<input type="checkbox"/> Wheat <input type="checkbox"/> Canola <input type="checkbox"/> Lupin <input type="checkbox"/> Medics <input type="checkbox"/> Oats	<input type="checkbox"/> Peas <input type="checkbox"/> Triticale <input type="checkbox"/> Barley <input type="checkbox"/> Sheep (pastures) <input type="checkbox"/> Cattle
Rooi Karoo	<input type="checkbox"/> Wheat <input type="checkbox"/> Canola <input type="checkbox"/> Lupin <input type="checkbox"/> Medics	<input type="checkbox"/> Oats <input type="checkbox"/> Maize <input type="checkbox"/> Sheep (pastures) <input type="checkbox"/> Cattle
Sandveld	<input type="checkbox"/> Wheat <input type="checkbox"/> Lupin <input type="checkbox"/> Medics (very little) <input type="checkbox"/> Oats <input type="checkbox"/> Triticale	<input type="checkbox"/> Barley <input type="checkbox"/> Mielies <input type="checkbox"/> Sheep (pastures) <input type="checkbox"/> Cattle

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of the farms in the study area farm with wheat, lupin, canola, medics, oats, sheep and cattle.

A2.2. Practice Crop Rotation?

Table A2.2.1 indicates whether the farm is under crop rotation.

TABLE A2.2.1: DOES THE FARMER PRACTICE CROP ROTATION?

Region	Yes	No
High Rainfall	100%	0%
Middle Swartland	100%	0%
Rooi Karoo	100%	0%
Sandveld	98.8%	1.2%
Entire Study Area	98.8%	1.2%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of the farms in the study area (98.8%) practice crop rotation.

Table A2.2.2 indicates when farmers started implementing crop rotation.

TABLE A2.2.2: WHEN FARMERS STARTED IMPLEMENTING CROP ROTATION

Region	High Rainfall	Middle Swartland	Rooi Karoo	Sandveld	Entire Study Area
Less than 5 years ago	22.2%	4.7%	50.0%	0%	8.2%
5 - 9 years ago	0%	7.0%	16.7%	3.7%	5.9%
10 - 19 years ago	22.2%	32.6%	0%	11.1%	22.4%
20 - 29 years ago	22.2%	27.9%	0%	0%	16.5%
30 - 39 years ago	22.2%	20.9%	16.7%	3.7%	15.3%
40 - 49 years ago	11.1%	2.3%	0%	0%	2.4%
More than 50 years ago	0%	0%	0%	7.4%	2.4%
Have always implemented crop	0%	0%	0%	70.4%	22.4%

Region	High Rainfall	Middle Swartland	Rooi Karoo	Sandveld	Entire Study Area
rotation.					
Can't remember because father was already doing it	0%	2.3%	0%	0%	1.2%
Not implementing crop rotation	0%	0%	0%	3.7%	1.2%
NA	0%	2.3%	16.7%	0%	2.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of the farms in the study area (81.4%) implemented crop rotation more than ten years ago. Farmers started implementing crop rotation:

- To control weeds
- To improve the soil fertility and decrease soil erosion
- To increase yields
- To minimise risk

A3. Crop Rotation System & Types of Planters Used

A3.1. Crop Rotation System Used on the Farm

Table A3.1 indicates the different types of crop rotation systems that are implemented by farmers in the study area.

TABLE A3.1: CROP ROTATION SYSTEMS IMPLEMENTED

Region	Crop Rotation System
High Rainfall	WMWM; WOWW; WWWC; WOWC; WCLM; LWCW; MWMC; WWLW; WLWL; eight-year rotation of Wheat, Barley, Canola, Barley and Potatoes.
Middle Swartland	WMWM; MWMC; LWCW; CWWC; MWWM; WLWL; WMWC; WLWO; WOWO; WCWL; CMWW; WLWL; WCWC.
Rooi Karoo	WMWM; WLWC; WLWL; WMWL; WLWO.

Region	Crop Rotation System
Sandveld	WLWL; WLWW; TOMT; CWLW; WMWM (only on clay & hard soil).

(Source: Urban-Econ Survey Questionnaire 2015)

The farmers in the study area implement various crop rotation systems with wheat. The types of crop rotation systems implemented are based on where the farm is located in terms of, amongst others, the amount of rainfall, the climate, the types of soils, and length of the seasons.

A3.2. Types of Planters Used

Table A3.2.1 indicates the types of planters farmers are using in the study area.

TABLE A3.2.1: TYPES OF PLANTERS USED

	Disc Planter	Knifepoint Planter	No-Till Planter	Scarifier	Thresh field Span	NA
High Rainfall	11.1%	77.8%	11.1%	0%	0%	0%
Middle Swartland	0%	93.0%	4.7%	0%	2.3%	0%
Rooi Karoo	33.3%	33.3%	16.7%	16.7%	0%	0%
Sandveld	0%	92.6%	0%	0%	0%	7.4%
Entire Study Area	3.5%	87.1%	4.7%	1.2%	1.2%	2.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (87.1%) make use of a knifepoint planter. Table A3.2.2 indicates when the farmer bought the planter.

TABLE A3.2.2: WHEN THE FARMER BOUGHT THE PLANTER

	Less than 5 years ago	5 - 9 years ago	10 - 19 years ago	20 - 29 years ago	30 - 39 years ago	40 - 49 years ago	NA
High Rainfall	11.1%	33.3%	44.4%	0.0%	0.0%	0.0%	11.1%
Middle	7.0%	25.6%	44.2%	2.3%	0.0%	0.0%	20.9%

	Less than 5 years ago	5 - 9 years ago	10 - 19 years ago	20 – 29 years ago	30 - 39 years ago	40 - 49 years ago	NA
Swartland							
Rooi Karoo	33.3%	16.7%	33.3%	0.0%	0.0%	0.0%	16.7%
Sandveld	0.0%	3.7%	7.4%	0.0%	0.0%	0.0%	88.9%
Entire Study Area	7.1%	18.8%	31.8%	1.2%	0.0%	0.0%	41.2%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (50.6%) bought the planter five to twenty years ago.

Table A3.2.3 indicates whether farmers plant or sow the crops on the farms.

TABLE A3.2.3: PLANT OR SOW ON FARMS

Region	Plant	Sow	NA
High Rainfall	77.8%	11.1%	11.1%
Middle Swartland	83.7%	9.3%	7.0%
Rooi Karoo	66.7%	16.7%	16.7%
Sandveld	92.6%	3.7%	3.7%
Entire Study Area	84.7%	8.2%	7.1%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (84.7%) plant the crops; while 8.2% sow the crops and 7.1% of farmers did not answer the question.

A4. Awareness of Trials at Langgewens

A4.1. Awareness of Trials at Langgewens

Table A4.1.1 indicates whether farmers are aware of the 20-year crop rotation trial on Langgewens farm.

TABLE A4.1.1: AWARENESS OF 20 YEAR CROP ROTATION TRIAL ON LANGGEWENS FARM

Region	Yes	No
High Rainfall	100%	0%
Middle Swartland	90.7%	9.3%
Rooi Karoo	83.3%	16.7%
Sandveld	96.3%	3.7%
Entire Study Area	92.9%	7.1%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (92.9%) are aware of the 20-year crop rotation trial on Langgewens farm. The farmers use the information accessed from Langgewens to:

- ❑ Apply the relevant information on the farm
- ❑ Compares the trials with own crop rotation practice
- ❑ Takes note of the cultivar choices used at Langgewens
- ❑ Use the information to increase profit margins on the farm
- ❑ Take note of what is happening at Langgewens but have not implemented the research because the soils at Langgewens are very different to the soils on the farmer's farm

The point of view farmers have of the long-term trials at Langgewens included:

- ❑ The trials should continue as it is very beneficial
- ❑ The trials provide useful guidance for the farmers
- ❑ The maximum point has been reached in crop rotation and now product beneficiation should be looked at
- ❑ Need trials in the Sandveld region as the soil at Langgewens is very different
- ❑ It is always good to compare different systems
- ❑ The trials lower the risks that farmers have to deal with and saves farmers from doing tests on their farms

- Langgewens has confirmed many allegations and showed where further improvement can take place

A4.2. Is Langgewens Information Easily Accessible?

Table A4.2.1 indicates whether farmers think that research findings and documents on the project on Langgewens are easily accessible.

TABLE A4.2.1: IS LANGGEWENS INFORMATION EASILY ACCESSIBLE?

Region	Yes	No	NA
High Rainfall	44.4%	44.4%	11.1%
Middle Swartland	76.7%	14.0%	9.3%
Rooi Karoo	66.7%	16.7%	16.7%
Sandveld	92.6%	7.4%	0%
Entire Study Area	77.6%	15.3%	7.1%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (77.6%) agree that research findings and documents on the project on Langgewens are easily accessible; while 15.3% do not think the information is easily accessible or do not know where to access the information.

Table A4.2.2 indicate whether the farmer would recommend a friend farmer to start crop rotation as opposed to monoculture crop production.

TABLE A4.2.2: RECOMMEND A FRIEND FARMER TO START CROP ROTATION?

Region	Yes	No	NA
High Rainfall	100%	0%	0%
Middle Swartland	100%	0%	0%
Rooi Karoo	100%	0%	0%
Sandveld	100%	0%	0%
Entire Study Area	100%	0%	0%

(Source: Urban-Econ Survey Questionnaire 2015)

All of the farmers in the study area (100%) would you recommend a friend farmer to start crop rotation as opposed to monoculture crop production.

A4.3. Attendance at Farmer's Days

Table A4.3.1 indicates whether farmers attend farmers days and info sessions.

TABLE A4.3.1: ATTENDANCE AT FARMER'S DAYS

Region	Yes	No
High Rainfall	88.9%	11.1%
Middle Swartland	97.7%	2.3%
Rooi Karoo	83.3%	16.7%
Sandveld	96.3%	3.7%
Entire Study Area	95.3%	4.7%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (95.3%) attend farmers days and info sessions.

A5. Effect of Crop Rotation on Farming Inputs

A5.1. Effect on Yields

Table A5.1.1 indicates how crop rotation affected yields on the farm.

TABLE A5.1.1: CROP ROTATION EFFECT ON YIELDS

Region	Increase	No Change	Decrease	NA
High Rainfall	77.8%	11.1%	0%	11.1%
Middle Swartland	97.7%	2.3%	0%	0%
Rooi Karoo	83.3%	16.7%	0%	0%
Sandveld	92.6%	0%	3.7%	3.7%
Entire Study Area	92.9%	3.5%	1.2%	2.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (92.9%) indicated that crop rotation resulted in an increase in yields; while 3.5% of farmers did not notice a change in yields after implementing crop rotation.

A5.2. Effect on Seeds

Table A5.2.1 indicates how crop rotation affected seeds on the farm.

TABLE A5.2.1: CROP ROTATION EFFECT ON SEEDS

Region	Increase	No Change	Decrease	NA
High Rainfall	0%	55.6%	33.3%	11.1%
Middle Swartland	0%	39.5%	51.2%	9.3%
Rooi Karoo	0%	50.0%	33.3%	16.7%
Sandveld	0%	74.1%	18.5%	7.4%
Entire Study Area	0%	52.9%	37.6%	9.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (52.9%) indicated that crop rotation resulted in no change in the amount of seeds used; while 37.6% indicated there was a decrease in the amount of seeds (an average of 25% decrease).

A5.3. Effect on Weed Control

Table A5.3.1 indicates how crop rotation affected weed control on the farm.

TABLE A5.3.1: CROP ROTATION EFFECT ON WEED CONTROL

Region	Increase	No Change	Decrease	NA
High Rainfall	55.6%	0%	33.3%	11.1%
Middle Swartland	39.5%	4.7%	55.8%	0%
Rooi Karoo	66.7%	33.3%	0%	0%
Sandveld	11.1%	3.7%	81.5%	3.7%
Entire Study Area	34.1%	5.9%	57.6%	2.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (57.6%) indicated that crop rotation resulted in a decrease in weed control on the farm; while only 34.1% indicated an increase in weed control.

A5.4. Lowering of the Weed Seed Bank

Table A5.4.1 indicates whether crop rotation resulted in a lowering of the weed seed bank.

A5.4.1: LOWERING OF THE WEED SEED BANK

	Yes	No	NA
High Rainfall	44.4%	44.4%	11.1%
Middle Swartland	76.7%	20.9%	2.3%
Rooi Karoo	83.3%	16.7%	0%
Sandveld	14.8%	81.5%	3.7%
Entire Study Area	54.1%	42.4%	3.5%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (54.1%) indicated that crop rotation resulted in a lowering of the weed seed bank. Table A5.4.2 indicates when these 54.1% of farmers noticed a lowering of the weed seed bank.

TABLE A5.4.2: WHEN A LOWERING OF THE WEED SEED BANK WAS NOTICED

Region	Less than 5 years after	5 - 9 years after	10 - 19 years after	20 - 29 years after	30 - 39 years after	40 - 49 years after	Still a problem	NA
High Rainfall	33.3%	0%	11.1%	0%	0%	0%	0%	55.6%
Middle Swartland	7.0%	14.0%	7.0%	4.7%	0%	0%	0%	67.4%
Rooi Karoo	33.3%	0%	0%	0%	0%	0%	0%	66.7%
Sandveld	3.7%	3.7%	7.4%	0%	0%	0%	70.4%	14.8%
Entire Study Area	10.6%	8.2%	7.1%	2.4%	0%	0%	22.4%	49.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (25.9%) noticed a lowering of the weed seed bank one to 20 years after implementing crop rotation; while 22.4% indicated that the weed seed bank is still a problem.

Table A5.4.3 indicates whether these 54.1% of farmers who noticed a lowering of the weed seed bank noticed a change in the yields of the farm.

TABLE A5.4.3: LOWERING OF THE WEED SEED BANK EFFECT ON YIELDS

Region	Increased	Decreased	Too soon to tell	NA
High Rainfall	50.0%	25.0%	25.0%	0%
Middle Swartland	47.8%	18.2%	12.1%	21.2%
Rooi Karoo	80.0%	0%	20.0%	0%
Sandveld	0%	100%	0%	0%
Entire Study Area	47.8%	23.9%	13.0%	15.2%

(Source: Urban-Econ Survey Questionnaire 2015)

Of the 54.1% of farmers whom noticed a lowering of the weed seed bank, the majority (47.8%) indicated an increase in the yields on the farm; while 23.9% indicated a decrease in yields on the farm.

A5.5. Effect on Diseases

Table A5.5.1 indicates whether crop rotation had a positive impact on the diseases the farm was struggling with.

TABLE A5.5.1: CROP ROTATION EFFECT ON DISEASES

Region	Yes	No	NA
High Rainfall	55.6%	33.3%	11.1%
Middle Swartland	81.4%	11.6%	7.0%
Rooi Karoo	66.7%	16.7%	16.7%
Sandveld	18.5%	74.1%	7.4%
Entire Study Area	57.6%	34.1%	8.2%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (57.6%) indicated that crop rotation has a positive effect on the diseases the farm was struggling with. Of the 34.1% that indicated that crop rotation did not have a positive impact on the diseases the farm was struggling with, some indicated that there is a better effect with the type of planter that was being used on the farm.

A5.6. Effect on Pesticide Inputs

Table A5.6.1 indicates how crop rotation affected pesticide inputs on the farm.

TABLE A5.6.1: CROP ROTATION EFFECT ON PESTICIDES

Region	Increase	No Change	Decrease	NA
High Rainfall	22.2%	44.4%	22.2%	11.1%
Middle Swartland	14.0%	39.5%	37.2%	9.3%
Rooi Karoo	50.0%	16.7%	16.7%	16.7%
Sandveld	74.1%	11.1%	7.4%	7.4%
Entire Study Area	36.5%	29.4%	24.7%	9.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (36.5%) indicated that crop rotation resulted in an increase in pesticide inputs on the farm (of an average of 15%); 24.7% indicated a decrease in pesticide inputs (of an average of 19%); and 29.4% indicated that there has been no change in the amount of pesticide inputs since implementing crop rotation.

A5.7. Effect on Mechanisation Costs

Table A5.7.1 indicates how crop rotation affected mechanisation costs on the farm.

TABLE A5.7.1: CROP ROTATION EFFECT ON MECHANISATION COSTS

Region	Increase	No Change	Decrease	NA
High Rainfall	11.1%	22.2%	44.4%	22.2%
Middle Swartland	14.0%	14.0%	65.1%	7.0%
Rooi Karoo	0%	16.7%	66.7%	16.7%
Sandveld	70.4%	3.7%	22.2%	3.7%

Region	Increase	No Change	Decrease	NA
Entire Study Area	30.6%	11.8%	49.4%	8.2%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (49.4%) indicated that crop rotation resulted in a decrease in mechanisation costs on the farm (of an average of 27%); while 30.6% indicated an increase in mechanisation costs (of an average of 13%).

A6. Animal Production

A6.1. Animals on Medics, Stubble or Other Feed

Table A6.1.1 indicates whether there has been a difference in sheep/cattle grazing on medics, stubble or other feed at slaughter time.

TABLE A6.1.1: DIFFERENCE IN SHEEP/CATTLE GRAZING ON MEDICS, STUBBLE OR OTHER FEED AT SLAUGHTER TIME

Region	Yes, the animal weighed more	No, the animal did not weigh more	NA
High Rainfall	66.7%	0%	33.3%
Middle Swartland	88.4%	2.3%	9.3%
Rooi Karoo	33.3%	16.7%	50.0%
Sandveld	96.3%	0%	3.7%
Entire Study Area	84.7%	2.4%	12.9%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (84.7%) indicated that sheep/cattle grazing on medics, stubble or other feed weighed more at slaughter time.

A6.2. Animal Production & Crop Residues

Table A6.2.1 indicates whether animal production is affected by the availability of crop residues.

TABLE A6.2.1: WHETHER ANIMAL PRODUCTION IS AFFECTED BY THE AVAILABILITY OF CROP RESIDUES

Region	Yes	No	NA
High Rainfall	33.3%	66.7%	0%
Middle Swartland	65.1%	30.2%	4.7%
Rooi Karoo	100%	0%	0%
Sandveld	96.3%	3.7%	0%
Entire Study Area	74.1%	23.5%	2.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (74.1%) indicated that animal production is affected by the availability of crop residues. The other benefits farmers receive from livestock production include:

- ❑ Better cash flow and margins from overall farming produce
- ❑ Value add to the medics crop rotation system
- ❑ Aids in the management of crop residues
- ❑ Ability to keep more livestock on the farm
- ❑ More balanced nutrition for the animals
- ❑ Most of the time ewes can give birth to two lambs
- ❑ The lambs round off quicker
- ❑ Makes maximum use of farm land
- ❑ Better weed management

A7. Effect on Soil

A7.1. Soil Improvement

Table A7.1.1 indicates whether the farm's soil has improved (i.e. structure and texture) as a result of crop rotation.

TABLE A7.1.1: SOIL IMPROVEMENT DUE TO CROP ROTATION

Region	Yes	No	NA
High Rainfall	88.9%	0%	11.1%
Middle Swartland	100%	0%	0%

Region	Yes	No	NA
Rooi Karoo	100%	0%	0%
Sandveld	100%	0%	0%
Entire Study Area	98.8%	0%	1.2%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (98.8%) indicated that the farm's soil has improved (i.e. structure and texture) as a result of crop rotation. The changes that were noticed include:

- ❑ Improved ground/soil management (i.e. easier to work; better holding capacity; etc)
- ❑ Improved soil quality (and increased carbon content)
- ❑ Increased microorganism activity in the soil
- ❑ Decrease in water run-off
- ❑ Decrease in soil erosion
- ❑ Increased water retention capacity

A7.2. Effect on Fertiliser Inputs

Table A7.2.1 indicates how crop rotation affected fertiliser inputs on the farm.

TABLE A7.2.1: CROP ROTATION EFFECT ON FERTILISER INPUTS

Region	Increase	No Change	Decrease	NA
High Rainfall	0%	33.3%	55.6%	11.1%
Middle Swartland	7.0%	18.6%	74.4%	0%
Rooi Karoo	16.7%	33.3%	33.3%	16.7%
Sandveld	0%	14.8%	81.5%	3.7%
Entire Study Area	4.7%	20.0%	71.8%	3.5%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (71.8%) indicated that crop rotation resulted in a decrease in fertiliser inputs on the farm (of an average of 30%); 4.7% indicated an increase in fertiliser inputs (of an average of 13%); and 20% indicated that there has been no change in the amount of fertiliser inputs since implementing crop rotation.

A7.3. Organic Fertiliser

Table A7.3.1 indicates whether the farmer applies organic fertiliser on the farm.

TABLE A7.3.1: APPLICATION OF ORGANIC FERTILISER ON THE FARM

Region	Yes	No
High Rainfall	33.3%	66.7%
Middle Swartland	27.9%	72.1%
Rooi Karoo	33.3%	66.7%
Sandveld	11.1%	88.9%
Entire Study Area	23.5%	76.5%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (76.5%) do not apply organic fertilisers on the farms. Some farmers indicate that it is too expensive while others indicate that there was no change in yields or the soil therefore the farmer discontinued it. Of the 23.5% of farmers that apply organic fertiliser, the following changes were noticed:

- ❑ Higher yields
- ❑ Soil is easier to manage
- ❑ The grading was better and yields higher
- ❑ The soil is more porous

A8. Economic Outcomes

A8.1. Economic Viability of Crop Rotation

Table A.8.1.1 indicates whether the farmer felt that crop rotation is economically viable.

TABLE A8.1.1: IS CROP ROTATION ECONOMICALLY VIABLE?

Region	Yes	No	NA
High Rainfall	77.8%	11.1%	11.1%
Middle Swartland	97.7%	0%	2.3%
Rooi Karoo	83.3%	16.7%	0%
Sandveld	100%	0%	0%

Region	Yes	No	NA
Entire Study Area	95.3%	2.4%	2.4%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (95.3%) indicated that crop rotation is economically viable.

A8.2. Effect on the Cost of Production

Table A8.2.1 indicates whether practicing crop rotation has led to increased or decreased cost of crop production.

TABLE A8.2.1: EFFECT OF CROP ROTATION ON THE COST OF PRODUCTION

Region	Increased	No Change	Decreased	NA
High Rainfall	55.6%	11.1%	22.2%	11.1%
Middle Swartland	23.3%	2.3%	72.1%	2.3%
Rooi Karoo	16.7%	0%	66.7%	16.7%
Sandveld	85.2%	0%	14.8%	0%
Entire Study Area	45.9%	2.4%	48.2%	3.5%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (48.2%) indicated that crop rotation has led to a decrease in the cost of production (by an average margin of 20%); while 45.9% indicated an increase (by an average margin of 23%).

A8.3. Effect on Farm Income

Table A8.3.1 indicates whether crop rotation had an impact on the farm income.

TABLE A8.3.1: EFFECT ON FARM INCOME

Region	Increase	No Change	Decrease	NA
High Rainfall	100%	0%	0%	0%
Middle Swartland	79.1%	2.3%	4.7%	14.0%
Rooi Karoo	100%	0%	0%	0%

Region	Increase	No Change	Decrease	NA
Sandveld	100%	0%	0%	0%
Entire Study Area	89.4%	1.2%	2.4%	7.1%

(Source: Urban-Econ Survey Questionnaire 2015)

The majority of farmers in the study area (89.4%) indicated that farm income has increased since the implementation of crop rotation (by an average of 10-30%); while 2.4% of farmers indicated there has been a decrease in farm income (by an average of 10%).

A9. Recommendations

Table A9.1.1 indicates what farmers think should still be researched on Langgewens and other recommendations.

TABLE A9.1.1: RESEARCH NEEDS / RECOMMENDATIONS OF THE VARIOUS STAKEHOLDERS

	Research Needs / Recommendations
Continue with current research	<ul style="list-style-type: none"> ❑ Keep up with the current trials ❑ Consider adding crop rotation systems that are being implemented by farmers but are not being tested at Langgewens
New cultivars / new cash crops	<ul style="list-style-type: none"> ❑ Test genetically modified wheat ❑ Test wheat with higher proteins and higher returns ❑ Test new crop cultivars that have higher returns ❑ Test new alternative cash crops ❑ Research on the affordability and sustainability of wheat farming to legumes ❑ Test Wheat, Canola, Medics, Lupines, and Oats rotations ❑ Test the costs and economic viability of a wheat and lupin system ❑ Research on drought-resistant crops ❑ Test better crop rotation systems with lupins ❑ Research on silage crops ❑ Research on summer crops ❑ Find canola cultivars that binds with nitrogen in the soil ❑ Find more leguminous crops that can bind nitrogen in sandy soils

	Research Needs / Recommendations
	<p>(other than lupines)</p> <ul style="list-style-type: none"> ❑ More effort with cutting methods for medics instead of only using medics for grazing ❑ Research on cover crops in cereal farming ❑ Need a crop that can see Sandveld farmers through the summer (especially considering the amount sheep consume) ❑ Need a crop with a shorter growing period
Livestock Production	<ul style="list-style-type: none"> ❑ Test more sheep and lamb systems ❑ There are problems with government distributing enough vaccines for animals (in particular the Blue-Tongue disease) ❑ With "Johne's Disease" the government keeps showing out dated trends from the 1960's, new trends need to be shown ❑ Caracals are also a problem, especially in the Sandveld where caracals are being protected and breeding in the National Park
Planters	<ul style="list-style-type: none"> ❑ More tests with the Knifepoint Planter; Disc Planter; and Zero-Till Planter ❑ Test the economic difference between sowing and planting ❑ Test WMWM via sowing ❑ Weed control with minimum tilling remains a huge problem
Pests	<ul style="list-style-type: none"> ❑ Birds and mice (especially gerbils) in the wheat fields remains a significant problem, need research to determine solutions ❑ Geese eat the lupins and oats, need research to determine solutions ❑ The Blue Crane is a problem in Lupins but they are a protected bird, need research to determine solutions
Chemicals	<ul style="list-style-type: none"> ❑ The cost of chemical control is at a point where it is no longer affordable, test for cost effective alternatives ❑ Research on chemical and organic fertilisers and the effects they have on crops and the environments ❑ Research on better weed control alternatives (especially in medics where limited weed chemicals are available and are very expensive; and weed control for the entire Sandveld region where weeds have not been under control)

	Research Needs / Recommendations
	<ul style="list-style-type: none"> ❑ The grass-weed management capacity of WWMM in comparison with WMWM and WWCM ❑ There needs to be research on the impact that different pest poisons have on the biological life of the soil and what damage this causes and to what degree ❑ More research into curing plant illness and fungi. There needs to be more independent research to test the different fungi agents on the market ❑ Look at spraying the "Sakura chemicals", the farmers are too scared to test it because you need a certain amount of rain for it to work ❑ Does "Round-Up" even work? ❑ Do more testing of products advertised on the market such as spraying "Cocktails" and "Blaarvoedings". The marketing of the company shows how the product will help, but the marketing messages need to be tested and verified.
Fertilisers	<ul style="list-style-type: none"> ❑ Test the effectiveness and economic viability of organic fertilisers ❑ How can cow dung be applied as manure? ❑ Conduct trials on long term economic viability of organic fertilisers versus inorganic fertilisers
Soil life and soil temperature	<ul style="list-style-type: none"> ❑ The soil temperatures rise so much in summer that the heat of the soil kills microorganisms thus research must be done regarding the effectiveness of mulching on controlling soil temperatures in summer. ❑ Research from an environmental perspective on how crop rotation stimulates the life of microorganisms in the soil and the role they play in crop rotation ❑ Medics and lupines remove phosphate from the soil, therefore research the withdrawal of phosphate from the soil as a result of crop rotation ❑ More research on soil conservation ❑ Research new methods for alkaline soil and how to rehabilitate it
Diversity research	<ul style="list-style-type: none"> ❑ Test different regions and different rainfall scenarios

	Research Needs / Recommendations
areas	<ul style="list-style-type: none"> ❑ Research how medics can be planted in the Eendekuil area as the soil there is different from the soil in Langgewens ❑ Needs to be trials of crops done on sandy soil ❑ A research farm needs to be established in the Sandveld region
Fuel and mechanisation costs	<ul style="list-style-type: none"> ❑ Test the viability of bio-fuels ❑ Maintenance costs on tractors are high (especially considering the Dollar/Rand exchange rate), are there alternatives?
Market conditions and market information	<ul style="list-style-type: none"> ❑ More research must be done on the calculation of the wheat price. Local farmers want to pay the same price as the farmers from America or Australia ❑ The government must look at the quality that is being imported and pay local farmers correctly for their quality of crops ❑ The transport differential is having an adverse impact on the farmers and the input costs remain high even if the diesel prices decrease ❑ Information regarding Langgewens and crop rotation should be distributed via email, not just at annual farmer's days

Based on the above, the five main recommendations going forward include: (1) continue with the current trails at Langgewens; (2) investigate new cultivars and alternative crops; (3) develop new parallel research trails for sandy areas (i.e. Sandveld); (4) investigate input costs and consider alternatives to the norm; and (5) conduct closer combined research with industry.