

2023/2024 RESEARCH REPORT



Oil & Protein Seeds Development Trust & Oilseeds Advisory Committee



2023/2024 RESEARCH REPORT: OIL AND PROTEIN SEEDS DEVELOPMENT TRUST AND OILSEEDS ADVISORY COMMITTEE

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1. OIL AND PROTEIN SEEDS DEVELOPMENT TRUST

1.1 INTRODUCTION

During the past year, the Trustees of the Oil and Protein Seeds Development Trust (OPDT) once again succeeded in their efforts to achieve the Trust's objectives as set out in the Trust Deed.

The main objectives of the Trust are the promotion and development of the oilseeds industry in South Africa by:

- a) financing research projects relating to the improvement, production, storage, processing and marketing of oilseeds;
- b) providing funding to support information and advisory services to the oilseeds industry, particularly relating to the production of oilseeds and marketing conditions;
- c) investing and conserving the assets of the Trust;
- d) productive utilisation of the assets of the Trust as may be required from time to time, in such a manner that the real value of the assets is maintained or increased as far as possible; and
- e) financing market access or any other action that is in the interest of the oilseeds industry, provided that such funding is in accordance with the objectives and prescriptions of the Act (Marketing of Agricultural Products Act, Act 47 of 1996, as amended).



1.2 BOARD OF TRUSTEES

Representatives of affected groups serving as Trustees during the 2023/2024 financial year, appointed by the Oilseeds Advisory Committee (OAC), were as follows:

Mr AR Moosa (Chairperson)	- Representative of the oilseeds processor's industry
Mr JD Boshoff (Vice-Chairperson)	- Representative of the oilseeds trading industry
Mr S Shandu (Vice-Chairperson elected 29/08/2023)	- Representative of the Minister of Agriculture, Land Reform and Rural Development
Dr A van der Vyver	- Representative of the oilseeds trading industry
Mr DI Schutte	- Representative of labour involved in the oilseeds industry
Mr GL Roos	- Representative of the commercial producers of oilseeds
Ms J Dyer-Tselentis	- Representative of the consumers of oilseeds and their products
Mr RE Monaisa	- Representative of the developing producers of oilseeds
Mr R Pholo	- Representative of the developing producers of oilseeds
Ms D Makgatho - Mosehla	- Representative of the Minister of Agriculture, Land Reform and Rural Development



1.3 GENERAL OVERVIEW

During the reporting period, 1 March 2023 to 29 February 2024, the Trust met regularly to discuss and decide about matters that will benefit the oilseeds industry and specifically sunflower, soybean, groundnut and canola.

During the period under review, R 23 392 500 was approved in respect of research projects, provisions, technology transfer and information support and advisory services. The mentioned amount was allocated as follows:

- **Current Projects / Continuation Applications**

Approved	:	R 9 579 822
Provision	:	R 843 400

- **New Applications**

Approved	:	R 1 920 176
Provision	:	R 360 155

- **Transformation Projects**

Approved	:	R 8 102 703
Provision	:	R 18 538 945

- **Joint Project Proposals**

Approved	:	R 443 233
Provision	:	0

- **Provisions**

Approved	:	R3 650 000
Under consideration	:	0

➤ **Management of Research Projects: R 43 438 434**

The total budget approved for the 2023/2024 financial year therefore amounted to R 47 782 277.



The above-mentioned amount includes the following bursaries approved:

(a) Continuation Applications

No Continuation Bursaries were awarded during the reporting period.

(b) New Applications

- *“Establishing effective communication between the agricultural researcher. And the crop producer with special reference to the large-scale sugar cane, soybean and maize industry in two regions of South Africa.”*
(PhD - Mr PW Bruwer, University of the Free State)
- *“Quantification of sunflower head rot and preservation of at-risk sunflower through premature desiccation.”*
(MSc - Dissertation - Mr KS Sabela, University of KwaZulu Natal)
- *“Manipulating flowering time with plant growth regulators as a possible escape strategy from Sclerotinia head rot in Sunflower.”*
(PhD - Ms NSS Shinga, University of Pretoria)
- *“Evaluating the resistance [profile, distribution and diversity of herbicide resistant Palmer amaranth (Amaranthus palmeri) populations in South Africa.”*
(PhD - Ms NA Simelane, University of Pretoria)
- *“The effectiveness of various levels of nitrogen (N) application on the growth, yield, and quality of soybeans (Glycine max. L) in different agro-ecologies.”*
(MSc - Dissertation - Mr B Nkutha, University of the Free State)



During the reporting period, the following important matters were addressed by the Trust:

- Development of a Transformation Program for the Oilseeds Advisory Committee and Oil and Protein Seeds Development Trust;
- Challenges experienced at GFADA;
- Financial support to SAGL in respect of the replacement of capital equipment.

1.4 FINANCIAL OVERVIEW

1.4.1 INVESTMENT AND MANAGEMENT OF TRUST FUNDS

Three (3) portfolio managers, Allan Gray, Foord and Old Mutual Wealth manage the OPDT trust funds. The invested funds include trust funds invested in a balanced portfolio (Allan Gray) following a more conservative approach than that of Foord and Old Mutual Wealth.

The performance of the respective portfolio managers is monitored and reviewed constantly. Presentations by each Fund Manager are made to the Board of Trustees at least annually.

1.4.2 AUDIT

Ashton Chartered Accountants are currently charged with the auditing of the OPDT's financial affairs.

As in the past, the auditors issued an unqualified audit report. The report noted the efficient operations and management of the affairs of the OPDT by all concerned.



2. OILSEEDS ADVISORY COMMITTEE

2.1 INTRODUCTION

Over the past year, the members of the Oilseeds Advisory Committee (OAC) once again succeeded in their efforts to achieve the objectives set out in the OAC Constitution.

The main objectives of the Committee are:

- a) rendering advice to the trustees of the Oil and Protein Seeds Development Trust in respect of the application of its funds for the benefit of the oilseeds industry;
- b) making recommendations to all interested parties in the oilseeds industry;
- c) appointing trustees to the Oil and Protein Seeds Development Trust and any other institutions that the committee deems necessary to investigate, promote and report on matters relating to the oilseeds industry, referred to the Committee.

2.2 MEMBERS

Dr E Briedenhann (Chairperson)	- Representative of the manufacturers of balanced animal feeds
Mr JP Botma (Vice-Chairperson)	- Representative of the South African Sunflower Forum
Mr M Jacobsz	- Representative of the business sector dealing with oilseeds
Mr J Mathebula	- Representative of the developing oilseeds producers
Mr P Lovelace	- Representative of the oilseeds processors industry
Mr P Burger	- Representative of labour involved in the oilseeds industry



Ms SE Rudman	- Representative of the consumers union
Mr R Küsel	- Representative of commercial producers of sunflower
Mr R Pretorius	- Representative of commercial producers of oil seeds
Ms A Botha	- Representative of the South African Groundnut Forum

In terms of the provisions of the Constitution, the OAC must elect a Chairman and Vice-Chairman annually before 31 December from their ranks.

During the October 2023 meeting, Dr E Briedenhann and Mr JP Botha were elected Chairman and Vice-Chairman of the OAC, respectively for 2023.

2.3 GENERAL OVERVIEW

During the reporting period, 1 March 2023 to 29 February 2024, the OAC met regularly to discuss and decide about matters that are to the benefit of the oilseeds industry and specifically sunflower, soybean, groundnut and canola.

The OAC is tasked with inviting research proposals, considering, approving and recommending research projects for funding and managing the research projects. This is a mammoth task and the OAC appointed a Research Priority Committee, comprising of Dr E Briedenhann, Mr JP Botma, Dr J Dreyer and Dr M Visser to assist the OAC.

The projects managed by the OAC related to aspects such as research, transformation, technology transfer, generic marketing of commodities, market access and information.

The projects are categorised into new projects, continuation projects, joint projects, transformation projects and provisions.



3. RESEARCH PROJECTS

3.1 NEW RESEARCH PROJECTS

3.1.1 MONITORING & EVALUATION OF HERBICIDE RESISTANT AMARANTHUS SPECIES IN OILSEED CROPS; Prof BJ Vorster, University of Pretoria

This project is an ongoing project that has previously been funded by individual industry players, but that has been broadened to accommodate any potential cases of herbicide resistance (HR) in weeds, but particularly in the *Amaranthus* (pigweed) group of weeds. Currently the bulk of the funding is received from the Maize trust and the OPSDT, but we also get some funding from industry to look at specific cases or problem areas. Herbicide resistance in Palmer amaranth (*Amaranthus palmeri*) and common pigweed (*Amaranthus hybridus*) have been identified in the past couple of years and we have continued to track the spread of these populations as well as identifying new cases. In the past growing season, there has been a number of potential new cases of common pigweed investigated. These cases were mostly related to glyphosate resistance but increasingly also towards ALS-inhibiting herbicides. Figure 1 shows the increase in cases investigated in 2023/4 compared to the previous season. Most cases are however concentrated in regions of FS, KZN and KZN with new cases also reported in GP.

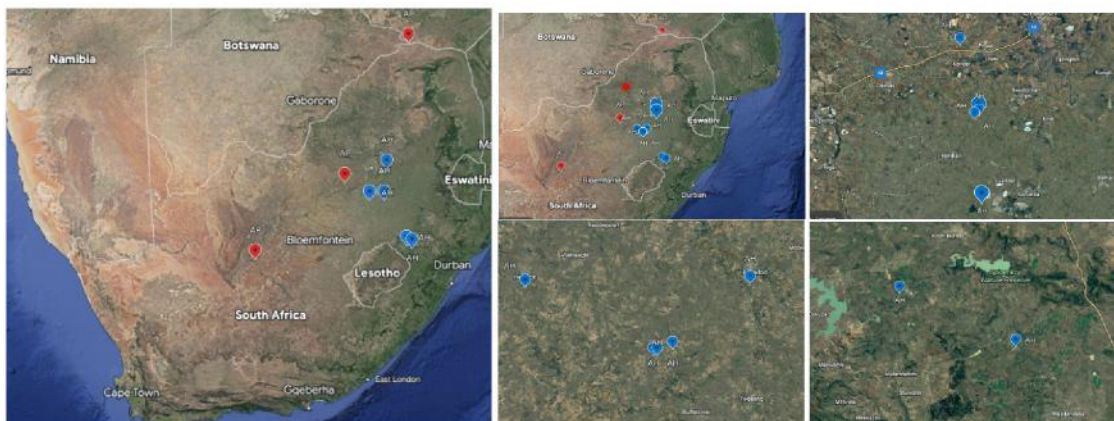




Figure 1. Sample sites of HR *Amaranthus palmeri* (Red) and *Amaranthus hybridus* (Blue) during the 2022/23 season (left) and during the 2023/24 season (right)

We have done a number of screenings, both on a DNA basis as well as through greenhouse screenings for herbicide resistance, but we have also focused much more on identifying alternative options with both pre-and post-emergence herbicide for the control of HR populations.

Confirmation of glyphosate resistance in two populations of *Amaranthus hybridus*

Based on the previous work reported that showed resistance to glyphosate in *Amaranthus hybridus* populations in Winterton and Bergville, the experiments were repeated and the results published in Weed Research as “**First report of target-site resistance to glyphosate in *Amaranthus hybridus* L. in the republic of South Africa**” by Shabangu NM, Simelane NA, Reinhardt CF, Marais D and Vorster BJ. *Weed Research* 2024; 64:29-301.

A second article confirming ALS resistance in these populations is currently in draft form, and we are waiting for the final analysis of data to verify whether the mechanism of resistance include metabolic breakdown of the herbicide AI's.

New cases of possible herbicide resistant *Amaranthus* populations investigated

(a) Leandra (MP)

Plant material from two fields from a farm in Leandra was received through SAHRI of possible glyphosate resistance. Then samples collected from a soybean field were used for DNA extraction. Its sequencing confirmed the samples to be *Amaranthus hybridus* and target site analysis of the EPSPS gene the presence of a triple mutation in seven plants and a double mutation in three plants. Thus, all tested plants from this field were confirmed to be resistant to glyphosate. The



results of this were communicated to the field agent and to the farmer and preventative steps were set in place to control these plants and prevent the spread of the resistant population. This field will be monitored in the next season to assess the success of the management plan.

(B) Delmas/ Kinross district

Reports of poor control of *Amaranthus* were received at the beginning of the 2023/24 season in the Delmas/ Kinross district on several fields. The fields were visited one month after planting in November 2023.

A combination of amicarbazone and mesotrione was applied at planting (HRAC group 5 and 27). It was obvious that all other weeds were controlled and that only *Amaranthus* was dominant in the fields. (Figure 2).



Figure 2. *Amaranthus* plants in a maize/ soybean rotation field 30 days after planting

Seedlings and soil samples were collected from three maize and one soybean field (Figure 3). Seedlings were transplanted in the greenhouse and a post-emergence application of the same formulation containing amicarbazone and mesotrione was done as per the label instructions. Soil samples were also taken, and a seedbank analysis is being conducted on these. Results so far show that the majority of seedlings germinating from the soil samples were *Amaranthus*.



Figure 3. Seedlings collected from the field (left) and seedlings germinated from collected soil samples in the growth chamber (right)

Post-emergence application of amicarbazone and mesotrione (280 and 288 g/kg applied at 200g/ha) on the seedlings collected from the different fields showed slightly different results with plants from one field surviving up to four times the recommended dose, while plants from another field sowed stunting at the recommended dose and damage at four times the dose (Figure 4 b) but plants from all fields did not die at the recommended dose.



SAHRI South African Herbicide Resistance Initiative





Figure 4. Plants treated post-emergence with amicarbazone and mesotrione collected from fields in the Delmas/ Kinross region.

This is the first case of resistance to a combination of amicarbazone (HRAC group 5 (C1/C2) Photosystem II inhibitors and mesotrione (HRAC group 27 (F2) HPPD inhibitors) that have been identified in South Africa and needs further investigation and confirmation with a repeat trial. Plants in these fields were controlled with a follow-up post-emergence application of a different combination of AIs, but the fields will be monitored in the coming season. Plants collected from the field were also treated with chlorimuron-ethyl (ALS-inhibitor) and all seedlings were killed. DNA from plants collected from the four fields were isolated and the EPSPS and ALS genes were sequenced to check for possible resistance, but no mutations were detected that would result either glyphosate or ALS resistance in this population.

Screenings of alternative herbicides on *Amaranthus hybridus* populations.

Various alternative herbicides with different modes of action (MOA) were screened on *Amaranthus hybridus* populations from various locations to test their effectiveness in controlling these populations Pre- and Post-emergence applications. Table one gives a summary of the results with green showing complete control, orange indicating some plants surviving (emerging



resistance) and red no control or resistance. The herbicides were applied at half the recommended rate (0.5X) the label recommended rate (1X) as well as double (2X) and four times the recommended rate (4X) as well as a control (0X). The results confirmed previously identified cases of glyphosate and ALS resistance, but also identified cases of emerging resistance to mesotrione, atrazine and the amicarbazone/mesotrione combination reported above.

Table 1: Screening of alternative herbicides for the control of *Amaranthus hybridus* populations.

Pre-emergence								
Active ingredient	MOA	1X Dose	Pop.	0X	0.5X	1X	2X	4X
Mesotrione	HPPD	99.84g a.i./ha	Hendrina	x	±	1	1	1
			Bergville	x	±	1	1	1
			Winterton	x	±	1	1	1
Acetochlor	VLCFA	1092g a.i./ha	Hendrina	x	1	1	1	1
			Bergville	x	1	1	1	1
			Winterton	x	1	1	1	1
Atrazine	PSII	1576.25g a.i./ha	Hendrina	x	±	1	1	1
			Bergville	x	1	1	1	1
			Winterton	x	±	1	1	1
Imazethapyr	ALS	30g a.i./ha	Hendrina	x	1	1	1	1
			Bergville	x	±	±	±	±
			Winterton	x	±	1	1	1
Post-emergence								
Active ingredient	MOA	1X Dose	Population	0X	0.5X	1X	2X	4X
Glyphosate	EPSPS	1080g a.e./ha	Hendrina	x	1	1	1	1
			Bergville	x	x	x	x	x
			Winterton	x	±	±	±	±
Mesotrione	HPPD	120g a.i./ha	Hendrina	x	x	x	x	x
			Bergville	x	1	1	1	1
			Winterton	x	1	1	1	1
Atrazine	PSII	970g a.i./ha	Hendrina	x	±	1	1	1
			Bergville	x	x	±	1	1
			Winterton	x	±	±	±	1
Tembotrione + Atrazine	HPPD + PSII	75.6 + 485g a.i./ha	Bergville	x	1	1	1	1
			Winterton	x	1	1	1	1
Chlorimuron-ethyl	ALS	10.5g a.i./ha	Carolina	x	1	1	1	1
			Hendrina	x	±	±	±	±
			Bergville	x	x	x	x	x
			Winterton	x	x	x	x	x
			Delmas F1	x	±	1	±	1
			Delmas F2	x	±	±	±	±
Fomesafan	PPO	250g a.i./ha	Hendrina	x	1	1	1	1
			Bergville	x	1	1	1	1
Imazethapyr	ALS	30g a.i./ha	Hendrina	x	±	1	1	1
			Bergville	x	x	x	x	x
Amicarbazone + Mesotrione	PSII and HPPD	70g a.i./ha +	Delmas F1	x	x	x	x	x
72g a.i./ha		Delmas F2	x	x	x	±	±	
Key	Untreated Control		x					
	Susceptible plants		1					
	Variation (Resistant and susceptible)		±					
	Resistant plants		x					

Workplan 2024/2025



During the coming season, greenhouse studies from seeds collected during the 2023/24 season will be done to establish resistance profiles. This will include the population identified in Delmas/ Kinross reported above. Field surveys of previously identified populations will be conducted to monitor the spread and identify new populations. We are actively working with industry partners, agricultural advisers, GrainSA, Croplife and HRAC to spread awareness, report new suspected cases of resistance and monitor existing populations.

The work will include:

1. Characterization of herbicide resistance profiles from identified populations of *Amaranthus* reported to show difficulty to control with glyphosate and other herbicides.
2. Evaluation of the herbicide resistance mechanisms in order to inform management strategies.
3. Monitoring of resistant populations, spread, fitness and population structure.
4. Development of herbicide resistance management plans for specific crops such as soybean, sunflower and groundnut.
5. Public awareness and information sessions.

We will also continue to do DNA analysis for glyphosate and ALS resistance on samples received from farmers or industry partners and is also working on alternative screening protocols for faster in-season resistance identification. Currently two PhD, two MSc and one BSc (Hons) students are working on the project. The BSc Hons student is expected to join the program as a MSc student next year and another MSc student has been identified to join the program in 2025. This provides critical capacity training in the Weed Science sector of South Africa.



3.1.2 INVESTIGATING THE IMPACT OF ENVIRONMENTAL FACTORS AND INOCULUM LOAD OF SCLEROTINIA STEM ROT OF CANOLA ON THE EFFICACY OF FUNGICIDE APPLICATIONS; Dr D Mostert, Dr LA Rothman, Dr GJ van Coller; A van der Merwe, L Nowers; Stellenbosch University

Canola (*Brassica napus* L.) is listed as the second most important oilseed crop (Raymer, 2002; Gacek *et al.*, 2018). In South Africa, the industry has grown vastly; 198 100 tonnes of canola were produced during the 2021 season compared to the 20 000 tonnes yielded in 2000 (Galal, 2021; Seetseng *et al.*, 2022). The Western Cape, which contains regions with the most suitable conditions for the crop (Lombard *et al.*, 2012; Kunz *et al.*, 2015), accounts for ~98% of canola produced in South Africa (DAFF, 2012). Sclerotinia stem rot (SSR) is considered a near-ubiquitous plant disease; the causal ascomycete *Sclerotinia sclerotiorum* affects more than 400 host plants around the globe, including commercial crops such as many *Brassica* species (Willettts and Wong, 1980; Bolton *et al.*, 2006). In the Southern Cape region of South Africa, canola production suffered yield losses equivalent to R 3,058 per hectare due to SSR in 2021. The sporadic nature of the causal pathogen and its tough survival structures that remains in soil and plant debris for years causes challenges in the management of SSR (Agrios, 2005; Rothmann, 2018). Chemical control remains the most effective method of SSR management, however, producers often over-apply or under-apply fungicides. The incorporation of a disease risk prediction tool for SSR has great potential to improve fungicide application timing.

The aim of this study is thus to develop the first disease risk prediction model for SSR of canola in South Africa. Two spore trap prototypes were designed and manufactured and installed at 10 different field locations in the 2023 and 2024 growing seasons. A protocol was established to determine the level of petal infestation and methodology applied sample petals in the 2023 growing season. A qPCR assay for SSR of canola (Almquist and Wallenhammar, 2015) has been optimised for quantification of *S. sclerotiorum* inoculum in leaves, petals, and from spore traps. Access to historical environmental and disease incidence data collected by Ms Nowers have been granted to be used in the



development of the disease risk prediction model. Field trials have been established at two field sites in the Overberg region to determine the efficacy of commercially registered fungicides.

3.1.3 AN INTEGRATED APPROACH TO CONTROL *S. SCLEROTIUM* ON SUNFLOWER; Dr B Janse van Rensburg, D Nkoko, I Mokowe, M Mothlatlhego, S Manzini, L Morey, P Dikhoba; ARC-Grain Crop Institute

Sclerotinia diseases are of serious concern to sunflower producers because the fungus can infect the plant through either the root, mid-stalk or the head. Due to multiple infection routes of the fungus and the difficulty of achieving satisfactory fungicide coverage to the target tissues, it is difficult to control Sclerotinia diseases in sunflowers with fungicides alone. Crop rotations with non-hosts can be used, but because sclerotia can survive in the soil for up to seven years, lengthy rotations are needed. Although there are potential biological control **organisms' available (mycoparasite), these operate in a cyclical pattern together with *S. sclerotiorum***. As the pathogen increases, this increase will be followed closely by an increase of the mycoparasite and similarly also with a decrease. *S. sclerotiorum* produces oxalic acid in high concentrations, creating an acidic environment in which it grows and causes disease by resulting in host tissue death. Increasing calcium levels in tissues can greatly decrease the pathogen's ability to invade the plant. The aim of this study is to incorporate the abovementioned strategies (fungicides, crop rotation, mycoparasites, calcium applications, resistance) in combinations to evaluate the most effective control option/s that farmers can practically apply in their fields.

In the fungicide spray trials, naturally infected plants had a significant ($P=0.01$, Table 4) lower percentage of infection with *S. sclerotiorum* when compared to plants that were inoculated x not sprayed and inoculated x sprayed with a fungicide. Fungicide spray as main factor did not have a significant effect on *S. sclerotiorum* infections, but a fungicide x cultivar interaction did show a highly significant effect ($P<0.0001$, Table 5). The highest mean *S. sclerotium* infection occurred in cultivars PAN 7160 CL with a Pydiflumetofen application (23.33%a), PAN 7160 CL with a Pydiflumetofen + Triazole and Strobilurin (2) application (22.33%a) as well as PAN 7160 CL with a Pydiflumetofen +



Dithiocarbamate and Dicarboximide application (21.67%a). The lowest mean *S. sclerotium* infection occurred in cultivars AGSUN5160 CLP with a Pydiflumetofen spray (9.33%d), AGSUN5160 CLP with a Pydiflumetofen + Triazole and Strobilurin (2) spray (8.44%d) as well as PAN 7160 CL with a Pydiflumetofen + Triazole and Strobilurin and Imidazole spray (6.88%d).

Results from the biocontrol and calcium trials are inconclusive due to low *S. sclerotiorum* infections that is mainly dependent on weather conditions.

3.1.4 EFFECT OF PLANTING DATES AND PLANT POPULATION OF DIFFERENT GROUNDNUT CULTIVARS AT DIFFERENT PRODUCTION REGIONS UNDER DIFFERENT CULTIVATION CONDITIONS (DRYLAND AND IRRIGATION); Dr ZA Bello; W Snijman; ARC Grain Crops Institute, Potchefstroom

The optimum plant population for any given situation results in mature plants that are sufficiently crowded to efficiently use resources such as water, nutrients, and sunlight. Planting date also plays important role in the growth, development and yield of crops. Adaptation and sustainability measures against the potential negative impact of extreme weather condition on crop production are regarded as being climate smart. Climate Smart Agriculture entails all the agronomic and management practices that can bring sustainability, adaptation and mitigation against climate change and climate variability. The combination of these two agronomic practices (optimum planting dates and plant population) with other management practices should be able to produce high groundnut yield that is financially and environmentally friendly irrespective of the location and the farm size. Therefore, the objective of this study was to evaluate the combination of different planting dates and plant population for optimum production of groundnut in selected producing areas of South Africa.

In 2023/2024 season, seven field trials were conducted under irrigation and rainfed conditions in four provinces of South Africa. The sites are situated in Free State (FS), Northern Cape (NC), North West (NW) and Limpopo (L) Provinces. These provinces are major groundnut producing areas. The actual sites under rainfed conditions are Hoopstad (FS), Bothaville (FS), Vaalharts (NC),



Groblersdal(L)and Setlagole (NW) while sites under irrigation were Hartswater (NC) and Vaalwater (L). The groundnut cultivars planted for the trials were Tufa, Schubert, ARC K6, Kwarts, and Sellie plus under irrigation and ARC474, Sellie plus, ARC K6 and Anel under rainfed were planted at three different planting dates. The first planting dates ranged between 09 November to 28 November 2023, second planting dates ranged between 05 December and 20 December 2023 while the third planting dates ranged between 03 January and 18 January 2024. The plant population for rainfed trials were 80 000, 100 000 and 120 000 plants ha⁻¹. The plant population for irrigation trials were higher, 250 000, 300 000 and 350 000 plants ha⁻¹. The trial design for all the site was randomize complete block design (RCBD) at three replications. Prior to planting, soil samples were collected at all the sites and sent for analysis to determine the nutrient status of each site. Thereafter, fields were ploughed, harrowed and rotovated before planting. The pre-emergence herbicide applied was Strongarm + Alachlor and post emergence was Basagran. The crops were monitored for any pest and diseases incidence at the regular basis.

The harvesting has been carried out in all the sites which started in April for all the first planting date plots, May for second planting dates plots and June for all the third planting dates plots. The two middle rows for each plot were considered for yield processing. The parameters monitored are weather data, yield and yield components. The yield components are total mass, mass per 100 seeds and gradings per treatments. The processing of the harvest and data is ongoing and will be put through statistical analysis before arriving at the conclusion for this season trials.

3.1.5 THE INFLUENCE OF PLANTING DENSITY, TIMING OF APPLICATION AND SPRAY VOLUME ON DEPOSITION PARAMETERS OF FUNGICIDES ON CANOLA IN THE WESTERN CAPE; Dr GJ van Coller, Ms L Nowers, Mr PJ Lombard, Dr J Strauss; Department of Agriculture Western Cape

This project commenced in 2023, with the aim of determining the influence of practices like different spray volumes, forward tractor speed, planting density, timing of application and method of application (tractor-mounted spray boom, UAV, airplane) on deposition achieved by fungicides aimed at managing



blackleg and Sclerotinia stem rot. Since little is known about the effect of these practices on deposition achieved on canola, the first year of this study laid the groundwork for the following years. Subsequently, a field trial was established at Tygerhoek research farm at Riviersonderend (Overstrand) with one medium season canola cultivar. The project is being conducted using the methodology described in the project application, with the amendments described in the application for continuation. During year one the effect of three different spray volumes applied with a tractor-mounted boom sprayer on deposition achieved at the ~5-leaf and 30% flowering stages was determined. The fungicide Prosaro was added to all treatments at the ~5-leaf stage to determine their effect on blackleg disease parameters.

The first fungicide application was made on 2023/07/03 at the 5-leaf stage for managing blackleg disease. The second application was made on 2023/09/08 at the 30% flowering stage. Three spray volumes were evaluated at each application, namely 100L ha⁻¹, 150 L ha⁻¹, and 200 L ha⁻¹ at the ~5-leaf stage, and 100L ha⁻¹, 200 L ha⁻¹, and 300 L ha⁻¹ at the 30% flowering stage, all at a constant forward tractor speed of 6 km h⁻¹. The spray liquid consisted of Prosaro ® fungicide (which is registered against blackleg disease), at the recommended rate and dosage, as well as fluorescent pigment [40% EC (SARDI, Loxton, South Australia); 3 ml L⁻¹] to visualize the deposition on leaves. Sampling, storage, transportation and fluorescent photography analyses were done using the methods described in the project application. Fungicide deposition was determined using the methodology described in the project application and includes deposition quantity, deposition quality, and deposition uniformity.

Spray deposition parameters indicated that canola plants in the four to six leaf growth stage are spray friendly on upper canopy leaves. All spray volumes realised acceptable spray deposition parameters when compared to results observed on other grain and vegetable crops sprayed with a horizontal boom sprayer. It is important to note that no biological efficacy benchmarks for spray deposition is available on canola plants for any of the targeted plant diseases such as blackleg (*L. maculans*). However, this study indicates that there is a



spray deposition advantage to using spray volumes lower than 200 L/ha down to 100 L/ha. The 100 L/ha treatment realised the best spray deposition parameters throughout the different parameters. Higher spray deposition quantity often correlates to better disease control as illustrated by van Zyl *et al.* 2013 and Rebel *et al.* 2019. It is advisable to evaluate spray volumes lower than 100 L/ha in future studies, as lower water volumes per hectare can aid canola producers to be more efficient and possibly increase deposition parameters further.

Although crown canker incidence was high overall treatments, this did not translate to a high crown canker severity. A rating technique for stem cankers has not yet been developed sufficiently and is proposed in the new project application submitted to the OPDT earlier in 2024. These results provide further evidence of the rising importance of stem cankers reported throughout the Western Cape. The fact that the fungicide vs no fungicide treatment had no effect of stem canker incidence also shows that application at the ~5-leaf stage may be insufficient in managing stem cankers. The effect of fungicide application at the 30% flowering stage on stem cankers will be investigated in this project during 2024/25 and 2025/26. It was worrisome that applying Prosaro at the ~5-leaf stage had no effect on crown canker incidence or severity. This may be due to early infection (prior to the 5-leaf stage), which would have provided time for the pathogen to establish. The fact that fungicide application at the ~5-leaf stage did not affect crown canker incidence or severity, or stem canker incidence, highlights the need to correlate atmospheric spore concentrations with disease onset and progression, which is proposed in the project submitted by Dr Diane Mostert from Stellenbosch University earlier in 2024.

Deposition quantity values realised at 30% flowering were lower than for the 4 - 6 leaf stage in trial one. This was expected as the fluorescent pigment dose rate per hectare was the same for both trials, however, in this trial, the canopies of the plants are now a three-dimensional, larger structure making it a more complex target to spray. The complexity comes from physical barriers such as branches growing towards light, leaves and flowers that would



inevitably act as filters intercepting incoming droplets. Despite the lower deposition quantity values observed the trend of higher deposition with a lower spray volume was the same as for the 5-leaf application, for the same reason of higher concentration of product per droplet intercepted. It is reasonable to hypothesize that there might be a benefit to going lower than 100 L/ha spray volume per hectare but that there will inevitably be a point of diminishing returns. Another trend that was observed in this study was the decrease in spray parameters on the middle and lower canopy positions. This trend was observed in all three deposition parameters. Spray volume per hectare increase has been ruled out as a possible solution for this problem with this study. A possible option that could be considered is the use of an air assisted spray machine together with the use of fine to very fine spray droplets. Reducing the size of droplets increases the area that could be covered by the volume on an exponential scale. However, smaller droplets do not have much momentum, making them prone to spray drift. For this reason, the use of air assistance to deliver droplets into these canopies could possibly increase the chances of leaves and leaf axils intercepting more droplets on the inside of canola canopies. The goal of these spray applications is to protect leaf and stem areas with fungicide where flower petals will fall and serve as a source of nutrition for SSR spores. An accompanying study that could be useful would be to establish the risk of lower deposition in lower canopy positions by quantifying the distribution of petals on top, middle and bottom canopy leaf axils.

3.1.6 EVALUATION OF ADVANCED OILSEED AND PROTEIN CROPS FOR THE WINTER RAINFALL REGION OF THE WESTERN CAPE; Mr PJA Lombard, Ms L Smorenburg and Dr JA Strauss, Department of Agriculture; Western Cape

During 2023, two Elite Canola trials were conducted at Langgewens in the Swartland and Tygerhoek in the Southern Cape. Both trials have been completed, and the results are as follows. In the 2023 Elite cultivar evaluation program, 17 hybrid cultivars were tested: one conventional, six CI (Clearfield, Imasamox-tolerant), five from the TT group (Triazine-tolerant), and two combination-type cultivars. The control cultivars were CC90014, Alpha TT,



and 43Y92. Four of the lines from the 2023 Elite trial have been included in the 2024 cultivar evaluation program. The average yield at Langgewens was 3176 kg ha⁻¹ and at Tygerhoek 2795 kg ha⁻¹. The 2023 season was extremely wet at times, not favourable for seed production. The cool and wet September resulted in a longer-than-normal growing season. Four new cultivars are included in the 2024 cultivar trials and will be commercially available from 2024 to 2025.

3.1.7 QUANTIFICATION OF SUNFLOWER HEAD ROT AND PRESERVATION OF AT-RISK SUNFLOWER THROUGH PREMATURE DISICCATION; Dr LA Rothmann; Mr K Sabela, Prof G Ceronio, M Monteiro; Ms C Korf, Mr C Koromora, Mr E Phunyugu, University of the Free State

Project Outline

Extensive losses are caused by *Sclerotinia sclerotiorum* infections of sunflower heads, of which the extent is prevalent in all sunflower production regions. Limited management strategies exist, mostly these focus on agronomics practices to reduce disease establishment. There are no resistant cultivars available, and no fungicides registered for use on sunflower. A further challenge to research is that no standard practice exists to assess the severity, i.e., damage caused by sunflower head rot, to determine if practices are effective/efficient. This project has two components, the first is to create a disease measurement tool, i.e., standard area diagram, and the second is exploring desiccation as a management option.

Sunflower head rot standard area diagram

Assessing and quantifying sclerotinia head rot is crucial for understanding potential yield loss, establishing thresholds for disease control, and evaluating host resistance (Bock et al., 2020; 2021, Nutter et al., 1991). Disease incidence, the percentage of plants or organs in a population exhibiting disease symptoms, is a straightforward disease quantification approach (Bock et al., 2022; Madden and Hughes, 1995). Incidence is commonly used to assess sclerotinia head rot, e.g., the tolerance levels of sunflower hybrids planted at different planting dates to SHR was evaluated by assessing their incidence (Páricsi et al., 2008; Meiring



et al., 2022; Mapfumo et al, 2024). However, disease incidence lacks the depth to understand the impact of SHR on production comprehensively. Severity measurements offer a comprehensive means to estimate the extent of yield and crop quality losses by measuring the percentage of symptoms (Shi et al., 2023; Bock et al., 2013). Severity is primarily measured through subjective visual estimation by raters without any visual aid. However, rater bias and a lack of experience can render estimates inaccurate and unreliable (Shi et al., 2023; Bock et al., 2015; Yadav et al., 2013, Bock et al., 2010a).

An improved method for achieving accurate, precise, and reliable measurements is using standard area diagrams (SADs) to aid visual disease assessments (Del Ponte et al., 2017; Michereff et al., 2009). SADs are pictorial representations depicting asymptomatic or symptomatic plant organs and their respective disease severity percentages (Nutter et al., 1993). The development of SADs involves capturing images of plant organs and analysing them with digital image analysis tools, e.g., Image J and Leaf Doctor, which separate colour thresholds and provide a percentage of the infected plant parts on respective pictures (Elliott et al., 2022; Fillipi et al., 2021; Araújo et al., 2019; Pethybridge and Nelson, 2015; Schneider et al., 2012).

Upon writing this report, 174 SADs on 69 hosts and 128 pathogens are deposited in the SADbank (<https://edelponte.shinyapps.io/sadbank/>). However, there is no SAD for sunflower head rot. Therefore, we designed and are validating a SAD for accurate and reliable measurements of sunflower head rot. The SADs will advance sunflower disease phytopathometry by elucidating the impact of SHR and improving control and management strategies.

Desiccation as a management option

Many producers reach out to Dr Rothmann, Dr Ceronio and Dr Janse van Rensburg regarding the current practice to pre-desiccate sunflower, in 2020-2021. Discussions on this topic have been entered into during producer information days, in both 2021 and 2022. Although there is an unknown



response of yield factors (weight and quality), in the presence of Sclerotinia head rot.

Although there have been increased enquiries regarding the use of pre-harvest desiccants from producers, peer reviewed literature on the topic is limited, particularly for oil- and protein seed crops. The application of a pre-harvest desiccant (in the form of herbicides) is used to protect harvests from bird predation, restrict disease development, such as head and stem rot, as well as assist in harvest efficiency. A study by North Dakota State University: Extension (2012), made use of glyphosate, paraquat as well as BAS 800 to determine which would be the most effective sunflower desiccator at various seed moisture levels, i.e., 20, 40 and 50%. The application timing of desiccants are critical, as the seed moisture levels are associated with crop maturity, yield and seed quality characteristics. A similar study in Argentina (Szemruch *et al.*, 2014), focusing on female seed production sunflower, were treated with paraquat at ~27 and 30% seed moisture and tested harvested seed for germination viability, dormancy and vigour. Their study determined, although there were sensitivity responses between the two tested genotypes, the germination and vigour were improved by desiccation, compared to the control and alternate treatment of removing heads from plants. The use of desiccants in Iranian Canola fields, applied at 40% seed moisture, was described by Esfahani *et al.* (2012). Low-level applications (0.4 L/ha) resulted in no to minimal yield and quality losses in canola harvested from paraquat treated plots. Although minimal residues were considered negligible, the authors suggest minimal residues to be determined.

Paraquat is a registered herbicide in South Africa, commonly used for annual and broadleaf weeds, and can also be utilised for fire breaks. Paraquat acts by killing all green tissue present, and thus has been used by producers as a desiccator for sunflower, where frost has not instigated desiccation or in some cases in the presence of sclerotinia head rot. Although, the use of paraquat is not registered for this purpose, a counterpart of paraquat, diquat is registered in South Africa. Three products are currently registered for sunflower desiccation, two through Villa (Disrupt 200 SL; Disturb 200 SL) and one product



through Syngenta (Reglone). The use of these products is considered harmful and should be handled with extreme care as they are fatal if consumed or breathed in. However, if safety wear, recommended dose rates, aerial applications and meteorological conditions are respected, understanding the impact of pre-harvest desiccation in sunflower affected by sclerotinia head rot could be determined. The limited management of Sclerotinia diseases particularly for sunflower producers as no fungicides are available for host crop protection requires out the box thinking. We propose to identify the most economically viable time, considering seed moisture levels, to desiccate sunflower infected with head rot is to preserve yield and quality.

Actions taken & Progress

The project has received ethical approval from the University of the Free State (UFS): Environmental and Bio-Safety Ethics Committee, [UFS-ESD2023/0036]. We are going to need to apply for General Human Ethics for the validation of the SAD, the application is underway.

We have successfully completed the field trials in Delmas. Data analyses have been initiated. We are awaiting samples for the laboratory analysis of protein content and oil quality, this was not originally budgeted for however there are funds remaining which I would like to use for this purpose.

The field trials in Kroonstad, have been removed (contact is not returning multiple attempts to phone, does not return phone calls or WhatsApp messages). Although, all three plantings were planted with seed purchased and delivered personally. However, I have not made a payment to Kroonstad and will not make a payment to them.

The Potchefstroom trial was mismanaged, please see below for details. This planting site is also not included, and funds have been requested to be refunded to the UFS (29 February 2024). I am still awaiting funds to be repaid, although, I did send a reminder (August 2024).

In March, the first set of images for the



Figure 1 Example of image analysis from sunflower head rot, caused by *Sclerotinia sclerotiorum*. A total of 9.27% diseased tissue is estimated by the image analysis.

SAD were taken (222 photos of symptomatic sunflowers). In April, the second set of images for the SAD were taken (100 photos of symptomatic and healthy sunflowers). Image analysis has been completed by Kwanele; an example of the image analysis has been provided below (Figure 1).

In May, we have initiated the SAD page, which we need to validate with experience and inexperienced raters. We consulted with Professor Paul Esker (an expert on disease assessment) and he confirmed that we can conduct the validation using an online approach with the assessment tools.

The economic analysis of the experiment will only start in November 2024.

Kwanele presented his research progress to the Plant Science Department on the 2nd of August.

Results & Anticipated outputs

The first project aim has a tangible outcome of a SAD, whereas the second aim of the project targets answering a question which producers will be able to implement in their production systems. Outcomes and methods of communications are listed in Table 1.

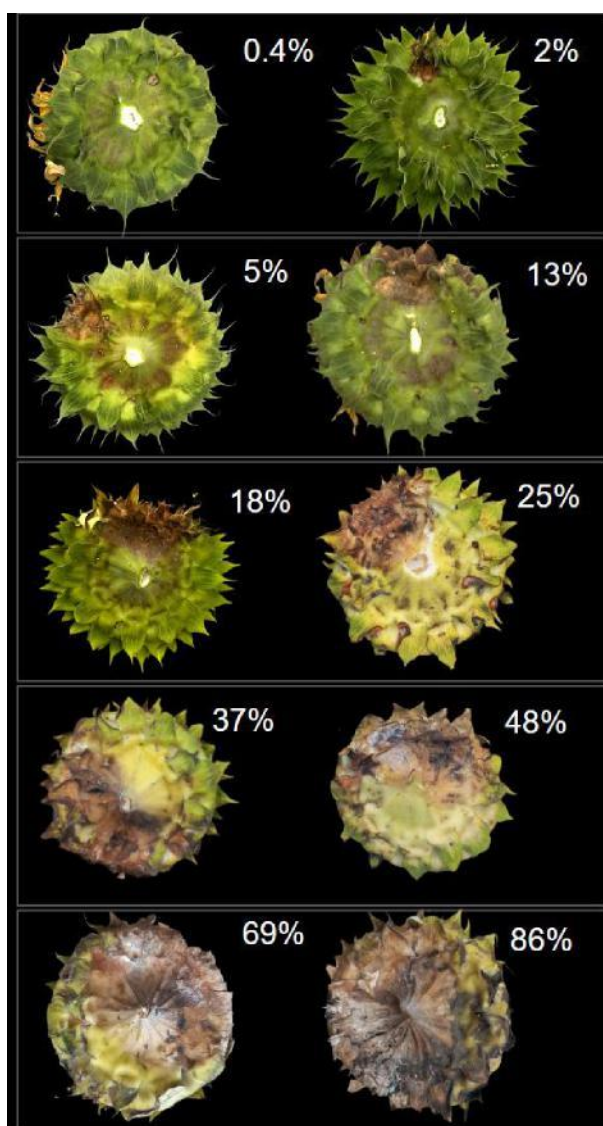


Figure 2 Preliminary standard area diagram for assessing the severity of sunflower head rot, caused by *Sclerotinia sclerotiorum*.

We have created the first SAD for assessing sunflower head rot, caused by *S. sclerotiorum* (Figure 2). The SAD accounts for the variation of symptoms observed in field, healthy (0% disease) to almost completely colonised (96%). The use of the SAD will allow for standardisation of head rot assessments for breeders, pathologists, and producers. We have consulted with Professor Emerson Del Ponte who is assisting us with developing an online validation tool for consulting with novices and experts on the SAD. Additionally, the SAD will be sketched in a black and white image to validate the accuracy for disease scoring in comparison to the true color version.

Provisional results from the desiccation field trials have indicated that the timing of herbicide applications to pre-maturely desiccate sunflower is critical to limit the infection of sclerotinia head rot. Treatments include, none = no desiccant; earliest = application of desiccant to sunflower; medium = application of desiccant to early maturing sunflower; latest = the final application of desiccant to sunflower near harvest. During all the planting dates where infection occurred and no desiccant was applied (none) the incidence was the highest (mean incidence = 82%, 77% and 72%). During the first and second planting date, 23 December and 30 December, the greatest reduction in incidence was where the application of



desiccant was at the earliest observation of symptoms (earliest). Although, the third planting date had contrasting results where the application of the desiccant yielded the lowest incidence. However, we need to also understand the interaction between host-pathogen under contrasting environments, created by the planting dates (Figure 3). The full results will be presented in Mr Sabela's dissertation on completion in July 2026.

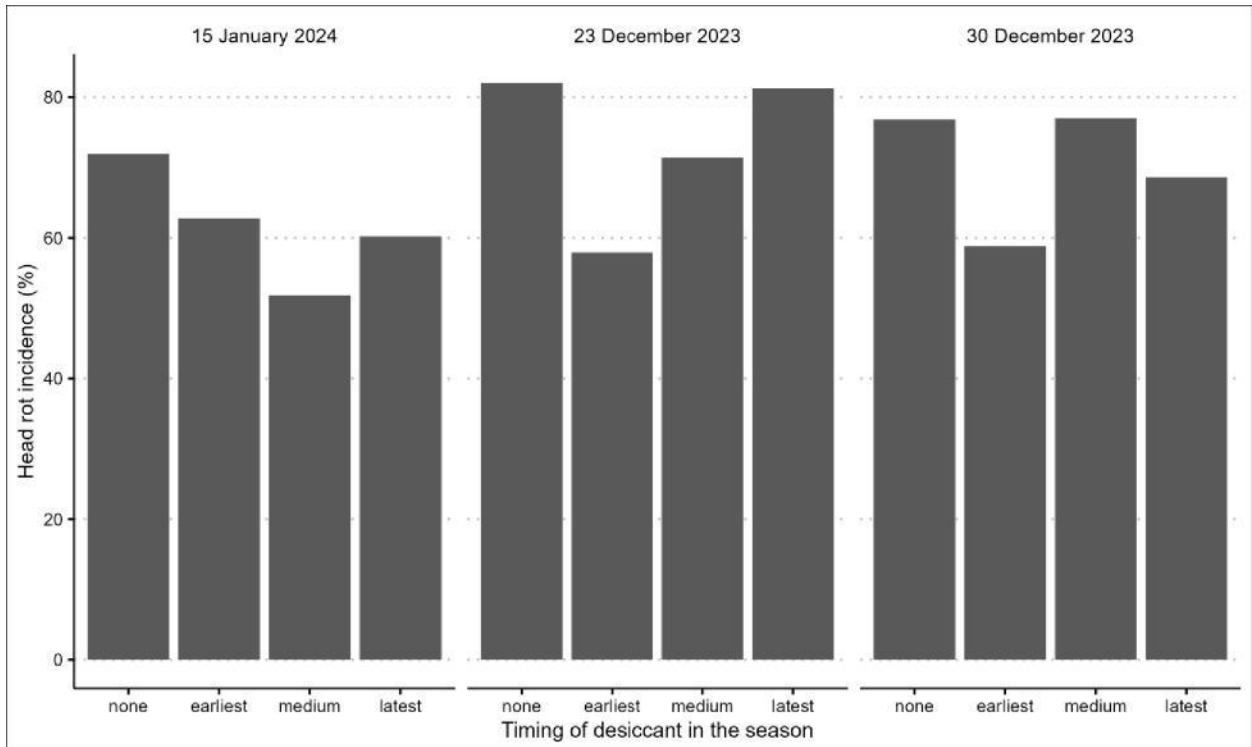


Figure 3 Preliminary results of desiccation on at-risk sunflower infected with *Sclerotinia sclerotiorum*.



Table 1. Aims, outcomes and communication of research findings.

Aim	Outcome	Communication	Actiontions taken
Create a disease measurement tool, i.e., standard area diagram,	1) A tool for producers, researchers, and industry members to better quantify sclerotinia head rot severity	Publish in a peer-reviewed journal.	Introduction, Methods and Materials have been written. SAD validation is underway.
		Popular articles in the Oilseed Focus Magazine.	An initial article was published in March 2023. We will only do a complete version once the SAD has been validated in 2025 to announce the use of the SAD to farmers and industry.
		Presenting a poster/oral presentation at the International Symposium on Plant Pathogenic <i>Sclerotiniaceae</i> in 2025 (Presented by Kwanele Sabela)	
Explore desiccation as a management option for at-risk sclerotinia	2) Understanding if desiccation is a viable disease management practice for producers and	Farmer information days— March 2024 and March 2025	Successful farmers day in Delmas (MP) and Ganyesa (NW) in 2024.
		Grain SA Research Road Show - 2024	This was not planned by Grain SA in 2024.
	3)The economic implications of this practice for producers.	Publish in a peer-reviewed journal.	Introduction, Methods and Materials have been written. Data analyses are underway.

Challenges & Milestone Management

Challenges

The trial has been terminated at Potchefstroom due to a lack of communication and mismanagement from the ARC team, this has been reported internally to the Director Dr Jeanette du Toit at the ARC-Grain Crops (Addendum 1). We attempted to find an alternative solution for a third locality however there was not sufficient time in our season.



Milestone management

- The postgraduate researcher provided a progress report in the Department of Plant Sciences. This is attached to the progress report.
- We have started planning for the second season of field trials. The Delmas site has been approved for a second season with our collaborator Dr van Staden.
- We aim to have the SAD component ready for a draft publication before March 2025.

Conclusion

As Kwanele is the key researcher on this project, I am going to provide an update on his progress in the conclusion. Kwanele has made significant progress in his MSc Agric research. He successfully completed all the field trials in Delmas, managing any shortcomings effectively and making the most of the opportunity. Demonstrating independence, he often worked alone in the field without needing supervision; once shown a task, he handled it on his own. Additionally, Kwanele has begun learning R and has taken ownership of this skill, using the standard area diagram as a foundation. He independently completed all the image analysis. Through the year, Kwanele has continued to develop as a confident and curious researcher. I look forward to seeing mature in his role as a sclerotinia researcher in the upcoming season.



3.2 CONTINUATION RESEARCH PROJECTS

3.2.1 WEB PAGE, Ms M du Preez and Ms Y Papadimitropoulos; OAC/OPDT

Period: 1 March 2023 to 29 February 2024

2023/2024 was a quiet year in terms of major updates to the programming languages and services that form the basis of the website framework. The focus, therefore, was mainly on updating existing pages and adding new content to the OPDT/OAC's website. On 29 February 2024 the OPDT/OAC's website hosted a total of 690 static HTML pages. These static pages exclude any dynamically created pages across the 15 content sections.

Google analytics 4

Google's Universal Analytics (UA) stopped processing data on 1 July 2023, because it was replaced with the next generation Google Analytics 4, or GA4 for short. Google Analytics is a platform that collects data from websites and apps to better understand the visitor's journey.

The switchover was relatively uneventful, because OPDT/OAC's new GA4 property has been running concurrently with the existing UA property since December 2022.

**Visitor statistics**

Reporting Year	Unique Visitors <i>Raw values*</i>	Unique Visitors <i>Google values</i>		
		<i>Visitors</i>	<i>Pages</i>	<i>Pages per visit</i>
2007	11	-	-	-
2008	74	-	-	-
2009	752	-	-	-
2010	2 964	-	-	-
2011	4 037	788	3 284	3.21
2012	4 052	720	3 775	4.25
2013	4 342	674	3 296	3.94
2014	4 503	1 086	4 600	3.62
2015	4 800	1 340	6 993	4.14
2016	4 329	927	5 042	3.83
2017	6 384	909	5 406	4.39
2018	5 428	1 841	8 885	3.59
2019	8 307	1 661	8 340	3.43
2020	14 982	4 805	12 475	2.03
2021	24 972	10 946	18 934	1.73
2022	30 324	7 338	17 511	1.85
2023	32 175	±8 029 **	±17 562 **	±2.19 **

[NOTE **: It is unclear if the new Google Analytics 4 system had an impact on the results.]

Google values show an increase in page views and an increase in active visitors. Visitors increased by approximately 691 and Page views increased by approximately 55 for the period: 1 March 2023 to 29 February 2024. The most page views came from the following pages in order of percentage share:

Figure based on User engagement > Page Title

1. Home page: Most amount of views
2. OAC OPDT Bursary Requirement
3. Bursary Application Form
4. Oilseeds Focus



3.2.2 OILSEEDS INFORMATION, Mr B Schultz, SAGIS Forums and Trusts

Forums

The grain and oilseeds industries established forums where role-players and market participants meet for matters of mutual interest, inter alia market information. With regards to information, the forums make recommendations to:

- The National Agricultural Marketing Council (NAMC) for the information needs of the industry and the institution (SAGIS) to provide the service.
- The Trust of each industry concerning the funding of the institution and additional services.

Trusts

- SAGIS has four Members namely The Maize Trust, Oil and Protein Seeds Development Trust, South African Winter Cereal Industry Trust, and The Sorghum Trust.
- The future existence of SAGIS totally depends on the existence and funding by the Trusts.

Main function: Whole grain and oilseeds for the 2023/24 financial year

During the 2023/24 financial year, SAGIS was funded by the four Members according to the approved basis of calculation for subscription.

The Maize Trust	67%
Oil and Protein Seeds Development Trust	15.70%
SAWCIT	12.70%
The Sorghum Trust	4.60%

Other data and information provided by SAGIS and paid for by Members

Weekly information 2023/24 financial year

The Maize Trust	62.53%
Oil and Protein Seeds Development Trust	16.23%
SAWCIT	21.24%



Production information 2023/2024 financial year

SAWCIT	75.91%
The Maize Trust	16.25%
Oil and Protein Seeds Development Trust	7.84%

Co-operation of co-workers

According to the SAGIS Statutory Measures, co-workers are compelled to submit their returns before or on the 10th of each month.

For the reporting period 99.9% (2023: 99.5%) of the total potential returns were received, of which 74.2% were received by the 10th.

Finances: 2023/24 financial year

External Audit

The Ashton CA (SA) Group Inc. conducted an audit at SAGIS for the 2023/24 financial year where SAGIS received an unqualified audit report. Although “The Ashton CA (SA) Group Inc.” have been appointed as auditors since March 2006, different auditors carried out the audits annually to ensure good corporate governance.

Subscription (Contribution from Trusts)

A net amount of R17 633 790 was approved by the Members (the four Trusts), for utilisation during the 2023/24 financial year and the final expenditure amounts to R17 633 790. This includes an amount of R1 014 629 for the replenishment of the Capital Reserve Fund. Funds available in the Capital Reserve Fund are earmarked for the replacement / upgrade of capital items such as electronic equipment, which should prevent or lower spikes in the request for money from the Trusts when these expenses incurred.

Appreciation

SAGIS appreciates the support and co-operation of all the role-players.



We wish to express our gratitude towards the four Members, namely, The Maize Trust, Oil and Protein Seeds Development Trust, South African Winter Cereal Industry and The Sorghum Trust for their continued support, financially and otherwise.

3.2.3 OILSEEDS SOUTH AFRICAN SOYBEAN CROP QUALITY SURVEY; Ms W Louw, SAGL

Goal

The goal of this project is to accumulate quality data on the commercial soybean crop on a national level. The specific analyses done are of generic importance to the South African oilseed industry and will on request be adapted according to the industry's requirements. The data will be processed statistically to give an average, minimum and maximum per soya production region.

This valuable data reveals general tendencies, highlights any quality differences in the commercial soya produced in different production regions for local market requirements and provides important information on the quality of commercial soya intended for export. The information will be available on the Southern African Grain Laboratory's (SAGL) website and the Oilseed Industry will determine the distribution list of the Directly Affected Groups and interested parties nationwide for the distribution of the report.

The long-term goal of the project is the annual determination of the quality of the commercial soya crop. A detailed database containing information collected over several seasons and different regions is essential.

Duration of Project

Sampling to ensure representative samples of the country's entire commercial soybean crop will start with the first deliveries during April/May 2025. The analyses of the samples will commence as soon as the funding of this project has been approved and samples are received by the SAGL. ***Results will be updated weekly on the SAGL website after the commencement of the***



analyses.

Number of samples

Based on an average crop size, the proposal is to analyse **200** samples annually to provide **representative data** of the commercial crop. The predicted crop for the 2023/2024 season is 1 778 790 tons (National Crop Estimates Committee (NCEC), 5th forecast, 27 June 2024).

Each registered silo represents a sampling point. A representative sample per class and grade per silo bin/bag/bunker will be taken by each of the commercial grain storage companies handling soybeans. There are two classes of soybeans, namely Class SB and Class Other soybeans. Provision is made for 200 samples. The Grain Silo Industry (Agbiz Grain) has offered to take and provide the samples to the SAGL. This sampling is done free of charge which has a huge cost saving effect on the survey.

Based on the agreements between the silo owners and their customers delivering the soybeans at the silos the quality information can only be made available on a regional basis.

Sampling procedure

On intake of the soybean crop at the silos, **a representative sample for grading is taken in accordance with the Grading Regulations for soybeans**, as published in the Government Gazette No. 40794 dated 21 April 2017, Government Notice No. R. 370. After grading, the grading samples are placed in a container representing each bin concerned. At the end of each week, the content of each container is divided in order to obtain a 3 kg sample. This is done for each bin and respective class and grade separately.

These samples are submitted for analyses to the SAGL by the different commercial grain handlers. The SAGL can be contacted to arrange for the samples to be collected by a courier company. Each sample bag is labelled with the name of the silo, bin, and the soya grade. Sampling is to be carried



out over the entire production area. All the soya production areas will be covered and **will be represented proportionally by the data.**

Types of analyses and methodologies applied

The following physical and chemical analyses will be done on **200 locally produced soybean samples:**

RSA Grading: Government Gazette 40794, 21 April 2017, Government Notice No. R. 370

Protein, % (d.b.) (AACC Method 46-30.01, latest edition)

Fat, % (d.b.) (Soxhlet, In-House Method 024)

Moisture, % (17 Hour; 103° C – ISTA, Section 9, latest edition)

Ash, % (In-House Method 011)

Crude fibre, % (Acid-base digestion; In-House Method 031)

Test weight, kg/hl (Kern 222; chondrometer)

NIR, including Protein, Fat, Moisture, Ash and Crude Fibre, %

Format of reporting on web site and hard copy

Individual results are e-mailed to the respective grain handlers on a weekly basis once the results become available.



SAGL website

Average results per region are available on the SAGL website as soon as the first results become available. The mean values of all samples per class and grade from each region are calculated in respect of every quality parameter analyses. These averages are available on the SAGL website per region and per quality parameter grouped into sub-groups such as RSA grading and Nutritional values.

Written report

The abovementioned averages will be tabled in the written report.

Distribution of data

Weekly updates of the data on the SAGL web site will be done on commencement of the analyses. The report, which can be downloaded from the SAGL website, will become available after all the samples have been analysed and the data processed. The written report will be distributed to all the Directly Affected Groups and interested parties. ***Reports will be submitted to the Trustees of the Oil and Protein Seeds Development Trust on completion.***

Value addition

In addition to this data being available for use by different role players in the soya industry, directly or indirectly affecting them, this information can also add value to research projects.

Crop quality data is also used when the grading regulations need to be revised, or new quality norms are being investigated.

Additional analyses to evaluate the quality of soybean meal, for example amino acid digestibility which relates to processing can be discussed and added to the scope of this project if deemed necessary by the industry.



3.2.4 EVALUATION OF COMMERCIALY AVAILABLE SUNFLOWER CULTIVARS; Dr SH Ma'ali, MW Makgoga, JL Erasmus, TD Mohohlo, RL Mohtsiwa, MJ Leshomo, ARC-GCI

Cultivar trials from previous years showed that the mean yield of the five best cultivars is usually about 0.18 t ha^{-1} higher than the overall mean yield of all the tested cultivars. Considering that the national mean yield that farmers obtain is normally between 1.0 and 1.4 t ha^{-1} , it is clear that cultivar selection has a significant effect on the profitability of sunflower production. This project is the only independent source of information on sunflower cultivar performance, available to producers. The aim of this project is to evaluate commercially available sunflower cultivars at different localities in collaboration with seed companies. During the 2023/24 season, 17 cultivars were evaluated in 30 successful locality trials. The highest trial mean yield of 3.40 t ha^{-1} was obtained at Bethlehem planted on 21 November 2023 and the lowest of 1.27 t ha^{-1} , at Makwassie planted on 15 of December 2023. The five best performing cultivars, in terms of average yield calculated over localities, were P 65 LL 25, AGSUN 5111 CLP, AGSUN 5106 CLP, PAN 7102 CLP and PAN 7160 CLP. The overall mean yield for 2023/24 was 2.22 t ha^{-1} , 0.45% lower than the mean yield of the last year.

Elven Clearfield and Clearfield Plus cultivars AGSUN 5103 CLP, AGSUN 5106 CLP, AGSUN 5110, CLP AGSUN 5111 CLP, P 65 LP 54, P 65 LP 65, PAN 7102 CLP, PAN 7160 CLP, PAN 7180 CLP, SNK 270 CL and SY 3970 CL were entered. Seven of these cultivars namely AGSUN 5111 CLP, AGSUN 5106 CLP, PAN 7102 CLP, PAN 7160 CLP, PAN 7180 CLP, P 65 LP 65 and P 65 LP 54 have yields even or higher than the overall mean yield of all cultivars.

Fifteen cultivars were evaluated at 73 localities for the last three seasons and the cultivars, PAN 7160 CLP, PAN 7080, AGSUN 5270, PAN 7180 CLP, P 65 LP 65, AGSUN 5106 CLP and PAN 7102 CLP, had yields higher than the overall mean yield of all cultivars at 2.26 t ha^{-1} . Probability to obtain an above average yield was calculated for all cultivars across the usual range of yield potentials. That was done for the 17 cultivars during the 2023/24 growing season, for the



15 cultivars that have been tested at 57 localities for the last two-seasons and for the 15 cultivars that have been tested at 73 localities for the last three seasons. The yield probability method is highly recommended for cultivar selection.

3.2.5 SOUTH AFRICAN SUNFLOWER SEED CROP QUALITY SURVEY, Ms W Louw, SAGL

Goal

The goal of this project is to accumulate quality data on the commercial sunflower crop on a national level. The specific analyses done are of generic importance to the South African oilseed industry and will on request be adapted according to the industry's requirements. The data will be processed statistically to give an average, minimum and maximum per production region.

This valuable data reveals general tendencies, highlight any quality differences in the commercial sunflower crop produced in different production regions for local market requirements and provide important information on the quality of commercial sunflower seed intended for export. The information as well as the report will be available on the Southern African Grain Laboratory's (SAGL) website and the Oilseed Industry will determine the distribution list of the Directly Affected Groups and interested parties nationwide for the distribution of the report.

The long-term goal of the project is the annual determination of the quality of the commercial sunflower crop. A detailed database containing information collected over several seasons and different regions is essential.

Duration of project

Sampling to ensure representative samples of the country's entire commercial sunflower crop will start with the first deliveries during April/May 2025. The analyses of the samples will commence as soon as the funding of this project has been approved and samples are received by the SAGL. ***Results will be updated weekly on the SAGL website after the commencement of the***



analyses.

Scope of project

Number of samples

Based on an average crop size, the proposal is to analyse 140 samples annually to provide **representative data** of the commercial crop. The predicted crop for the 2023/2024 season is 649 250 tons (National Crop Estimates Committee (NCEC), 5th forecast, 27 June 2024).

Each registered silo represents a sampling point. A representative sample per class and grade per silo bin/bag/bunker will be taken by each of the commercial grain storage companies handling sunflower seed, provision is made for 140 samples. There is only one grade of sunflower seed for classes FH and FS seeds, namely Grade 1. The Grain Silo Industry (Agbiz Grain) has offered to take and provide the samples to the SAGL. This sampling is done free of charge which has a huge cost saving effect on the survey.

Based on the agreements between the silo owners and their customers delivering the sunflower seeds at the silos the quality information can only be made available on a regional basis.

Sampling procedure

On intake of the sunflower crop at the silos, **a representative sample for grading is taken in accordance with the Grading Regulations for sunflower seed** as published in the Government Gazette No. 39613 dated 22 January 2016, Government Notice No. R. 45.

After grading, the grading samples is placed in a container representing each bin concerned. At the end of each week, the content of each container is divided to obtain a 3 kg sample. This is done for each bin and respective class and grade separately.



These samples are submitted for analysis to the SAGL by the different commercial grain handlers. The silos can contact the SAGL to arrange a courier to collect the samples. Each sample bag is labelled with the name of the silo, bin, and grade/class. Sampling is to be carried out over the entire production area. All the sunflower production areas will be covered and **will be represented proportionally by the data.**

The following physical and chemical analyses will be done on **140 locally produced sunflower seed samples: RSA**

Grading: Government Gazette 39613, 22 January 2016, Government Notice No. R. 45

Protein, % (as is) (AACC Method 46-30.01, latest edition)

Fat, % (as is) (Soxhlet, In-House Method 024)

Moisture, % (5 Hour; 105° C - AgriLASA method 2.1, latest edition)

Ash, % (as is) (In-House Method 011)

Crude fibre, % (as is) (Acid-base digestion; In-House Method 031)

Test weight, kg/hl (Kern 222 chondrometer)

NIR, including Protein, Fat, Moisture, Ash and Crude Fibre, %

Format of reporting on website and hard copy

8 Individual results are e-mailed to the respective grain handlers on a weekly basis once the results become available.

SAGL website

Average results per region are available on the SAGL website as soon as the first results become available. The mean values of all samples from each region are calculated in respect of every quality parameter analysis. These averages are available on the SAGL website per region and per quality parameter grouped into subgroups such as RSA grading and Nutritional values.

Written report

The abovementioned averages will be tabled in the written report.

Distribution of data

Weekly updates of the data on the SAGL web site will be done on commencement of the analyses. The report, which can be downloaded from the SAGL website, will become available after all the samples have been analysed and the data processed. The written report will be distributed to all the Directly Affected Groups and interested parties. **Reports will be submitted to the Trustees of the Oil and Protein Seeds Development Trust on completion.**

Value Addition

In addition to this data being available for use by different role players in the sunflower industry, directly or indirectly affecting them, this information can also add value to research projects.

Crop quality data is also used when the grading regulations need to be revised, or new quality norms are being investigated.

Publication Dates for 2023

2023	SAGIS Monthly Data	Crop Estimates	Supply & Demand Estimates
Jan	25	26	13, 31
Feb	27	28	9 (Crop Estimates Liaison Committee)
Mar	27	28	3, 31
Apr	26	26	-
May	25	25	11 (both Liaison Committees) 4, 30
Jun	26	27	30
Jul	25	26	28
Aug	25	29	-
Sep	26	27	1, 29
Oct	25	26	31
Nov	27	28	-
Dec	22	19	1



3.2.6 THE FUNDING OF THE SUPPLY AND DEMAND ESTIMATES COMMITTEE; Dr M Lubunga, NAMC

Introduction

The monthly Supply and Demand Estimates Committee (S&DEC) meetings serve the crucial function of gathering new information that becomes available in the market at a given moment. It is also critical to realize that any agricultural progress is largely dependent on having access to reliable market information, which can help, to a certain extent, address additional issues like food security. In 2011, Grain South Africa applied for a statutory measure for grain traders to report information on export and import contracts. A similar approach is practiced in the United States of America. The application by Grain SA was opposed by other directly affected groups such as the South African Cereals and Oilseeds Trade Association (SACOTA); however, collaboration between SACOTA and the Supply and Demand Estimates Committee was subsequently established. The proposed statutory measure was then put on hold, and the committee sought to perform its activities without the interference of the statutory measure. The industry thus appointed Dr John Purchase as Chairperson of this committee, with the National Agricultural Marketing Council (NAMC) acting as secretariat. Following all industry engagements and consultations, the first official Supply and Demand Estimates report was published at the end of June 2013. The establishment of this committee was demand driven by the need to produce accurate and transparent market information to ensure that the market functions more efficiently for the participants.

Purpose of the South African Supply and Demand Estimates (SASDE) Report

The report provides an analysis of the fundamental conditions of the major grains and oilseeds in South Africa. The report is normally released within four to five working days after the Crop Estimates Committee (CEC) meeting. The report is released into the public domain with the approval of the South African competition authorities. Please see the publication dates.



Composition of the S&DEC

The S&DEC is a technical committee that communicates directly with industry role-players through the Supply and Demand Estimates Liaison Committee (S&DELC). The S&DEC consists of a chairperson with two independent specialists appointed by the industry; the NAMC acts as the secretariat with three staff members and the South African Grain Information Service (SAGIS) and the secretariat of the CEC from the Department of Agriculture, Land Reform and Rural Development (DALRRD).

NAMC representatives

- Dr Moses Lubinga - Manager: Agro Food Chains
- Ms Lizette Mellet - Senior Economist: Statutory Measures
- Ms Funzani Sundani - Senior Economist: Grain Specialist

DAFF representatives

- Ms Rona Beukes - Senior Statistician: Crop Estimates
- Ms Marda Scheepers - Senior Statistician: Crop Estimates

SAGIS representative

- Mr Bernard Schultz - CEO: SAGIS

Independent specialists

- Prof Andre Jooste
- Prof Johan Willemse
- Dr Anton Lubbe

Attendance of Meetings by Members

The table below indicates the attendance of monthly S&DEC meetings by members. Please note that the December meeting is usually held in January of the following year, due to the festive season holidays. It is important to note that independent specialists are only reimbursed for the meetings they attend.



Methodology used by the S&DEC

Process before the meeting

- The S&DEC meeting takes place three to five working days after the CEC meeting, at the end of each month with the exclusion of December.
- A reminder is sent to all co-workers approximately seven days before the S&DEC meeting, requesting that they submit estimates on imports, exports, and consumption for selected grains and oilseeds.
- The S&DEC meeting takes place in a lockdown room with no cell phones allowed, except when there is uncertainty about any of the figures sent by co-workers.

Factors that are considered during the meeting

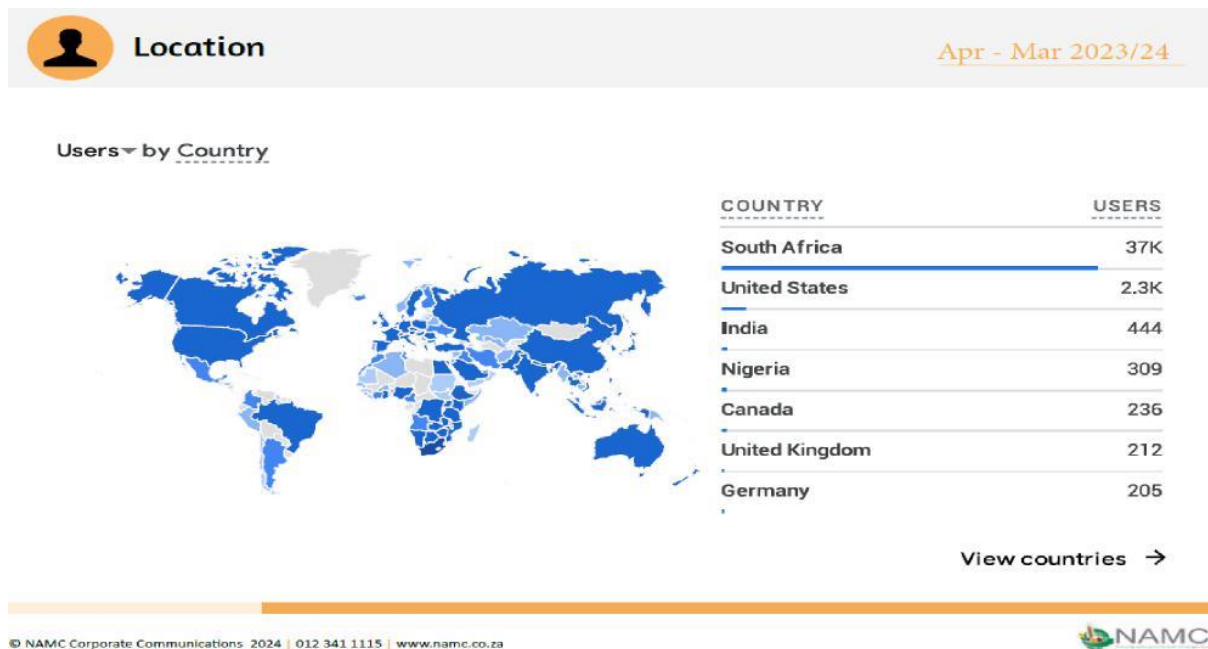
- Supply figures;
- CEC Published figures;
- S&D historical figures;
- Demand figure;
- Historical figures (SAGIS);
- Current deliveries published by SAGIS (extrapolations, regression modelling);
- Co-workers' figures, without disclosing their identity
- SAGIS figures;
- Figures and opinions of, and discussions with, co-workers;
- Baseline modelling figures on demand and consumption from the Bureau for Food and Agricultural Policy (BFAP); and
- Other modelling, including industry forecasting modelling and computable general equilibrium (CGE modelling), is also considered for use in the future, taking into consideration the expansion incapacity

Distribution and users of the SASDE Report

To keep track of the end-users of the SASDE report, the NAMC retrieves the



number of website hits on a regular basis. Based on the annual (April 2023-March 2024) website statistics, NAMC's reports generally have a wide readership of about 43 thousand active users spread in various geographical locations (See Figure 1). According to the website traffic source, a diversity of institutions including academia, government entities, grain millers, oilseed processors, feed manufacturers, traders, and the baking industry, among others use the SASDE report.



According to a snippet below from the website report, over 1 000 users accessed SASDE reports with a relatively high number of views per user of 3.28, which is slightly below the annual average of 3.76 for the entire website.

Page path and screen class		Views	Users	Views per user	Average engagement time	Event count
		↓				All events
		162,469	43,255	3.76	1m 46s	456,688
		100% of total	100% of total	Avg 0%	Avg 0%	100% of total
1	/careers/	60,057	21,477	2.80	1m 20s	155,727
2	/	35,434	16,267	2.18	55s	113,453
3	/namc-tenders/	4,296	1,755	2.45	1m 21s	10,900
4	/aamp/	3,521	1,987	1.77	1m 27s	11,633
5	/category/research-publications/supply-demand-estimates/	3,340	1,017	3.28	1m 00s	11,975
6	/publications/	2,616	1,429	1.83	27s	6,268
7	/about-us/executive-committee/	2,114	1,396	1.51	56s	5,373



Stakeholder Engagements

Building connections with important industry players is essential to the Supply and Demand Estimates project in order to guarantee that the report provides a comprehensive summary of important industry data related to grains and oilseeds. The Grain Specialist engaged with industry stakeholders on several occasions, and occasionally a liaison committee representative also met with industry stakeholders. These kinds of interactions were intended to build connections and ensure that vital data regarding grains and oilseeds was gathered. There were several parties involved in the grain business. During these meetings, information was shared for the mutual benefit of the involved parties and the NAMC. Notably, a variety of engagement methods were employed, such as in-person meetings and phone conversations with different stakeholders.

Conclusion

Information effectiveness is important in developing countries. Accurate and pertinent information helps guarantee market sustainability and careful consideration of a country's food security in light of both public and private goals. Initiatives like creating the SASDE report have the potential to give the market useful information for a set amount of time. The facts on the report's end users show that the release of the SASDE report has elevated the grain and oilseeds market in South Africa and the surrounding area. The mutual understanding and cooperation between the trusts and the NAMC have also made a substantial contribution to the S&DEC's operation. The committee needs this kind of help to make sure that its duties are carried out properly.

3.2.7 NATIONAL SOYBEAN CULTIVAR TRIALS; Ms AS de Beer, L Bronkhorst, HSJ Vermeulen, N Cochrane, NN Mogapi, TC Ramatlotlo, TJ Makoatsane, ARC Grain Crops Institute, Potchefstroom

The National Soybean Cultivar Trials (project M101/62) were planted for the 46th successive year during the 2023/24 growing seasons. Thirty-five (35) commercially certified cultivars were evaluated in 36 field trials on 33 localities, representing the cool-, moderate- and warm areas. Nine (9) of the 35 (25.7%)



cultivars evaluated during the 2023/24 season were new cultivars. These figures emphasised the importance of the constant evaluation of cultivars in an aggressively growing soybean industry. Unfortunately, 6 of the trials were terminated due to flooding and hail damage Chrissiesmeer, poor emergence and hail damage (Cornelia), (Delareyville and Groblersdal) CV% too high, poor stand due to heat wave after emergence (Potchefstroom) and flooding just after planting (Rietvlei). Due to the late rains and cool temperatures, the harvesting process took longer as anticipated. Only 30 trials were successful and could be included in the report.

A randomised latinised row/column design with three replicates was used for all field trials. Date of flowering (50% flowering), date of harvest maturity, length of growing season, plant height, pod height, green stem, lodging, shattering, 100 seeds mass, undesirable seed and the yield probability of cultivars calculated. Yield probabilities served as guidelines for cultivar selection.

The mean number of days from planting to 50% flowering of cultivars calculated across cultivars for the 2023/24 season were 77 days (77 days during 2022/23) for the cool -, 61 (63 days during 2022/23) for the moderate - and 51 days (60 days during 2022/23) for the warm production areas, in comparison to the previous season. The unfavourable climate also impacted on the days from planting to harvest, resulting in an average of 171 days (168 days in 2022/23), 147 days (149 days during 2022/23) and 140 days (148 days during 2022/23), respectively for the cool-, moderate -and warm areas.

The mean yield of cultivars within climate areas varied from 1512 kg ha⁻¹ (PAN 1555R) to 2168 kg ha⁻¹ (RA5022BR) (difference 656 kg ha⁻¹), 1732 kg ha⁻¹ (LAKE 250 RR) to 2487 kg ha⁻¹ (DM 61I63 RSF IPRO) (difference 755 kg ha⁻¹) and 2288 kg ha⁻¹ (LAKE 253 RR) to 3504 kg ha⁻¹ (RA4918RR) (difference 1216 kg ha⁻¹) respectively for the cool -, moderate - and warm production areas. The overall mean yield was 1764 kg ha⁻¹ (2651 kg ha⁻¹ for 2022/23) 2126 kg ha⁻¹ (3776 kg ha⁻¹ for 2022/23) and 3005 kg ha⁻¹ (4246 kg ha⁻¹ for 2022/23) (cool, moderate, warm).



Cultivars with a high yield probability are important in the selection of cultivars by producers due to the reliability of the expected future yield. RA565R showed an above average yield probability for all yield potentials in the cool and moderate areas, while PAN1521 R had an above average yield probability for both the cool and warm areas. RA4918R, Y540, P62T16R, Y657 and P71T74R performed above average for the moderate areas. RA660R, P64T39R and Y657 showed an above average yield probability in warm areas.

3.2.8 CULTIVAR EVALUATION OF OIL AND PROTEIN SEEDS IN THE WINTER RAINFALL AREA: WESTERN AND SOUTHERN CAPE (CANOLA); Mr PJA Lombard, Ms L Smorenburg and Dr JA Strauss, Department of Agriculture: Western Cape

In 2023, trials were planted at five Swartland and Southern Cape localities. Two sowing date trials were planted on Langgewens and Tygerhoek Research Farms. All the trials in the 2023 season have been harvested except the trial at Eendekuil, which was damaged by either cutworms or white grubs. In the 2023 cultivar evaluation program, a total of 18 cultivars, compared to the 17 from 2022, were tested. The cultivars consisted of four conventional, four CI (Clearfield, Imasamox-tolerant), eight from the TT group (Triazine-tolerant), and combination type of cultivars with both CI and TT tolerance (Enforcer CT and PY520 TC). In 2023, six new cultivars were tested, and all were hybrid cultivars. In the Swartland, the average yield per trial varied between 3323 kg ha⁻¹ (Langgewens 2nd planting) and 2266 kg ha⁻¹ at Philadelphia. In the Rûens, the trial averages at Roodebloem were the best (3359 kg ha⁻¹), followed by the other localities, which yielded above 3104 kg ha⁻¹. The Southern Cape had a very long and high rainfall season. Canola as a crop has once again proven its adaptability to local climate conditions in 2023. In comparison, 2022 was very dry, and the canola also did well. Sclerotinia infection also occurred widely in the Swartland in 2023, with an increased risk for 2024.



3.2.9 SUDDEN DEATH SYNDROME OF SOYBEAN IN SOUTH AFRICA: ETIOLOGY DETECTION AND MANAGEMENT; Dr S Lamprecht, ARC-PPRI

Sudden death syndrome (SDS) of soybean is one of the most important soilborne diseases of soybean and is responsible for economically devastating reductions in yields in North and South America. Several *Fusarium* species including *Fusarium brasiliense*, *F. crassistipitatum*, *F. tucumaniae*, and *F. virguliforme* cause the disease in other countries. All these species, as well as *F. azukicola*, and *F. cuneirostrum*, were recently included into the newly described *Neocosmospora phaseoli*. SDS was first reported in South Africa in 2013 in the Lydenburg/Badfontein area, Mpumalanga Province. The causal organism was initially reported to be *F. virguliforme*, but later re-identified as *F. brasiliense* and a novel *Fusarium* sp. Judging by published information on the disease in other countries, SDS may pose a threat to the South African soybean industry. In order to conduct any epidemiological research and develop management strategies for SDS in South Africa, it is essential to determine the distribution and identity of all SDS-causing *Neocosmospora* spp. (*Fusarium* spp.) in soybean-producing areas in South Africa. The first phase of the project therefore aimed to determine the distribution of the disease, identify the causal organisms, and developed a molecular technique for rapid identification of the SDS-causing pathogen/s and for detection and quantification of these pathogens in soil and plant material. Surveys conducted in soybean production areas showed that *N. phaseoli* was present on soybeans in the Free State, KwaZulu-Natal, Limpopo, Mpumalanga, and North West provinces. These results indicate that SDS is widespread and may be a concern for producers when environmental conditions are conducive to disease development. A species-specific TaqMan probe-based qPCR assay was also developed for the specific detection of *N. phaseoli* in naturally infected soybean crown, root and soil samples with DNA quantities well within the quantifiable range of the assay. This detection assay will be an invaluable tool for the rapid and sensitive detection of SDS in samples submitted by farmers. The project thus far has clarified the distribution of *N. phaseoli* on soybean in South Africa. Furthermore, a sensitive and specific qPCR assay was developed that can reliably detect and quantify *N. phaseoli* in soybean



plant and soil samples. During the next phase of the project, strategies for the management of SDS will be investigated and developed.

3.2.10 SOUTH AFRICAN SCLEROTINIA RESEARCH NETWORK (SASRN), Dr L Rothmann, University of the Free State

General introduction

Sclerotinia sclerotiorum causes severe diseases in soybeans and sunflowers, including Sclerotinia stem rot and head rot, leading to up to 80% yield losses. This fungus can infect over 400 plant species and persist in the soil for up to eight years, presenting a significant management challenge due to the lack of resistant cultivars and limited chemical controls.

To address these challenges, the South African Sclerotinia Research Network (SASRN) was formed to facilitate collaboration among researchers, industry, and producers. SASRN aims to develop practical, producer-focused research and management strategies for Sclerotinia diseases, serving as a platform for addressing producer needs through applied research.

Between 2018 and 2023, SASRN conducted research on integrated pest management (IPM) for Sclerotinia. The four projects targeted enhancing industry-farmer interactions, screening for resistance in soybeans, conducting cultivar trials, and exploring alternative non-chemical management strategies. Projects focused on identifying tolerant cultivars and assessing various management methods have concluded, with results summarized in this report.

Recent Sclerotinia Day meetings led to the creation of an article on IPM strategies and the initiation of new projects. SASRN's expansion includes collaboration with the South African Cultivar Technology Agency (SACTA) and seed companies, with SACTA providing technicians to manage fungicide trials and bolster monitor pest and disease prevalence.



This report outlines the completed projects and updates on new initiatives, highlighting ongoing efforts to advance Sclerotinia management strategies.

SECTION A: CLOSE-OUT OF PREVIOUS SASRN PROJECTS

Project 1: Sclerotinia sclerotiorum disease potential and management responses in soybean and sunflower

Primary institutions	University of the Free State
Principal investigators	Dr Lisa Rothmann
Collaborating institutions	Dr Derick van Staden (DMS Genetics), Prof Neal McLaren (UFS)

Project overview

Cultivar selection is often the preferred method of disease management as it is economically viable. Currently no soybean and sunflower cultivars with complete resistance to *S. sclerotiorum* are available, although numerous cultivars have been identified with partial resistance or escape resistance, locally and internationally. Host resistance describes the ability of a plant to reduce the ability of the pathogen to infect and colonise tissues, either partially or completely. In this study we refer to escape resistance instead of tolerance so to consider influential factors beyond host plant genetics. Escape resistance is defined as the plants' ability to tolerate high levels of disease potential before succumbing to the pathogen, thus providing various degrees of risk reduction. The development of cultivars resistant to Sclerotinia diseases would be ideal as it would provide producers with a longer-term solution to reduce disease risk. This is the final report for this project as this project has come to a close and all objectives have been met.

Aim: Provide producers and plant breeders with information on the response of soybean and sunflower cultivars to act as a tool for decision making prior to planting to mitigate the risks of Sclerotinia stem rot of soybean and head rot of sunflower



Objectives:

- Validation of relationship between weather x host x pathogen
- Cultivar evaluations

Results and discussions

Objective 1: Validation of relationship between weather x host x pathogen

Data collected from Crop Estimates Committee on Sclerotinia disease incidences formed the basis of this study. It must be noted, the survey data which are used were not originally intended for forecasting when the data were collected. Unfortunately, the model which could be developed from the data had insufficient accuracy and reliability for use by producers. This is due to insufficient data points, and weather data and Sclerotinia infection reports not being well distributed across South Africa, and over-representation of data points in some provinces.

Objective 2: Cultivar evaluations

The purpose of this objective was to determine which soybean and sunflower cultivars are more tolerant to Sclerotinia diseases in relation to recommended and late planting dates.

In the first planting, significant differences among soybean cultivars were noted under inoculation but not under natural conditions. Three groups emerged: Y540 had the highest prevalence (~50% mean stem rot), while five cultivars (DM 61i63 RSF IPRO, NS 5909 R, P 71T74 R, RA6422 BR, and RA6521 BR) had the lowest (2.9% to 0.7%). Other cultivars showed varying responses (39.9% to 5.1%) (Table 1).

In the second planting, similar trends were observed, with significant differences under inoculation but not natural conditions. LG60261IPR had the highest prevalence (~43%), while 19 cultivars had lower rates (10.5% to 0%).



DM5351 RSF and RA5022 BR had no stem rot. Other cultivars varied from 26.1% to 11.1% (Table 2).

P71T74R consistently showed lower prevalence in both plantings. NS 5909 R (1.4% to 6.5%) and RA6521BR (0.7% to 3.3%) also had low rates. In contrast, RA6422 R and DM61I63 RSF IPRO had higher prevalence in the second planting (15% and 16.3%, respectively). LG60261IPR was highly susceptible in the second planting (~43.8%). Under natural infection in planting two, Y540 had the highest prevalence, similar to inoculated conditions, indicating less tolerance. SM 6.8i RR showed contrasting responses under natural (0.7%) and inoculated conditions (10% to 6.5%).

For sunflower cultivar trials, Clocolan (FS) had mean *Sclerotinia* prevalences of 14.3% and 3.4% for the first and second planting dates, respectively. Delmas (MP) had mean prevalences of 12.5% and 18.6% under artificial pressure. No head and stem rot were observed in the third planting at either location. Cultivars were categorized by head rot prevalence: >40% least tolerant, 39-11% moderately tolerant, and <10% most tolerant.

PAN 7100 had the highest prevalence in Clocolan's first planting (~40.8%) but a tolerant response (5.6%) in the second planting. AGSUN 5106 CLP had the highest prevalence in the second planting (13.7%) and a tolerant response (8.1%) in the first. Three cultivars with no head rot in the second planting had lower prevalence in the first (Table 3). Under inoculated conditions in Delmas, mean head rot ranged from 24.5% to 2.1% and 27.8% to 5.2% across planting dates. PAN7160 CLP consistently showed lower prevalence (Table 4).

Conclusion

While no cultivars exhibit complete resistance to *S. sclerotiorum*, several cultivars have shown partial or escape resistance, offering varying degrees of risk reduction. Escape resistance, which includes factors beyond genetic resistance, provides plants the ability to tolerate high disease potential before succumbing to the pathogen.



The validation of the relationship between weather, host, and pathogen was challenging due to the limitations of the survey data, which were not initially intended for forecasting or modelling diseases. The insufficient number of data points and their uneven distribution across South Africa compromised the accuracy and reliability of the developed model. Therefore, it is recommended that future studies collect more comprehensive and evenly distributed weather and disease incidence data to improve forecasting models.

Cultivar evaluations revealed significant differences in the tolerance levels of various soybean and sunflower cultivars to *Sclerotinia* diseases. The findings from the 2022/23 planting seasons showed that certain cultivars, such as P71T74R and NS 5909 R, consistently exhibited lower prevalence rates, while others like Y540 and LG60261IPR were more susceptible. These results underscore the necessity for producers and plant breeders to consider cultivar-specific responses to disease pressures when making planting decisions.

Accurate information on cultivar responses to infection by *Sclerotinia sclerotiorum* is critical information for producers in order to plant cultivars with high tolerance. Popular publications and communications were shared on various platforms. Cultivar plantings were successful and disease screenings have been completed. This is the final report for this project as this project has come to a close and all objectives have been met.

Publications:

The outcomes from this study were made available via popular and academic publications.

- https://www.opot.co.za/poems/images/projects/0827/article/1-6-2-pp-meiring-mc-rothmann-la-de-beer-as-cochrane-nm-dec-20-p7_9.pdf
- https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4235963



Other associated articles:

- https://www.proteinresearch.net/poems/images/projects/1129/article/1-6-2_10-6-2-pp-rothmann-la-meiring-mc-mclaren-nw-june-2019-p22-23.pdf
- <https://onlinelibrary.wiley.com/doi/full/10.1111/jph.13124>

ADDENDUM 1

Table 1. Mean stem rot prevalence (%) in the first planting date of soybean cultivar evaluations in Delmas (MP) under inoculated field conditions

Cultivar	Mean Stem Rot Prevalence (%)	Groups	Cultivar	Mean Stem Rot Prevalence (%)	Groups
Y540	47.8	a	PAN 1507 R	13.0	ab
PAN 1502 R	39.9	ab	PAN 1555 R	10.9	ab
RA 660 R	36.2	ab	NS 5258 R	10.1	ab
Y657	34.8	ab	RA4918 R	10.1	ab
Y657	32.6	ab	Y651 RR PRO	10.1	ab
DM 59E03 RSF	31.9	ab	DM 59R03 RSF	10.1	ab
RA 565 R	31.9	ab	DM 6.8i RR	10.1	ab
RA5821R (CT233R)	23.2	ab	RA5722BR	7.2	ab
LS 6851 R	21.0	ab	RA5022 BR	5.8	ab
PAN 1644 R	20.3	ab	LG60260IPR	5.1	ab
LS 6860 R	17.4	ab	LG60261IPR	5.1	ab
P62T16R	17.4	ab	P71T74R	2.9	b
PAN 1521 R	17.4	ab	RA6422 R	2.9	b
SM 53I54 RSF IPRO	15.9	ab	DM61I63 RSF IPRO	1.4	b
D 5351 RSF	15.2	ab	NS 5909 R	1.4	b
P64T39R	15.2	ab	RA6521BR	0.7	b



Table 2. Mean stem rot prevalence (%) in the first planting date of soybean cultivar evaluations in Delmas (MP) under inoculated field conditions

Cultivar	Stem Rot Prevalence (%)	Groups	Cultivar	Stem Rot Prevalence (%)	Groups
LG60261IPR	43.8	a	P71T74R	9.2	b
PAN 1507 R	26.1	ab	PAN 1521 R	8.5	b
Y657	25.5	ab	PAN 1644 R	8.5	b
DM 59E03 RSF	21.6	ab	P57T19 R	7.2	b
P64T39R	19.0	ab	PAN 1502 R	7.2	b
RA 660 R	18.3	ab	DM 6.8i RR	6.5	b
DM61I63 RSF IPRO	16.3	ab	NS 5909 R	6.5	b
P62T16R	15.7	ab	LS 6860 R	5.9	b
RA 565 R	15.0	ab	PAN 1555 R	4.6	b
RA5821R (CT233R)	15.0	ab	RA6521BR	3.3	b
RA6422 R	15.0	ab	SM 53I54 RSF IPRO	2.6	b
DM 59R03 RSF	12.4	ab	LG60260IPR	1.3	b
Y540	11.1	ab	Y651 RR PRO	1.3	b
LS 6851 R	10.5	b	NS 5258 R	0.7	b
RA5722BR	10.5	b	DM 5351 RSF	0.0	b
RA4918 R	9.8	b	RA5022 BR	0.0	b



Table 3. Mean head rot response on cultivars planted in Clocolan (FS) under natural field conditions

Planting 1		Planting 2	
Cultivar	Mean Head Rot Prevalence (%)	Cultivar	Mean Head Rot Prevalence (%)
PAN 7100	40.8	AGSUN 5106 CLP	13.7
PAN 7090	28.7	PAN 7090	9.5
P 65 LL 46	26.0	AGSUN 5108 CLP	8.8
AGSUN 5108 CLP	22.3	PAN 7100	5.6
AGSUN 5103 CLP	19.7	AGSUN 5270	5.3
P 65 LP 54	18.0	AGUARA 6	4.5
AGSUN 5270	16.8	AGSUN 5103 CLP	3.9
P 65 LL 02	14.6	PAN 7180 CLP	3.5
PAN 7080	13.8	LG 5710	2.2
PAN 7160 CLP	12.7	P 65 LP 65	2.2
AGSUN 5110 CLP	11.9	AGSUN 5111 CLP	2.1
LG 50745	11.1	LG 50745	2.1
LG 5710	8.3	P 65 LP 54	2.0
AGSUN 5106 CLP	8.1	PAN 7080	1.9
AGUARA 6	7.8	AGSUN 5110 CLP	0.0
SY 3970 CL	6.8	P 65 LL 02	0.0
PAN 7180 CLP	6.5	P 65 LL 46	0.0
AGSUN 5111 CLP	5.7	PAN 7102 CLP	0.0
PAN 7102 CLP	4.8	PAN 7160 CLP	0.0
P 65 LP 65	1.7	SY 3970 CL	0.0



Table 4. Mean head rot response on cultivars planted in Delmas (MP) under inoculated field conditions.

Planting 1		Planting 2	
Cultivar	Mean Head Rot Prevalence (%)	Cultivar	Mean Head Rot Prevalence (%)
P 65 LL 46	24.5	P 65 LP 54	27.8
AGUARA 6	20.1	AGSUN 5270	25.9
AGSUN 5270	19.6	AGSUN 5110 CLP	24.5
P 65 LL 02	17.3	PAN 7160 CLP	23.7
PAN 7100	17.2	SY 3970 CL	23.1
SY 3970 CL	15.5	P 65 LL 02	21.7
P 65 LP 54	15.3	AGSUN 5108 CLP	20.6
AGSUN 5110 CLP	14.9	PAN 7080	19.8
PAN 7180 CLP	14.4	AGSUN 5103 CLP	17.5
LG 5710	13.7	AGUARA 6	16.9
AGSUN 5106 CLP	11.2	PAN 7180 CLP	15.2
PAN 7090	10.9	P 65 LP 65	15.1
LG 50745	10.7	LG 5710	14.2
P 65 LP 65	10.5	P 65 LL 46	12.7
PAN 7080	8.0	AGSUN 5111 CLP	12.4
AGSUN 5103 CLP	6.5	LG 50745	12.1
PAN 7102 CLP	6.5	PAN 7090	11.8
AGSUN 5111 CLP	3.3	PAN 7102 CLP	9.8
AGSUN 5108 CLP	3.0	AGSUN 5106 CLP	6.3
PAN 7160 CLP	2.1	PAN 7100	5.2

Project 2: Phenotypic and genotypic screening of soybean to identify potential sources of resistance to the destructive pathogen, *Sclerotinia sclerotiorum*

Primary institutions	University of the Free State
Principal investigators	Dr Adré Minnaar-Ontong & Dr Chrisna Steyn
Collaborating institutions	Dr Derick van Staden (DMS Genetics), Mr Roean Wessels (Syngenta)
Students and postdoctoral fellows	Faith Kobedi (MSc) and Henry Basson (MSc)
Technicians	Diana Mngomezulu, Pieter du Preez and Brewis Fourie



Project overview

Soybean is highly susceptible to *S. sclerotiorum*, and infections can significantly impact crop yield. While agronomic practices have been proposed to mitigate Sclerotinia disease damage, these methods are often insufficient in favorable conditions for the pathogen. Consequently, developing resistant varieties remains one of the most effective strategies for managing Sclerotinia diseases. In South Africa, there are no widely accepted sources of resistance to *Sclerotinia*, and knowledge about potential resistance is limited due to screening constraints. However, resistance sources from various countries and regions are available for incorporation into soybean breeding programs. Therefore, this study aims to screen South African commercial soybean cultivars for Sclerotinia resistance using both phenotypic and genotypic screening methods, to complement project 1.

Aim: The aim of this study is to screen South African commercial soybean cultivars for Sclerotinia resistance by using both phenotypic and genotypic screening methods.

Objectives:

- Selection of potential resistant lines based on the targeted Sclerotinia resistant QTL.
- Identification and selection of potential resistant lines/cultivars available from South African germplasm.
- Phenotypic validation of resistance using best inoculation method in both greenhouse and field trials.
- Establish and maintain a culture collection of South African *S. sclerotiorum* isolates.



Results and discussions

Objective 1: Selection of potential resistant lines based on the targeted *Sclerotinia* resistant QTL.

The goal of this objective was to identify and select potential resistant lines by targeting specific Quantitative Trait Loci (QTL) associated with *Sclerotinia* resistance. This objective has been successfully completed. To achieve this, Argentinian cultivars known for their tolerance to *Sclerotinia* were acquired and used as a benchmark to compare against local cultivars. Both the local and Argentinian cultivars underwent comprehensive screening, which included genotypic analysis using Simple Sequence Repeat (SSR) markers and phenotypic evaluation conducted in greenhouse conditions and through a detached leaf assay.

The use of SSR markers enabled the precise identification of genetic variations associated with *Sclerotinia* resistance. This molecular approach has helped in understanding the genetic basis of resistance and facilitates the selection of lines that carry the desired QTL. The phenotypic screening involved assessing the cultivars' actual performance under controlled greenhouse conditions and through a detached leaf assay. This dual approach provided a comprehensive evaluation of each cultivar's resistance level, ensuring that the selected lines exhibit both genotypic potential and phenotypic resilience to *Sclerotinia*.

Objective 2: Identification and selection of potential resistant lines/cultivars available from South African germplasm.

The second objective of this study aimed to identify and select potential resistant lines or cultivars from the South African germplasm. This objective has been successfully completed through a comprehensive process involving both genotypic and phenotypic screening. The selection and analysis of local commercial cultivars are crucial steps in enhancing agricultural resilience



against *Sclerotinia* diseases, particularly in the context of soybean and sunflower production.

To achieve this objective, 42 local commercial cultivars were chosen for thorough screening. The selection process was guided by the need to evaluate a diverse range of cultivars, ensuring that the most promising candidates for resistance could be identified. This approach leverages the genetic diversity present in South African germplasm, which is essential for developing cultivars that are well-adapted to local conditions and disease pressures.

The genotypic screening of these cultivars was conducted using 52 molecular markers. These markers are powerful tools for identifying genetic variations associated with tolerance to *Sclerotinia*. By examining the genetic makeup of the cultivars, researchers can pinpoint specific traits that contribute to disease resistance. This molecular approach provides a detailed understanding of the genetic factors that influence tolerance, enabling more targeted and efficient breeding programs.

In addition to genotypic analysis, the cultivars underwent phenotypic screening. This involved evaluating the actual performance of the plants under controlled conditions to assess their response to *Sclerotinia* infection. The integration of genotypic and phenotypic data was a critical aspect of this objective. By combining these two approaches, the study ensured a robust and comprehensive evaluation of the cultivars. This integrated methodology allows for the identification of the most promising lines that not only possess the genetic traits associated with resistance but also demonstrate tangible resistance in practical settings.

The identified resistant cultivars offer valuable options for producers seeking to mitigate the impact of *Sclerotinia* diseases. By incorporating these cultivars into their planting schedules, producers can enhance crop yields, reduce losses, and minimize the reliance on chemical controls. This approach aligns



with sustainable agricultural practices, promoting environmental stewardship and economic viability.

Objective 3: Phenotypic validation of resistance using best inoculation method in both greenhouse and field trials.

The third objective of this study was to validate the phenotypic resistance of soybean cultivars using effective inoculation methods in both greenhouse and field trials. This objective was successfully achieved, offering crucial insights into how soybean cultivars perform under different environmental conditions and confirming the genotypic screening results. A total of forty-two local commercial soybean cultivars, previously selected for genotypic screening, were subjected to rigorous testing, including three repetitions each of greenhouse and field trials.

In the controlled environment of the greenhouse, inoculation methods were applied, providing a stable setting to observe the cultivars' resistance to *Sclerotinia*. The results from the greenhouse trials showed a strong correlation with the genotypic screening results, indicating that the genetic markers used for screening were effective predictors of resistance. Conversely, the field trials, conducted under natural conditions, presented a more variable environment, essential for evaluating natural and field performance. The results from the field trials did not correlate as well with the genotypic results, a discrepancy observed in previous studies due to the variability in field conditions affecting disease expression and resistance mechanisms.

Of the 42 cultivars tested, three showed evidence of tolerance to *Sclerotinia* in both greenhouse and field trials. This finding is significant as it highlights the potential of these cultivars for use in breeding programs aimed at developing more resistant soybean varieties. The identification of these tolerant cultivars provides a valuable resource for enhancing the genetic resistance of soybean crops in South Africa, supporting the development of more robust disease management strategies in the industry.



Objective 4: Establish and maintain a culture collection of South African *S. sclerotiorum* isolates.

The fourth objective of this study was to establish and maintain a comprehensive culture collection of *Sclerotinia sclerotiorum* isolates from South Africa, which is housed at the University of the Free State. This objective will ongoing as long as the *Sclerotinia* samples are being collected. The collection includes isolates gathered from eight provinces and various host plants, providing the necessary genetic diversity for robust research and effective disease management strategies. This diversity is crucial for understanding the pathogen's variability and for developing effective management strategies. The collected isolates underwent rigorous identification and characterization processes to confirm their identity as *S. sclerotiorum*.

Once collected, the isolates were subjected to pathogenicity screening to evaluate their virulence and disease-causing potential. These screenings are essential for identifying the most aggressive isolates, which were used in the current research project and other research applications. The University of the Free State maintains this culture collection, ensuring its preservation and viability. They also commit to expanding the collection by adding new isolates, ensuring it remains up-to-date and reflective of the current pathogen population in South Africa.

Conclusion

This project focused on four key objectives which include: identifying potential resistant lines, screening local germplasm, validating phenotypic resistance, and establishing a culture collection of *S. sclerotiorum* isolates, the project has provided valuable insights and resources for future breeding programs. The integration of genotypic and phenotypic screening methods has proven effective in identifying cultivars with potential resistance, although variability in field conditions highlights the need for continued testing and validation.



The identification and selection of potential resistant lines from both local and international sources are vital for developing robust soybean varieties. The use of molecular markers for genotypic screening, combined with rigorous phenotypic evaluation, ensures a thorough understanding of the resistance traits. This integrated approach not only enhances the accuracy of identifying resistant cultivars but also provides a solid foundation for breeding programs aimed at improving crop resilience.

Project 3: Effects of crop rotation, burial depth and duration on the viability and germination of *Sclerotinia sclerotiorum* sclerotia

Primary institutions	University of Pretoria
Principal investigators	Prof Martin Steyn
Collaborating institutions	Prof. Jacque van der Waals, Dr Dirk Uys (Potatoes SA), Dr Mariëtte Marais (ARC)
Students and postdoctoral fellows	Mandla Sibiya

Project Overview

Not enough is known about the epidemiology and management of *Sclerotinia sclerotiorum* in South Africa. An improved understanding of the soil and crop factors that affect *S. sclerotiorum* inoculum availability and viability will provide important risk assessment information to producers, which will allow them to make informed management decisions, both pre-plant and in-season. This could lead to reduction of disease incidence and in turn, better management of the pathogen, ensuring sustainable production of crops. Therefore, it is important to conduct research that will investigate the effect different crop rotation systems and sclerotia burial depth on the survival, viability and germination of sclerotia. Results from this research will facilitate the identification of optimal crop rotation systems that will improve productivity and result in more (environmentally and financially) sustainable crop production in the Eastern Free State region.



Aim: To gain an improved understanding of the soil properties and crop factors that affect *S. sclerotiorum* inoculum survival, viability and germination in a dryland production region of South Africa, to improve management of this pathogen.

Objectives

- To evaluate the effects of
 - Crop rotation cycle
 - Sclerotial burial depth and duration on *Sclerotinia sclerotiorum* sclerotia survival, viability and germination (and therefore potential to cause disease).

Results and discussion

A long-term crop rotation trial was initiated in 2015 in the potato-growing region of the Eastern Free State (EFS) under dryland conditions. The selected crops for the various rotation cycles include maize (*Zea mays* L.), sugar bean (*Phaseolus vulgaris* L.), soybean (*Glycine max* L. Merr.), sunflower (*Helianthus annuus* L.), teff (*Eragrostis tef* Zucc.), and potato (*Solanum tuberosum* L.). This trial was utilised to evaluate the effects of different crop rotations on the viability of *Sclerotinia sclerotiorum* sclerotia and to explore sustainable agricultural practices that could mitigate the impact of this pathogen.

Soil samples were collected from the Eastern Free State long-term crop rotation trial from the top 15 cm in the various treatment replicates at the end of the fallow season (year 4; see bold text in Table 1).

**Table 1. Trial layout for crop rotation trial in Eastern Free State.**

Rotation cycle-year	Season	R1	R2	R3	R4
Year 1	2016/2017	Maize	Maize	Maize	Maize
Year 2	2017/2018	Maize	Sugar beans	Soybeans	Sunflower
Year 3	2018/2019	Teff	Maize	Maize	Maize
Year 4	2019/2020	Fallow	Fallow	Fallow	Fallow
Year 5	2020/2021	Potatoes	Potatoes	Potatoes	Potatoes

Sclerotinia sclerotiorum (Ss) sclerotia were collected through destructive sampling at 20 weeks. Notably, none of the sclerotia produced apothecia or mycelia during their burial, suggesting that higher temperatures reduce the likelihood of Ss sclerotia germinating myceliologically or carpogenically. The study further emphasised the importance of maintaining hydration for Ss sclerotia during inoculum formation, as it significantly increases germination rates (Huang 1985; Huang and Kozub 1991; Huang et al. 1998; Foley et al. 2016). Sclerotia inoculum that developed at low temperatures and remained consistently hydrated demonstrated more efficient germination.

Viability tests conducted after 20 weeks showed a clear trend (Figure 1). Sclerotia viability was consistently higher on the soil surface (0 cm) compared to those buried at depths of 5 and 10 cm across all crop rotation treatments. It is hypothesized that buried sclerotia, exposed to a greater soil volume, experienced more colonization by beneficial microorganisms (BCAs) than those on the surface. A detailed analysis of the sclerotia viability across different crop rotations (R1 – Potatoes-Maize-Maize-Teff, R2 – Potatoes-Maize-Sugar Beans-Maize, R3 – Potatoes-Maize-Soybeans-Maize, R4 – Potatoes-Maize-Sunflower-Maize) revealed significant differences in BCA presence, as illustrated in Figure 2. The study's fourth year, however, showed no significant differences in microbial functional diversity across treatments.

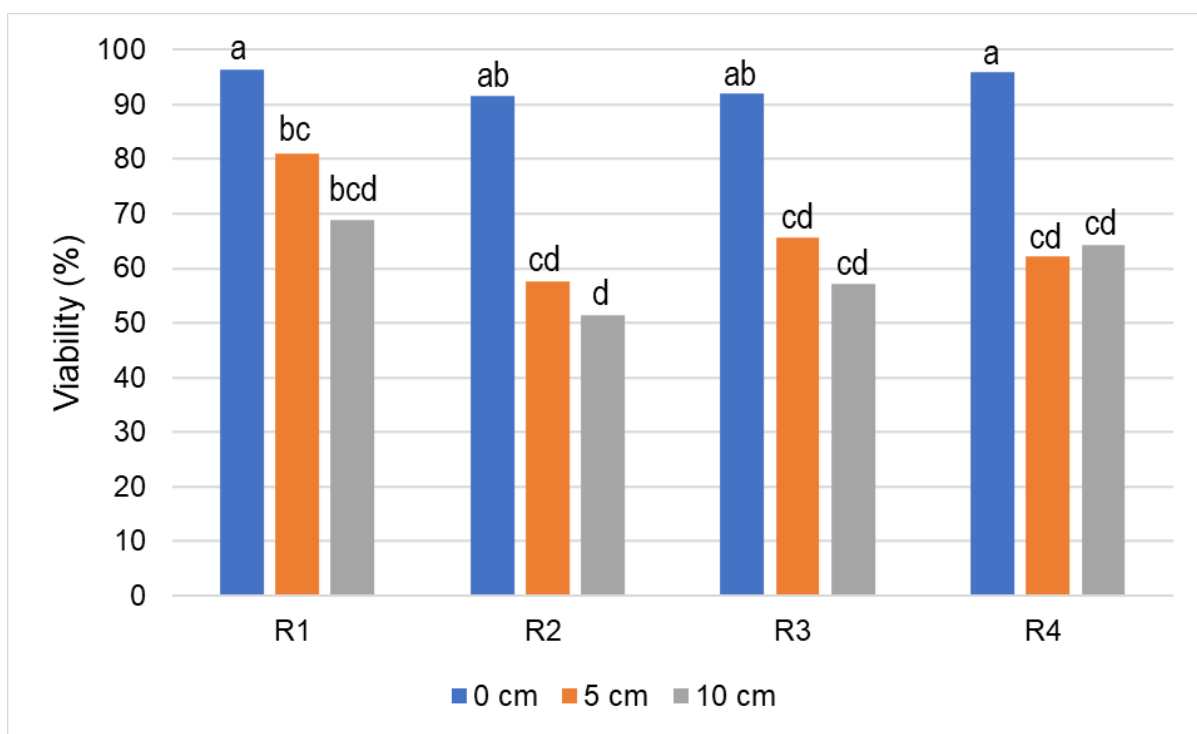


Figure 1. Viability of sclerotia buried at various depths for 20 weeks. R1 – Potatoes-Maize-Maize-Teff, R2 – Potatoes-Maize-Sugar beans-Maize, R3 – Potatoes-Maize-Soybeans-Maize, and R4 – Potatoes-Maize-Sunflower-Maize rotations. *In each rotation, bars with different letters differ significantly according to Tukey's HSD Post Hoc Test ($P < 0.05$).

Efforts to extract nematodes from *Ss* sclerotia, supported by Dr Mariëtte Marais (ARC) and Prof Driekie Fourie (University of North West), indicated the presence of fungivorous nematodes in various treatments. Despite their low numbers, these nematodes effectively degraded sclerotia. Due to the complexity, cost, and identification challenges associated with nematode isolation, their exploration as potential BCAs was excluded from the study. Literature reviews confirmed that all identified microbial isolates had recorded biocontrol activity, including some against *Ss*. In vitro screening of nine bacterial isolates and four *Trichoderma* spp. fungi from different rotation treatments assessed their antagonistic activity against *Ss* mycelia using the dual culture method.

Among the bacterial isolates, *Achromobacter mucicolens*, cultivated primarily from sclerotia buried at 10 cm, showed potential for biocontrol, despite limited research (Abdel-Rahman et al. 2017; Zia et al. 2021). *Alcaligenes faecalis*, isolated from R2 and R4 rotations, and *Microbacterium hydrocarbonoxydans*,



from R3, exhibited biocontrol capabilities through antifungal metabolite production (Wang et al. 2015). *Paenibacillus lautus*, isolated from R4, also showed promise for biocontrol and plant growth promotion (Lal et al. 2016). *Bacillus subtilis*, isolated from R2 soil, is an effective BCA already available commercially (Fernando et al. 2007; Gao et al. 2014), utilizing mechanisms like enhancing host resistance and antibiosis (Ongena et al. 2005).

While most bacterial strains showed inconclusive inhibition effects due to multiple sub-culturing, *Trichoderma* spp. were effective in inhibiting Ss mycelial growth. *T. harzianum* received a partial growth inhibition rating, while *T. spirale* and *T. hamatum* showed inhibition zones, with inhibition averaging between 30 and 50% (Figure 2). There was no significant difference in mycelial growth inhibition among the *Trichoderma* spp. ($p > 0.05$).



Figure 2: Dual culture assay interaction between *Sclerotinia sclerotiorum* and *Trichoderma hamatum*.

Conclusion

The project has provided valuable insights into the epidemiology and management of *Sclerotinia sclerotiorum* (Ss) in South Africa, specifically within the dryland potato-growing region of the Eastern Free State. The findings underscore the significance of understanding soil and crop factors that



influence the survival, viability, and germination of Ss sclerotia. This knowledge is crucial for producers as it enables informed pre-plant and in-season management decisions, potentially reducing disease incidence and enhancing pathogen management, thus ensuring sustainable crop production. The long-term crop rotation trial revealed that different rotation systems impact the viability of Ss sclerotia. For instance, rotations involving soybeans and sunflowers showed different levels of beneficial microbial colonization compared to other rotations. The study also highlighted the role of sclerotial burial depth in Ss management, with surface sclerotia displaying higher viability than buried ones, likely due to less microbial colonization.

Viability tests after 20 weeks indicated that buried sclerotia experienced more colonization by beneficial microorganisms (BCAs), reducing their viability. This suggests that strategic crop rotations and tillage practices could enhance microbial activity, thereby managing Ss more effectively. The results from nematode extraction efforts, although not fully explored, pointed to the potential role of fungivorous nematodes in sclerotia degradation.

The study also identified several microbial isolates with biocontrol potential, such as *Achromobacter mucicolens*, *Alcaligenes faecalis*, *Microbacterium hydrocarbonoxydans*, *Paenibacillus lautus*, and *Bacillus subtilis*. These isolates demonstrated varying degrees of antagonistic activity against Ss mycelia, with *Trichoderma* spp. showing consistent effectiveness.



ADDENDUM 2

Table 1: Molecular identification by sequencing of bacterial (SB) and fungal (SF) strains cultivated from sclerotia buried in the soil collected from the various crop rotation treatments.

Strain	Rotation Treatment	Depth (cm)	Time elapsed (weeks)	Possible microbial species	Genome sequence used	Identification after insertions	Accession number
SB10	1	10	10	<i>Achromobacter mucicolens</i>	Whole	100%	CP123364.1
SB9	2	5	10	<i>Alcaligenes faecalis</i>	Whole	100%	CP033861.1
SB1	2	5	10	<i>Bacillus subtilis</i>	Whole	100%	CP123773.1
SB11	3	10	10	<i>Achromobacter mucicolens</i>	Partial	99.15%	ON703261.1
SB13	3	10	10	<i>Achromobacter mucicolens</i>	Partial	99.44%	OK287286.1
SB6	3	10	10	<i>Microbacterium hydrocarbonoxydans</i>	Partial	100%	MT533996.1
SB5	4	10	10	<i>Alcaligenes faecalis</i>	Whole	100%	CP033861.1
SB12	4	10	20	<i>Achromobacter mucicolens</i>	Partial	99.81%	MH196994.1
SB2	4	10	20	<i>Paenibacillus lautus</i>	Whole	100%	CP032412.1
SF1	2	5	10	<i>Trichoderma harzianum</i>	Partial	99.16%	OR366537.1
SF2	3	5	10	<i>Trichoderma harzianum</i>	Partial	99.57%	OR366537.1
SF3	4	10	10	<i>Trichoderma hamatum</i>	Partial	98.42%	OR435188.1
SF5	3	5	10	<i>Trichoderma spirale</i>	Partial	99.77%	MK594119.1

SECTION B: UPDATE OF NEW SASRN PROJECTS

Project 1: South African Sclerotinia Research Network

Primary institutions	Jointly led by the University of the Free State, Grain SA
Principal investigators	Dr Lisa Rothmann
Collaborating institutions	AgriSeed & DMS Genetics, Dr Adré Minnaar-Ontong, Western Cape Department of Agriculture
Students & postdoctoral fellows	Kwanele Sabela (Social media manager)



Project Overview

The South African Sclerotinia Research Network (SASRN) functions as an online community of practice and a research consortium dedicated to identifying optimal management strategies for local farmers to combat Sclerotinia diseases. The network also focuses on direct interaction and communication with producers, disseminating pertinent information to help them make informed decisions regarding the prevention and management of these diseases. SASRN provides a platform for South African researchers, industry members, and producers to connect, fostering a community aimed at addressing Sclerotinia species diseases affecting economically significant crops.

Aim: The three key issues on which the SASRN focuses on are 1) generating a virtual centre of excellence and expertise (using a website and communication platform); 2) the role South Africa can play in the Sclerotinia research arena internationally and most important 3) developing and communicating practical management strategies for diseases caused by Sclerotinia for our local producers.

Objectives:

- Annual General Meeting
- Research Accountability Meeting
- Website & Social Media (Facebook, Instagram, Twitter)
- Producer Extension, Farmer's Days and Laboratory analysis



Objective 1: Annual General Meeting

In early 2023, SASRN hosted the Sclerotinia Day which included various stakeholders of the grain industry, such as researchers, agricultural companies and farmers. The purpose of this was to prioritise the next focus areas within the network. The outcomes of this meeting led to the development of five new projects listed in Section B of this report. A Plant Health Day will be hosted 16 August 2024, and a Sclerotinia discussion will be hosted later in the year. The Plant health day will focus on various aspects of pests and disease surveillance and management, including that of Sclerotinia. The Sclerotinia discussion will focus on strengthening the network, ensuring that duplication does not occur and establish good working relationships between researchers.

Objective 2: Research Accountability Meeting

The GSA research team has conducted several meetings with Dr. Lisa Rothmann to discuss the progress of SASRN and potential activities within the current initiatives. Informal discussions with the research community are frequently held to ensure these initiatives remain on track. The Community of Practice (CoP) is growing, with active members contributing regularly. Due to the ongoing threat of Sclerotinia among producers and its national media coverage (e.g., <https://www.youtube.com/watch?v=R00r2Xrl1ys>), the project is gaining more attention, necessitating better organization of the CoP through online tools and collaboration.

Researchers funded for Sclerotinia studies are actively contributing to CoP platforms. Year on year, there has been an increase in research meetings and collaborations. A material transfer agreement is being revised for the Sclerotinia culture collection, which will facilitate smooth and transparent transfer of cultures between institutions and researchers, further enhancing trust and collaboration.



Objective 3: Website & Social Media (Facebook, Instagram, Twitter)

Social media and website posts were uploaded in the past season to share information. Posts included information on Sclerotinia in cabbages, sclerotial formation, population genetic structure and biological control agents. Mr Kwanele Sabela has consistently been posting social media materials and this has had a good impact on engagements.

The website will continue to publish short research articles and the collaboration with Pula Invula to reach emerging producers. The unique branding and marketing for the network has been shared on an online platform so that all who participate can have equal and free access to the items generated.

Objective 4: Producer Extension

The below points will indicate the interactions that SARSN has had with farming communities, whether in person or via online plant platforms.

- Dr Lisa Rothman gave presentation on SARSN at the Grain SA Research Roadshows in Middelburg, Bothaville and Lichtenburg during September and October 2023. The roadshows were made possible by ABSA and John Deere Financial and covered topics related to climate, plant health and agronomy. Talks centred around seasonal forecasts, Sclerotinia management and precision agriculture. The roadshows was to engage producers on topics that are current on farm-level and shared scientific information to aid with decision-making. The roadshows also provided the opportunity for researchers to engage with producers to make research relevant. Various stakeholder of the agricultural industry have participated in this event.

Below is a link from the SA Grain Mag summarising the Bothaville session.

<https://sagrainmag.co.za/2023/10/10/agronomy-and-plant-health-road-shows-address-current-issues/current-issues/>



Dr Lisa Rothmann presenting on Sclerotinia life cycle and management at the Grain SA Research Roadshow in Lichtenburg, North West.

- Dr Lisa Rothmann attended to the Agricol soybean cultivar launch in February 2023 and the Sclerotinia Network was well presented, with banners at the launch as well. The trip was sponsored by Agricol (Figure 2). The team has also engaged in discussions to share the team's research on Agricol's App in the Eastern Free State.



Figure 2. Field tour at the Agricol soybean cultivar launch with Don Mario partners.



- Dr Lisa Rothmann and her team presented their research at the Agronomy Info Services “Insette Dag” in March 2024.
- Mr Vusi Ngcobo from North West Department of Agriculture and Dr Rothmann have diarised a workshop for producers in August 2024.
- A producer that has been engaged with the Network reported to the Network the presence of sclerotinia on his farm. Dr Rothmann will visit this producer and discuss management strategies that are already being implemented by the producer.
- A colleague from Bayer, Mr Johann Wethmar, Western Cape, has engaged with Dr Rothmann to discuss future work which can be conducted in the province. Dr Rothmann will engage with Ms Diane Mostert and Ms Lizette Nowers when conversations can commence with Bayer.
- Lourens Ras from UPL-South Africa has also reached out to Dr Rothmann via the Network Facebook Page.

The Grain SA Team and Dr Rothmann has submitted multiple articles to the SA Grain Magazine and the Pula/Imvula Magazine (dedicated to developing farmers) in the 2023/24. These articles relate to the identification and management of Sclerotinia diseases.

Table 1: Popular articles written by the SASRN Community

Sclerotinia diseases: Cultural control	https://sagrainmag.co.za/2023/08/31/sclerotinia-diseases-cultural-control/#:~:text=Cultural%20control%20practices%20include%20crop,and%20eradication%20(Table%201).
Sclerotinia diseases: Biological and chemical control	https://sagrainmag.co.za/2023/07/31/sclerotinia-diseases-biological-and-chemical-control/
Seed treatments with a focus on Sclerotinia diseases	https://sagrainmag.co.za/2023/08/31/seed-treatments-with-a-focus-on-sclerotinia-diseases/
How to identify Sclerotinia	https://www.grainsa.co.za/how-to-identify-sclerotinia-sclerotiorum



Dr Godfrey Kgatle, Prof Sandra Lamprecht, and Thabo Phasoana, titled: "[Seed treatments with a focus on Sclerotinia diseases](#)" on 31 August 2023.

An article on USA producers' perceptions of managing sclerotinia stem rot is still underway. Mr. Kwanele Sabela and Dr Rothmann have submitted an article for the OSF magazine for publication in December, titled, "The life of ascospores: their origin from sclerotia, destiny through air and host infection pathway.

Dr Rothmann and Ms Nomvula Moloi (Honours student under Dr Rothmann's supervision) was published in the Oilseed Focus Magazine, [The art of war on plant disease through surveillance](#).

- More articles are being written-up to be included in the SA Grain and the Pula/imVula Magazines.

Highlights

As SASRN expands, the South African Cultivar Technology Agency (SACTA) and several chemical companies have joined the network to help develop new management strategies. SACTA will contribute two technicians, who will be stationed at the University of the Free State. These technicians will oversee Sclerotinia fungicide evaluation trials and monitor pest and disease prevalence in sunflowers and soybeans using the National Cultivar Trials (NCT).

Conclusion

From the outlined objectives, it is evident that interactions among various stakeholders have intensified in the effort to manage Sclerotinia diseases. The South African Sclerotinia Research Network (SASRN) has seen a notable increase in participation from researchers and private entities, as well as a rise in farmers reaching out for support. A prime example of these collaborative efforts is the Sclerotinia Days, where stakeholders from the grain industry convene to discuss the latest advancements in management tools. These events also highlight existing gaps that, if addressed, could significantly enhance farmers' ability to manage Sclerotinia diseases more effectively.

SASRN stands as a vital collaborative effort in combating Sclerotinia diseases, spearheaded by the University of the Free State and Grain SA, and now involving more participants. Through its comprehensive approach, SASRN has created a robust online community and a research consortium that brings



together researchers, industry members, and producers. This initiative not only focuses on creating a virtual centre of excellence but also emphasizes South Africa's significant role in the international Sclerotinia research arena. By leveraging annual meetings, social media, and direct farmer engagement, SASRN has effectively disseminated practical management strategies, fostering a well-informed agricultural community. The consistent contributions from stakeholders and the increasing collaboration underscore the network's success in enhancing local agricultural productivity and sustainability. SASRN's efforts in research, communication, and practical application demonstrate a model of excellence in addressing economically significant crop diseases.

Project 2: Fungicide evaluation trials on Sclerotinia head and stem rot in sunflower

Primary institutions	University of the Free State
Principal investigators	Dr Lisa Rothmann
Collaborating institutions	University of the Free State, Agricultural Research Council – Grain Crops, Agronomy Info Services

Project Overview

Sclerotinia head rot poses a significant threat to sunflower production in South Africa, particularly impacting farmers in the Northwest and Free State provinces. The severity of Sclerotinia infections has led many producers to exclude sunflowers from their crop rotations, limiting their agricultural diversity and potentially affecting overall productivity.

Currently, benomyl is the sole registered chemical control for Sclerotinia on sunflowers in South Africa. However, with its high toxicity and subsequent bans in the United States and Australia, benomyl is expected to be phased out in South Africa as well. This project aims to address this challenge by evaluating alternative chemical formulations for managing Sclerotinia diseases in sunflowers, seeking to secure new options for effective control.



The project employs a collaborative approach, engaging industry stakeholders to test various formulations in field trials across three diverse climatic zones: Delmas (Mpumalanga), Potchefstroom (Northwest), and Clocolan (Free State). Each participating company will contribute its proprietary formulations, which will be tested under both inoculated and natural infection conditions. This collaborative effort aims to gather comprehensive data to support the registration and use of new chemical controls, ensuring continued protection against Sclerotinia and enhancing sunflower production sustainability in South Africa.

Aim: The project is aimed at evaluating the efficacy of various formulations (biocontrol and fungicide) in controlling/suppressing sclerotinia head rot and stem rot in sunflowers, under natural and inoculated field conditions.

Objectives:

- Secure industry partners
- Field trial planting, inoculations, and fungicide applications
- Disease assessments and data analyses
- Reporting and sharing findings

Results and discussions

Objective 1: Secure industry partners

Service Level Agreements (SLA) and Material Transfer Agreements (MTA) signed with Syngenta, Bayer and Farm-Ag.



Objective 2: Field trial planting, inoculations, and fungicide applications

Fungicide trials were initiated at the end of 2023 to explore potential active ingredients against *Sclerotinia sclerotiorum* causing head rot on sunflower. **Company 1** provided two active ingredients for Plantings 1 and 2. However, at Planting 3, we did not have enough for Entry 2 to apply; consequently, a double dose application of Entry 1 was applied. **Company 2** provided one entry as a single application at the second planting date and a single and double dose application at planting three. There was sufficient space to accommodate one entry of a tester of **Company 3** at the third planting date. Please note the below summary is descriptive statistics and does not reflect significant differences. Each company will receive their report to indicate if there are significant differences in the treatments. A **control** of inoculated and no fungicide applications was included at all planting dates.

Field trials were planted in Delmas (MP) at an experimental farm with artificial inoculations of *S. sclerotiorum*. The trials in Clocolan (FS) were planted in fields with a history of sunflower head rot and were not inoculated as this is a commercial farm of a producer partner. Successful disease assessments were completed at the Delmas site due to the presence of sunflower head rot. However, no sunflower head rot developed in Clocolan. As such, no disease assessments were conducted there.

Planting Date 1 | The control (no fungicide) mean sunflower head rot was 64.2%. Company 1-Entry 1 during the first planting shows potential for reducing sunflower head rot incidence (mean incidence = 18.7%).

Planting Date 2 | The control (no fungicide) mean sunflower head rot was 81.5%. Company 1-Entry 1 during the second planting shows potential for reducing sunflower head rot incidence (mean incidence = 58.7%). Company 2-Entry 1 showed the greatest reduction from the mean sunflower head rot at the second planting date (mean incidence = 35.1%).



Planting Date 3 | The control (no fungicide) mean sunflower head rot was 54.0%. Company 3-Entry 1 showed the greatest reduction in sunflower head rot incidence at the third planting date, i.e., mean incidence = 22.6%, as it was the only product which showed meaningful reductions in mean head rot incidence.

Considerations | The weather data during this time must be explored to understand the potential influence on treatments.

Conclusion

This year experienced a dry season, which typically does not favor the development of Sclerotinia disease. Despite this, artificial inoculations were employed to facilitate infection of sunflower heads, allowing for effective evaluations. To achieve different levels of sunflower head rot with the artificial inoculum, it is necessary to use various planting dates, as fungicides may perform differently depending on the disease threshold. Disease severity assessments will be more accurate once a standardized area diagram for sunflower head rot is established, as incidence alone may only reflect the number of infected heads without providing insight into the extent of the infection.

Planning for 2024/2025

Continued invitation to various stakeholders is ongoing to discuss entries with the trials so that we can budget accordingly. Additionally, all contracting and paperwork will need to be completed before then. This process has been streamlined in the year of trials, completed in 2023/2024.

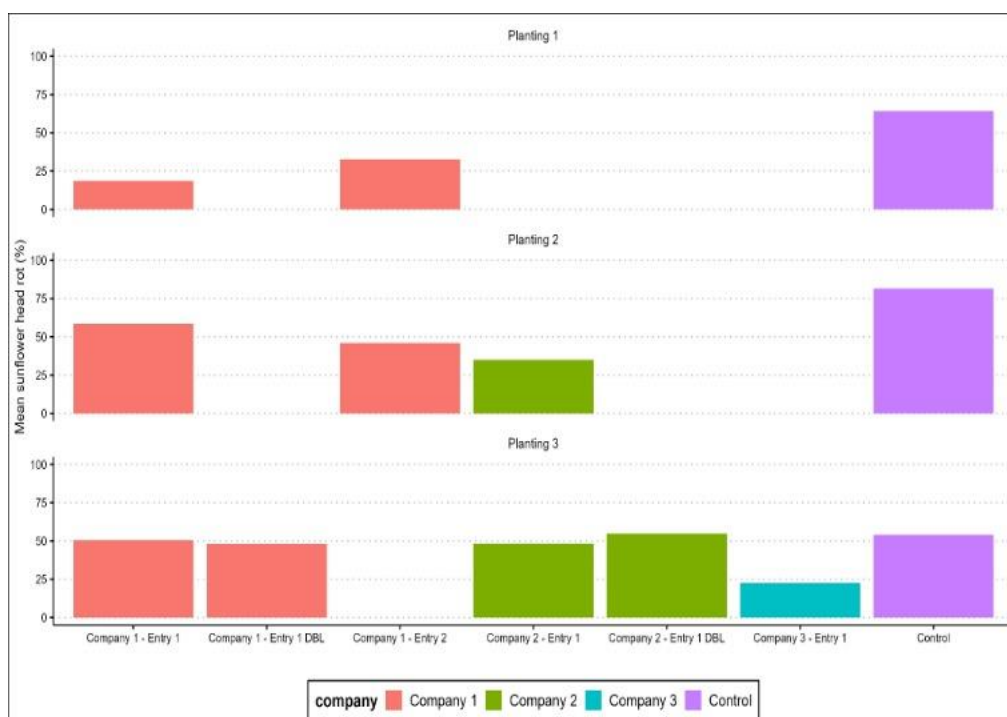


FIGURE 1. Mean sunflower head rot incidence (%) across three planting dates from fungicide trials planted in Delmas (MP).

Project 3: Manipulating flower timing with plant growth regulators as a possible sunflower escape strategy from Sclerotinia head rot

Primary institutions	University of Pretoria
Principal investigators	Dr. Nicky Creux
Collaborating institutions	ARC – BTP
Students and postdoctoral fellows	Ms Nomfundo Shinga – PhD student (2023), Ms Jolize Kruger – BSc (Hons) student (2024)
Technicians	

Project Overview

Sclerotinia head rot (SHR) is one of the major diseases affecting sunflower production in South Africa and leads to major losses across the country. A limiting factor in the control of this disease is its erratic nature, where incidence is limited in some seasons, but almost ubiquitous in others (e.g., 2021–2022 and 2013-2014 seasons). There are still very few effective management strategies. Currently, staggered plantings are considered most effective in



minimising losses due to SHR. This strategy limits the losses due to SHR by ensuring only a subset of plants will be lost if a favourable environment for infection and appropriate flowering stages coincide. However, staggered plantings complicate agricultural practices, and aligning flowering with seasonal variation can be challenging, since the planting date is linked to the onset of rain in South African rain-fed systems. Various studies have indicated that plant growth regulators may change flowering time and it is worth considering whether plant growth regulators can be used to artificially align plant growth/flowering stages with specific environments. This may allow plants to escape infection from pathogens, such as *Sclerotinia*, that require the coincidence of a specific growth stage and environment for disease establishment.

Aim: The main aim of this study is to investigate the feasibility of using plant growth regulators to manipulate flowering in sunflowers as an escape strategy from SHR.

Objectives:

- To determine the effect of plant growth regulators *in vitro* on sclerotia germination and mycelial growth of *S. sclerotiorum*.
- To determine the *in-planta* effect of plant growth regulators on infection of *S. sclerotiorum* on detached sunflower heads.
- To determine the effect of plant growth regulators on manipulating the timing of anthesis in sunflower and impacts on yield.
- To assess the effects of selected plant growth regulators on SHR incidence in field grown sunflowers and the impact on yield.



Results and discussion

Objective 1: To test plant growth regulators effect in vitro on carpogenic and myceliogenic germination, mycelial growth and sclerotia development

In the first year of this project, significant progress has been made on Objective 1. To date, seven out of eight selected plant growth regulators have been tested for their effects on myceliogenic germination of sclerotia, mycelial growth, and sclerotia formation. The plant growth regulators examined so far, each at multiple concentrations, include gibberellic acid (GA), paclobutrazol (PAC), salicylic acid (SA), 1-naphthaleneacetic acid (NAA), ethephon, 6-benzylaminopurine (6-BAP), and methyl jasmonate (JA).

Objective 1 aimed at assessing the impact of plant growth regulators on different stages of *Sclerotinia sclerotiorum* development, including mycelial and carpogenic germination, mycelial growth, and sclerotia formation. We tested five concentrations of gibberellic acid (GA) and paclobutrazol (PAC), a GA inhibitor, using solid Potato Dextrose Agar (PDA) media. Our observations indicated that GA consistently promoted mycelial growth across all concentrations and led to the formation of 50-60 sclerotia per plate. However, GA's effect on sclerotia development was minimal, suggesting that even at low concentrations, it might influence sclerotia weight.

Conversely, PAC did not support mycelial growth at any concentration, from 50 mg/L to 300 mg/L. Instead, a melanized mass, likely an attempt by the fungus to form new sclerotia, was observed. This melanized structure grew larger with increasing PAC concentrations, but no fully developed sclerotia were formed (Figure 1). These findings suggest that GA is crucial for mycelial growth, while PAC likely interferes with a different pathway related to sclerotia formation.

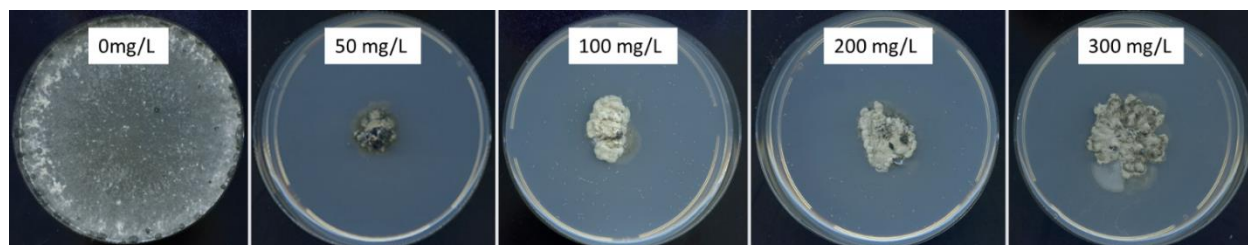


Figure 1. Mycelial growth and attempted sclerotia formation of *S. Sclerotiorum* on half PDA amended with different concentrations (0 mg/L, 50 mg/L, 100 mg/L, 200 mg/L and 300 mg/L) of paclobutrazol at four weeks post inoculation (n=5).

Five concentrations of salicylic acid (SA) from 0 mg/L to 300 mg/L, finding that increased SA levels inhibited mycelial growth and reduced sclerotia production by over 30% (Figure 2A and E). At the highest SA concentration, the average weight of sclerotia increased, indicating that *Sclerotinia sclerotiorum* produces fewer but larger sclerotia under high SA conditions, likely as a stress response to enhance survival. These results suggest SA could be a promising plant growth regulator for further research.

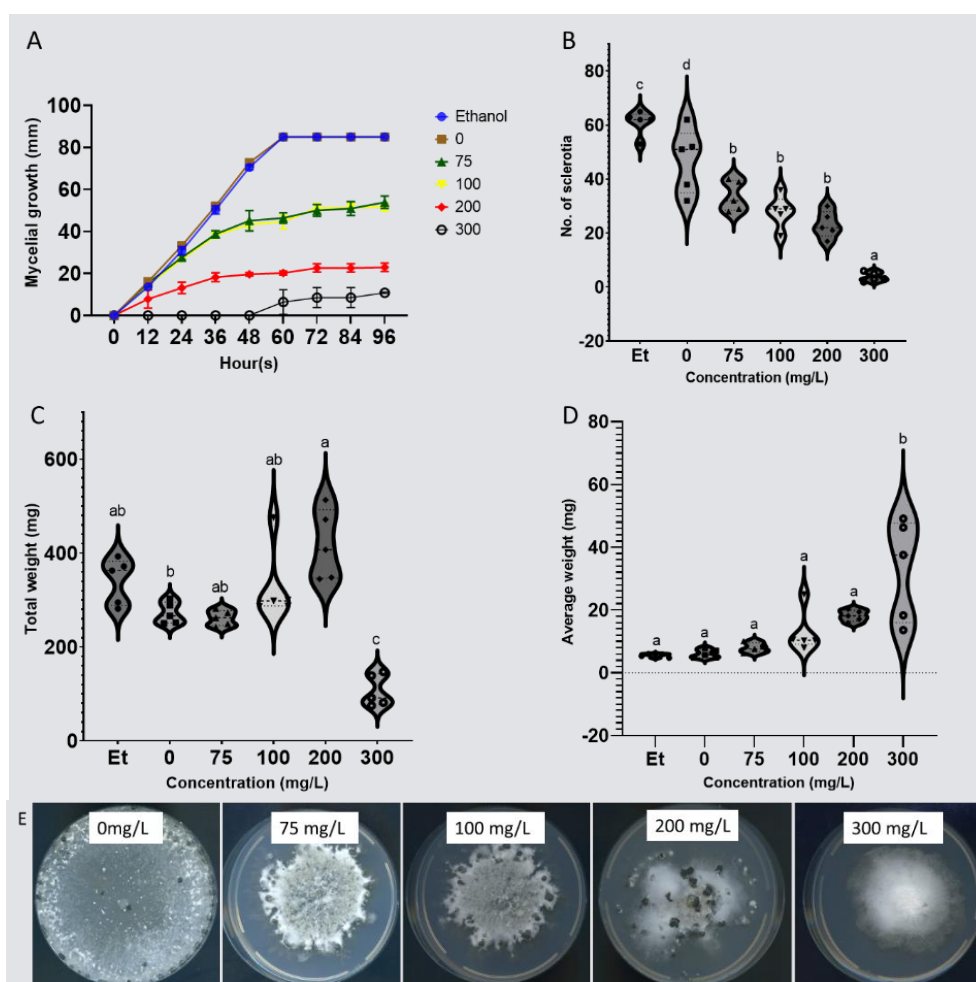


Figure 2. Mycelial growth (A) and number of sclerotia formed (B) for *S. sclerotiorum* on half PDA amended with different concentrations (0mg/L, 75 mg/L, 100 mg/L, 200 mg/L and 300 mg/L) of salicylic acid (SA).



salicylic acid. The total weight of sclerotia produced per plate (C) and the average weight of each sclerotia (D). The panel of images provides visual confirmation of *S. Sclerotium* mycelial growth and sclerotia (black patches) at 4 weeks post inoculation. Different letters above the plots indicate statistically significant differences as calculated by one-way ANOVA and the Tukey multiple comparison test (n = 5). Et = ethanol control.

Similarly, 1-Naphthaleneacetic acid (NAA), a synthetic auxin analog, was tested and showed effects similar to SA, with higher concentrations significantly suppressing mycelial growth and decreasing sclerotia production (Figure 2B and E). Given that NAA influences growth similarly to indole acetic acid (IAA), which affects floret development, exploring NAA further could reveal its potential to modify floret development timing and help manage *Sclerotinia* head rot in field conditions.

Methyl jasmonate (JA), a plant signaling molecule, was evaluated for its impact on *Sclerotinia sclerotiorum* growth and sclerotia formation but showed no significant effects compared to salicylic acid (SA) (Figure 2A and E). Ethephon, commonly used in South African agriculture, successfully inhibited mycelial growth and induced the formation of fewer but heavier sclerotia, suggesting it may suppress pathogen growth and trigger a stress response (Figure 2B and E). However, since ethephon converts to ethylene, which may affect fungal development differently, further in planta studies are needed to confirm its effectiveness.

Synthetic cytokinin 6-benzylaminopurine (BAP) was also tested and resulted in reduced mycelial growth and fewer sclerotia as its concentration increased (Figure 2D and E). These results are promising, but additional research across various fungal species is required to fully understand BAP's effects and its potential use in managing *Sclerotinia* diseases.

Objective 2: To determine the in-planta effect of plant growth regulators on infection of S. sclerotium on detached sunflower heads by artificial inoculation.

The initial screening of plant growth regulators identified two substances, 1-naphthalene acetic acid (NAA) and salicylic acid (SA), as inhibitors of *S. sclerotiorum* mycelial growth and sclerotia formation *in vitro*. NAA, a synthetic



auxin analog, shows potential for influencing floret opening timing and limiting fungal growth, pending *in-planta* confirmation without impacting yield. SA demonstrates potential for enhancing plant disease resistance but requires comprehensive evaluation for its effects on plant growth and yield. Methyl jasmonate (JA), ethephon, and 6-benzylaminopurine (BAP) lack clear results and need further investigation, particularly in understanding their effects on fungal growth and plant development in field conditions.

Conclusion

Although the project is in its early stages, it has already yielded notable findings. Initial results suggest that gibberellic acid (GA) may play a crucial role in the lifecycle of *Sclerotinia sclerotiorum*, or that paclobutrazol (PAC) might be interfering with another key fungal pathway. Among the plant growth regulators tested so far, 1-naphthaleneacetic acid (NAA) and salicylic acid (SA) have shown promise in inhibiting both mycelial growth and sclerotia formation in vitro.

The project has made substantial progress since its commencement, with objectives largely on track. Seven plant growth regulators have been selected and tested, and protocols for carpogenic germination and spore formation are in development. A pilot study is currently underway, with plants now five weeks old in the glasshouse. Upcoming research will focus on validating the role of GA and assessing the impact of these regulators on floral development and yield in in-planta tests. Preliminary results highlight the potential of GA and other inhibitors in controlling the pathogen, suggesting further exploration in this area.



Project 4: Plant disease surveillance: value adding to the National Soybean and Sunflower Cultivar Trials

Primary institutions	University of the Free State
Principal investigators	Dr Lisa Rothmann
Collaborating institutions	Agricultural Research Council – Grain Crops
Students and postdoctoral fellows	None
Technicians	Marais Cloete

Project Overview

In South Africa, controlling *Sclerotinia* diseases typically involves choosing cultivars with varying degrees of resistance. While no soybean or sunflower cultivars offer complete resistance to *Sclerotinia sclerotiorum*, some exhibit partial or escape resistance. The ongoing National Cultivar Trials (NCT) are essential for evaluating cultivar performance, given that seasonal changes can affect disease responses. Additionally, these trials provide valuable insights into potential new diseases that could impact sunflowers and soybeans.

Aim: Disease surveillance, involving the NCT and collaboration with experts, for early detection and timely management of soybean and sunflower diseases, including ongoing screenings for *Sclerotinia sclerotiorum* in Delmas.

Objectives:

- Appoint field technician and extension officer;
- Surveillance of soybean and sunflower NCTs;
- Identification of surveyed samples;
- Continued screening of NCTs for *S. sclerotiorum* under inoculated and natural field conditions.



Results and discussion

Objective 1: Appoint field technician and extension officer

Completed. Marias Cloete was appointed to serve in this capacity. SACTA has agreed to provide funding for an additional two technicians to bolster the activities related to fungicide screening and the cultivar evaluation trials. This much needed capacity will support Dr Rothmann and build future capacity.

Objective 2: Surveillance of soybean and sunflower NCTs

Mr Cloete, with support from Dr Ma'ali from the Agricultural Research Council - Grain Crops (ARC-GC), has successfully conducted a survey of sunflower cultivars in the Free State and North West provinces. This comprehensive field survey aimed to evaluate the performance of various sunflower cultivars under field conditions. Additionally, Mr. Cloete has completed evaluations of soybean cultivars in March 2024, collaborating with Ms. Lizette Bronkhorst from ARC-Grain Crops. This effort is crucial for assessing how different soybean and sunflower varieties respond to Sclerotinia diseases.

Objective 3: Identification of surveyed samples

During these surveys, Mr. Cloete documented the symptoms observed, which are suspected of being related to diseases, though laboratory confirmation is still required. The surveys involved extensive sampling, highlighting the need for a streamlined workflow to ensure timely diagnostics and effective data analysis. Strengthening the survey process with additional capacity could enhance its efficiency. Currently, the data collected is undergoing analysis and is expected to be ready for sharing in a popular article by the end of July, providing valuable insights into cultivar performance and disease management strategies.



Objective 4: Continued screening of NCTs for *S. sclerotiorum* under inoculated and natural field conditions

Objective 4 involves the ongoing screening of National Cultivar Trials (NCTs) for *Sclerotinia sclerotiorum* under both inoculated and natural field conditions. The screening process has seen success in the plantings of soybean and sunflower at the Delmas and Clocolan sites. Despite this, high temperatures and dry conditions adversely affected the germination rates for the second planting date of sunflower at these locations. Although the germination was less successful compared to the first planting, data collection will still proceed, providing valuable information on cultivar responses under challenging conditions.

In terms of progress, soybean inoculations have been completed successfully, and the initial planting of sunflowers has also been inoculated at Delmas. The inoculation process is crucial for assessing how different sunflower cultivars respond to *S. sclerotiorum* under controlled conditions, allowing for a thorough evaluation of their resistance and susceptibility. This ongoing work is essential for refining disease management strategies and understanding cultivar performance in varying field conditions. As the project continues, the data gathered from these screenings will be instrumental in guiding future research and cultivar selection efforts. [click on this link.](#)

Conclusion

The completion of a successful season of disease surveying is something noteworthy for the oilseed industry. Although this is the first time we have utilised the national cultivar trials for this purpose it strengthens plant disease surveillance in South Africa. Professor Paul Esker (Associate Professor of Epidemiology and Field Crop Pathology, Penn State University) stated that having long-term survey data is rare and crucial to understanding diseases under certain environmental conditions.



Project 5: Innovative disruption of *Sclerotinia sclerotium* melanin production: a novel polymer approach to manage sunflower head rot

Primary institutions	University of the Free State
Principal investigators	Dr Lisa Rothmann

Project Overview

Oilseed crops are highly susceptible to the fungal pathogen *Sclerotinia sclerotiorum*. Diseases caused by *S. sclerotiorum* are initiated by the germination of sclerotia. The sclerotia are protected by a melanin rind. The success of *S. sclerotiorum* is due to the nature of the melanin rind, protecting the structure against UV, soil and weather factors and microbe degradation over a significant period. *Sclerotial* populations accumulate after successive seasons and can render fields unprofitable due to the high risk for disease initiation. The combination of pyrone/s and specially engineered pyranones have known anti-fungal properties, where some have shown the potential to manage the severity of plant diseases. This research proposes a novel polymer-approach intervention, one of which is patented at the UFS, to manage *S. sclerotiorum*.

Aim: Evaluate the effect of different combinations of pyrones and pyranones on *S. sclerotiorum* *in vitro* and *in vivo*

Objectives:

- *In vitro* evaluations of the efficacy of pyrones and pyranones in limiting *sclerotial* formation.
- Glasshouse trials for *in vivo* evaluations of the efficacy of pyrones and pyranones in limiting *Sclerotial* formation.
- Analyses of *in vivo* and *in vitro* data for section of polymer that will be used for up-scaling.



- Conducting field trials to determine the efficacy of pyrones and pyranones and on limiting *sclerotial* formation.

Results and discussions

There has been delays in the project due to the delay in identifying a suitable post-doctoral fellow in the position. Screening of applications is currently underway.

Objective 1: In vitro evaluations and microscopy

The efficacy of putative pyrone's/combination was screened as a pilot test. Two of the 13 candidates tested were identified as potentially inhibiting or reducing melanin production. An additional five candidate pyrones/combinations thereof need to be evaluated. At the initial testing, the chemistry department only does it at 5ml per polymer. Once tested and there are signs of efficacy, the effective polymers will be produced in larger quantities and be made more chemically stable.

Conclusion

This research explores a novel polymer-based approach using pyrones and pyranones to manage the fungal pathogen *Sclerotinia sclerotiorum* in oilseed crops. Despite delays in recruiting a suitable postdoctoral researcher, initial *in vitro* evaluations have yielded promising results, with two out of thirteen candidate compounds demonstrating potential in inhibiting or reducing melanin production, a key factor in the pathogen's persistence. The next steps will focus on further screening additional candidate compounds and producing effective polymers in larger quantities for *in vivo* testing. The findings so far suggest that this approach could be a viable method for managing *S. sclerotiorum*, paving the way for subsequent glasshouse trials and field studies to validate the efficacy of these compounds in a real-world agricultural setting. Continued progress in this project could lead to a significant breakthrough in controlling a pathogen that poses a major threat to oilseed crops, potentially improving yield stability and profitability for farmers.



General Conclusion

The South African Sclerotinia Research Network (SASRN) has played a crucial role in advancing the understanding and management of *Sclerotinia sclerotiorum*, a pathogen that causes significant yield losses in soybean and sunflower crops. The projects within Section A provided valuable insights into the complex interactions between the pathogen, host plants, and environmental factors, which are essential for developing effective management strategies. These efforts have established a strong foundation for further research and practical applications in combating *Sclerotinia* diseases.

Project 1 validated cultivar responses to *Sclerotinia*, despite data limitations, highlighting the need for expanded data collection across regions to improve disease forecasting. Project 2 identified potential resistant soybean lines using phenotypic and genotypic screening, emphasizing the importance of integrating these resistant varieties into crop management to reduce chemical dependency. Meanwhile, Project 3 explored the effects of crop rotation, burial depth, and duration on *Sclerotinia* sclerotia viability, suggesting that strategic rotations and tillage practices can enhance beneficial microbial activity and offer an effective non-chemical management strategy.

As SASRN expands, the South African Cultivar Technology Agency (SACTA) and several seed companies have joined the network to help develop new management strategies. SACTA will contribute two technicians, who will be stationed at the University of the Free State. These technicians will oversee *Sclerotinia* fungicide evaluation trials and monitor pest and disease prevalence in sunflowers and soybeans using the National Cultivar Trials (NCT).

Section B introduces new projects that build on the findings of Section A, aiming to refine and expand the management strategies for *Sclerotinia* diseases. These new projects are invaluable as they continue to explore alternative and innovative approaches to disease management, such as the development of biological control methods and the identification of new



sources of resistance in crops. By focusing on these areas, Section B will not only contribute to reducing the impact of Sclerotinia on crop yields but also promote sustainable agricultural practices that are less dependent on chemical inputs. The continuation of this research will ensure that the agricultural industry remains resilient in the face of evolving pathogen challenges, ultimately supporting the long-term viability and profitability of soybean and sunflower production in South Africa.

3.2.11 INVESTIGATE THE EFFECT OF DIFFERENT PLANTING DATES ON SUNFLOWER SEED YIELD AND OIL CONTENT AT FREE STATE AND NORTH-WEST; Dr S Ma'ali, MW Makgoga, JL Erasmus, TD Mohohlo, MJ Leshomo, ARC Grain Crops Institute, Potchefstroom

In South Africa, sunflower is often used as a catch crop and is planted as an alternative when rainfall onset is too late for maize or soy plantings. Therefore, the stable yields under these late planting conditions are well below the crop's yield potential. To maximize the use of natural resources, optimum planting time of a crop is significant because it ensures good seed germination and optimum root system development, which, in turn, enable the plant to absorb essential nutrients from a large volume of soil. Therefore, this study aims to study the effect of different planting dates on sunflower grain yield and quality and demonstrate and promote the optimum planting dates at the farmers' field.

Over three consecutive growing seasons (2021/22-2023/24), twelve field trials were established at GC Potchefstroom research farm, seven at Bethlehem, and five at Steynsrus, with different planting dates. Six sunflower hybrids were planted and evaluated for seed yield and quality in a randomized complete block design with three replications.

At the Potchefstroom site, a highly significant effect of planting date, sunflower hybrids and year on all studied parameters was observed. November planting yielded the highest seed yield of 2.68 t ha⁻¹, while the lowest seed yield was recorded for January planting (1.77) t ha⁻¹). January planting recorded the highest oil content, 42.02 %, across hybrids and years. Oil yield ranged from 0.75 t ha⁻¹ for the January planting to 1.12 t ha⁻¹ for November planting. The



mean seed yield across hybrids and different planting dates was 2.31 t ha^{-1} , AGSUN 5270 produced the highest yield of 2.44 t ha^{-1} and the lowest yield of 2.25 t ha^{-1} was recorded for AGSUN 5106 CLP., SY 3970 CL produced the highest oil content 48.53% and the highest oil yield of 1.17 t ha^{-1} .

At the Bethlehem site, planting dates, sunflower hybrids, and year significantly affected all studied parameters. December planting recorded the best seed and oil yield (2.02 t ha^{-1} & 0.82 t ha^{-1}) respectively. The last planting date, in January, yielded the lowest yield and oil yield of 1.62 t ha^{-1} . November planting produced the highest oil content, 40.68 %, and the lowest oil content, 39.17%, recorded for the October planting date. Evaluated sunflower hybrids showed significant differences for all studied parameters under different planting dates. For seed yield, AGSUN 5270 produced the best seed yield of 1.93 t ha^{-1} , followed by PAN 7180 CL, which yielded 1.85 t ha^{-1} . SY 3870 CL produced the highest oil content 48.00% and the highest oil yield (0.82 t ha^{-1})

At the Steynsrus site, planting dates, sunflower hybrids, and years significantly affected all studied parameters. January planting recorded the best seed and oil yield (2.80 t ha^{-1} & 1.15 t ha^{-1}) respectively. November planting yielded the lowest seed and oil yields (1.61 t ha^{-1} and 0.70 t ha^{-1}). November planting produced the highest oil content, 43.55 %, and the lowest oil content, 40.22%, recorded for December planting. Evaluated sunflower hybrids showed significant differences for all studied parameters under different planting dates. For seed yield, PAN 7180 CLP produced the best seed yield of 2.29 t ha^{-1} , followed by P 65 LP 65, which yielded 2.17 t ha^{-1} . SY 3870 CL produced the highest oil content 50.19% and the highest oil yield (1.04 t ha^{-1})

Several factors, including the site, year, planting date, hybrid selection, and their interactions, impacted sunflower seed yield, oil content, and oil yield. The optimal period for planting sunflowers in the Northwest and the Free State region is November to December. Conversely, planting sunflowers in late January is discouraged due to a substantial reduction in seed yield, oil content, and oil yield.



3.2.12 EFFECT OF FERTILIZATION AND SCLEROTINIA ON SUNFLOWER YIELD AND QUALITY; Dr SH Ma'ali, Dr B Janse van Rensburg, MW Makgoga, JL Erasmus, TD Mohohlo, DP Nkoko, ARC Grain Crops Institute, Potchefstroom

The effects of fertilizers on sunflower yield have been described previously. However, little work has been done to elucidate the effects of fertilizer on sunflower yield and quality. It is imperative that the effect of nitrogen with different fertilizer application levels and timing on sunflower yield and quality be statistically verified. International studies proved that nitrogen top dressing increases the content of crude fat and linoleic acid while more top dressing of N reduces the content of protein, oleic acid, and palmitic acid. Unfortunately, little or no research has been conducted in South Africa. This study will address this topic in a scientifically sound manner. Up to date, resistance to Sclerotinia is limited and additional screening for cultivars with partial resistance would aid in breeding programmes and in cultivar recommendations.

Due to heavy and continuous rainfall in 2021/22 and adding to the nature of the soil at the site we could not manage to plant the first planting date which is considered the optimum planting. The second planting date was established on 26 January 2022 and is considered the late planting date. Five sunflower hybrids, i.e. two conventional (PAN 7080 and AGSUN 8251), two Clearfield (AGSUN 5106 CLP and PAN 7160CLP) and one high oleic hybrid (PAN 7158 HO), were planted. Five different levels of nitrogen fertiliser were applied and consisted of 0 (control) or 45 kg ha⁻¹ nitrogen as a basal application at planting or as a treatment one month prior to planting. This was followed with a topdressing one month from planting applied as (0, 45 or 75 kg ha⁻¹).

The milled grain mycelium method was used to prepare inoculum and for the inoculation method. Lesion sizes of all heads (from individual plots) were calculated and divided by the number of heads assessed to get an average disease score.

Results of analysis of variance (ANOVA) for the main and interaction effects of N levels with different times of applications and sunflower hybrids on



sunflower yield and quality show highly significant effects of N levels and sunflower hybrids. Highly significant interaction effects of N levels and sunflower hybrids were only present for oil content and only for a slight interaction for oil yield.

For N treatment levels, 120 kg N per ha applied as 45 kg ha⁻¹ at planting and 75 kg ha⁻¹ as topdressing produced the highest yield (2.29 t ha⁻¹), this was followed by 90 kg ha⁻¹ applied as 45 kg ha⁻¹ at planting and 45 kg ha⁻¹ as topdressing. There were no significant differences between 45 kg ha⁻¹ applied one month before planting and the 0 kg ha⁻¹ application. 45 kg N per ha applied one month before planting yielded the lowest yield of 0.57 t ha⁻¹. Highly significant differences were detected among the different tested sunflower hybrids for seed yield and quality. AGSUN 8251 produced the best seed yield of (1.60 t ha⁻¹), PAN 7160 CLP produced the highest oil content (40.64 %), whereas PAN 7080 produced the lowest yield (1.17 t ha⁻¹) and PAN 7158 HO produced the lowest oil content (36.43 %).

For *S. sclerotiorum* screenings, significant differences were noticed among different hybrids. An average lesion size of 1.03 cm² was recorded and it ranged from 1.26 cm² for PAN 7158 HO to 0.84 cm² for PAN 7160 CLP. According to the ANOVA results, the nitrogen applications did not significantly influence sclerotinia infections.

3.2.13 CULTIVAR EVALUATION OF SOYBEANS IN THE WESTERN DRY LAND PRODUCTION AREA OF SOUTH AFRICA; Mr GP De Beer, Contractor, Protein Research Foundation

The past season was certainly one of the driest and hottest seasons in the past few years. We had some rain at the beginning of November for our first planting date and then in the middle of December for our second planting date and the rest of the trials.

In the past season 2023/24 the crop estimates committee predicted an average yield of 1.5 t/ha for the whole country but this season the crop estimate committee predicted a yield of 1.15 t/ha for the Northwest Province.



The new Intacta cultivars were some of the best performers the past season. In the past season, the hectares in the Northwest stayed the same as the previous season at 155 000 /ha.

The trials consist of 35 cultivars from MG 4.9 to MG 7.1. All the cultivars in the trials were indeterminate except for LS 6851 R, LAKE 250 RR and LAKE 253 RR were determinate. The LAKE cultivars had a problem with poor germination. We had nine new cultivars in the trial which consisted of 7 new RR1 cultivars (LG60259R, P52T52R, PAN 1515 R, US56-26R, LAKE 250 RR, LG60353R and LAKE253R) and 2 RR2 (Intacta) cultivars (USB-12 IPRO and US63-22 IPRO)

The trials were planted at Schweizer Reneke (2 planting dates), Hoopstad, Leeudoringstad and Baberspan.

The trials at Schweizer Reneke were planted on 9 November 2023 and 14 December 2023 with the farmers' planter. We planted one repetition from MG 4.7 to 7.1 and randomised the other two replications.

The trial at Schweizer Reneke (PD 1) had a mean yield of 2943 kg/ha. The cultivar with the highest yield was DM 59160 RSF IPRO (MG 6.0) with 4339.3 kg/ha and the cultivar with the lowest yield was LAKE 250 RR (MG 5.8) with 1643.8 kg/ha.

The trial at Schweizer Reneke (PD 2) had a mean yield of 1564.2 kg/ha. The cultivar with the highest yield was DM 53154 RSF IPRO (MG 5.0) with 2941.8 kg/ha and the cultivar with the lowest yield was LAKE 250 RR (MG 5.8) with 1109.2 kg/ha.

The trial at Leeudoringstad was planted on 14 December 2023 and was planted with the planter of the ARC. All these trials were randomised differently.



The trial at Leeudoringstad has a mean yield of 1944.2 kg/ha. The cultivar with the highest yield was DM 59160 RSF IPRO (MG 6.0) with 2785.5 kg/ha and the cultivar with the lowest yield was NS 5258 R (MG 4.9) with 1154.2 kg/ha.

The trial at Baberspan was planted on 15 December 2023 and was planted with the planter of the ARC. All these trials were randomised differently.

The trial at Baberspan had a mean yield of 930.4 kg/ha. The cultivar with the highest yield was LAKE 253 RR (MG 5.5) with 1204.7 kg/ha and the cultivar with the lowest yield was PAN 1515 R (MG 5.0) with 554.8 kg/ha.

The trial at Hoopstad was planted on 14 December 2023 and was planted with the planter of the ARC. All these trials were randomised differently.

The trial at Hoopstad had a mean yield of 3844.7 kg/ha. The cultivar with the highest yield was PAN 1555 R (MG 5.7) with 5215.7 kg/ha and the cultivar with the lowest yield was PAN 1515 R (MG 5.0) with 1630.1 kg/ha.

The trial at Hoopstad was planted on 29 October 2022 and was planted with the planter of the ARC. All these trials were randomised differently.

The trial at Hoopstad had a mean yield of 5520.6 kg/ha. The cultivar with the highest yield was DM 53154 RSF (MG 5.1) with 6580.4 kg/ha and the cultivar with the lowest yield was PAN 1555 R (MG 5.7) with 4183.2 kg/ha. This trial also had a lot of rain but it was spread more evenly.

3.2.14 DETERMINING THE RACE STRUCTURE AND GENETIC DIVERSITY OF *LEPTOSPHAERIA* SPECIES CAUSING BLACKLEG DISEASE OF CANOLA IN THE WESTERN CAPE; Dr G Mostert, Ms HM Schreuder, Mr AB Folscher, B Coetzee, Dr GJ van Coller, University of Stellenbosch and, Western Cape Department of Agriculture

The cultivation of canola cultivars in South Africa has expanded dramatically since its introduction into crop rotation systems, with a projected production of 200,000 tons by 2027 (Becker *et al.*, 2020). Production is severely constrained by the presence of blackleg disease, the most damaging disease of canola worldwide (Van De Wouw *et al.*, 2016). Blackleg disease is caused by the



Leptosphaeria species complex, with two genetically related species mainly implicated – *Leptosphaeria maculans* and *Leptosphaeria biglobosa* (Zhang *et al.*, 2014). Various management strategies have been implemented over the years, the most successful being long-term crop rotation, sanitation, delayed sowing, the development of resistant cultivars, and chemical control via fungicide application. For any management strategies to be efficient, however, knowledge on genetic diversity and pathogenic potential of the local *Leptosphaeria* population is vital. The aim of this project is, therefore, to gain a comprehensive understanding of the population biology and pathogenic potential of *Leptosphaeria* spp. causing blackleg of canola in the Western Cape and to continuously monitor the changes that can occur due to the sexual reproduction strategy of the pathogen. As the pathogen adapts it can lower the efficacy of management obtained with host resistance and fungicide applications.

Symptomatic leaves, crown tissue and stubble were collected over three seasons (2020-2023) from the canola cultivar evaluation trials at six locations, including Langgewens, Hopefield and Eendekuil in the Swartland region and Tygerhoek, Napier and Riversdal in the Southern Cape region. To date, 2 122 samples were confirmed as *L. maculans* and 329 as *L. biglobosa* from the 2020-2023 growing seasons. Thirty-five isolates were sent for whole genome sequencing to Dr Angela van de Wouw at the University of Melbourne, Australia and phenotypic virulence expression was also determined. An additional 230 samples collected in the Western Cape were selected to be representative of season, location and avirulence gene profile and high-quality DNA was extracted which were sent for whole genome sequencing and subsequent population genomics analysis. Results show that major gene resistance in canola cultivars planted in South Africa is not effective to suppress the local population of *L. maculans* and the resistance of cultivars as exhibited in the cultivar trials is rather due to quantitative resistance. South African isolates were closely related to those of Australia and New Zealand indicating these countries as the possible source of pathogen introduction. The genetic structure of *L. maculans* isolates collected in the Swartland is different from those collected in the Southern Cape, showing that gene-flow between these



regions is limited. Interestingly isolates from the Swartland were more similar to Australian isolates than to isolates from the Southern Cape. The genomes of the South African isolates were also screened for the presence of insertions in the promotor region of the *CYP51* gene, which are associated with demethylation inhibitor (DMI) fungicide resistance (Yang *et al.* 2020). These inserts were not found, which suggest that the *L. maculans* population is still sensitive to DMI fungicides.

The availability of seeds from companies has been limited in the past two seasons, driving farmers to plant retained seeds. To determine if retained seed is a source of inoculum, different lots of retained seed was collected from 34 farmers and 8 research farms in the Swartland and Southern Cape region over the 2022 and 2023 seasons. Out of the 90 seed lots investigated to date, only five lots in the Southern Cape region and three lots in the Swartland region were infected, and at very low levels. To determine the effect on blackleg disease incidence and yield penalty when planting retained seeds of hybrid cultivars, field trials were established in 2023 in the Swartland and Overberg growing regions. A disease severity index was used to determine the extent of crown infections during the end of the season. The trial included five cultivars and compared company bought seeds with retained seeds that were treated with a seedcoat fungicide/insecticide mixture as well as retained seeds with no seedcoat application. Seed source (company seed, treated retained seed, untreated retained seed) had no significant effect on blackleg disease severity at either location. Yield, however, were generally higher in company seed than treated and untreated retained seed. For some cultivars, F₁ seed (43Y92 and Diamond treated with fungicide) had a lower blackleg severity than respective F₂ seed, although no significant differences were evident for the same treatments in other cultivars.

Due to typical blackleg symptoms noticed on cover crops in the conservation agriculture system in the 2021 growing season, sampling from symptomatic weed and cover crops species were conducted in the 2022 and 2023 seasons. To date, a total of 112 isolates of *L. maculans* and 16 *L. biglobosa* were identified from white mustard, turnip, radish, and the common weed species



Ramnas, indicating that these crops serve as an alternative source of inoculum and contribute to genetic diversity within the pathogen population.

3.2.15 INTEGRATED MANAGEMENT OF BLACKLEAF OF CANOLA IN THE WESTERN CAPE BY MEANS OF CULTIVAR RESISTANCE AND CHEMICAL CONTROL; Dr GJ van Coller, Ms HM Schreuder, Mr AB Folscher, University of Stellenbosch

This study commenced in 2021, with the aim of i) determining the resistance of local canola cultivars against blackleg disease annually at different locations throughout the Western Cape, ii) determining the fungicide efficacy of a range of foliar fungicides, and to iii) screening for the sensitivity of the local *L. maculans* population to selected fungicides. The same cultivars present in the canola cultivar evaluation trials of Mr Piet Lombard were included each year in the trials to evaluate cultivars for resistance to blackleg, while cultivars Diamond (susceptible) and 44Y94 (resistant) were included in the fungicide evaluation trials. Five registered fungicides (Amistar, Faculty top, Prosaro, Santana and Aviator) and one unregistered fungicide (Bumper) were included in the field trials to evaluate fungicide efficacy. All field trials (for cultivar resistance screening and fungicide evaluation) were planted in a randomised block design with four and three replicates, respectively. Additionally, inoculum pressure was raised by distributing canola stubble obtained from the previous season's canola cultivar evaluation trials onto the respective trials, thereby ensuring that the emerging canola seedlings are in close proximity to ascospores from the blackleg pathogen, *Leptosphaeria maculans*. Disease evaluations were done toward the end of the growing season by sampling a representative number of plants of each treatment, cutting it diagonally open at the crown region and rating the disease severity index (DSI) caused by blackleg using published methodology. The sensitivity of *L. maculans* isolates representative of the different regions within the Western Cape toward the fungicides tebuconazole and prothioconazole was determined using an *in vitro* assay to determine EC₅₀ values.

DSI's for cultivars included in the cultivar evaluation trials ranged from 4% in CC90014 at Riversdale in 2022 to 66.33% in Hyola® 559TT at Langgewens



in 2021. The performance of individual cultivars varied between locations and years, however, in most cases the best and worst performing cultivars were similar between locations. When compared per location, 45Y95 and 44Y94 consistently had the lowest DSI (ranging from 10,93% and 13,51% respectively at Tygerhoek to 24,33% and 30,76% at respectively at Langgewens). Diamond was among the two cultivars with the highest DSI at all locations, ranging from 22,5% at Tygerhoek to 40,33 at Hopefield. Two cultivars with resistance gene *Rlm7* (corresponding to Australian group H) were included in the trials (CC90014 in [2022 and 2023] and Solstice [2023]). This is the first cultivars from this resistance group available in South Africa. Although generally among the best performing cultivars, their performance varied between years and locations.

For the evaluation of fungicides in field trials, the DSI, as expected, was higher in Diamond in both years and all locations compared to the more resistant 44Y94. Disease pressure was higher in 2023 than in 2022 at all locations except Tygerhoek, where the DSI in untreated controls were similar between these years. The average DSI in untreated controls for Diamond ranged from 18.67% at Riversdale to 38,67% at Langgewens. The average DSI in untreated controls for 44Y94 ranged from 7.04% at Riversdale to 23.67% at Langgewens. Fungicide application reduced the DSI in Diamond compared to the unsprayed control at all locations.

A treatment with Bumper never reduced the DSI significantly in both Diamond and 44Y94. This indicates that propiconazole (the active ingredient in Bumper) is not effective in managing blackleg. In 44Y94, fungicide treatments only resulted in significantly reduced DSI's at Langgewens and Hopefield where the disease pressure was higher. These results show that the benefit of a fungicide application depends on disease pressure and cultivar resistance, as was seen in numerous other studies.

Regarding the *in vitro* fungicide sensitivity assay, the tebuconazole EC₅₀ for all isolates ranged from 144,9 ng/mL to 985,3 ng/mL with a median of 490 ng/mL and an average of 504,4 ng/mL). Comparing these EC₅₀ values with results



from other indicates that the *L. maculans* population is still sensitive to tebuconazole. Prothioconazole EC₅₀ for all isolates ranged from 270,3 ng/mL to 1 620,4 ng/mL with a median and average of 731 ng/mL and 765 ng/mL respectively. Locations specific averages (excluding isolates collected in 2007) ranged from 556 ng/mL at Eendekuil to 830,5 ng/mL at Hopefield, with the EC₅₀ at Eendekuil significantly lower than all locations except Langgewens. Unfortunately, sufficient data to compare prothioconazole EC₅₀ from the present study with is not available; however, results from the fungicide trials suggest that the *L. maculans* population is sensitive to prothioconazole.

In summary, this study is the first comprehensive study of blackleg of canola in South Africa. It has identified groupings of resistance genes in cultivars that currently provides better resistance to blackleg than other resistance gene groupings, although variation, as expected do occur between locations and years. Field trials revealed that early fungicide applications offer limited control benefits under low disease pressure or when resistant cultivars are grown. This emphasizes the importance of considering different factors when making decisions around fungicide applications. Moreover, the inefficacy of Bumper® should discourage the off-label use of this product. This is the first study on fungicide sensitivity of *L. maculans* in South Africa and shows that the local *L. maculans* population is currently sensitive to commonly used fungicides. It also serves as an important basis for comparison for future studies. An important observation made in this study was the increasing dominance of upper canopy infection (infection > 5cm above the crown region) which includes stem cankers of the main stem, but also of side branches, florets and pods. This is addressed in the new project application submitted earlier in 2024 to the OPDT.



3.2.16 MONITORING OF SCLEROTINIA STEM ROT OF CANOLA IN THE WESTERN CAPE; Ms L Nowers, Western Cape Department of Agricultural

The final report is still awaited.

3.2.17 PROFICIENCY TESTING SCHEME FOR SOYBEANS AND SOYBEAN MEAL, Ms W Louw, Southern African Grain Laboratory

Proficiency testing schemes are designed to provide participants with an independent assessment and the tools to supplement their internal quality control systems. They can use the proficiency testing report to investigate any outlier results, identify the root cause of the problem and improve their testing procedures.

The soybean proficiency scheme was developed in 2021 on request of the Oilseed Industry. Since 2021, SAGL has presented this scheme in four cycles per year - February, May, July and November. The proficiency scheme is done for both soybeans and soybean meal.

Since this project is funded by the Oilseeds Advisory Committee and the Oil and Protein seed Development Trust (OAC/OPDT), the participants have access to the valuable information on a continuous basis and no cost to the participant.

Soybean Meal is sourced from producers in the industry who are also participating in the scheme. These producers are used on a rotational basis. The soybean samples are made up from retention samples received for analysis.

All the samples are tested for homogeneity before it is packed and distributed to the participants. In the table below is the list of the parameters for analysis included for both soybean and soybean meal:



SOYBEANS	SOYBEAN MEAL
Grading	Ash
Ash	Crude Fibre
Crude Fibre	Crude Fat (oil)
Crude Fat (oil)	Crude Protein
Crude Protein	Protein Solubility in KOH (KOH)
Moisture	Moisture
	Protein Dispersibility Index (PDI)
	Trypsin Inhibitor Activity (TIA)
	Urease Activity (UA)

The participants conduct the analyses with their own testing methods and the results submitted by the participants are statistically analysed to provide an assigned value for each analyte. The assigned value for each analyte is derived from the consensus of the results submitted by the participants.

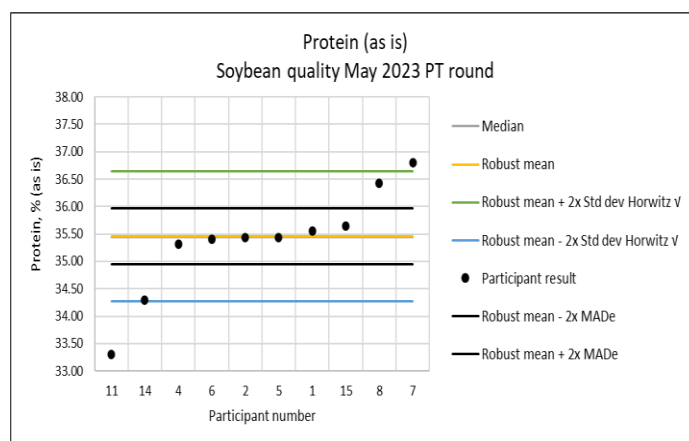
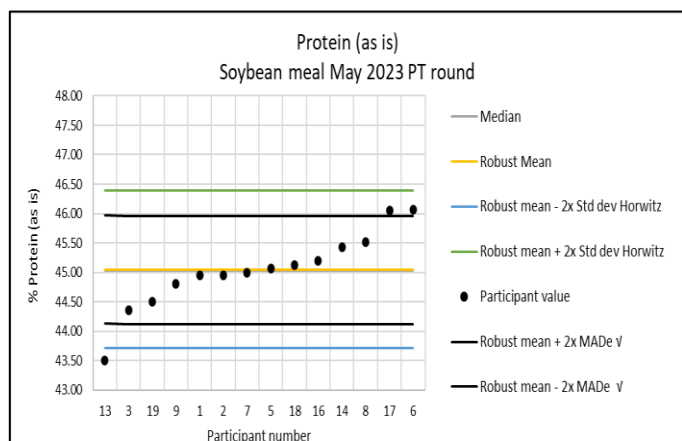
Where applicable, the assigned values are then used in combination with the standard deviation for proficiency to calculate the z-score for each result. Participants receive a report, compiled by the SAGL and each participant has their own uniquely coded results to preserve confidentiality.

Information on specific methods used by the participants is also included in the report. This provides the participants with additional information on the different methods being used by other testing facilities.

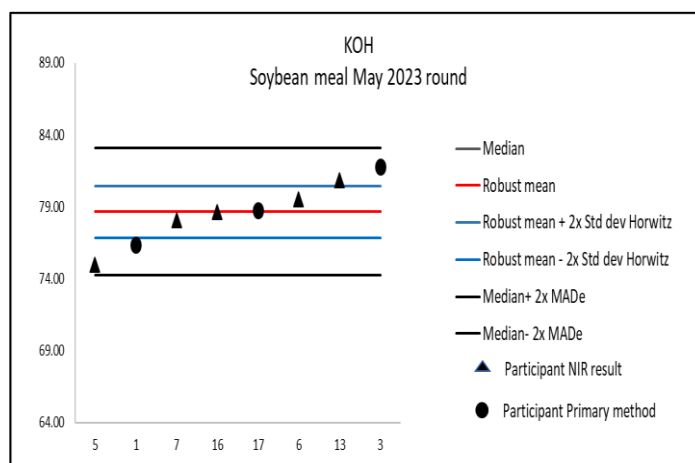
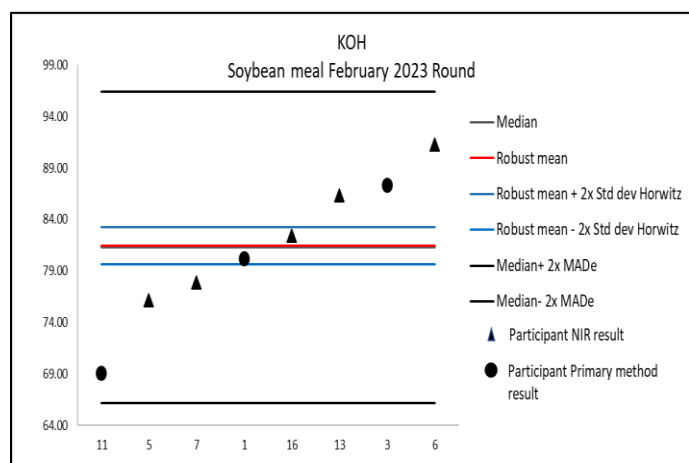
SUMMARY OF RESULTS:

The reporting of the results was standardized to 'as is' values which improved the comparison between the participants.

Protein results between the participants correlate well and the protein results of the May 2023 cycle for both soybeans and soybean meal are shown below:



Where necessary, further statistical evaluation is used to analyse the data and final results are presented in the report. Below are examples for the KOH analysis results from the February and May 2023 soybean meal report. Because of the wide spread of analysis results received during the February 2023 round, no z-scores were reported.



The reporting of more detailed information on the methods used by the participants contributed to a better understanding of differences between the participants. More information is required on the test methods used for the determination of crude fibre and ash, as these results between the participants do not correlate well.

Below is an example of the % crude fibre results from the May 2023 soybean quality report.



3.2.18 PROFICIENCY TESTING SCHEME FOR SUNFLOWER AND SUNFLOWER MEAL, Ms W Louw, Southern African Grain Laboratory

Background and goal

Based on the development and presentation of a proficiency testing scheme on soybeans and soybean meal on request of the Oilseed Industry and with funding from OAC/OPDT, SAGL developed and presented the first proficiency testing scheme for the sunflower value chain during 2022. This included selected parameters on sunflower seeds and sunflower oilcake. Proficiency testing aims to provide an independent assessment of the competence of participating testing facilities and is an essential element of quality assurance.

The proficiency samples are prepared by confirming homogeneity before it is distributed to all the participants. The participants conduct the analyses with their own testing methods and the results submitted by the participants are statistically analysed to provide an assigned value for each analyte. The assigned value for each analyte is derived from the consensus of the results submitted by participants. Where applicable, the assigned values are then used in combination with the standard deviation for proficiency to calculate a z-score for each result.

To ascertain the number of participants in the Proficiency scheme, a questionnaire was developed, indicating the specific parameters to be included and distributed. Accredited testing laboratories involved in the testing of sunflower and sunflower products were also included in the distribution list.

Participant list for the first cycle of 2023

ORGANISATION	SUNFLOWER SEEDS	SUNFLOWER OILCAKE
ARC	√	X
Afgri (Labworld div of Philafrica)	√	√
CAL	√	√
CEOCO (Central Edible Oil)	√	√
Chem Nutri Analytical	√	√



De Heus	X	✓
DSM	✓	✓
Evonik	✓	✓
Gauteng Oil & Cake Meal (Africa Sun Oil)	✓	✓
Grainvest Oil (Meets)	X	✓
Intertek SA	✓	✓
Louis Dreyfuss (Epko Oil Seed Crushing)	✓	✓
Majesty Oil Mills	✓	✓
Monti Feeds	X	X
Nvirotek Wynland	✓	✓
RCL Foods Central laboratory	✓	✓
Russel Stone Protein	✓	X
Senwes	✓	X
Trouw Nutrition	✓	✓

Scope of Project

Communication with participants

The participants receive communication on specific dates and other information relating to the proficiency testing scheme. This information includes the dates when the samples will be shipped, the dates when and the required format in which the results need to be submitted and the contact person at the SAGL.

Samples

Sunflower oilcake is sourced from cake producers in the industry, preferably a different producer for each cycle. According to the number of participants and the sample size requested, about 25 kg of sunflower oilcake/meal is required. Homogeneity testing is conducted on the sample (moisture and crude protein). Once homogeneity has been confirmed, the samples are packaged and shipped to all the participants.



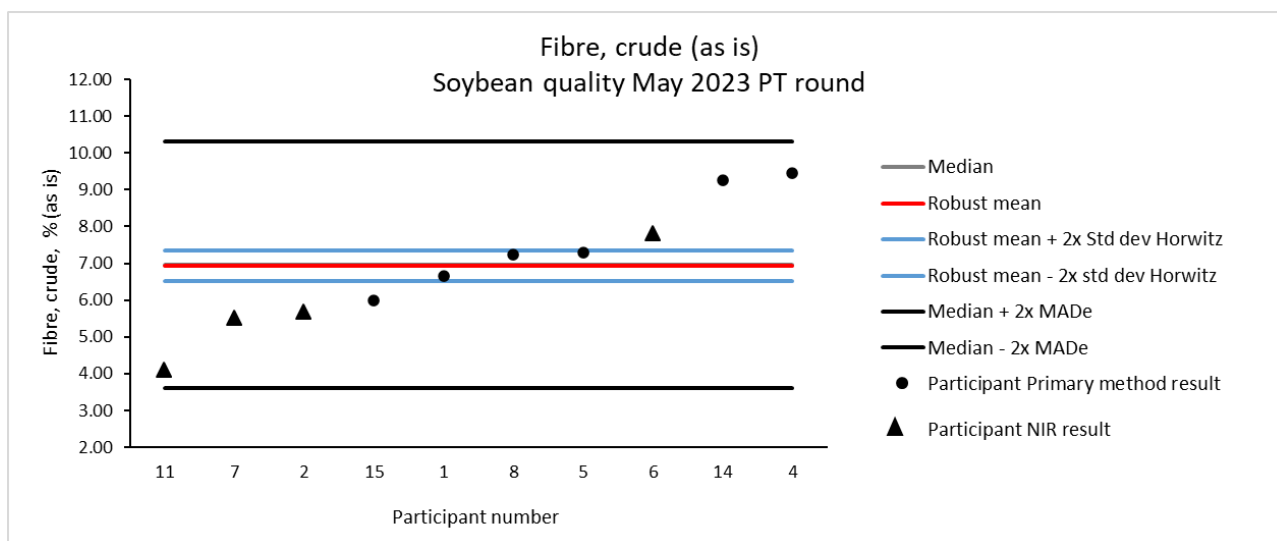
Parameters included

SUNFLOWER SEED	SUNFLOWER OILCAKE
Crude Fat (oil)	Crude Fibre
Moisture	Crude Fat (oil)
	Crude Protein
	Moisture

Format of Reporting

Participants will receive a report, compiled by the SAGL, giving all results for assessment but without identifying individual laboratories to preserve confidentiality. Results will be presented in table format and the performance of the participating laboratories will be assessed using z-scores where applicable. Each participant can use their own uniquely coded results to evaluate their performance. Information on the specific methods used by the participants will also be included in the report. This information provides participants with additional information on the different methods being used by other testing facilities.

It remains the responsibility of each participant to investigate the reason and take action if an out of spec result is reported.





3.3 JOINT RESEARCH PROJECTS

3.3.1 INCOME AND COST BUDGETS FOR SUMMER AND WINTER CROPS IN SOUTH AFRICA; Mr D van der Westhuizen, The Bureau for Food and Agricultural Policy (BFAP)

Background

The Bureau for Food and Agricultural Policy (BFAP), founded in 2004, serves the agro-food, fibre and beverage sectors in South Africa and Africa. Our purpose is to inform better decision-making by providing unique insights gained through rigorous analyses, supported by credible databases, a combination of integrated models and considerable experience. Over more than 15 years, the Bureau has developed a very distinct value proposition to deliver a holistic solution to public sector and private clients active in the agricultural sector and related value chains. This offering is complemented through BFAP's investment in the Integrated Value Information System (IVIS), a geo-spatial platform which further enhances BFAP's product offering by providing enhanced systems solutions to the integration of data and insights visualisation to support strategic decision-making along multi-dimensional value chains.

The BFAP Group consist of a team of experienced private and public sector experts with a range of multi-disciplinary skills including agricultural economics, food science, mathematics and data science, engineering, supply chain management, socio-economic impact assessment, systems technology, and geo-informatics. In addition, we fundamentally believe that a competitive and thriving agricultural sector with its related value chains is built on long-run partnerships. Hence, BFAP has developed a well-established network of local and international collaborators and partners in the public and private sectors. This includes long-standing partnerships with private sector clients for more than a decade, research partners like the Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri in the USA and the Food and Agricultural Organization of the United Nations (FAO). BFAP is also one of the founding members and partners of the Regional Network of



Agricultural Policy Research Institutes (ReNAPRI) in Eastern and Southern Africa. As a team and as a network, we pool our knowledge and experience to offer the best possible insights and access to a unique high value network.

The BFAP Group utilises globally recognised techniques and modelling systems to analyse the food, fibre and beverage sectors.

The current BFAP modelling system covers more than 50 commodities each supported by:

- in-depth study of agro-resources and input-output markets, production systems and farming business operations, offering the ability to evaluate the competitiveness and sustainability of farming systems.
- end-to-end value chains analysis, tracking product flow, efficiencies, and margins along the chain.
- commodity markets scenario modelling and forecasting to quantify future outcomes, evaluate risk, identify growth opportunities and assess impacts of changes in the macro-economic, business and policy environment.
- analysis of the consumer and retail space to provide insights on food price impacts and food security.
- credible analysis, monitoring and evaluation of rural and socio-economic development related to the food, fibre and beverage industries

The extensive integrated database and modelling frameworks enable BFAP to analyse and generate long-run projections and unpack alternative future scenarios for agricultural commodity markets and within the main sub-sectors (grains, livestock, and horticulture).



The BFAP Farm & Production Analytics Division

The program: The BFAP Farm & Production Analytics was established with the main objective to assist agribusinesses and farm businesses with strategic decision-making under changing and uncertain market conditions. This is done by means of advanced quantitative analyses of how different policy options, macroeconomic variables, and volatile commodity market conditions could impact upon farm businesses in selected production regions in South Africa.

The BFAP Farm & Production Analytics Division includes economic analysis of the production of grain, oilseed, livestock, wine, fruit, sugar, and vegetables. Proto-type farms across South Africa's key producing regions are constructed according to a standard operating procedure (SOP) defined by the agri benchmark methodology and are presented in **Table 1**.

The models & methodology: The farm-level activity of BFAP consists of two key components on which services to individual clients are based. These include the system of linked models between the sector and the FinSim farm-level models and the agri benchmark international network.

➤ Farm-level modelling

The BFAP farm-level model (FinSim) is a total budgeting model capable of simulating a (representative) farm comprising various enterprises, e.g. grain, oilseeds, and livestock. Apart from the enterprise specifics, the model captures business specifics, such as the asset structure and financing method(s). The output of the farm-level model is presented through various financial performance indicators. The BFAP FinSim model is utilised in various ways, which include whole-farm planning (capital and operational expenditure), financial and economic feasibility on farm-level, risk analysis via stochastic simulation, impact of policy decisions, input- and market-related shocks on farm-level, and the intermediate and long-term projection based on the BFAP sector model output.



Table 1: BFAP existing network of prototype farms

Summer Grains	Winter Grains	Oilseeds	Small-scale	Sugarcane	Potatoes	Horticulture	Pig Network
Western Free State: maize	Overberg: Wheat	Eastern Free State: Soybeans	KwaZulu-Natal: Traditional producers	KwaZulu-Natal: Northern Coastal Dryland	Eastern Free State: Dryland	Western Cape: Apples	Western Cape integrated farm
Northern Free State: maize	Overberg: Barley	Eastern Free State: Sunflower	KwaZulu-Natal: Grain Development Program	KwaZulu-Natal: Southern Coastal Dryland	Limpopo: Irrigation	Western Cape: Pears	KwaZulu-Natal integrated farm
Eastern Free State: maize	Northern Cape: Wheat	Northern Free State: Sunflower & Cotton		KwaZulu-Natal: Midlands	KwaZulu-Natal: Seed	Citrus	North West integrated farm
Northern Cape: maize	Northern Cape: Barley	North West: Sunflower & Cotton		Mpumalanga: Irrigation	Sandveld: Irrigation	Western Cape: Table grapes	
Mpumalanga: maize (budgets)	Swartland: Wheat, barley & canola: 2019	Mpumalanga: Soybeans (budgets)		KwaZulu-Natal: Northern Coastal Dryland (small-scale)			
North West: maize		Overberg: Canola					
		Northern Cape: cotton					
		Limpopo: cotton					



➤ Agri benchmark

The agri benchmark network is an international network of agricultural research and advisory economists aiming to create a better understanding of global cash crop farming and the economics thereof. The objective of the agri benchmark initiative is to create a national and international database on farm information through collaboration between the public sector, agribusinesses and producer organisations. The link between the local and international networks provides the means to benchmark South African agriculture with worldwide farming systems.

More specifically, the national farm information database that is linked to the international information system provides decision makers and stakeholders in South African agriculture with a useful tool to obtain business intelligence information, to obtain updates on local and international agriculture, to make financial and managerial strategies for profitable and sustainable farming, and finally, it provides a platform to compare farming businesses and production systems of 16 cash crop enterprises all over the world. The map below illustrates the major countries and crops in the agri benchmark network.

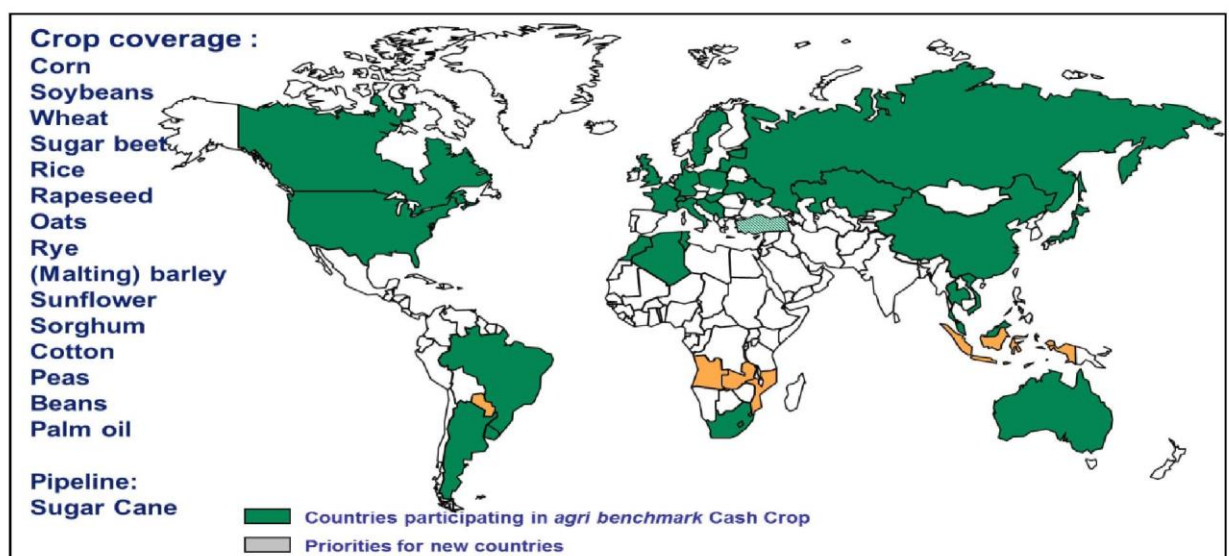


Figure 1: agri benchmark cash crop network



Objectives & key deliverables

The Protein Research Foundation (PRF), Grain South Africa (GSA) and the Bureau for Food and Agricultural Policy (BFAP) historically had their own cost of production efforts which focussed on key summer- and winter crops produced in South Africa's key agro-ecological zones. Given on-going activities associated within the organisations and the extent of the coverage of South African agricultural production, the PRF, GSA and BFAP together with agri businesses agreed to collaborate on the compilation of enterprise budgets.

The main objective of this collaboration and project is to consolidate these efforts and to generate comprehensive crop income and cost budgets for key summer- and winter growing regions and to generate sensitivity analysis for these crops. The compilation of these enterprise budgets is underpinned by the latest macroeconomic trends, BFAP sector model underlying assumptions and international- & domestic market updates. BFAP together with the PRF, Grain SA, agri businesses and industry experts will continue to engage with the objective to refine model assumptions and to ensure alignment.

Please refer to annexure of this proposal for detailed regions and proposed crops.

Specific objectives:

- Generate crop income- and cost budgets for key summer grains- and oilseeds in selective regions in South Africa: Dryland: Mpumalanga / Eastern Highveld, Eastern Free State, Northern- and Western Free State, North West and KwaZulu-Natal. Irrigation: Northern Cape, Brits, Limpopo & Bergville;
- Generate crop income- and cost budgets for key winter grains- and oilseeds in selective regions in South Africa: Dryland: Eastern Free State, Southern Cape and Western Cape. Irrigation: Northern Cape, Brits, Limpopo and Bergville;



- Generate sensitivity analysis for the above identified crops based on the latest market trends and projections. The identified regions and proposed crop coverage are presented in the annexure of this proposal; and
- Generate a bi-annual report on crop budgets for the subsequent season.

Proposed schedule of reports

- February/March - Planning & analysis for subsequent winter crop; and
- August/September - Planning & analysis for subsequent summer crop

Annexure: Regions & crops covered:

Figures 2 - 11 illustrate the existing coverage between the GSA, BFAP and agri businesses. It is proposed to continue with the below listed regions and crops covered by GSA and BFAP.

Levels definitions:

- Level 1: Commodity enterprise budgets: updated annually;
- Level 2: Actual cost of production (historic); and
- Level 3: Projections / Quarterly Updates.



CROP CATEGORY	PROVINCE / REGION		CROP TYPE	PNS		GSA		BFAP	
				Coverage	Description	Coverage	Description	Coverage	Description
Summer	Mpumalanga	Eastern Highveld	Maize: Conventional			x	Eastern Highveld: Level 1		
			Maize: Round-up	x	Piet Retief & Trichardt: Level 1	x	Eastern Highveld: Level 1	x	Eastern Highveld: Level 1
			Maize: Stack genes			x	Eastern Highveld: Level 1		
			Maize: BT	x	Piet Retief & Trichardt: Level 1				
			Maize: Irrigation			x	Eastern Highveld: Level 1		
			Soybeans: Conventional	x	Piet Retief & Trichardt: Level 1	x	Eastern Highveld: Level 1	x	Eastern Highveld: Level 1
			Soybeans: Minimum tillage	x	Piet Retief & Trichardt: Level 1	x	Eastern Highveld: Level 1		
			Sunflower	x	Piet Retief & Trichardt: Level 1				
			Sugarcane					x	Mpumalanga Irrigation: Level 1-3

Figure 2: Mpumalanga / Eastern Highveld

CROP CATEGORY	PROVINCE / REGION		CROP TYPE	PNS		GSA		BFAP	
				Coverage	Description	Coverage	Description	Coverage	Description
Summer	Free State	Eastern Free State	Maize: Conventional			x	Eastern Free State: Level 1	x	Eastern Free State: Studygroup averages: Level 1-3
			Maize: Round-up			x	Eastern Free State: Level 1	x	Eastern Free State: Studygroup averages: Level 1-3
			Maize: Stack genes			x	Eastern Free State: Level 1	x	Eastern Free State: Studygroup averages: Level 1-3
			Maize: BT	x	Reitz/Petrus Steyn/Bethlehem/Warden: Level 1	x	Eastern Free State: Level 1	x	Eastern Free State: Studygroup averages: Level 1-3
			Sunflower	x	Reitz/Petrus Steyn/Bethlehem/Warden: Level 1	x	Eastern Free State: Level 1	x	Eastern Free State: Studygroup averages: Level 1-3
			Soybeans RR	x	Reitz/Petrus Steyn/Bethlehem/Warden: Level 1	x	Eastern Free State: Level 1	x	Eastern Free State: Studygroup averages: Level 1-3
			Potatoes					x	Eastern Free State: Studygroup averages: Level 1-3

Figure 3: Eastern Free State

CROP CATEGORY	PROVINCE / REGION		CROP TYPE	PNS		GSA		BFAP	
				Coverage	Description	Coverage	Description	Coverage	Description
Summer	Free State	Northern Free State	Maize: Conventional			x	Parys region: Level 1		
			Maize: Round-up			x	Parys region: Level 1	x	Bothaville / Wesselsbron: Level 1-3
			Maize: Stack genes			x	Parys region: Level 1		
			Maize: BT			x	Parys region: Level 1	x	Bothaville / Wesselsbron: Level 1-3
			Maize: Irrigation			x	Parys region: Level 1		
			Sunflower			x	Parys region: Level 1	x	Bothaville / Wesselsbron: Level 1-3
			Groundnuts			x	Parys region: Level 1		
			Grain Sorghum			x	Parys region: Level 1		
			Soybeans			x	Parys region: Level 1		
Summer	Free State	Western Free State	Maize: Round-up					x	Bultfontein: Level 1-3
			Maize: BT					x	Bultfontein: Level 1-3
			Maize: Irrigation					x	Bultfontein: Level 1-3

Figure 4: Northern- and western Free State



CROP CATEGORY	PROVINCE / REGION		CROP TYPE	PNS		GSA		BFAP	
				Coverage	Description	Coverage	Description	Coverage	Description
Summer	North West		Maize: Conventional	x	Koster Hoëveld & Lichtenburg/Ottosdal/Sannieshof/Delareyville: Level 1	x	North West: Level 1	x	Lichtenburg / Delareyville / Koster / North West prototype: Level 1-3
			Maize: Round-up			x	North West: Level 1	x	Lichtenburg / Delareyville / Koster / North West prototype: Level 1-3
			Maize: Stack genes			x	North West: Level 1		
			Maize: BT			x	North West: Level 1		
			Maize: Irrigation			x	North West: Level 1		
			Sunflower	x	Koster Hoëveld & Lichtenburg/Ottosdal/Sannieshof/Delareyville: Level 1	x	North West: Level 1	x	Lichtenburg / Delareyville / Koster / North West prototype: Level 1-3
			Soybeans	x	Koster Hoëveld & Lichtenburg/Ottosdal/Sannieshof/Delareyville: Level 1	x	North West: Level 1		

Figure 5: North West

Summer	KwaZulu-Natal	KwaZulu-Natal	Maize	x	Bloedrivier: Level 1			x	Northern-Natal: Level 2
			Maize: Irrigation	x	Bergville: Level 1				
			Soybeans	x	Bloedrivier: Level 1			x	Northern-Natal: Level 2
			Soybeans: Irrigation	x	Bergville: Level 1				
			Sugarcane					x	Coastal Dryland & Midlands: Level 1-3
			Potatoes					x	Moorivier: Level 1-3
			Small-scale maize					x	Bergville: Level 2

Figure 6: KwaZulu-Natal

CROP CATEGORY	PROVINCE / REGION		CROP TYPE	PNS		GSA		BFAP	
				Coverage	Description	Coverage	Description	Coverage	Description
Summer	Irrigation	Northern Cape	Maize	x	GWK region: Level 1	x	Orange River: Level 1	x	Prieska & Douglas: Level 1-3
			Soybeans RR	x	GWK region: Level 1	x	Orange River: Level 1		
			Groundnuts	x	GWK region: Level 1				
		Limpopo / Britz	Maize	x	Loskop & Britz/Koedoeskop/Makoppa: Level 1	x	Limpopo/Britz: Level 1		
			Soybeans	x	Loskop & Britz/Koedoeskop/Makoppa: Level 1	x	Limpopo/Britz: Level 1		
			Sorghum			x	Limpopo/Britz: Level 1		
			Sunflower			x	Limpopo/Britz: Level 1		
		Bergville	Maize	x	Bergville: Level 1				
			Soybeans	x	Bergville: Level 1				

Figure 7: Summer Irrigation: Northern Cape, Brits, Limpopo & Bergville



				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	Coverage	Description	Coverage	Description	Coverage	Description
Winter	Irrigation	Northern Cape	Wheat	x	GWK region: Level 1	x	Northern Cape: Level 1	x	Prieska & Douglas: Level 1-3
			Barley			x	Northern Cape: Level 1	x	Prieska & Douglas: Level 1-3
			Canola	x	GWK region: Level 1				
		Limpopo / Britz	Wheat	x	Loskop & Britz/Koedoeskop/ Makoppa: Level 1	x	Winter irrigation: Level 1		
			Barley			x	Winter irrigation: Level 1		
		Bergville	Wheat	x	Bergville: Level 1				

Figure 8: Winter Irrigation: Northern Cape, Brits, Limpopo & Bergville

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	Coverage	Description	Coverage	Description	Coverage	Description
Winter	Free State	Eastern Free State	Wheat conventional	x	Reitz/Petrus Steyn/Bethlehem/Warden	x	Eastern Free State: Level 1	x	Eastern Free State: Studygroup averages. Level 1-3
			Wheat after fallow			x	Eastern Free State: Level 1		
			Irrigation wheat			x	Eastern Free State: Level 1		
		Central Free State	Wheat conventional			x	Central Free State: Level 1		
			Wheat: minimum tillage			x	Central Free State: Level 1		

Figure 9: Free State – Winter

			PNS		GSA		BFAP			
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	Coverage	Description	Coverage	Description	Coverage	Description	
Winter	Southern Cape		Overberg / Ruens	Wheat conventional			x	Western Ruëns: Level 1		
			Wheat minimum tillage	x	Bredasdorp / Caledon: Level 1	x	Western Ruëns: Level 1	x	Bredasdorp / Caledon: Level 1-3	
			Barley	x	Bredasdorp / Caledon: Level 1	x	Western Ruëns: Level 1			
			Canola	x	Bredasdorp / Caledon: Level 1	x	Western Ruëns: Level 1	x	Bredasdorp / Caledon: Level 1-3	
			Oats	x	Bredasdorp / Caledon: Level 1	x	Western Ruëns: Level 1	x	Bredasdorp / Caledon: Level 1-3	
			Lupines			x	Western Ruëns: Level 1			
			Medics					x	Bredasdorp / Caledon: Level 1-3	
			Lucerne					x	Bredasdorp / Caledon: Level 1-3	
	Swellendam	Wheat	x	Swellendam: Level 1						
		Barley	x	Swellendam: Level 1						
		Canola	x	Swellendam: Level 1						
		Oats	x	Swellendam: Level 1						

Figure 10: Southern Cape – Winter

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	Coverage	Description	Coverage	Description	Coverage	Description
Winter	Western Cape	Swartland	Wheat conventional			x	Swartland: Level 1		
			Wheat minimum tillage	x	Swartland: Level 1	x	Swartland: Level 1		
			Canola	x	Swartland: Level 1	x	Swartland: Level 1		
			Lupines			x	Swartland: Level 1		

Figure 11: Western Cape – Winter



3.3.2 EVALUATION OF SHORTENED CANOLA PRODUCTION PERIODS AND THE USE OF ALTERNATIVE CROPS ON THE SUSTAINABILITY OF WINTER GRAIN PRODUCTION UNDER CONSERVATION AGRICULTURAL PRACTICES IN THE RIVERSDALE FLATS; Prof JA Strauss, Western Cape Department of Agriculture

Objective

The aim of this study is to determine the short- and long-term effects of six of the most feasible crop rotation systems identified for the high potential soil of the Riversdale area on:

- Crop yields;
- Weed control;
- Disease suppression;
- Soil production potential; and
- Economically sustainable land-use in the Riversdale area.

Motivation and project description

- Reduced input costs for wheat production;
- Increased protein and oil seed production;
- Increased diversification of the farming system for greater financial stability;
- Increased production potential of soils due to increased organic matter content, and micro-and macro-organism activity; and
- Less compaction of high potential soil from animal movement.

The new Riversdale project will use the existing 15 large plots being used in the current trial that is part of the previous extended southern Cape crop rotation trial. The 15 plots will be split into 4 to provide a total of 60 plots to provide enough small plots to plant the different rotations, which will be replicated 3 times with all crops present each season.

New systems tested

- Legume crop – Wheat - Canola - Wheat (4 year system as control) - 50% smallgrain, 25 % canola, 25% legume crop;



- Canola - Wheat - Canola - Wheat (2 year repeating system) - 50% smallgrain, 50 % canola;
- Canola - Barley - Legume crop - Wheat - Wheat (5 year system) - 60% smallgrain, 20% canola, 20% legume crop;
- Wheat - Barley - Canola (3 year repeating system) - 67% smallgrain, 33 % canola;
- Wheat - Wheat - Green manure cover crop (3 year pure grain system) - 100% grain (oats can be used as smother crop/green manure if needed); and
- Green manure cover crop - Wheat - Canola (3 year system with an alternative broadleaf cash crop - 33% grain, 67% broadleaf

Funding institutions

This application will be sent to both the Protein Research Foundation (PRF) and SAWCIT. The budget will be split: 50% PRF & 50% SAWCIT.

The Western Cape Department of Agriculture provides all manpower and facilities required for successful implementation of the trial.

This long-term project will be entering its 12th year in 2023 and has a 12 year planning horizon.

Motivation

Problem

Lack of knowledge on the biological and economic sustainability of crop rotation systems for use on high yielding soil in the Riversdale area.

Nature and extent

The economic viability of long-rotation crop/pasture systems has been shown through two 5 year crop rotation trials following lucerne pasture in the



Riversdale area (see previous technical reports presented by the Hardy & Strauss on: ***“Economic sustainability of short- and long-rotation crop/pasture production systems in the southern Cape”***). Increased input costs and lower product price as well as variable rainfall have resulted in high economic risk to wheat farmers. Alternative crops and cropping systems have been identified as potentially financially viable alternatives to the traditional wheat monoculture (Smit & van Zyl 1998). The value of these alternative crops including canola (Arkcoll 1998) and lupins (Agenbach undated) has been shown over the past 10 years in numerous reports and talks by the authors.

In Australia, the introduction of ley pastures since the late 40's in wheat cropping areas has successfully restored fertility and improved soil structure such that grain yields have increased (Donald 1964, White et al 1978, Hardy 2010). The relative success of these crop and crop/pasture rotation systems depends on economic conditions as well as environment and farm size (White et al 1978). However, the relative biological and economic benefits of potential crop rotation systems on high yield-potential improved soils can usually be identified only by long-term studies (Elliott & Jardine 1972). These studies allow for examination of the effects and interactions of, for example, reduced use of fungicides and herbicides due to rotation of a broadleaf crop with the cereal crop (Jordan *et al* 1998).

Of particular importance to emerging farmers and the developing agricultural sectors (but also to commercial farmers) is the concept of reduced input systems (Jordan *et al* 1998) which involve manipulation and integration of husbandry practices within crop management. Crop rotation is a key component in reduced and integrated systems of production, with maximum use made of crops which contribute positively to soil fertility. Based on data from a five-year "less-intensive strategy" crop rotation experiment, Jordan *et al* (1998) showed reduced overall yields of wheat and oilseed rape of up to 18%. However, production costs were also reduced by 32% and overall profitability of crop production was maintained. There were substantial reductions in applied nitrogen (36%), herbicides (26%), fungicides (79%) and pesticides (78%) where "low-input" was compared to a conventional



production strategy. Crops such as canola and lupins are ideally suited to rotation with wheat as it is important (from a disease prevention point of view) that neither canola nor lupins are planted on the same land more frequently than every third or fourth year. Not only do they provide suitable broad-leaf "break" crops in which grass weeds may be effectively controlled in wheat production systems, but they also have the potential to improve soil structure (Arkcoll 1998) and, in the case of lupins, provide nitrogen to the following wheat crop.

Summary

Aim

The aim of this study is to determine the short- and long-term effects of six of the most feasible crop rotation systems identified for the high potential soil of the Riversdale area on:

- Crop yields
- Weed control
- Disease suppression
- Soil production potential
- Economically sustainable land use in the Riversdale area

Motivation

- Reduced input costs for wheat production;
- Increased protein and oil seed production;
- Increased diversification of the farming system for greater financial stability;
- Increased production potential of soils due to increased organic matter content, and micro-and macro-organism activity; and
- Less compaction of high potential soil from animal movement.



Key questions

Short - term

- Production. What is the production potential of wheat, canola and lupins in a specific season when applying the crop production protocols recommended for the area concerned?
- Alternative crops. What are the effects of incorporating crops such as “koljander” on cereal production in the traditional cereal production systems practised in the southern Cape?
- What is the effect of the previous season's crops (wheat, canola, lupins, barley, oats and “koljander”) on the quantity and quality of crop production in the following season? How do these effects change over time?
- Economics. Are there any short-term differences in the gross margins attained among the rotation systems being tested?
- Production. Does increased frequency in canola production have an effect on sustainability in terms of disease pressure and economic sustainability?

Potential short-term component studies (*Should additional research capacity and funding become available*)

- Are there differences in soil-borne disease infestations in the same crop among rotation systems?
- Are there differences in soil micro-organism populations among rotation systems?
- How do soil nitrogen dynamics differ among crop rotation treatments?
- What is the effect of crop rotation system on the baking quality characteristics of wheat?



- What is the effect of nematodes on the production of the different crops?

Long-term

- Economics. What is the long-term effect of crop rotations on farm income in the Riversdale “vlaktes”?
- Sustainable production. How do rotation systems influence crop yield and quality over time?
- Alternative crops. What are the long-term effects of incorporating green manure cover crops in crop rotation systems?
- Weed control. How does rotation system influence weed seed-banks over time?
- Sustainability of soils. What influence does crop rotation system have on the maintenance and improvement of the organic carbon content of soils?
- Disease suppression. The occurrence and intensity of diseases over time?
- Reducing inputs. How do input requirements for optimal crop and pasture production change over time for the different rotation systems?

Potential long-term component studies (*Should additionally research capacity and funding become available*)

- What are the long-term effects of crop rotation on soil-borne diseases?
- What are the long-term effects of crop rotation on soil micro-organisms?
- What are the long-term effects of crop rotation on soil nitrogen dynamics?

The following null hypotheses will be tested:



Long-term (in four year cycles)

- ***There is no long-term economic benefit to the farming enterprise from applying various crop rotation systems without incorporating pastures on the high potential soil.***
- Crop rotation has no significant effect on the quantity, quality or consistency of wheat production in the Riversdale area.
- Crop rotation systems will not improve soil organic matter content when compared to a crop/pasture system.
- Crop rotation systems will not reduce the input (nitrogen fertiliser, herbicides, insecticides and fungicides) requirements for wheat production.

Short-term (annual)

- The previous season's crop has no effect on the quantity, quality or consistency of wheat production.
- The previous season's crop has no effect on the nitrogen requirements for wheat production.

Summary of experimental design and treatments

The new Riversdale project will use the existing 15 large plots being used in the current trial that is part of the previous extended southern Cape crop rotation trial. The 15 plots will be split into 4 to provide a total of 60 plots to provide enough small plots to plant the different rotations, which will be replicated 3 times with all crops present each season.

New systems tested:

- Legume crop - Wheat - Canola - Wheat (4 year system as control) - 50% smallgrain, 25 % canola, 25% legume crop;
- Canola - Wheat - Canola - Wheat (2 year repeating system) - 50% smallgrain, 50 % canola;



- Canola - Barley - Legume crop - Wheat - Wheat (5 year system) - 60% smallgrain, 20% canola, 20% legume crop;
- Wheat - Barley - Canola (3 year repeating system) - 67% smallgrain, 33% canola;
- Wheat - Wheat - Green manure cover crop (3 year pure grain system) - 100% grain (oats can be used as smother crop/green manure crop); and
- Green manure cover crop - Wheat - Canola (3 year system with an alternative broadleaf crop - 33% grain, 67% broadleaf.

Treatments: 6 rotation treatments, fully represented each year and replicated 3 times, in a randomised blocks design.

Camp areas: 0.11 ha

Total area involved: 9 hectares

Number of camps planted to various crops each year: 60

Annual plan of operation

Soils and fertilisation	
Month	Operation
January	Analyse 60 soil samples (collected in November/December) for micro-and macro-elements and determine the fertilisation requirements of each camp. Analyse 60 soils samples to determine organic carbon content of soils in each camp.
March to November	Take additional soil samples and analyse as necessary to deal with specific soil problems as they become evident during the season
March/April	Correct any problems associated with soils e.g. drainage and "brak" patches, as necessary.
April/ May	Prepare soils for cropping (minimum tillage procedures) and apply P, K and lime were necessary. Apply N & P (band placement) as basal dressing at planting.
July/ August	Apply N top-dressings as required
November/ December	Collect 60 soil samples for fertility analyses (1 composite sample from each camp). Collect 60 soil samples for organic carbon determinations.



Weed seed bank studies	
Month	Operation
End March	Collect 60 composite top-soil samples - two from each of the camps in the trial. Prepare samples in seedling trays and place in germination facility.
April to September	Monitor medic, clover and weeds species germination and emergence at monthly intervals in all 60 seedling trays.
October to March	Capture data, summarise, analyse and report on findings.
Crop management and data collection	
Month	Operation
March	Determine TKW of seed of all crops to be planted. Determine germination % of seed. Use above to ensure correct seeding rate.
May	Plant all crops, timing depends on climatic conditions.
June to October	Control weeds, diseases and pests according to requirements and management protocols. Fertilise according to requirements and management protocols Monitor diseases in each camp.
June/July	Do plant counts in each camp to determine plant densities. (10 samples per camp - 600 samples in total).
November	Do plant counts in stubble of camp after harvesting to obtain estimates of plant survival through season.
October	Harvest crops using combine harvester, individual camps harvested each season. Weigh total harvest from each camp in portable weighing bin on each camp (> 60 tons in total depending on the season). Take samples of grain from each camp for quality determinations
	(%CP, HLM, "sifsel" %, and baking quality measures)
Component research projects (from 2012)	
Month	Operation
January to December	ECONOMIC ANALYSIS Record all inputs and output for each camp e.g. time taken for operation, amount of input used, costs of inputs, crop yield and quality, price for product etc. Enter all data into Gross Margin Analysis program for economic analyses. Finalise economic analyses for previous year by June and produce hard copy of the results.
January to December	Rainfall and temperature data: collected continuously using a data logger that is located within the experimental area. Data are summarised and reported on annually.



General management of experiment and reporting	
Month	Operation
February	Organise and hold meetings of the Riversdale Crop Rotation Technical Committee to develop management protocols for the crops in each treatment, to solve problems and present results to extension staff, and to view development of the crops each season
March/ April	Hold planning meetings with co-workers on their component experiments to be conducted within the experimental area.
January to December	Meet with potential co-workers to design research projects to be conducted within the experimental area aimed at answering specific questions arising as the project progresses.
January to December	Daily management and inspection of experimental area by field manager. Maintain experimental infrastructure (information boards, roads, fences, gates and watering points) and equipment (data loggers, boom sprayers, tractors and implements). Bi-monthly visits to Riversdale by project leader to view progress, to develop and adjust monitoring procedures, assist with data collection and for quality control. Accept ad-hoc invitations to present results of crop rotation experiment to local study groups and farmer's association meetings Attend study group and farmer's association meetings to be updated on latest technology relating to crop production in the southern Cape Present results as they become available at scientific symposia and congresses of professional societies.
March and September	Present management requirements and results of experiment at the Riversdale information day in September.
April to June	Summarise and analyse all data collected from the previous season. Prepare and submit a detailed annual report on the activities and results.
June and July	Prepare annual progress reports for funders (SAWCIT & PRF) and apply for continuation of funding.
January to December	Prepare talks, as well as popular and scientific publications on the results and implications of the crop rotations being tested.



3.3.3 IS ADDITIONAL NITROGEN BENEFICIAL TO SOYBEANS (*GLYCINE MAX. L*) IN DIFFERENT AGRO-ECOLOGIES OF THE EASTERN HIGHVELD?, Mr B Nkutha, University of the Free State

Problem description

Soybeans are commonly known for their ability to fix nitrogen, and this results in the application of nitrogen fertiliser being relatively small in this summer grain crop compared to other non-leguminous grain crops. One of many other reasons for small amounts of inorganic nitrogen being applied in soybeans is the negative effect it arguably has on biological nitrogen fixation. However, it remains an essential nutrient element because it plays two essential roles in plants.

Firstly, it is an essential constituent of reserve proteins and secondly, it is part of the enzymatic systems responsible for the growth and development of plants. Therefore, it is highly essential to ensure nitrogen levels are always sufficient in crop production.

Even though minimal nitrogen is applied in soybeans, most producers still apply supplemental nitrogen with the aim of obtaining higher yields of great quality (high protein and oil content). However, the rate at which they apply this nitrogen is either too high, too low, or unnecessary (in situations where the obtained yield is comparatively high without any nitrogen application). This research project seeks to test the effectiveness of various levels of nitrogen application and eventually determine the optimum level that will effectively enhance the growth, yield and quality of the crop while ensuring a substantial return on investment.

Aim and methodology

The aim is to test effectiveness of various levels of nitrogen application on the growth, yield and quality of soybeans in different agro-ecologies and to statistically identify the optimum level of nitrogen application that will enhance the amount and quality of production. This is carried out by planting field trials at various locations using complete randomised block design plots with four replicates per treatment. The treatments are 0 (Control), 10, 20, 30 and 40 kg



N/ha. The fertiliser is band placed 5 cm below and 5 cm away from the seeds. This application takes place before the plant enters peak nitrogen demands, at grain filling (R3).

Soil samples are collected for analysis prior to planting and after harvesting; among other measurements obtained from their analysis, they are also taken to measure the nitrogen status of the soil. The trials are monitored weekly and raw data is collected from emergence to harvest. The effect of nitrogen on nodulation will be monitored from the time of administration until maturity. The primary parameters that will be measured are growth-related parameters of the plant, the yield, yield components, as well as protein and oil content.

Motivation

This research project is a very important ‘farm level’ trial that will assist farmers in taking sound decisions that will help them realize substantial returns on investment. It constitutes a best management practice trial to ensure high yields with higher protein and oil contents are obtained by altering controllable aspects in soybean production. It is also highly significant to agronomists and other crop related research scientists and consultants, particularly when making recommendations to farmers.

Farmers also need this information because optimum levels of nitrogen application remain questionable. The importance of the project to dryland producers is significantly high because of the adverse climatic conditions, a large variety of soil types and ever-changing rainfall patterns in summer rainfall regions. Outcomes from this project will assist in the mitigation of risks and making informed decisions.

The area estimates and first production forecast of summer field crops shows that soybeans will be planted on a total of 915 300 ha for the 2022 production year, which is an increment of more than 10% from the 2021 production year. This simply means more and more farmers in the summer rainfall regions are expanding their soybean production.



Possibility of technology transfer and application

The results obtained from the project will be published by a registered institution as a master's degree thesis. They will further be provided to various industry stakeholders and role players, voluntarily and upon request. They will also be presented at farmer's days and/or conferences.

Does your institution have the necessary infrastructure and resources?

The institution does have the necessary infrastructure and resources to ensure that this research project is executed the best way possible. In cases where extra equipment or external evaluations and analysis are required then the researcher will make use of Agricultural Research Council (ARC) facilities as and when required.

Relevance and impact of proposed outcomes

The production of soybeans in South Africa at large is increasing, particularly now that fertiliser costs have tremendously increased. The total area planted increased from 705 000 ha in 2020 to 827 100 ha in 2021, which is a 17,3% increase. The expansion comes with a strong desire to achieve high yields using minimal nitrogen fertiliser. The outcome of the project will be very helpful to farmers because the amount of money they save from applying enough nitrogen will give enough returns compared to applying a lot of nitrogen and still obtaining the same yield.

Chances for success

The chances for success are very high because the trials will be planted at three different locations, and this will ensure that should any of the trials at a specific location face any environmental challenges then there are two more trials still active. The treatments will be replicated four times; this also minimizes the risk of failure.

Added to that, the trials are planted on lands of commercial farmers and there is a great guarantee that they will produce every season. The necessary equipment: implements, planters, sprayers, tractors, and combines are



available, highly maintained and kept in sound conditions. Furthermore, my advisory committee is very experienced and has good credentials. My supervisors, Dr GM Ceronio and Dr E van der Watt (University of the Free State) have more than 20 years of research experience in agronomy and plant physiology respectively.

Mr JGT Prinsloo who is a farmer, agriculturalist and mentor contribute a great deal of support and knowledge towards planting, monitoring, harvesting, and interpreting different laboratory analyses, thus ensuring the project becomes successful. My colleague, Mr R Senekal is very supportive and always available for data collection and making remarks.

VKB Landbou, particularly the agricultural management department is also playing an important role in ensuring this project becomes successful.

Economic justification

Fertiliser is relatively expensive, and it is not financially viable to spend a lot of money on large quantities of nitrogen fertiliser, and to also apply it in high quantities but not really make a good return from it. Regardless of whether supplemental nitrogen application is too high or not, the costs involved need to be evaluated and sound decisions should be taken to ensure that the money spent on fertiliser secures higher yields. Fertiliser prices have been increasing by more than 5% year on year. After the Russia Ukraine War, they increased even more and this is becoming a problem for most South African farmers, particularly those producing under dryland conditions. For example, Greensulf 35 retail price on the 3rd of March was R11 825.00/ton and on the 14th of March the cost price was R12 978.00/ton, this is a 9.7% increase within a period of days.

This shows how expensive fertiliser has become.

This project seeks to help farmers use their fertiliser wisely and save substantial amounts of money on fertiliser.



3.4 TRANSFORMATION PROJECTS

3.4.1 GRAINSA FARMER DEVELOPMENT; Pula/Imvula Magazine and Training, Mr N Vermaak, Phahama Grain Phakama NPC

Introduction

South Africa has many black developing farmers producing grains and oil seed crops on wide ranging scales of operations, from subsistence and small holder farmers to potential and highly intensive commercial farmers. Vision 2030 of the National Development Plan calls for an inclusive rural economy in which rural communities should have greater opportunities to participate fully in the economic, social and political life of the country. It holds that rural economies will be supported by agriculture and there will be better integration of rural areas through land reform, job creation and poverty alleviation. Clearly transformation in the grain sector remains at the center of national government policy therefore a multi-pronged approach towards ensuring the commercial viability and sustainability of emerging commercial farmers is a priority for all stakeholders in the agricultural sector.

The challenges to this growth path are however not insignificant:

- Rising input costs;
- An uneven trade environment, including highly subsidised imports which jeopardise local economy and small-scale producers in particular e.g. the competition for local poultry and dairy industries against cheap imports;
- Lack of infrastructure including rail, roads and electricity supply; and
- An erratic and unreliable transformation policy environment.
- Within the global scenario, the challenges deepen. Apart from the cost of accessing foreign markets, raised standards for food safety often exclude small-scale farmers from participating in international markets.



At PGP we believe that critical strategic interventions are necessary if land reform programs are intended to revive rural communities. Although we do not have infinite financial capacity to change policy as grain farmers of this country, we do have the required expertise to ensure successful production at grass roots level. This is why we have committed ourselves and our collective expertise and energy, to the pursuit of opportunities to share knowledge and assist in the transformation process. We are the voice of ALL grain farmers in South Africa and will continue to lobby on their behalf.

The existing PGP Farmer Development program framework has its **head office in Pretoria and 9 other Regional Development offices** situated in Bethlehem, Bultfontein, Dundee, Kokstad, Lichtenburg, Louwsburg, Maclear, Mthatha and Nelspruit. This extensive network of expertise has enabled the roll out of diverse projects in collaboration with other sectoral stakeholders.

PGP and OPDT Collaboration

The OPDT and the PGP Farmer Development Programme have partnered towards the implementation of meaningful grain farmer development since 1999. This supportive collaboration has enabled the building of a solid network that is able to fast-track information and offer valuable support services to developing farmers.

We wish to acknowledge the OPDT for its continued support of this initiative. We would like to also thank the Trustees for making this work possible. Together we make a difference!

We believe our efforts are making a difference to the lives of many farmers and contributing towards positive change in our country and, despite the challenges, we have seen encouraging growth and development of many competent, committed grain farmers who have been equipped with knowledge and skills for best practice with modern technologies, mentorship and practical information systems at their fingertips.



PGP Farmer Development Program Footprint

The PGP Farmer Development Programme Interim Lead, Jane McPherson, is tasked with the thought leadership and strategic initiatives and all project planning, project monitoring and project reporting processes as well as maintaining the communications between all Regional Farmer Development offices. She is supported by Ms Liana Stroebe, Development: Training and Operations Manager and Ms Jean Adams who is secretary to the Farmer Development Lead.

The footprint of the PGP Farmer Development program presently extends to nine Farmer Development Offices managed by Development Coordinators and Administrative Assistants based in the regions.

Each Regional office deals with different scenarios and unique features in terms of the characteristics of the farmers in that region, and the natural resources available. This may be due to the nature of agricultural activity in that region, location of the study group or the level of exposure the farmers have had to modern farming methods.

In order to have some point of reference, we have defined the following groups of farmers:

- Subsistence Farmers cultivating less than 1 - 3 ha of arable land;
- Small Holder Farmers operating on 4 - 49 ha arable land;
- Potential Commercial Farmers farming on 50 ha, producing up to 250t/year; and
- New Era Commercial Farmers who are producing more than 250 tons/year.



- ➔ It is important to remember that the focus of this program is **ALWAYS** on farmer development and to assist active grain farmers to grow, regardless of the size of their operation.

Demonstration Trials

“Science and technology coupled with improved human capital have been powerful drivers of positive change in the performance and evolution of smallholder systems.” FAO Farmlands that are used to teach agricultural techniques and technologies - known as demonstration plots – are widely considered a smart investment that can help accelerate the adoption of **game-changing innovations**. Here farmers can learn new ways of doing things without having to do it on their farms. Demonstration plots are used to teach various agricultural techniques and technologies, showcase new or improved crops. They also serve as a space to research and test new methods alongside familiar and more traditional ones.

In the Eastern Cape, the farmers are not familiar with crops other than maize and dry beans. These trials were able to demonstrate planting sunflowers and soya beans so that the farmers can become familiar with these alternative crops.

There are huge benefits to be had where farmers can actually be shown the results of doing things the right way – or sometimes even what happens when things are done wrong. We aim to plant demonstration trial plots to prove the value of particular practices and show the improved yields which result from best practice. We involve local farmers in the planning and preparation of trial plots. We show them why we propose to do things in a specific way. Scientific research has proved that farmers learn best from seeing with their own eyes in their own location and they change more willingly and arrive at more effective farming operations.

The Farmer's Days provide an opportunity to visit places where there is a learning opportunity or the Demonstration Trial sites. It is a place for peer-to-peer education and where farmers can share experiences and exchange



information. They also get to meet input supply company representatives and technical experts, local extension officers and other sector stakeholders who are strategically invited to these days. The exposure and information to which farmers are exposed cannot be under-valued particularly for the subsistence and small- scale developing farmers who are being introduced to a broader support network beyond the PGP Farmer Development team.

Training Courses.

There is a **lack of knowledge and practical skills** relating to advanced oil and protein seeds production, marketing and agri-business development. If there is to be sustainable development in this sector, **farmers need to be trained appropriately**. The departmental agricultural extension officers often lack the specific expertise or knowledge, skills and practical know-how relating to oil and protein seeds production. Over many years PGP has networked with agriculture development experts to develop well designed and appropriate training courses. We roll out these courses as needs are identified by regional team members with the goal of increasing the skills and knowledge of grain farmers, contractors as well as farm workers.

Our training courses are structured to address **theory and practical** application on a wide range of topics. They cover a vast spectrum of topics directly related to grain farming and business development.

What are considered important criteria in project roll out?

- Training is delivered in a language that the farmers understand;
- The training we offer is designed to make an immediate impact to their farming business;
- Attention is paid to theory but there is an important practical aspect to each course too. The regular feedback from the farmers consistently reassures us that we are equipping and empowering them in a meaningful way.



The main aim of the project

The objective of our training program is specifically intended to further equip farmers and farm workers in the agricultural sector. Courses are delivered to oil and protein seed production growers wherever a particular need is identified.

We aim to offer relevant Training Courses at easily accessible venues, to farmers. Course presentation is in the language of the particular region where the courses are held. Each attendee will receive a copy of the manual to use as a farming resource, based on the training he or she has received.





Communications - Pula Invula Newsletter

PGP's Pula Invula magazine is a useful development communication tool. It is an exciting, multidimensional publication disseminating important information to the developing agricultural sector. It is well received by the farmers who tell us they find the information useful and easy to understand.

The Pula Invula has become recognised as a reliable source of information that is tailored specifically for developing farmers. Topics cover many aspects of production and marketing of specific crops as well as other generic information that is useful towards equipping and upskilling the farmers.

Copies of the magazine are distributed freely to recipients. They are also made available online via the www.grainsa.co.za platform and the publication can also be emailed to recipients in digital format.

The target audience is wide and this publication holds interest for all stakeholders interested in farmer development, as well as farmer development facilitators and developing farmers who wish to equip themselves better. In light of the fact that many of our farmers live in remote deep rural areas where expert mentorship, advice and knowledge about modern farming and latest technologies and farming systems is scarce and difficult to access we believe this publication is significant.



Development communication and extension advisory services are important instruments for encouraging dialogue about science-based farming solutions with communities, helping to stimulate agricultural production.

Grain SA's Pula Imvula magazine is a useful development communication tool. It is a colourful publication reporting to the developing agricultural sector. It is well received by the farmers who tell us they find the information useful and easy to understand.

The Pula Imvula has become recognised as a reliable source of information that is tailored to accessibility needs.



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EFFECTS OF CLIMATE CHANGE ON SOYBEAN PRODUCTIVITY

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DR NTLADI HAS GREAT PLANS FOR GROUNDNUT BREEDING IN SA

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A WORD FROM...
Du Toit van der Westhuizen

WE CELEBRATED THE SUCCESS OF OUR FARMERS IN OCTOBER WITH A DAY OF CELEBRATION IN BOTHAUVILLE. YOU DO NOT HAVE TO COMPETE WITH YOUR FELLOW FARMERS, AS THIS OFFER LEADS TO DISAPPOINTMENT IF YOU DO NOT ACHIEVE THE SAME RESULTS. RATHER MEASURE YOURSELF AGAINST YOURSELF. LOOK AT YOUR PAST - WHERE YOU STARTED AND WHERE YOU ARE NOW. SEE IF YOU HAVE GROWN AT ALL.



MAMPHO'S STORY

WHERE DID YOUR INTEREST IN FARMING ORIGINATE?

I used to spend school holidays on the farm in Mankweng with my parents. I just loved it. The huge cows and the pigs where the pigs were kept fascinated me. I was also in awe of the huge tractors and implements as they worked the fields and loved the smell of the soil when I was sent to take food to my father where they were growing. When I had to go back to the township, I used to cry. I have always dreamed of

HOW DID YOU BECOME A FARMER?

In 2014, my farm Pula was purchased by the CORCER and the next contract was given to the Thaele family. My uncle, Pula van Thaele, was put in charge of the farm. He was already very old and sick and because he knew from experience I was about having the place and the job of farm manager. This was a dream come true - I was now a farmer. I didn't care that the land was overgrown with grass and weeds - the farm was mine and I could make a plan.

AND WHAT WAS YOUR PLAN?

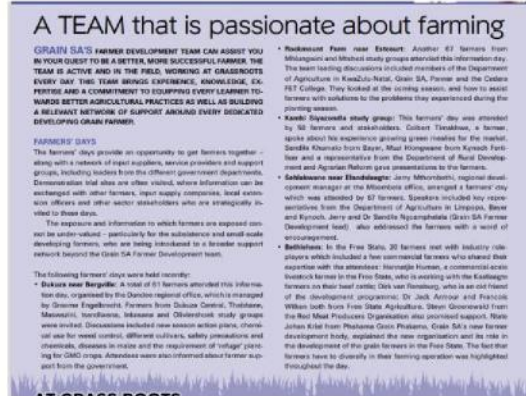
I heard about Grain SA's study group meetings and attended my first meeting on 30 July 2015 in Mankweng. I learned so much about farming - about soil, fertiliser, seed and grass control and much more. Suddenly I knew that it was time to bring it all together. The Grain SA Farmer Development Programme saved my career as a farmer. I also completed a National Diploma in Animal Production to learn more about cattle.

HOW HAS YOUR FARMING ENTERPRISE DEVELOPED?

Last season (2020/2021) I was part of the Abenew Project and I planted 50 ha and made a 40 ha yield. I am now part of the Seed and Soil and Soil project and planted 250 ha of which 150 ha was soybeans. 100 and 80 ha were planted. These 200 ha were planted with soybeans and have a piggy bank. The piggy bank is in the seed bank in the Thabang township.

WHAT IS YOUR DREAM FOR YOUR FARMING OPERATION?

I would love to tillage all the available land on the farm and plant it under cash crops. The rest can be used as pastures - if there is more grazing, I will definitely be able to grow my stock. I would love to get a big herd so that I can get income to support my children. My big dream is to become a



A TEAM that is passionate about farming

GRAIN SA'S FARMER DEVELOPMENT TEAM CAN ASSIST YOU IN YOUR QUEST TO BE A BETTER, MORE SUCCESSFUL FARMER. THE TEAM IS ACTIVE AND IN THE FIELD, COLLECTING INFORMATION EVERY DAY. THE TEAM BRINGS EXPERIENCE, KNOWLEDGE, EXPERTISE AND A COMMITMENT TO SUPPORTING EVERY LEARNER TO IMPROVE BETTER AGRICULTURAL PRACTICES AS WELL AS BUILDING A RELEVANT NETWORK OF SUPPORT AROUND EVERY DEDICATED DEVELOPING GRAIN FARMER.

FARMERS' DAYS

The Farmer's Days provide an opportunity to get farmers together along with a network of input suppliers, service providers and support groups, including leaders from the different government departments. Demonstration field sites are often visited, where information can be exchanged with other farmers, input supply companies, local extension officers and other sector stakeholders who are strategically involved in these days.

The exposure and information to which farmers are exposed cannot be under-valued - particularly for the existence and small scale developing farmers, who are being introduced to a broader support network beyond the Grain SA Farmer Development team.

The following farmer's days were held recently:

- Bokone near Bergville:** A total of 61 farmers attended this information day, organised by the Duthie regional office, which is managed by Grouse Engelbrecht. Farmers from Sishulu Central, Thabang, Mankweng, Mankweng, Mankweng and Othman's study groups were invited. Discussions included new season action plans, crop rotation, soil use for seed control, different cultivars, safety precautions and materials, diseases in maize and the requirement of 'village' control for OMD crops. Attendees were also informed about farmer support from the government.
- Bokone near Bergville:** Another 61 farmers from Mankweng and Mankweng study groups attended this information day. The team leading discussions included members of the Department of Agriculture in Mankweng, Grain SA, Farmer and the Cedara FET College. They looked at the existing season, and how to assist farmers with solutions to the problems they experienced during the growing season.
- Kaabo Nqayanda study group:** This farmers' day was attended by 50 farmers and stakeholders. Cultured Tsebebe, a farmer, spoke about his experience growing green peas for the market. Sandra Khumalo from Bokone, Mankweng from Kaabo Farm and a representative from the Department of Rural Development and Agrarian Reform gave presentations to the farmers.
- Selobane near Butha Buthe:** Jerry Mkhonto, regional development manager at the Mankweng office, arranged a farmers' day which was attended by 61 farmers. Speakers included key representatives from the Department of Agriculture in Limpopo, Bokone and Kynoch. Jerry and Dr Sandra Nqayanda (Grain SA Farmer Development lead) also addressed the farmers with a word of encouragement.
- Bethlehem:** In the Free State, 30 farmers met with industry role players which included a few commercial farmers who shared their expertise with the attendees. Hannelie Houten, a commercial cattle breeder farmer in the Free State, who is working with the Exchange farmers on their beef cattle. Dick van der Merwe, who is an old hand of the development programme, Dr Jack Aronson and Patricia Willem both from Free State Agriculture, Steven Gommersall from the Red Meat Producers Organisation also provided support. Ntseke John Kile from Mankweng Grain Producers, Grain SA's new farmer development body, explained the new organisation and its role in the development of the grain farmers in the Free State. The fact that farmers have to diversity in their farming operation was highlighted throughout the day.

AT GRASS ROOTS

We cannot afford to underestimate the significance of this publication which ultimately becomes a tool in the farmers' hands.

PGP's development managers, study group leaders and farmers all report they find the publication invaluable.

Herewith the current distribution statistics

English	Tswana/Sesotho	Zulu/Xhosa	TOTAL
1810	2 728	5 374	9 912

Considering the critical importance of the role of oil and protein seeds production in the South African farmers' toolbox, we believe our Pula Imvula publication has an important role to play in the developing agriculture arena:

4 The information is published in time to address seasonal issues and create awareness of potential problems or monitoring processes which should be happening on the farm. 4 The articles are written in easy to understand terms which are not intimidating to the new farmer.



Period: March 2023 - Feb 2024

1. Soybean farming: To measure is to know
2. How to minimise aflatoxin production
3. Guidelines for first-time soybean growers
4. Advantages of soybean production
5. Effective nitrogen management in soybeans is crucial
6. Control weeds to optimise sunflower yield
7. Avoid crop losses with early harvesting
8. How to identify *Sclerotinia sclerotiorum*

Period: March 2024 - July 2024

1. Planting date and fertilisation can ensure an optimal sunflower yield;
2. Minimise sunflower and soybean harvest losses;
3. Plan ahead to ensure a profit; and
4. Add soybean to your production.

The Pula Imvula is a monthly newsletter used as a vehicle to disseminate grain farming information to the readers at the appropriate time of year. All aspects of farming from production, financing, mechanization, pests and diseases, weeds, maintenance, marketing, storage, labour management, planning and budgeting are all covered. There are a large numbers of different people who contribute to the writing of the articles for the Pula. The newsletter is funded by the Maize Trust and the Oil and Protein Seeds Development Trust.

The magazine started in the early 2000's and was a black and white leaflet available only in Setswana for developing farmers in the North West. Since that time, it grew to a full colour newsletter printed in 7 languages (English, Afrikaans, Sesotho, Setswana, Sepedi, isiXhosa and isiZulu). Subsequently, due to cost constraints, Afrikaans and Sepedi were excluded, and more recently only 3 languages (alternating isiZulu with isiXhosa in alternate months, with Sesotho and Setswana in alternate months).



One of the driving factors of the of the costs are the translations and layouts of the different languages. The translations also add a considerable length of time to the process of producing and disseminating the newsletter.

Over the past 25 years, many things have changed in our country and English has become widely used as the language of communication. Although there are still some older rural farmers who do not use English well, there are always younger members of the family who are conversant in English.

We have consulted with the farmers in the programme and the response has been positive in terms of accepting that the Pula will be available in English only. At the recent PGP board meeting, the matter was discussed and the board is also comfortable to reduce the languages to only English.

Unfortunately the Pula has been distributed through the Post office for many years, and now that service is failing. In the interest of reaching more readers, in future, we will be making use of couriers to distribute the physical copies, while we also make it available electronically to anyone who can manage to download it. Many of our farmers do not have access to data or have smart phones which is why we continue to print it.

Going forward, we plan to have a 20 page Pula every month containing articles proportionately paid for by the Maize Trust and OPOT. We also plan to make the facility open to other commodities who may like to use this as a vehicle to send out information and new to their developing farmers. The pages that contain information not relevant to our donors will be paid for by the company placing the information. They will add pages and information to the benefit of all readers, and they have the advantage of using an established platform that already reaches a large number of farmers. We are also updating the distribution lists.

The reduction in costs will be communicated to the donors and included in the continuation applications.



Mentorship

Our Regional Managers and their teams of Mentors are tasked with paying regular visits to the farmers and their fields (2 – 4 times per month). The visits include one-to-one mentoring on a wide range of topics throughout the season; but also include visits to check on soil health and crop progress. Often we assist in identifying mechanical problems and help the farmers find the best repair solution for the problem. Our mentors become intimately involved with planning, budgeting, trouble shooting, training and advising farmers throughout the season. In this way, our team can play an important part towards improving farmers' production practices and also identify unique challenges or assistance the farmer may need. We are also able to alert the farmer to any issues that may compromise his crop.

3.4.2 NUTRITIOUS SNACK MULTIMIX DEVELOPMENT FOR ADDRESSING UNDER AND OVER NUTRITION AND PROMOTING SMALL, MEDIUM AND MICRO-SIZED ENTERPRISES (SMME's) IN LOW INCOME COMMUNITIES; Prof W Oldewage-Theron, University of the Free State

In a significant step towards alleviating food insecurity in South Africa, the Food Innovation Laboratory at the University of the Free State has introduced a new line of affordable, protein-rich soy-based dairy alternatives.

This initiative is part of a community project at Texas Tech University and a Research Fellow at the UFS Department of Sustainable Food Systems and Development. In collaboration with the Food Innovation Laboratory at UFS, the project aims to produce a range of economically feasible, high-protein snacks and dairy alternatives using soybeans.

The vision for the Food Innovation Lab was conceived by Prof Johan van Niekerk, Vice-Dean of Agriculture at UFS, and Dr Brandon van Rooyen from the Department of Sustainable Food Systems and Development. Dr Van Rooyen, leveraging his expertise in product development and commercialisation, leads the project's efforts to create these innovative products.



Since the lab's inception in early 2023, it has developed a variety of high-protein plant-based products, including soya sausages and mince. They have also introduced healthy snack options such as roasted soya nuts, which serve as high-protein alternatives to peanuts.

3.4.3 CREATING JOB OPPORTUNITIES IN SOY PLANTING AND MICRO OR MACRO SOY AGROPROCESSING BUSINESS TO WARRANT FOOD SUSTAINABILITY; Mr H Davies, Eden Social Development Foundation

Department of Agriculture

Advisors

- The program was implemented in Okhahlamba 5 years ago & in Northern Natal 4 years ago. 90% Of the Advisors bought into the program and are involved in all aspects of the soy program.
- In Estcourt it took the Advisors up to 3 years to commit to the soy program.
- About 50% of the Advisors in Limpopo & Mpumalanga are committed to the soy program.
- The Eastern Cape is proving problematic as there are the same number of farmers vs Advisors in certain areas and these advisors are not involved in the soy program. No crop is expected for this area. It is proven that the areas where the advisors are actively involved do much better than areas where they are not involved.
- There are only a few selected advisors in Zululand and the South Coast that are involved in the project as they only planted soy in certain areas of the Zululand and South Coast. There is potential to increase the hectares planted in Zululand in the new season. The Department of Agriculture advisors requested to be more involved.



Provincial & National

- The Landcare project from the Department of Agriculture made equipment and raw material available to the farmers from Okhahlamba, Amajuba & Harry Gwala.
- The Department of Agriculture supplied fertilizer to some areas, but the fertilizer supplied was not nearly enough to plant properly.
- The Department of Agriculture appointed contractors on a 5-year term to assist with planting and spraying. These contractors did not prove successful in the areas where the ESDF program was implemented. Thankfully this year was the final year of the 5-year term. The contractors either arrived too late in the season to plant or their equipment was not suitable for planting soy or not well maintained resulting in a lot of breakdowns. The contractors also rushed the planting to maximize hectares planted for increased profits resulting in poor germination. Hopefully the Department of Agriculture will assist farmers in fixing their own equipment in the new season instead of contracting the contractors.
- The National Department of Agriculture has had budget cuts, so they do not have funding available to assist the farmers. The Department of Agriculture Head office has made many empty promises to the farmers during their visit, creating a certain level of expectations by the farmers. When these expectations are not met the Advisors that works with the farmers daily gets blamed. These empty promises by Head office make things difficult for the Advisors.

General

- Many fields were still planted by hand and animal drawn planters. Some of the fields planted by hand is actually looking better than a few fields planted by tractor and planter. Planting by hand limits the total hectares that a farmer can plant during a season.



- ESDF has delivered the raw materials for planting during October, however some of the raw materials only reached the farmers in December. There were some farmers that did not plant during December as it was the festive season and only planted in January. The planted to late and will show little to no profit. All these farmers have received training on correct planting periods.
- The farmers that planted early need their Pre-emergence raw materials early in January however they only receive their raw materials at the end January due to festive season closures. ESDF wants to order Pre-emergence raw materials earlier in November to ensure delivery in early January.
- There are farmers that did not plant during the previous season and used last seasons raw material to plant this season.
- ESDF created WhatsApp groups for the farmers and advisors in the program. ESDF mentors use these groups to distribute relative soy related information on a Bi-weekly basis. The farmers use these groups to ask questions, discuss issues, share information and to proudly share photos of their fields. These groups have proven to be highly successful and valuable.
- 'The Soy Training Workshop' will be renamed 'Soy Information Day for Farmers'. Information and Manuals on Soy Planting will be distributed, and the WhatsApp groups promoted.
- An Advisor from the Okhahlamba Loskop area approached ESDF with a request for a trial on a Step-by-Step approach to soy planting with the farmers. 154 Hectares were planted in this trial.



The steps were as follows:

- ❖ Ensure that the farmers have equipment available to plant, fix the equipment that they do have available and offer training on calibrating the planters and spraying equipment.
- ❖ Ensure the fields are suitable for planting.
- ❖ Ensure the PH of the soil is correct and apply Lime were deemed necessary.
- ❖ Fields are to be inspected prior to distributing the Raw Materials. ESDF will only dispatch the raw material once the field has been approved.
- ❖ Farmers must be able to show that they have the fertilizer available to plant.
- ❖ The Famers use the available, fixed equipment to plant the fields and spray the fields.
- ❖ The WhatsApp groups are used to distribute information and arrange field visits if deemed necessary.
- ❖ Harvesting might prove problematic but there is a small harvester available to harvest. The fields are situated as close to each other as possible to easily manage and facilitate planting, spraying and harvesting.
- ❖ The delivery and marketing of the soy in the trail is more convenient as it saves on transport costs.



Crop

Okhahlamba (Bergville, Northern Natal, Newcastle, Utrecht, Dannhauser)

The majority of the farmers in these areas have been part of the ESDF program for 5 years plus and are farmers that are eager to plant. The advisors in these areas also do more than what is expected of them, and this leads to better yields per hectare. ESDF is expecting good yields in these areas.

Zululand (Paul Pietersburg/Dundee/Weenen)

The farmers and the Department of Agriculture are new in the program but are keen to plant soy. The Advisors and farmers are assisted by the Northern Natal groups as the Advisors in both areas have a good working relationship. ESDF is expecting good yields in these areas.

Estcourt

The program has been implemented in the area for 3 years and the Advisors are only getting involved now. The crops are looking better than usual but is still not up to standard. ESDF is expecting average yields in these areas.

Mpumalanga (Nkomazi, Mbombela)

Some of the Advisors are involved in these areas.

Nkomazi: All the soy raw material handed out in this area has been planted and been planted by hand. The program has been implemented in the area for 2 years. The heatwave and excessive rain late in the season damaged a great deal of the crop resulting in yield losses.

Mbombela: This was the area's first-time planting soy, and it is looking good. ESDF is expecting average yields in these areas.



Limpopo (Capricorn, Sekhukhune, Vhembe, Mopani)

The Department of Agriculture Advisors in the area are very uninvolved, they only participate in the program when they are requested to go with the ESDF Mentor. ESDF will not be planting in all the districts that were planted in this season but will instead focus on and plant in the areas that are showing potential. The heatwave and excessive rains late in the season damaged a great deal of the crop resulting in yield losses.

Eastern Cape (Mhlontlo, KSD, Nyandeni, Ngquza Hill, Amathole Mbashe)

There are only a few Department of Agriculture Advisors that are actively involved in the program. Some areas have more Advisors than farmers and yet there is no crop. ESDF will be planting in areas south from Umtata during the new season. The yield in these areas is not good at all and only a few farmers will have yields by the end of the season.

South Coast (Ugu, Ubuhlebezwe)

There are a few advisors in this area that is actively involved in the program and the soy are doing well in these areas.

The farmers lost interest in the crop when it came to harvesting. They waited for Threshers from the Department of Agriculture that led to crop losses. Rains late in the season resulted in mouldy & wet soy that could not be delivered.

Equipment

- The farmers equipment needs to be fixed, and the planter's seed plates changed to suit Soy planting. The farmers lack of steady income makes this difficult. However, if we can assist the bigger farmers in fixing their planting and harvesting equipment these farmers can assist the smaller farmers with planting and harvesting on a contract basis. ESDF will be assisting the bigger farmers with SACTA loans during the new season to facilitate the possibility of bigger farmers acting as contractors for the small farmers.



- The Department of Agriculture has a lot of Equipment on their books. ESDF will request the Department of Agriculture to compile a list of available equipment in the various districts to fix the equipment and rent it out to the farmers in the surrounding areas. This can be facilitated by local farm groups/organizations in the area. Fixing the equipment will be much cheaper than replacing all the equipment.

Harvesting

- Harvesting is still a major issue for most of the farmers as the soy is ready for harvesting at the same time. Most of the soy is pulled by hand, transported to their homes & stored until they can thresh it by hand.
- Harvesting by hand results in crop losses. There was a lot of moldy, wet soy that was not suitable for delivery.
- ESDF has explored the option of small harvesting equipment that can be rented to farmers to thresh their soy. ESDF has received funding for 10 threshing machines and will be testing them in the Okhahlamba area.

Threshers

- The Threshers were used with great success in the Okhahlamba area after modifications. These threshers will be of great value to the smaller farmers in future.

Challenges

- Due to a lack of income the smaller farmers can't afford to buy equipment. These small farmers need assistance to contract bigger farmers in their area to assist with planting and harvesting.
- Funding for ESDF to increase hectares planted and to take on new areas.



Progress Plan

- ESDF to source additional funding from major role players (national & international) in the Agricultural Industry.
- ESDF to increase hectares in areas with potential.



3.4.4 ADVANCED FARMER INPUT SUPPORT - INSURANCE, SOIL CORRECTION AND MENTORSHIP; Mr N Vermaak, Phahama Grain Phakama NPC

Introduction

Farmer development and agricultural transformation remain a priority in South Africa. South Africa is characterized by a dual agricultural economy. On the one side, are large commercial farmers who are comparatively some of the best in the world, and on the other side, are smaller developing farmers who continue to struggle to become self-sustainable. The former homeland areas cover 13% of South Africa which is in the region of 18 million ha (only a portion of which is arable). There is a large number of farmers who have access to land and the skills to farm but unfortunately do not have access to finance and the necessary technical support. Grain SA has made it a priority to act on behalf of these farmers making sure to negotiate on their behalf and support their endeavours to become fully commercial. This effort is in line with the OPDT objectives specifically to support; market access in respect of the South African Oil and Protein Seed industry (inter alia by providing marketing infrastructure, training, and assistance in rural areas where the need thereto exists). The project advances transformation by supporting emerging farmers. PGP's approach to sustainable and comprehensive farmer development and transformation is to create a network of funding and collaborative technical partners to allow farmers to access the wider benefits of full grain farming support. This project is a great part of this complementary support to oil and protein seed farmers. The project provides complementary funding for farmers that are also supported through input funding by other parties. The fact that there is a functional support system and infrastructure provided through other parties makes it possible for the OPDT support to help achieve full support for many developing farmers also funded through other initiatives it is possible to link a number of other initiatives to the work sponsored by the OPDT.

The funding from the OPDT has been the anchor to the PGP Farmer Development Program providing direct technical and input support benefits to many oil and protein seed farmers over the years. None of the individually



funded programmes have enough funds to provide the adequate support required by emerging black farmers. Often, farmers get input support without the extra supported needed to ensure successful production and growth. Such support covered by the OPDT support, including soil corrections to conserve and maintain good quality soils; crop insurance gives oil and protein seed farmers provides a buffer in the face of unfavourable production seasons; and the mentoring support ensures one-on-one agribusiness coaching and technical support for success.

Project objectives

The advanced farmer support is extended as complementary funding to farmers who already have access to input funding. The complementary funding is therefore used to cover costs related to **soil correction, insurance, and mentorship support**. This is an effort effectively meant to assist the farmers in addressing any emerging barriers that could make it difficult to achieve commercial yields. As farmers exploit their soils, there is an increasing need to support soil health and ensure good soil pH to ensure efficient utilisation of nutrients. Knowledge transfer through professional mentorship is a key part of the extra support that PGP can provide to participating farmers because of the funding support provided by the OPDT.

PGP will continue to support the farmers currently participating in the project as part of the longer term support to help strengthen the farming capacity of farmers and improve the prospects for self-sustainability and commercialisation. PGP will target to increase the participating farmers to boost the hectares under oil and protein seed production. Enrolling new farmers will help ensure that the pool of supported farmers includes those that are advanced as well as new entrants to ensure sustained growth and a wider impact of the program. The final list of participating farmers and hectares planted can be updated later at the beginning of the season.



Progress Report

Overall number of Active Advanced farmers that received support with regard to Soil corrections, Insurance and Mentorship is 33 farmers in total. A total of 33 farmers are currently being supported in this period of reporting and they have received 183 visits where they were afforded one-on-one mentorship from our expert team. Over time these individuals have proven themselves on a number of levels including commitment, competency and potential. It is believed that with intensive one-on-one support, they could grow their farming enterprises further.

Every time one of the team members visit a farmer, they complete a report such as the one below which is uploaded onto the PGP Farmer Development website so the whole team can monitor activities and follow progress through the season. As presented in some of the mentorship reports below, the report is also accompanied by photos and details of the discussion points and follow-up activities to be done by the supported farmer.

Conclusion

The contribution of the OPDT is key to the sustainability of the project as a contribution to the larger Farmer Development Program of PGP as supported through other collaborating partners. The combined support strengthens PGP's offering to provide a comprehensive package in support of developing OPDT farmers.

Overall, the season started and progressed under very tough conditions which were particularly more pronounced for all late plantings. Due to the late access to funds, most of the farmers funded under this project were certainly challenged by the late October, November, and December rains. Those that were targeting to conclude their planting later in January were further challenged by the dry and hot weather conditions experienced in late January to mid-February. Then more rains were experienced at the end of February with generally low temperatures. These conditions, were experienced differently by different farmers, depending on the soils, field slopes and the stage of the crop to conduct the necessary



agronomic activities.

We expect a fair season for most farmers from a yield perspective but certainly a very difficult season in terms of the commodity prices especially for soya beans that remain under great pressure globally. Specifically, to note for soybeans, a large Brazilian crop is currently being exported to the global market, which is weighing negatively on prices. In the long-term, the US soyabean crop is also quite huge, which could continue to weigh negatively on the soya bean prices. The latest USDA crop progress report showed an increase in the US planting pace in mid-April. Locally, as the maize exports began, there has been great pressure on soya beans as the stock continues to rise with limited exports. For maize, prices are beginning to demonstrate some stability.

In the short and longer term, the economic outlook therefore looks very difficult, especially for soya beans and a little more positive for maize. Farmers with the capacity to hold on to the crop are likely going to wave the dropping prices in the short term. Unfortunately, this is hardly the case for developing farmers who are generally always pressured to release their crops to settle loans and secure the following season's production loans and inputs.

On behalf of the benefiting farmers, PGP wishes to express great gratitude for the financial support provided by the OPDT.



3.4.5 FARMER SUPPORT FOR SUNFLOWER FARMERS IN THE FREE STATE AND NORTH WEST; Mr A Kole, FarmSol

A. SUNFLOWER _ DIRECT PRODUCTION INPUT SUPPORT

Reasons why it is deemed that the project will contribute to the above objective.

The farmers are part of the FarmSol project in North-West and Free State. In the summer season, the farmers grow Sunflower through a non-interest bearing Siqalo Foods production loan.

The farmers are planning to plant 975 hectares of sunflowers in the upcoming 2024/2025 summer season, Siqalo Foods have again committed production funding as well as an offtake market for the High oil content sunflower to be produced.

The farmers need an additional funding of R 1,3 million to be used as a top-up grant and subsidy specifically to cover expenses associated with transporting the sunflower seeds to the facility of CEOCO based in Boksburg.

Main aim of the project

To access grant funding to make up the shortfall of the Siqalo loan financing which will enable these farmers to diversify into sunflower production, a crop well suited to the areas in which these farmers are situated.

B. GROUNDNUTS (TAUNG) DIRECT PRODUCTION INPUT SUPPORT

Reasons why it is deemed that the project will contribute to the above objective.

FarmSol would like to request support from OPOT for the on-farm support and mentoring to approximately 4 farmers on the irrigation scheme in Taung. The farmers each plant 10 hectares and share in a centre pivot covering 40 hectares.



The support will be for 4 farmers producing groundnuts on a total of 40 hectares. This support will be part of a crop rotation plan with non-GMO Maize funded by AB InBev and Soya Bean funded by SACTA.

Main aim of the project.

Full input production support to produce 40 hectares of groundnuts.

C. GROUNDNUTS SMALLHOLDER DIRECT PRODUCTION INPUT SUPPORT

Reasons why it is deemed that the project will contribute to the above objective.

FarmSol would like to request support from OPOT that will enable 9 smallholder Groundnuts farmers to plant 64 hectares of Groundnuts, under this project hectares planted range from a minimum of 1 hectare to a maximum 20 hectare per farmer. The support will be for the full input costs.

Main aim of the project

Full input production support to produce 64 hectares of groundnuts.

D. MENTORING AND MANAGEMENT SUPPORT

Reasons why it is deemed that the project will contribute to the above objective.

The farmers need support to ensure that they do the right thing at the right time. Activities farmers are assisted with include:

- Advice on cultivar choice recommendations, crop protection and fertilizer applications;
- Soil sampling and GPS mapping;
- Budgeting, financial controls and management, including monthly farmer statements;



- Procurement and delivery of production inputs;
- Calibrations of equipment, mechanisation plans and activity execution
- Offtake arrangements, hedging, pricing and risk mitigation; and
- Contracting and agreements

Main aim of the project

To support the farmers in this program with mentoring - advice on all aspects of production. The farmer mentor coordinates all aspects of production, including budgeting, ordering production inputs, liaising with input suppliers and contractors and assisting farmers with the delivery of the grain at harvesting.

Project objectives

- Hold farmer sessions with each group every two weeks from November to March;
- Assist the farmers with the procurement of inputs;
- Assist the farmers to plant and manage the crop;
- Strive to have the farmers reach the yields that are attained by commercial sunflower producers in the area;
- Support, mentor and train the farmers on the entire sunflower production cycle, financial management and marketing; and
- Maintain a database of study groups and members which includes the hectares they plant annually as well as the yields they achieve.

3.4.6 OAC INTEGRATED MONITORING AND EVALUATION; Prof F Meyer, BFAP

In order to support O.A.C to monitor, evaluate and report on transformation performance and manage potential risks BFAP proposes the customisation and implementation of an Integrated Systemised M&E Framework.

“Turning data into information and information into insights”

The Integrated M&E product offering is structured around the Integrated Value



Information System (IVIS) providing a systemised solution and framework to enable the capture, integration, and storage of data and the Bureau for Food and Agricultural Policy (BFAP) to utilise and evaluate the available data to conduct timeous, independent and credible analysis and review of performance and provide informed insights for decision making and risk mitigation.

Key Principles:

- Phased and modular approach.
- Holistic integrated structure for monitoring and reporting across all aspects of transformation initiatives:
 - Skills Development;
 - Farmer Development;
 - Value Chain SMME;
 - Busary & Internships.
- Geo-spatial contextualisation initially focused on advanced farmer development programs but potential to expand functionality and scope.
- Program tracking and seasonal monitoring and evaluation
 - time series data and analysis of selected program performance indicators;
 - future integration of benchmarking functionality;
 - Multiple source data capture.
- Standardised templates
 - web forms;
 - future integration with other systems and platforms.
- Customised, interactive, filterable dashboards and reporting

The Integrated M&E product offering is structured around the Integrated Value Information System (IVIS) providing a systemised solution and framework to enable



the capture, integration, and storage of data and the Bureau for Food and Agricultural Policy (BFAP) to evaluate the available data to conduct timeous, independent and credible analysis review performance and provide informed insights for decision making and risk mitigation.



To deliver insights performance while scoping future requirements and functionalities BFAP proposes a progressive approach to deliverables and budget:

BASE PHASE: Deliverables

The BASE PHASE scope, systems design, functionality, key deliverables, timelines, and budget are based on the current programs and known requirements should these change during the course of the project the parties will jointly agree on the impact of the changes to project scope, budget and milestone timelines.

BASE PHASE DELIVERABLES:

- Implementation of customised web-based application to facilitate the uploading of standardised templates associated with the Skills Development and Farmer Development Programs.
- BFAP will work with OAC to develop standardised templates to capture required performance metrics for the different programs and initiatives
 - The advanced farmer develop programme will be structured around a geo-spatial grower data base.
- OAC will work with appointed service providers to obtain data in standardised templates and will load templates onto the system;



- The Base phase of the projects requires historical information to be captured and uploaded as well as the current season information.
- BFAP will support with training to OAC on the uploading of standardised templates onto the system;
- BFAP will develop customised dashboards and reports based on OAC requirements per initiative and at an aggregated view.

The value of a systemised solution requires a multi-year approach to functionality development and data analysis for time series impact reporting. The multi-year budget structure is provided to illustrate the longer term project costs **but approval is only required for Year 1 to initiate the project and illustrate the value of an Integrated Systemised M&E Framework.**



4. CONCLUSION

The Oil and Protein Seeds Development Trust (OPDT) and Oilseeds Advisory Committee (OAC) are particularly proud of this research report. As in the past, the OPDT and OAC continue to contribute to the Oil Seeds Industry in South Africa within the provisions of the trust deed and constitution, respectively.

The success is based on the hard work and dedication of OPDT Trustees, OAC members and staff, but definitely also on the work done by co-workers and contractors who always support the many actions, and to whom we owe a debt of gratitude. We also express unqualified appreciation to local and international co-workers, researchers and institutions, the press, fund managers, auditors, lawyers and web masters. We trust that this co-operation will continue in the new year and over many years to come leading to far-reaching and ever greater achievements.

G.T. du T. Keun
CHIEF EXECUTIVE OFFICER