2022/2023 RESEARCH REPORT

Oil & Protein Seeds Development Trust & Oilseeds Advisory Committee

P O Box 5562 Rivonia 2128 **TEL** 011 234 3400/1 **E-MAIL** oliesade@opot.co.za **WEB** www.opot.co.za

2022/2023 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 2022/23 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
Dr A van der Vyver	-	Representative of the oilseeds trading industry
Mr DI Schutte	-	Representative of labour involved in the oilseeds industry
Mr RJ Küsel	-	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
Ms UC Speirs	-	Representative of the Minister of Agriculture
Mr K Gaoraelwe	-	Representative of the Minister of Agriculture
Mr S Shandu	-	Representative of the Minister of Agriculture, Land Reform and Rural Development

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 2022 to 28
February 2023, 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, R39 936 875 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 9 037 119
Under consideration	:	R 1 088 222

- **New Applications**

Approved	:	R 0
Under consideration	:	R 1 201 785

- **Transformation Projects**

Approved	:	R 6 158 335
Under consideration	:	R 18 538 945

- **Joint Project Proposals**

Approved	:	R 363 283
Under consideration	:	R 0

- **Provisions**

Approved	:	R 3 049 186
Under consideration	:	R 500 000

- **Management of Research Projects**: **R 3 993 688**

The total budget approved for the 2022/2023 financial year therefor amounted to R 43 930 563.

The above-mentioned amount includes the following bursaries approved:

(a) Continuation Applications

- "*Investigating resistance inducers and the phytobiome for sustainable crop production and control of sclerotinia stem rot of soybean.*"
(PhD - Mr A Edwards, University of the Free State)

- "*Factors affecting liver health in egg laying hens.*"
(MSc - Mr L Ndlebe, University of KwaZulu-Natal)

- *"The effect of selected Regenerative Agriculture practices on soil productivity, plant growth and crop yield in a winter cereal and canola production area of the Western Cape."*
(MSc - Mr GA Musto, University of Stellenbosch)

- "*A novel approach to discover fungal biodiversity..*"
(PhD - Ms C Dewing, University of Pretoria)

- *"The physiological impact of heat wave conditions on anthesis and pollination in domesticated sunflower."*
(MSc - Ms UNN Memela, University of Pretoria)

- *"Analysing Helianthus annuus transcriptomes in response to heatwaves in field."*
(MSc - Ms V Röder, University of Pretoria)

- "*Genetics and genomics of South African isolates of the agricultural pathogen Sclerotinia sclerotiorum affecting sunflower.*"
(PhD - Mr ST Buthelezi, University of KwaZulu-Natal)

- "*Effect of inclusion of legumes in maize on ensiling characteristics and productivity of South African Merino sheep.*"
  (MSc - Mr O Hawu, North-West University)

- "*Impact of climate change adaptation practices on income and poverty among smallholder sunflower farmers in the North West.*"
  (MSc - Ms LE Molefe, University of Pretoria)

(b) New Applications

- "*A pre-breeding approach towards Fusarium soybean sudden death syndrome resistance in South African soybeans using marker-assisted breeding*."
  (MSc - Dissertation, Mr HJ Basson, University of the Free State)

- "*Identification, prevalence and fungicide control of seedborne fungi associated with soybean.*."
  (MSc - Dissertation - Mr NV Hlongwane, 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 I Motlhabane	-	Representative of the developing oilseeds producers
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 JA du Plessis	-	Representative of South African Soybean Forum
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 own ranks.

During the October 2021 meeting Dr E Briedenhann and Mr JP Botha were elected Chairman and Vice-Chairman of the OAC, respectively for the 2022 year.

2.3 GENERAL OVERVIEW

During the reporting period, 1 March 2022 to 28 February 2023, 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 EXPLORING OPINIONS ABOUT SOYA IN THE LOWER INCOME GROUPS; Dr C Muller, University of Pretoria

The final report is still awaited.

3.1.2 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, 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 very important 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. Therefor the objectives of this study are to study the effect of different planting dates on sunflower grain yield and quality, and to demonstrate and promote the optimum planting dates at the farmers' field.

Four field trials were established at GC Potchefstroom research farm, three at Bethlehem and one at Henneman with different planting dates. Nine sunflower hybrids were planted and evaluated for seed yield and quality in a randomized complete block design with three replications.

At Potchefstroom site, highly significant effect of planting date on all studied parameters was observed while sunflower hybrids showed significant differences for all studied parameters except the seed yield. First planting date planted in the 31 October 2022 yielded the highest yield of 2.73 t /ha^{-1}, while the lowest seed yield recorded for the fourth planting date on 12 January 2023 (1.74 t/ha^{-1}). Second planting date recorded the highest oil content 45.88 % across hybrids while the third planting yielded the lowest oil content of 41.26%. Protein content ranged from 10.20% for the second planting to 14.60 % for the last planting. Oil yield ranged from 0.72 t/ha^{-1} for the fourth planting to 1.24 t/ha^{-1} for the second planting. Mean seed yield across hybrids and different planting dates was 2.31 t/ha^{-1}, PAN 7080 produced the highest yield of 2.46 t/h^{-1} and the lowest yield of 1.21 t/h-1 was recorded for AGSUN 5106CLP. For oil yield, SY 3970 CL produced the highest oil yield of 1.16 t/ha^{-1}.

At Bethlehem site planting dates and sunflower hybrids showed highly significant effects on all studied parameters except the seed yield. First planting date on 20th of November recorded the best seed and oil yield (2.64 t/ha^{-1} & 1.13 t/ha^{-1}) respectively. The last planting date on January 11, 2023, yielded the lowest yield and oil yield of 1.98 t/ha^{-1} & 0.86 t/ha^{-1} respectively. The last planting produced the highest oil content 43.58 % and the lowest oil content 40.82% recorded for the second planting date. The highest protein content 15.43% was recorded for the last planting date and the lowest was recorded for the first planting 14.45 %. Tested sunflower hybrids showed significant differences for all studied parameters under different planting dates. For seed yield, PAN 7080 CLP produced the best seed yield of 2.54 t/ha^{-1} followed by AGSUN 5270 yielded 2.53 t/ha^{-1} hybrids. SY 3870 CL produced the highest oil content 51.01% and AGSUN 5106CLP produced the highest protein content 15.36 %.

Due to heavy rainfall during the season only one planting date was successful At Henneman. The mean seed yield is 3.17 t/ha^{-1}, PAN 7080 produced the highest yield (3.77 t/ha^{-1} followed by AGSUN 5270 produced 3.57 t/ha$^{-1.}$ SY 3970CL produced the highest oil content (54.71%) and the highest oil yield of 1.69 t/ha$^{-1.}$

In conclusion, planting date showed a significant effect on all studied parameters. At Potchefstroom site, end of October and November plantings produced higher seed and oil yield while at Bethlehem 20th of November produced the highest seed and oil yield.

3.2 CONTINUATION RESEARCH PROJECTS

3.2.1 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, University of Stellenbosch and Dr GJ van Coller, Western Cape Department of Agriculture

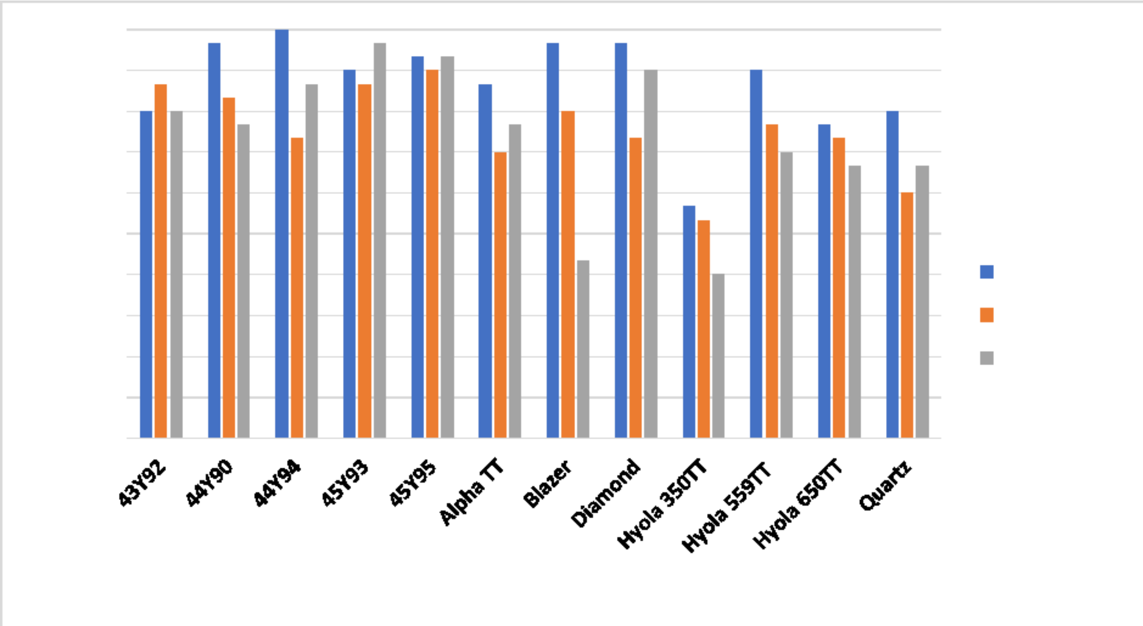
Surveillance of canola production in the Western Cape

Incidence and severity:

The incidence of leaf lesions (percentage of plants with at least one leaf lesion) caused by *Leptosphaeria* were determined in 2021 at the rosette stage at Langgewens and Tygerhoek research farms and Uitkyk farm near Riversdale. Incidence measurements for the 2022 season is currently in process.

Blackleg incidence was slightly higher at Riversdal (87%) than at Langgewens (76%) and Tygerhoek (74%) (Fig. 1). Disease incidence was above 60% in all cultivars at all three locations, except for Hyola 350TT which had the lowest disease incidence at all locations and Blazer at Tygerhoek with around 40% incidence. This may be due to cultivar Hyola 350TT having the most *R*-genes of all the local canola cultivars, namely: *Rlm1*, *Rlm4*, *Rlm6*, *LepR1.*

Figure 1: Incidence of leaf lesions (percentage of plants with at least one leaf lesion) on 12 cultivars assessed at rosette stage in 2021 cultivar trails.



Blackleg severity was also determined in these trails in 2021 two weeks before harvest using the method described by Peng *et al*. (2021). The severity for the 2022 will be conducted towards the end of the season.

The results are summarised in Fig. 2 which was also submitted in the report by Dr van Coller on the integrated management of blackleg of canola in the Western Cape by means of cultivar resistance and chemical control. Overall, the highest disease severity was recorded at Langgewens (41%), followed by Riversdale (33%) and Tygerhoek (19%). Due to heavy rains and flooding during planting in May 2021, the trial at Tygerhoek had to be replanted in early June 2021, which negatively influenced the results of this trial. Results from Tygerhoek were therefore omitted from statistical analysis. Combined data from Riversdale and Langgewens indicated that the Clearfield cultivars 45Y95 (20%), 45Y93 (21%), 43Y92 (29%), 44Y94 (30%) had the lowest disease severity, while Blazer (44%), Hyola 650 TT (46%) and Hyola 559 TT (61%) had the highest disease severity. A statistically significant difference was found between these two groups of cultivars.

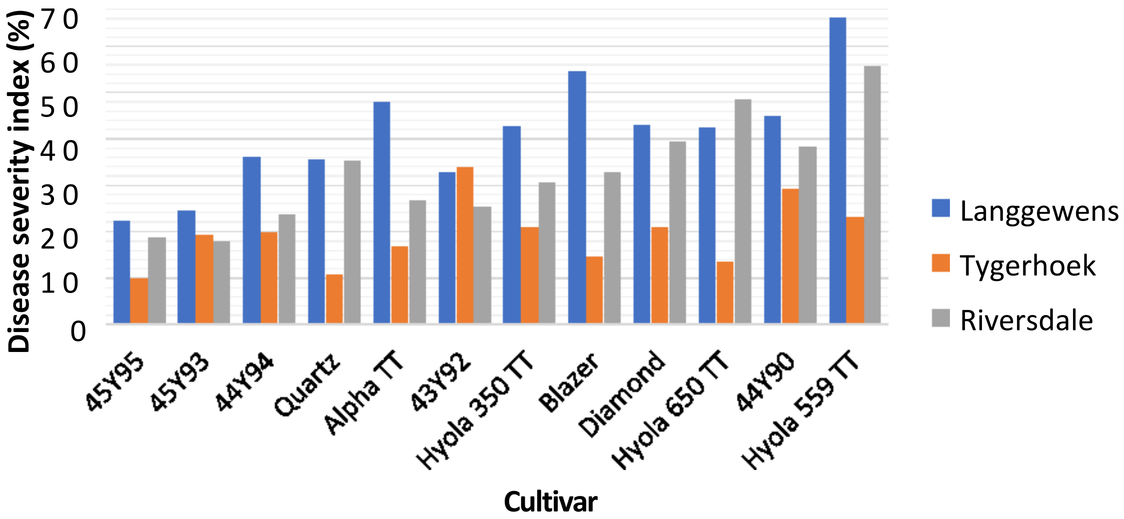


Figure 2: Blackleg disease severity index (%) of 12 cultivars evaluated in the 2021 cultivar trials

<u>Sample collection</u>

In the 2020 and 2021 seasons, symptomatic leaves (flowering stage), crown tissue (two weeks before harvest) and stubble (after harvest) were collected from the cultivar evaluation trials at six locations, including Langgewens, Hopefield and Eendekuil in the Swartland region and Tygerhoek, Napier and Riversdal in the Overberg region. The sampling of leaves from the 2022 season is currently in progress and crown and stubble will also be collected at the end of the growing season.

To investigate whether seed is a source of inoculum, different lots of retained seed was collected from 29 farmers in the Swartland and Overberg region. In addition to the seeds collected from farmers, seeds were collected from cultivar evaluation trials at five different locations which were retained from the 2021 season: Malmesbury (Langgewens), Riviersonderend (Tygerhoek), Riversdale, Hopefield, and Napier. Sampling of retained seeds from producers was done with a seed probe. To ensure representative sampling, the probe was used to collect seeds from large seed storage bags by inserting the probe at 5-6 different angles at different locations and dispensing the collected seeds into a container that was then used to mix the seeds. A volume of 200 ml sample was then taken and labelled, and stored at 5°C.

Surveys were designed to understand the behaviours of farmers around the storage and use of seed (Attachment 1). Ethical clearance was obtained from Stellenbosch University to conduct surveys throughout the 2022 growing season.

Due to typical blackleg symptoms noticed on some of the Brassica crops used as cover crops in the conservation agriculture system in the 2021 growing season, it must be determined to what extend these crops serve as an alternative source of inoculum and contribute to genetic diversity within the pathogen population. Sampling from symptomatic weed and cover crops species will be conducted in the 2022 and 2023 seasons.

Fungal isolation

In the 2020 season, 23 isolates were recovered from leaf samples and 806 samples from stubble. In the 2021 season, 544 samples were recovered from leaf samples and 236 samples from infected stems. Stubble isolations for the 2021 season is still in process. To date a total of 1609 isolates have been recovered (Table 1) within cultivar screening trials. Isolations from leaf samples of the 2022 season is also currently in progress, while isolations from infected stems and stubble will commence towards the end of the growing season. Isolations from seed will also be conducted from the seeds collected from farmers from the 2021 and 2022 growing seasons.

Table 1: The number of isolates of *Lepthosphaeria spp.* recovered from different locations in the

Region	Location	Growing season			
		2020		2021	
Swartland	Langgewens	0	248	105	93
	Hopefield	0	34	10	-
	Eendekuil	-	-	103	-
Overberg	Tygerhoek	0	193	196	77
	Napier	9	132	62	-
	Riversdal	14	199	68	66
Source		Leaves	Stubble	Leaves	Stems

Characterization of genetic diversity present in *Leptosphaeria* populations

Confirmation of species identity

The DNA of isolates were screened with species-specific as described by Liu *et al*. (2006). To date 1023 samples were confirmed as *L. maculans* from the 2020 and 2021 growing seasons. No isolates were thus far identified as L. biglobosa.

Population genetics study

Thirty-five isolates collected were sent for whole genome sequencing to Dr Angela van de Wouw at the University of Melbourne, Australia. These isolates will be included in an international Leptosphaeria maculans population study and the information gained through this study will be made available for comparative genomics.

A representative subpopulation of isolates of 20 isolates from each sampling location per growing season will be selected for whole genome sequencing, instead of using microsatellite markers that were originally envisioned in the proposed project. The genome sequences will be used to determine mating type, to construct a phylogeny, to identify avirulence genes and to determine patterns in migration in the South African L. maculans population. Much more information can therefore be obtained from whole genome sequencing, compared to the microsatellite markers. A subset of 100 isolates have been chosen from the 2020 populations and DNA extraction is in progress. Fifty isolates each from the 2021 and 2022 growing season will also be included in the analysis at a later stage. Some samples isolated from symptomatic weed and cover crop species will also be included in the population genetics study.

Characterisation of pathogenic potential of L. maculans isolates

PCR identification of known avirulence genes

The DNA of isolates selected for the population genomics study, as well as isolates collected from alternative host species, will be used to screen for the presence or absence of avirulence genes before it will be sent for whole genome sequencing.

Pathogenicity testing

Due to the difficulties in availability and import of seed of differential hosts needed for race identification, the race identity will be inferred by the absence and/or presence of the known avirulence genes from the whole genome data generated in the population genomics study, as described by Chen et al. (2021).

3.2.2 INTEGRATED MANAGEMENT OF BLACKLEF 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

Introduction

Blackleg, caused by *Leptosphaeria macu!ans* and *Leptosphaeria big!obosa*, is the most devastating disease of canola globally, with annual losses in 2008 estimated at more than US$ 900M (Fitt *et a!.*, 2008). Losses in Australia amount to between 10 and 15% of the annual harvest, although yield losses of up to 90% has been recorded (Van de Wouw *et a!.*, 2016b). Blackleg is a known major constraint to canola production locally. While there are no official numbers available on the impact of blackleg on canola in the Western Cape, a yield increase of only 5% during the 2021 growing season would have resulted in an additional 9750 tonnes of grain produced. With a market price of R 10 200 / ton (Grain SA Market report, 2022), this would have resulted in an additional R99 450 000 of revenue generated within the canola industry.

Blackleg is managed by integrating host resistance with chemical control. Agronomical practices like ploughing or burning of stubble, which decreases the inoculum load, is effective in reducing disease levels (Guo *et a!.*, 2005), but cannot be integrated with conservation agriculture (Kassam *et a!.*, 2009; Rochecouste *et a!.*, 2015). Planting canola at least 500m away from the previous year's stubble, which enables the crop to evade the disease, is also effective (Marcroft *et a!.*, 2004), but limited space on farms often makes this impractical. The use of host resistance is the most durable, cost-effective and environmentally friendly approach to manage blackleg (Huang *et a!.*, 2018), but must be managed carefully due to the large number of genetically distinct races of the pathogen occurring globally. In Manitoba, Canada, for example, 170 races of the pathogen have been identified (Fernando *et a!.*, 2018). Furthermore, the occurrence and frequency of races of the pathogen within a country or region is not static, but changes in response to the major resistance genes present in canola cultivars (Van de Wouw *et a!.*, 2018). When cultivars with the same compliment of major resistance genes are cultivated each year in the same region, it can result in the rapid increase of races not suppressed by these resistance genes, up to the point where resistance is effectively overcome. This can happen within three years, as witnessed in Australia and France (Sprague *et a!.*, 2006a, b). The pathogens are heterothallic, meaning that the different mating types (similar to male and female) are carried on separate individuals (Fernando *et a!.*, 2018). Sexual reproduction occurs easily and in large numbers in canola stubble and results in offspring carrying genetic material from both parents. This ability, coupled with the seedborne nature of the pathogens, allows for the introduction of new races into production regions (Van de Wouw *et a!.*, 2016a).

The use of azole fungicides has contributed to the 50-fold increase in canola production in Australia in the last 25 years (Van de Wouw *et al*., 2017). Indiscriminate or repeated use of the same fungicides, however, allows for the build-up of tolerance toward fungicides over time, and represent a real threat to continuing canola production. Cases of blackleg isolates highly resistant against triazoles has been reported in Australia, while cross-resistance between triazole and triazole + strobilurin fungicides have also been reported (Van de Wouw *et al*., 2021).

The aim of this project will be to evaluate the resistance of local canola cultivars against blackleg in different production regions as well as in the greenhouse against identified local races of the pathogen, to determine the fungicide sensitivity of the local pathogen populations to a range of fungicides, and to screen the efficacy of selected foliar fungicides and seed treatments for the control of blackleg under greenhouse conditions. This project will be complimentary to the project proposed by Dr G. Mostert of the Department of Plant Pathology, Stellenbosch University; together these two proposals will provide a much more complete approach to understanding blackleg in the Western Cape, as well as developing management strategies.

<u>Materials and methods</u>

<u>Evaluation of canola cultivars for blackleg resistance</u>

<u>Greenhouse evaluation</u>

According to the project proposal, greenhouse evaluation of cultivar resistance will commence in 2022. However, after reassessing the objectives of this project, we decided that more meaningful data for canola producers will be generated by including an additional field trial for cultivar resistance evaluation than by conducting greenhouse trails, to ensure that the important production regions are included in the resistance evaluation. A field trial to determine cultivar resistance has thus been established at Waterboerskraal farm near Hopefield in May 2022 and will continue from 2023 onwards. This is in addition to the field trials which started in 2021 at Langgewens research farm (Moorreesburg, Swartland) and Tygerhoek research farm (Riviersonderend) and Uitkyk farm (Riversdale) in the southern region of the Western Cape.

Field evaluation

To evaluate the blackleg resistance of cultivars that are commercially available in South Africa, three cultivar trials were established in April/May 2021 at Uitkyk farm (Riversdale), Tygerhoek research farm (Riviersonderend) and Langgewens research farm (Swartland), respectively. A total of twelve cultivars were planted at each locality (**Table 1**). Agronomical practices commonly used in the respective regions were used, including minimum tillage, a standard fertiliser regime, as well as weed and insect control. To ensure infection from as many races of the pathogen occurring naturally in the respective regions, canola stubble from the previous season's canola cultivar evaluation trials at each location was collected and scattered on the planted paddocks immediately after planting. This ensured that emerging seedlings was in the immediate vicinity of fruiting bodies of the pathogen, thereby increasing the likelihood of infection (Marcroft *et a!.*, 2004). Given that infection up to the ~5-leaf stage is responsible for crown cankers later in the season (Marcroft *et a!.*, 2005), disease incidence was measured at the 5-leaf stage to ensure infection occurred. Results indicated that all cultivars at all three localities were infected.

The blackleg disease severity index (DSI) was evaluated two weeks before harvest using the method described by Peng *et a!.* (2021), with the DSI calculated as a percentage. The higher the percentage, the more severe the blackleg infection. Due to heavy rains and flooding during planting in May 2021, the trial at Riviersonderend had to be replanted in early June 2021. This, however, is an unfavourable time for planting canola in the Overberg region and the plants subsequently did not develop optimally, which negatively influenced the results of the trial. Therefore, the results from Tygerhoek were not included in the statistical analysis.

Analysis of variance (ANOVA) for location and cultivar effects and interactions were obtained using the GLM Procedure of SAS software (Version 9.4, SAS Institute Inc, Cary, USA). Homogeneity of trial variance was confirmed using Levene's test (Levene, 1960). To test for deviation from normality, Shapiro-Wilk's test was performed (Shapiro and Wilk, 1965). Fisher's protected least significant differences (LSD) were calculated at the 5% level of significance to establish differences between treatment means (Ott, 1998).

Table 1. Cultivars evaluated in field trials in the Western Cape for blackleg resistance during 2021.

Cultivar	Herbicide group	*R*-genes present	*R*-grouping[1]
Blazer	Conventional	*LepR1* (probably *R!m1* also, unconfirmed)	AD
Diamond	Conventional	*R!m1*, *R!m4*, *R!m6*	ABF
Quartz	Conventional	*R!m1*, *R!m4*, *LepR1*	ABD
44Y90	Clearfield	*R!m4*	B
43Y92	Clearfield	*R!m4*	B
44Y94	Clearfield	*R!m3*, *R!m4*	BC
45Y93	Clearfield	*R!m3*, *R!m4*	BC
45Y95	Clearfield	Unknown	
Alpha TT	Triazine tolerant	Unknown	
Hyola 350TT	Triazine tolerant	*R!m1*, *R!m4*, *R!m6*, *LepR1*	ABDF
Hyola 559TT	Triazine tolerant	*R!m1*, *R!m4*, *LepR1*	ABD
Hyola 650TT	Triazine tolerant	*R!m1*, *R!m4*, *LepR1*	ABD

1 Australian Blackleg Resistance Grouping (Van de Wouw and Howlett, 2020)

Evaluation of fungicides for control of blackleg

In vitro *fungicide sensitivity and determination of EC50 values*

According to the project proposal, *In vitro* fungicide sensitivity screening will begin in 2022, and is planned to commence in July 2022. We will make use of a high throughput screening technique as described in Troskie *et al.* (2012) which will allow us to include a larger collection of *Leptosphaeria* isolates. Results from this Objective will be included in the next progress report, relevant to this period.

Field evaluation

According to the project proposal, greenhouse evaluation of fungicides will commence in 2022. Similar to Objective 1.1., however, we decided that more meaningful results for canola producers will be generated by conducting field trials at the same locations mentioned for the cultivar evaluation. The first fungicide trails were therefore planted at four locations in April/May 2022 and included 6 different fungicides. More information on these trials will be included in the next progress report relevant to this period.

Results and discussion

Langgewens Research farm (Swartland)

The DSI varied from just over 20% to more than 70% at Langgewens research farm in the Swartland. With the exception of cultivar 44Y90, all Clearfield cultivars were among the best-performing group at Langgewens research farm during 2021. Conversely, the cultivars Alpha TT, Blazer and Hyola 559TT were the worst-performing cultivars (Fig. 1). This may be due to the presence of the *LepR1* gene in Blazer, and the absence of the *Rlm3* gene in Hyola 559TT, although the race structure of the pathogen population, which is currently being characterised by Ms Huibré Schreuder as part of her PhD, is needed to explain this. It is also important to note that this represents only the first year's data of this project, and data from additional years are needed to verify the resistance/susceptibility of the cultivars.

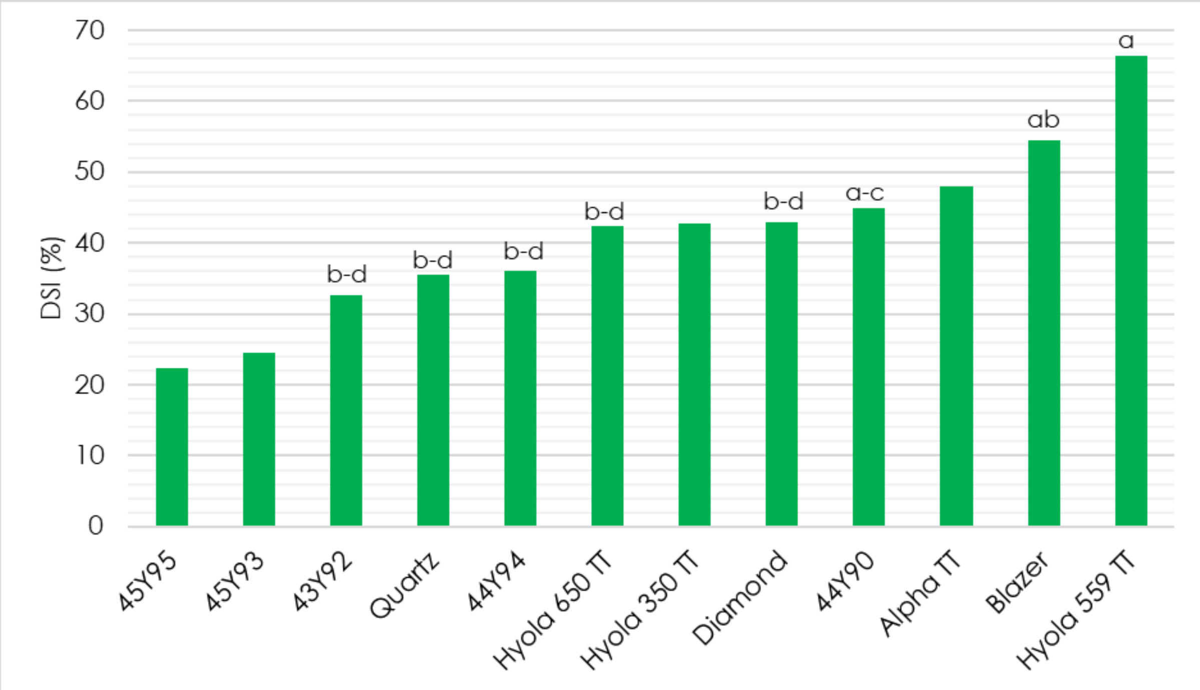


Figure 1: Blackleg disease severity index (DSI) (%) of 12 canola cultivars evaluated in the 2021 cultivar trail at Uitkyk farm near Riversdale. The group of cultivars in the green box was the most resistant group.

Uitkyk farm (Riversda!e)

The DSI varied from ~20% to almost 60% at Uitkyk farm near Riversdale. Similarly, to Langgewens, with the exception of cultivar 44Y90, the Clearfield cultivars were the best-performing group at Uitkyk farm near Riversdale during 2021. Conversely, the cultivars Hyola 650TT and Hyola 559TT were the worst-performing cultivars (Fig. 2). This may be due to the absence of the *R!m3* gene in the latter two cultivars, although the race structure of the pathogen population, which is currently being characterised by Ms Huibré Schreuder as part of her PhD, is needed to explain this. It is also important to note that this represents only the first year's data of this project, and data from additional years are needed to verify the resistance/susceptibility of the cultivars.

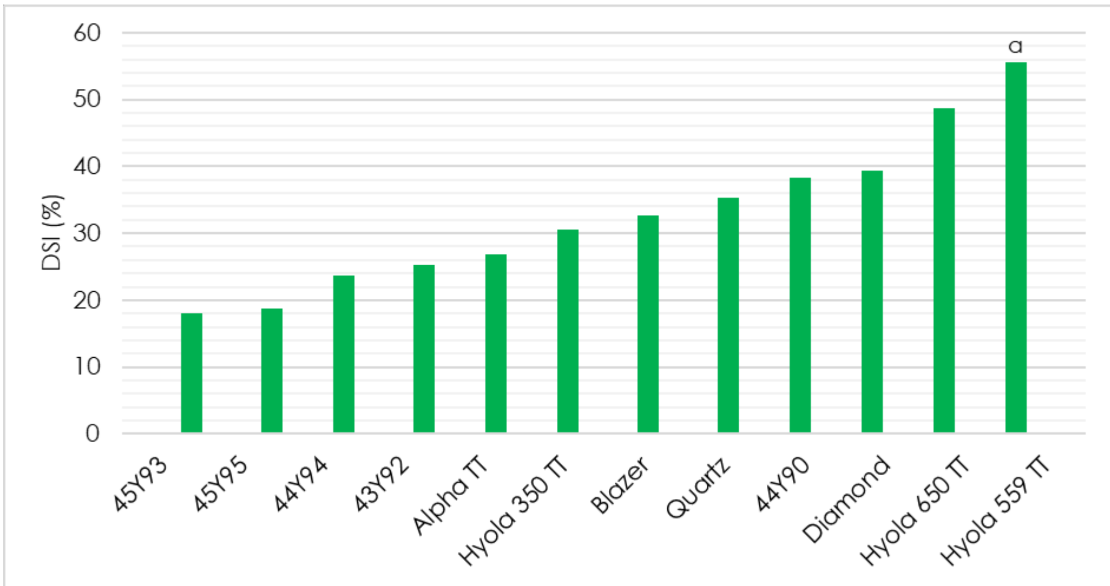


Figure 2: Blackleg disease severity index (DSI) (%) of 12 canola cultivars evaluated in the 2021 cultivar trail at Uitkyk farm near Riversdale.

Tygerhoek Research farm (Overberg)

Due to heavy rains and flooding during planting in May 2021, the trial at Riviersonderend had to be replanted in early June 2021. As mentioned, this is an unfavourable time for planting canola in the Overberg region and the plants subsequently developed poorly. This was also evident in the results obtained (Fig. 3), which are believed to be unreliable. The overall low DSI further confirms this.

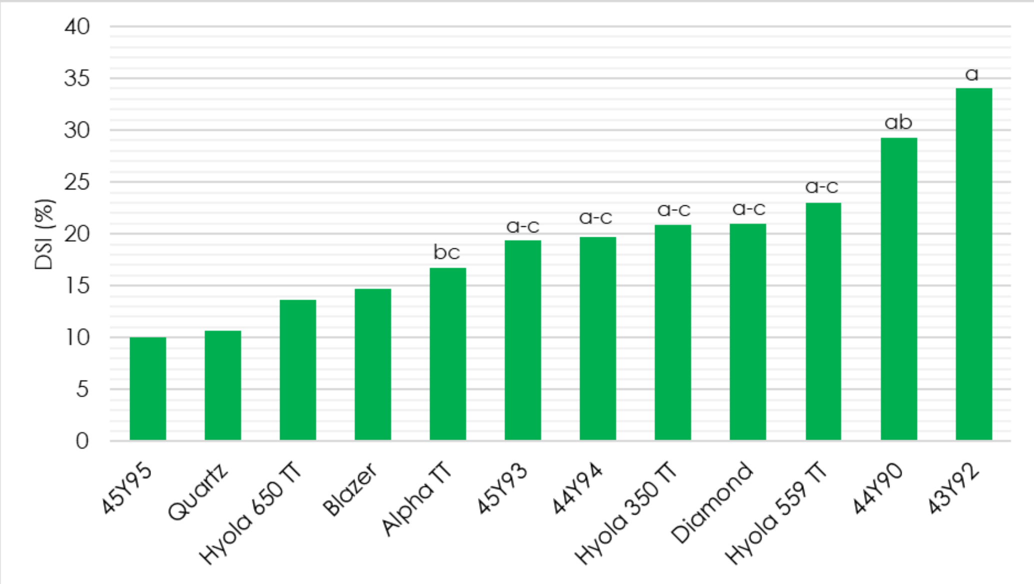


Figure 3: Blackleg disease severity index (DSI) (%) of 12 canola cultivars evaluated in the 2021 cultivar trail at Tygerhoek research farm in the Overberg.

<u>Overall DSI ratings (locations combined)</u>

The overall DSI were highest at Langgewens research farm, followed by Uitkyk farm and Tygerhoek research farm. When the data from Uitkyk farm and Langgewens research farm were combined, the Clearfield cultivars 45Y95, 45Y93, 43Y92, 44Y94 had the highest resistance while Blazer, Hyola 650 TT and Hyola 559 TT had the lowest resistance. A statistically significant difference was found between these two groups of cultivars. A summary of the cultivars evaluated for all locations, and the results obtained from blackleg severity ratings are presented in Figure 4.

<u>Field trials 2022</u>

The canola field trials to evaluate cultivar resistance during 2022 has been planted in April / June 2022, and include a total of 17 canola cultivars at four different locations (Uitkyk farm near Riversdale, Tygerhoek research farm in the Overberg, Waterboerskraal farm near Hopefield, and Langgewens research farm in the Swartland). Results will be presented in the following progress report.

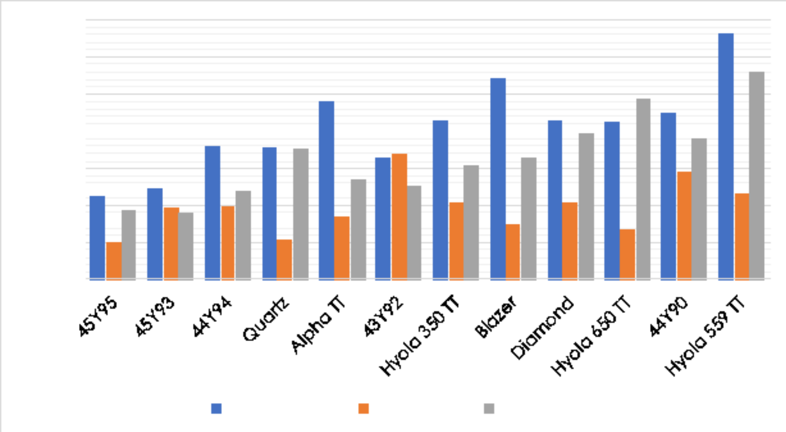


Figure 4: Overall blackleg disease severity index (DSI) (%) of 12 canola cultivars evaluated in the 2021 cultivar trails.

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

The Monitoring project was planned for the canola seasons of 2021, 2022 and 2023 and OPDT approved funding for all three years, with the final report due March 2024.

The results envisaged for this project (see application document of May 2020) can be reported on by March 2024, as follows:

a) Seed density trials were concluded successfully (see Progress Report of 2022).

b) Spraying time trials were conducted successfully and resulted in a new, separate project being registered by Dr GJ van Coller.

c) Tillage as a contributing factor to Sclerotinia Stem Rot (SSR) has rendered little data thus far, as all of 2021's data was lost due to flooding of the trial and very low infection rates for 2022 did not contribute to much information. One more year would be helpful towards more sound statistical conclusions.

d) The crop rotation systems trial for the Heidelbergvlakte region concludes in 2023, but a comprehensive summary will be possible by March 2024 due to data collection that was done on this trial by the WCDA since 2013.

e) The crop rotation systems trial for the Ruêns region has been changed to a Regenerative trial in 2022. The Monitoring project will have recorded 2 years of data by March 2024. A third year of data will render a clearer picture of the effect of Regenerative practices vs general Conservation agricultural practices on the occurrence of SSR.

With regards to the additional objective to use data generated by the Monitoring project for the development of a SSR forecasting model:

This objective has been fulfilled, as the WCDA and the University of Stellenbosch have collaborated in registering a project specifically for this purpose. An MSc student has started working on this project in the 2023 season, stretching until the end of 2024. This study is however dependent on the SSR incidence figures generated by the Monitoring project and should monitoring end in 2023, the Forecasting Model project would not receive disease rate data for 2024. A new addition to the data gathered in the Western Cape with regards to SSR, is the spore counting facility of the MSc student in the 2023 season. This data should ideally be matched with the disease monitoring function of the Monitoring project, as spore traps are set up at the Monitoring project's sites. It would be ideal for SSR disease monitoring to continue in conjunction with spore counting.

Additional factors that contribute to the request to extend the Monitoring project are the following:

- During the execution of the project, the **monitoring technique** has been improved through trial and error. For example, initially, only post-harvest sampling was done, but it has become evident that pre-harvest sampling is important (even though it is extremely cumbersome). Pre-harvest sampling could only be done more extensively since the 2022 season, but 2022 had very low SSR-infection rates. One more year of pre-harvest data would be preferable to compare with the 2022 and 2023 data sets.

The additional request to observe possible **susceptibility differences between commercial cultivars,** was only received at the end of 2021, hence this was done only for the 2022 season - which was a low infection rate year. This trial is being repeated for 2023, but a third year's data (2024) would be preferable for scientifically sound recommendations to industry.

During the execution of the project, it was discovered that some data loggers became faulty in their relative humidity readings over the 6 months that they were placed in the field. After deliberation with the UK manufacturer, it was established that the loggers' service and calibration by the manufacturer only guaranteed 6 months' accurate RH-readings (even though the apparatus' pamphlet indicates it should be done only once a year). It was only since the 2023 season that loggers were calibrated shortly before placing them in canola fields. One more year's RH readings from **more reliable loggers** would be preferable.

Extremely beneficial relationships with some **canola producers** have been established over the past three years and **requests** from them to continue the monitoring motivate this extension request.

- OPDT's financial support was applied to obtain:
  - Good data in 2021 with high SSR incidence;
  - Reasonable data in 2022 (very low SSR incidence); and
  - Expected good data for 2023 (currently mid-season, hence uncertain of outcomes).

The Monitoring project was executed within the allocated budget thus far. Actual figures from the 2021 season (with infection rates ranging from 0% in the Porterville area to 25% in the Swellendam area) made it possible to accurately calculate that producer incurred losses due to SSR of up to R 3060 per hectare, even with applying fungicides according to general practice. This confirms the necessity to continue monitoring of and research on SSR in the Western Cape.

3.2.4 ASSESSING THE EFFECT OF PLANTING DATE AND ENVIRONMENT ON SUNFLOWER DEVELOPMENT, *SCLEROTINIA* HEAD ROT AND YIELD; Dr N Creux, M Wilken, E Archer, D Swanevelder, A Mokhele; University of Pretoria

In South Africa, where sunflower planting dates rely on the timing of the rains and the potential for *Scleractinia* head rot, it is important to understand how a changing environment might alter these strategies in the future. This research project has three main aims focused around understanding the interplay between the sunflower development, the environment and *Sclerotinia* head rot incidences. The first aim is to evaluate how planting date and weather conditions impact sunflower developmental stages. The second aim is to identify the possible factors involved in *Sclerotinia* head rot incidence in relation to planting date and environmental conditions. The final aim is to develop a small operational predictive system to explore the possibility of predicting optimal planting dates for yield and limiting head rot incidence.

The work towards these aims can be broken into three main phases: **Phase 1** is a field study testing the extent to which planting date impacts sunflower developmental stages and *Sclerotinia* head rot incidences; **Phase 2** entails a small survey of sunflower growing regions for *Sclerotinia* head rot incidence; and **Phase 3** will use the collected data to inform models and predict the effects of planting date on sunflower development and *Sclerotinia* head rot occurrence. This multidisciplinary project brings together agronomists, plant scientists, geneticists and meteorologists to provide a holistic view of how environmental factors associated with planting date might affect sunflower development, yield and *Sclerotinia* head rot incidence. The project was initiated in 2020 and, as with many projects started at this time, there were limitations due to the global pandemic and the move towards a new normal. However, the project has progressed well and is in the finalization stages - largely due to the work of a strong PhD candidate, Ms Phrasia Mapfumo, who is currently writing her thesis with a view to submit early 2024. This work will form the basis of at least three manuscripts with the first accepted with revisions in *Plant Pathology* this month. Our goal is to write a summary piece of this paper for the *Oilseed Focus* once the publication process is completed.

Phase 1 is complete and Ms Mapfumo, in collaboration with the ARC, established three separate planting date trials in two locations over two seasons with the PAN7080 cultivar (Figure 1A). At the ARC experimental farm in Potchefstroom two planting date trials were established, with one located in a regular field site for manual phenotyping (Figure 1B) and one located under the Phenospex FieldScan for automated phenotyping (Figure 1C). At the Innovation Africa@UP field site, five planting dates for the first season and six planting dates for the second season were completed. At the ARC experimental farm four planting dates were completed (November, December, January and February) in season 2020/2021, and four dates in season 2021/2022 (October, November, January and February). Unfortunately, in the second season, heavy rains prohibited planting in December. Manual phenotyping was performed by

Ms Mapfumo, and measurements for germination, leaf number, plant height and biomass were collected weekly (UP) or biweekly (ARC-Potch). At the ARC-Potch site, the first trial was planted under the Phenospex FieldScan for automated phenotyping in 2020/2021. As is the case with much new technology, the first season (2020/2021) was predominantly focused on optimization and trouble shooting. The analysis of the manual phenotyping and yield assessments are complete. For the Phenospex FieldScan approximately 50 000 scans were generated for the 2021/2022 season. A new bioinformatics MSc student, Tshego Mbere, is developing an app to analyse this data offline as loadshedding limits the application of the propitiatory software. She has established the start of a Shiny App based in R that will be used to test the application and analyse the data from these trials.

Figure 1. Overview of the planting date trials at Innovation Africa@UP (drone image of planting dates - A), ARC Grains Crops, Potchefstroom manual (B) and automated phenotyping plots (C).

In terms of mean seed yield in Potchefstroom and Pretoria there were some interesting seasonal variations. The 2020/2021 season was hotter and drier than the 2021/2022 season and this is reflected in the mean yield of the trials. **In the hotter drier season both sites yielded similarly and there was little difference between the planting dates** except for the very late February and March planting dates, which was expected (Figure 2). The very late planting dates function as a control producing expected results and allowing us to compare across the other planting dates from the baseline level. Interestingly, in **the wetter, cooler season the planting dates had a significant effect on yield and the**

earlier November, December planting dates yielded well and did better than the equivalent planting dates in the drier season. In the wetter season the later January and February planting dates appeared to perform worse than the earlier planting dates of the same season but similar to the same planting dates in the drier season. This adds support to the evidence that sunflower yields are stable in harsher environments, but also indicates that planning earlier in wetter years will produce better yields.

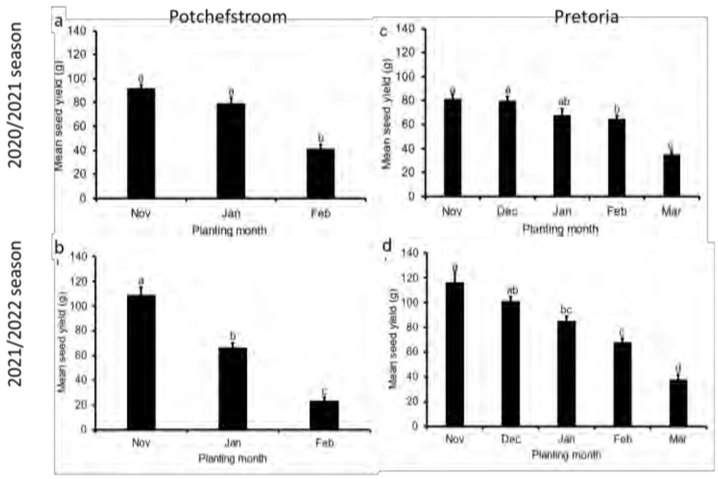


Figure 2. Yield for the 2020/2021 season (a and c) and 2021/2022 season (b and d) for the Potchefstroom (a and b) and Pretoria (c and d) measured in grams per plant with n = 15 per planting date. ANOVA and with a multiple comparison test show significant differences with p-value <0.05. The same letters indicate no significant difference. Error bars indicate standard error.

To assess seed quality we measured oleic acid, linoleic acid and protein content across the locations and planting dates. The oleic and linoleic acid content seemed to fluctuate across season, location and planting date with no clear pattern. It is likely that localized climatic conditions at the timing of flowering and seed development influenced these traits and further analysis is required to understand the factors regulating these traits. There were some interesting patterns observed in seed protein content across planting date, location and season (Figure 3). In Potchefstroom the protein content appeared to be elevated at the later two planting dates in the drier season while in the wetter 2021/2022 season the January planting date had significantly lower protein content and was more similar to the early November planting date. In Pretoria, in the dry 2020/2021 season there was no significant difference in protein content across the planting dates. However, in the wetter, cooler season planting date did influence protein content with later planting dates containing a higher percentage of protein (Figure 3). This indicates in general that seed protein content increases at later planting dates in most situations, but this is dependent on local climates and seasonal variations.

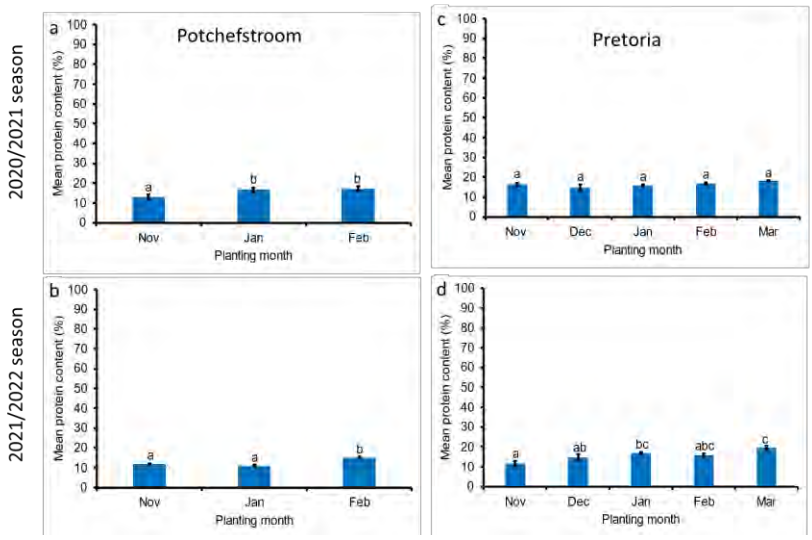


Figure 3. Seed means protein content for the 2020/2021 (a and c) and 2021/2022 (b and d) seasons for the Potchefstroom (a and b) and Pretoria (c and d) measured in grams per plant with n = 15 per planting date. ANOVA and with multiple comparison tests show significant differences with p-value <0.05. The same letters indicate no significant difference. Error bars indicate standard error

An interesting finding has, emerged from the first season on sunflower response to heat waves. In February 2021, a heat wave struck the Pretoria site - and at this time, the December planting was eight weeks old, the January planting was four weeks old, while the February planting was just germinating. This heat wave had the greatest impact on the January and February planting dates, where the February planting date showed very poor germination as expected and the January planting showed stunted growth and small head diameter. Interestingly, at anthesis the stunted January planting showed elevated stigma receptivity. When seed traits were assessed, we found the January planting had significantly fewer unfilled seeds and did not have reduced yield compared to the earlier planting dates, suggesting that pollination in this planting date was more effective. The second season had no heat wave and elevated stigma receptivity was not observed. This suggests that **sunflower yield stability is maintained under elevated temperatures, because plants may enhance floral traits and pollination when heat stress is experienced that stunts growth and biomass accumulation**. We have had two BSc honours projects (Stiaan Odendaal and Jessica Berry) follow up on this in controlled environments and the same phenomena was observed. Jessica's work has revealed that the floral meristem, which produces the florets is altered under heated conditions indicating that this early life stage heat stress can trigger changes to the flowers at later mature stages, allowing sunflower to adapt to these adverse conditions and contributing to yield stability during these conditions.

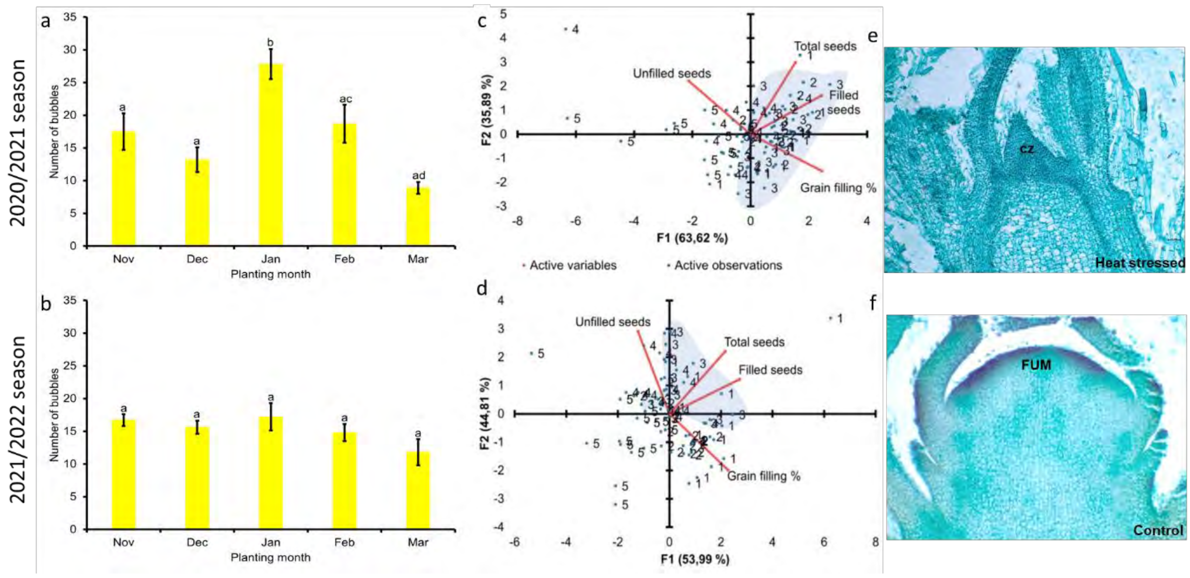


Figure 4. Stigma receptivity for five planting dates in Pretoria for the 2020/2021 and 2021/2022 seasons (a-d). ANOVA (a and b) and PCA biplot (c and d) on unfilled seeds, total seeds, filled seeds and grain filling percentage across the five planting dates. The active variables are indicated by red vectors (Unfilled seeds, total seeds, filled seeds, grain filling %). The F1 (horizontal axis) indicates the first principal component, and the F2 (vertical axis) indicates the second principal component. The numbers represent the planting date of the active observations (blue dots) with November (1); December (2); January (3); February (4) and March (5). The light blue shading shows the January planting date's active observations are clustered. n = 15 and error bars are SE. Microscopy images of sunflower floral meristem formation under heated and unheated conditions showing significantly under developed meristems (CZ) in heat stressed plants and a developing control floral meristem forming the precursors to florets (FUM).

In the second season in Pretoria the very late March planting date also provided us with the opportunity to understand the effect of frost on flowering. The March planting date had highly variable plant with flowers at different stages from mature flowers, flowers mid anthesis and young buds still to open. We observed that the young buds were significantly affected producing little or no filled seed, while the flowers at anthesis were moderately affected and the mature plants yielded as expected. **This suggests that different floral stages have different tolerance to extreme weather events** and further studies my provide a detailed understanding of the effect of frost during the bloom period.

Another interesting observation from these field trials was the establishment of disease in the different planting date trials. The focus of **Phase 2** is on *Sclerotinia* incidences, and in both trials *Sclerotinia* head rot was only observed in the November planting date. *Sclerotinia* root rot was observed at both sites for the November, December and January planting dates, indicating different growth stages or environmental factors influence the different modes of this disease. We also observed that *Alternaria* appears to be more prevalent on the later planting dates at both sites. We have also observed several viral diseases associated with planting date, with some being the first report on sunflower in South Africa. These viral diseases are currently being further identified by Dr Davis Reed at FABI. **These casual observations are interesting, as they suggest that sunflower may be susceptible to different diseases at different planting dates possibly due to plant growth stage or environmental condition**.

In order to follow up on the *Sclerotinia* disease observations, in our second field trial, we included a *Sclerotinia* inoculation trial at the different planting dates, and the progress of the head rot was tracked over time and compared to environmental factors associated with each planting date. As part of the survey component of this project, several isolates of *Sclerotinia* have been collected from both the UP and ARC sites, and entered into the FABI culture collection for preservation. One of these isolates was selected for the inoculation trial, and used to infect several heads in the field along with a negative and positive control. Disease progression was scored over time after initial inoculation. Ms Mapfumo found that disease progression was different at different planting dates, and this appears to be closely associated with humidity and temperature at or just after inoculation. The November planting date in the 2021/2022 season showed the slowest disease progression likely due to the high temperatures experienced just after inoculation, which limited the disease progression. **These findings suggest that infection and progression of *Scleriotinia* head rot is closely associated with humidity and temperature at time of infection (accepted in *Plant Pathology*) and will be key information for modelling the interaction of planting date and infection for yield.**

Overall, this project has progressed well, and a great wealth of information has been collected and is currently being analysed and completed as part of Ms Mapfumo's PhD. **The work, to date, was well received by the international sunflower community when presented by Dr Creux and Ms Mapfumo at the 20th International Sunflower Conference in Novi Sad, Serbia. Ms Mapfumo was awarded the Runner-up Poster Award for her work on the planting date trials that forms the bulk of this project.** The summary of the conference was published in *Oilseed Focus (Vol 8 No 4, December 2022 ISSN 2410-1206)*. Our first scientific publication was accepted last month and is currently undergoing revision before publication in *Plant Pathology* and this work focuses on *Sclerotinia* head rot progression associated with climate and planting date.

The final phase of this project was predominantly dependant on the data collected in phase 1 and phase 2. We have initiated a collaboration with Dr Phillipe Debaeke and Dr Pierre Casadebaige at INRAE in France. We have used the SUNFLO model to model yield against planting date and the next step is to test if Sclerotinia head rot data collected in this project can be used to weight yield predictions based on environment. This work is currently underway and will be further advanced once Ms Mapfumo has submitted her PhD for examination.

3.2.5 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. 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 addresses this topic in a scientifically sound manner.

Five field experiments were established at ARC-Grain Crops Potchefstroom research farm over the last three (2020/21, 2021/22 and 2022/23), growing seasons. The first planting date (planted on 15 December during 2020 and 2022, respectively) was considered the optimum planting date. The second planting date (on 26 January 2021 and 20122, and 18 January 2023, respectively) was considered as late.

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 time of applications and sunflower hybrids on sunflower yield and quality shows 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 at both planting dates, 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 45 kg/ha^{-1} applied at planting. The seed yield was lowest where no N was applied at the optimum and at the late planting date. Highly significant differences were detected among the different tested sunflower hybrids for seed yield and quality.

For *S. sclerotiorum* screenings, significant differences were noticed among different hybrids. An average lesion size of 1.03 cm^2 was recorded and it ranged from 1.26 cm^2 for PAN 7158 HO to 0.84 cm^2 for PAN 7160 CLP. According to the ANOVA results, the nitrogen applications have a significantly influence sclerotinia infections.

Keywords: Planting dates, N fertilization, Sclerotinia, sunflower

3.2.6 EVALUATION OF COMMERCIALLY AVAILABLE SUNFLOWER CULTIVARS; Dr SH Ma'ali, MW Makgoga, JL Erasmus, TD Mohohlo, 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 2022/23 season, 20 cultivars were evaluated in 27 successful locality trials. The highest trial mean yield of 3.57 t/ha-1 was obtained at Boskop planted on 20th of January 2023 and the lowest of 1.11 t/ha-1, at Kroonstad planted on 7 February 2023. The five best performing cultivars, in terms of average yield calculated over localities, were PAN 7080, PAN 7180CLP, AGSUN 5270, PAN 65 LP 65 and PAN 7090. The overall mean yield for 2022/23 was 2.23 t/ha-1, 1.40 % lower than the mean yield of the 2021/22 season.

Eleven Clearfield and Clearfield Plus cultivars were entered and one of these cultivars PAN 7180 CLP had the one of the highest yields of 2.37 t ha^{-1} and performed the best in terms of seed yield. Seven of these cultivars namely PAN 7180 CLP, P 65 LP 65, PAN 7102 CLP, P 65 LP 54, AGSUN 5111 CLP, AGSUN 5106 CLP & PAN 7160 CLP have yields even or higher than the overall mean yield of all cultivars.

Fifteen cultivars were evaluated at 63 localities for the last three seasons and the cultivars, PAN 7080, AGSUN 5270, PAN 7160 CLP, PAN 7180 CLP, P 65 LP 65, AGSUN 5106 CLP,PAN 7100, PAN 7102 CLP, P 65LP 54, and P 65 LL 02 had yields higher than the overall mean yield of all cultivars at 2.28 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 20 cultivars during the 2022/23 growing season, for the 15 cultivars that have been tested at 44 localities for the last two-seasons and for the 15 cultivars that have been tested at 63 localities for the last three seasons. The yield probability method is highly recommended for cultivar selection.

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

The National Soybean Cultivar Trials (project M101/62) were planted for the 45th successive year during the 2022/23 growing seasons. Thirty-two (32) commercially certified cultivars were evaluated in 33 field trials on 29 localities, representing the cool-, moderate- and warm areas. Thirteen (13) of the 32 (41%) cultivars evaluated during the 2022/23 season were new cultivars. These figures emphasise 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 Cedara), (Chrissiesmeer and Frankfort) flooding (Cornelia) hail damage, (Derby) CV% to high and flooding followed by extreme drought (Lichtenburg). Due the late rains and cool temperatures the harvesting process took longer as anticipated. Only 27 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 2022/23 season were 77 days (74 days during 2021/22) for the cool -, 63 (61 days during 2021/22) for the moderate - and 60 days (55 days during 2021/22) for the warm production areas, in comparison to the previous season. The unfavourable climate also impacted on the days from planting to harvest, resulted in an average of 168days (164 days 2021/22), 149 days (149 days during 2021/22) and 148 days (150 days during 2021/22), respectively for the cool-, moderate -and warm areas.

The mean yield of cultivars within climate areas varied from 2155 kg/ha^{-1} (LS 6860 R) to 3082 kg/ha^{-1} (DM 53I54RSF IPRO) (difference 927 kg/ha^{-1}), 3520 kg/ha^{-1} (LS 6860 R) to 4015 kg/ha^{-1} (P62T16 R) (difference 495 kg/ha^{-1}) and 3601 kg/ha^{-1} (P57T19 R) to 4684 kg/ha^{-1} (RA660 R) (difference 1083 kg/ha^{-1}) respectively for the cool -, moderate - and warm production areas. The overall mean yield was 2651 kg/ha^{-1}, 3776 kg/ha^{-1} and 4246 kg/ha^{-1} (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. P64T39 R showed an above average yield probability for all yield potentials in the cool, moderate as well as the warm areas. PAN1521 R, RA660 R and P7174 R performed above average for both the moderate and warm areas. DM 5351RSF and PAN 1644 R only performed above average for the cool area, while RA565 R and DM 6.8i RR showed an above average yield probability in warm area.

3.2.8 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, highlight any quality differences in the commercial soya produced in different production regions for local market requirements and provide 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.

To add value to the annual crop quality report, fatty acid profile analyses on 20 composite crop samples representing different production regions as well as 20 cultivar samples from different localities were included in the proposal since the 2018/2019 season. Fatty acid profiles are the most important tool for the identification of the authenticity of vegetable fats and oils. The variation of fatty acids in a specific oil also influences the stability and physical properties of the oil. Fatty acids vary depending on climate, latitude, cultivar as well as seasonal variation. These variations should be included when specifying ranges for identification of authenticity.

It is imperative to identify the ranges wherein fatty acids vary, to successfully validate the authenticity of a specific vegetable oil. Building of a database requires gathering of information over different seasons, areas, and cultivars to give a true reflection of the ranges wherein fatty acids can differ. Currently, no national updated database is available. If a national database is kept and maintained, time and money lost by the industry because of rejected batches can be avoided.

The natural variation caused by different cultivars, climate, and locality as well as seasonal variation will be included in the values of this database for the South African produced seed oils.

<u>Duration of project</u>

Sampling to ensure representative samples of the country's entire commercial soybean crop will start with the first deliveries during April/May 2023. The analysis 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 150 samples annually to provide representative data of the commercial crop. The predicted crop for the 2021/2022 season is 2 091 350 tons (National Crop Estimates Committee (NCEC), 5th forecast, 28 June 2022).

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 150 samples (130 SB1 and 20 samples COSB). 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. Once 80% of the expected harvest has been received, 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. 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 150 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; chrondrometer)
NIR, including Protein, Fat, Moisture, Ash and Crude Fibre, %
On 15 randomly selected locally produced soya seed samples, the following analysis will be performed:
Genetic Modification (GM) analyses for CP4 EPSPS (RUR) (Envirologix QuickComb kit for bulk soybeans)
**Fatty Acid Profile (AOCS Ce2-66) analyses will be performed on 20 cultivar trial samples as well as 20
commercial crop samples. These analyses will be subcontracted to Precision Oil Laboratories, a SANAS accredited laboratory (SANAS Accreditation Number T0802).

3.2.9 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.

To add value to the annual crop quality report, this application also includes fatty acid profile analyses on 20 composite crop samples representing different production regions as well as 20 cultivar samples from different localities. Fatty acid profiles are the most important tool for identification of authenticity of vegetable fats and oils. The variation of fatty acids in a specific oil also influences the stability and physical properties of the oil. Fatty acids vary depending on climate, latitude, cultivar as well as seasonal variation. These variations should be included when specifying ranges for identification of authenticity.

It is imperative to identify the ranges wherein fatty acids vary, to successfully validate the authenticity of a specific vegetable oil. Building of a database requires gathering of information over different seasons, areas, and cultivars to give a true reflection of the ranges wherein fatty acids can differ. Currently, no national updated database is available. If a national database is kept and maintained, time and money lost by the industry because of rejected batches could be avoided.

The natural variation caused by different cultivars, climate, and locality as well as seasonal variation will be included in the values of the database. This motivation is therefore to continue with the development of a fatty acid profile database for the South African produced seed oils.

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 2023. 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 commencement of the analyses.***

Scope of project

Number of samples

Based on an average crop size, the proposal is to analyse 176 samples annually to provide **representative data** of the commercial crop. The predicted crop for the 2021/2022 season is 961 350 tons (National Crop Estimates Committee (NCEC), 5th forecast, 28 June 2022).

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 176 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. After 80% of the expected harvest has been received, 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 analyses to the SAGL by the different commercial grain handlers. 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.**

Types of analyses and methodologies applied

The following physical and chemical analyses will be done on **176 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 chrondrometer)

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

Fatty Acid Profile (AOCS Ce2-66) analyses will be performed on **20 cultivar trial samples** as well as **20 commercial crop samples**. These analyses will be subcontracted to Precision Oil Laboratories, a SANAS accredited laboratory.

(SANAS Accreditation Number T0802).

Format of reporting on website 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 from each region are calculated in respect of every quality parameter analysed. 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 website will be done on the 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 Seed Development Trust on completion.**

3.2.10 THE FUNDING OF THE SUPPLY AND DEMAND ESTIMATES COMMITTEE; Ms F Sundani, NAMC

Introduction

It is important to note that the purpose of the monthly Supply and Demand Estimates Committee (S&DEC) meetings is to capture new information that is available in the market at a specific time. It is also crucial to understand that access to accurate market information plays a central role in any agricultural development and, to some extent, information can address other issues such as 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 efficient 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 Annexure 1 for 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, Forestry and Fisheries (DAFF).

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

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)

- 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

The NAMC retrieves the number of website hits every month. The purpose of this exercise is to track the number of end-users of the SASDE report. It is noted from the NAMC monthly website hits that about 1000 hits are received for the SASDE report. The report is mainly utilized by the following:

- Academia
- Financial and investment institutions
- Government officials
- Grain Millers
- Oilseed processors
- Feed manufactures
- Grain and oilseed traders
- Grain and oil seed storage handlers
- Oilseed storage handlers
- Baking Industry
- Research institutions and transport organisations
- Others

Actual expenses for 2022/23 and new proposed budgets

The S&DEC want to extend their gratitude to the Maize Trust, Oil and Protein Seeds Development Trust, and the Sorghum Trust for the payment of their contributions for the 2022/23 financial year. The decision was taken to depart with a zero base budget and based on the actual expenses and contributions received for the 2022/23 financial year. For the proposed budget for the 2023/24 financial year, expenses were recalculated based on tariffs and occurrences applicable to meetings and planned excursions. The contributions from the Trusts were calculated based on the difference between the total expenses and the NAMC contribution and allocated according to the same percentages as used by SAGIS. The salaries and allowances were adjusted by 2% going forward from the actual expenditures of 2022/23 and all the other expenditures were adjusted by 6%. From Table 2, it can be seen that the travel & accommodation budget line shows a noticeable increase from 2022/23 to 2023/24 because there was only one physical meeting(s) held during the 2022/23 financial year as well as no planned excursions.

Supply & Demand Estimates Committee (S&DEC)	Actual Expenses 2022/23	Budget 2023/24	Budget 2024/25
Incomes			
NAMC	595 351	631 000	643 620
Maize Trust (66.2% of diff.)	201 174	246 087	254 091
Oil & Protein (15.8% of diff.)	65 494	58 734	60 644
Winter Cereal (13.5% of diff.)		50 184	51 816
Sorghum Trust (4.5% of diff.)	21 532	16 728	17 272
Total Income	**883 551**	**1 002 733**	**1 027 444**
Salaries and allowances	871 285	872 831	890 288
Travel & Accommodation	25 272	117 404	124 448
Catering		3 498	3 708
Miscellaneous	-13 006	9 000	9 000
Total expenses	**883 551**	**1 002 733**	**1 027 444**

On the proposed budgets, the Winter Cereal trust is still listed, but the S&DEC is investigating the viability of this and also possible replacements.

Stakeholder engagements

As part of the Supply and Demand Estimates initiative, it is imperative to establish relationships with key industry stakeholders to ensure that the Supply and Demand Estimates Report gives an in-depth overview of key industry information pertaining to grains and oilseeds.

To that end, the Grain Specialist and the Chairperson of the Liaison Committee met with industry stakeholders on March 22nd, 2023. The objective of these meetings was to foster relationships and assure the collection of critical information about grains and oilseeds. The stakeholders who were engaged were from the manufacturing and trade industries. Information was exchanged during these meetings for the benefit of the NAMC and the engaged stakeholders. It is worth noting that, in addition to physical visits there is an ongoing telephone consultation process with various stakeholders to ensure that the Supply and Demand Estimates Committee's estimates reflect a comprehensive overview of the trends pertaining to grains and oilseeds.

Conclusion

The efficacy of information plays a significant role in developing nations. Relevant and accurate information can ensure the sustainability of the market and that a nation’s food security is well-considered following private and government objectives. It is initiatives such as generating the SASDE report that could provide effective information to the market for a specific period. The publication of the SASDE report has taken the grain and oilseeds market in South Africa and the region to another level, as evident from the statistics about the end-users of the report. The mutual understanding and collaboration of the NAMC and the trusts have also contributed significantly to the functioning of the S&DEC. Such support is what the committee requires to ensure that its functions are fulfilled and continuously improved.

3.2.11 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

During 2022, the number of trials in the Swartland and Southern Cape has been increased to five localities per area. Additionally to that, two sowing date trials were planted on Langgewens and Tygerhoek Research Farms, including an Elite trial on both locations. All the trials in the 2022 season have been harvested. In the 2022 cultivar evaluation program, a total of 17 cultivars were tested. In 2022, eight new cultivars were tested and all cultivars were, as in the past few seasons, hybrid cultivars. The cultivars consisted of five conventional, four Cl (Clearfield, Imasamox-tolerant), eight from the TT group (Triazine-tolerant) and for the second time a combination type cultivar was included in the trials that covered both the Cl and TT -tolerance (Enforcer CT).

Climate

The 2022 growing season at Langgewens was the 4th driest season since 1964. The rainfall during all the months of the growing season was below average. The temperatures were also higher than in 2021, although the average minimum temperature during September was 0.9°C lower than the long-term average. Canola plants are very sensitive to high temperatures during the period from flowering (July) to the end of seed filling.

The yield from the earlier planting date trial on Langgewens was over 1000 kg ha^{-1} lower (2622 kg ha^{-1}) than in 2021. The seed only germinated after the first significant rain on 29 May. In 2021, the trial germinated on 15 May with a very average rainy season. The 2022 rainfall not only started late, but it was also very dry in the entire Swartland.

Tygerhoek, in the Southern Cape, received 269 mm of rain during the 2022 growing season. This was less than the average of 303 mm over the last 15 years. During the period from May to August, the monthly average rainfall was more than the long-term average. However, September and October, which are considered two important months for increased crop yield, were drier than normal.

Above-average warm maximum temperatures occurred during the growing season. The minimum temperatures were very close to the long-term average, except for August and September which were colder than normal. Low night temperatures are very important for the recovery of the plant. On 23 and 24 August, the Southern Cape experienced temperatures of >28°C over the two days. This shortened the flowering period of the canola in most areas. The cooler than normal night temperatures were indeed beneficial to the recovery of the plant.

Results

In the Swartland, the dry season affected the yield negatively, particularly at Eendekuil, and the trial's data were not included. Very little *Sclerotinia* occurred in 2022. The harvest season was late in the Swartland, due to the later than normal germination. The higher than normal humidity during September and October contributed to the best seed yield (kg seed) mm^{-1} rainfall in history, at Langgewens.

Swartland

In the Swartland, the average yields per trial varied between 2849 kg/ha^{-1} (Pools in Piketberg district) to 1693 kg/ha^{-1} at Hopefield. The trial at Pools started germinating on 30 May, two weeks before the rest of the trials (most of Langgewens' plants started germinating on 15 June). The seed of the line CC91117 was not 100% pure and this may negatively influence the seed yield. The line CC90014 (2535 kg/ha^{-1}) produced the highest yield on average, followed by the cultivar Diamond (2440 kg/ha^{-1}) and Hyola 90013 (2363 kg/ha^{-1}). The yields of the three cultivars did not differ significantly from each other.

Of the four CI cultivars tested in 2022, 43Y92 (2535 kg/ha^{-1}) produced the highest yield within the group. The new CI cultivar 44Y94 produced the second highest yield (2436 kg/ha^{-1}) followed by the cultivars with a longer growing season (45Y93 and 45Y95). The second planting date at Langgewens was 22 June, which is considered extremely late and this adversely affected the yield of the cultivars with longer growing seasons. The planting date had to be postponed, as the first planting date trial did not fully germinate until after the rain on 15 June.

The new TT cultivar HyTTec Trophy produced the highest yield (2238 kg/ha^{-1}) within the TT group, followed by another new TT cultivar, HyTTec Trifecta. Unfortunately, these cultivars will only be available for the local market in 2024. Blazer TT (2111 kg/ha^{-1}) was the best producer among the commercially available TT cultivars and followed by Alpha TT and Hyola350 TT. The three cultivars did not differ significantly from each other. The average yield of the TT cultivars in 2022 was 15% lower than the conventional and CI cultivars.

<u>Southern Cape</u>

In the Rûens the combined seed yield at Klipdale was the best (2550 kg/ha^{-1}), followed by Napier (2322 kg/ha^{-1}). The average yield in 2022 was 2124 kg/ha^{-1}, compared to 3271 kg/ha^{-1} and 3704 kg/ha^{-1} in 2021 and 2020 respectively.

The Southern Cape had a below average rainfall season and the period during seed filling was extremely dry. This negatively affected the yield of all the cultivars. The CL cultivar 43Y92 (2429 kg ha^{-1}) produced the highest yield within the group. The cultivar, 44Y94 produced the second highest yield (2227 kg ha^{-1}) followed by the cultivars with longer growing seasons, 45Y95 and 45Y93. The yield of the CL cultivar 43Y92 was significantly higher. The conventional line/cultivar CC90014 (2470 kg/ha^{-1}) produced the highest yield within the conventional group, followed by Diamond (2350 kg/ha^{-1}). There was no significant difference between CC90014 and Diamond. The cultivars in 3rd and 4th place were Quartz and Hyola 90013 respectively.

The TT cultivar Alpha TT (2196 kg/ha^{-1}) followed by Blazer TT (2060 kg/ha^{-1}) was the highest-producing cultivar within the TT group. They were followed by the new TT cultivar HyTTec Trophy. The three cultivars did not differ significantly from each other. The average yield of TT cultivars was 12% and 6% lower than the conventional and Cl cultivars respectively

Conclusion

Canola as a crop has proven its adaptability to local climate conditions in 2022. In the Swartland, humid conditions during the night in spring cooled the plants to such an extent that a reasonable yield was possible, even though the seed germinated very late in the growing season. Yields of well above 2 tons/ha^{-1} can be expected with an average rainfall season. Please be aware of the risk of *Sclerotinia* during a wetter growing season - this remains a risk and can drastically reduce yield.

3.2.12 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.

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

(a) Community of Practice

The South African Sclerotinia Research Network (SASRN) was established to foster collaboration between relevant stakeholders involved with *Sclerotinia* research and disease management.

Three projects were initiated at the University of the Free State:

- **Community of Practice (Dr Lisa Rothmann)**
- **Phenotypic and genotypic screening of soybean to identify potential sources of resistance to the destructive pathogen, *Sclerotinia sclerotiorum* (Dr André Minnaar- Ontong)**
- ***Sclerotinia sclerotiorum* disease potential and management responses in soybean and sunflower (Dr Lisa Rothmann).**

Introduction

Sclerotinia sclerotiorum is a prolific fungal plant pathogen, with multiple host crops of agricultural and economic importance. South African host crops of importance include soybean, sunflower and canola which make significant contributions to the South African economy.

The South African Sclerotinia Research Network (SASRN) was established to promote collaboration among researchers involved with *Sclerotinia* research, enable engagements between researchers and industry members as well as to facilitate interactions between researchers and producers affected by *Sclerotinia* diseases. The virtual community of practice (CoP) serves as a platform for researchers to create collaborations, to allow for parallel and comprehensive research and to act as catalyst for the development of applied intervention technologies for producers. Furthermore, generating social and academic capital, where experienced investigators exchange knowledge with junior investigators, will contribute to developing skills related to *Sclerotinia* diseases, ensuring technology and intellectual transfers, and contribute significantly to advancement of research on this pathogen.

The Community of Practice also drives communication between producers and network members. Producer-focused research is pivotal for the network and will be supported through collaborations established. These collaborations promote communication between the parties involved, which prevents duplication and allows researchers to inform the industry directly of findings, and vice versa. In addition, the network is a platform where industry and academia can listen to the needs of producers to actively resolve issues through applied and directed research questions.

The SASRN focuses on three key themes, namely: 1) generating a virtual centre of excellence and expertise (through the use of a website and communication platform); 2) the role South Africa can play in the *Sclerotinia* research arena internationally and most importantly 3) developing and communicating practical management strategies for diseases caused by *Sclerotinia* for local producers.

The objectives through which the SASRN aims to achieve the above themes are as follows:

- Host an Annual General Meeting to facilitate discussions between researchers and industry;
- Host research Accountability Meetings to monitor the progress of research objectives;
- Industry engagements;
- Share information via a website;
- Share information on social media platforms;
- Provide extension services to producers via farmer's days, laboratory analyses, the *Sclerotinia* hotline, surveys and extension articles.

<u>Progress</u>

<u>Annual General Meeting</u>

The Annual General Meeting allows for the network to communicate and strengthen the community. It further serves as a platform for the research community at large to communicate with industry and align priorities. Continuous meetings take place to discuss project progress and research focus areas. Dr Rothmann will be presenting the progress of the CoP and Research Consortium at the Rhizobia Symposium in September 2022.

Research accountability meetings

Focused meetings were held between SASRN researchers and Grain SA.

Industry engagements

Meetings were held with representatives from chemical companies to discuss these companies' specific needs. As trials are notoriously difficult to execute successfully (due to the sporadic nature of the disease), the support which can be provided by researchers was discussed. This includes providing inoculum for trials, conducting trials to test the efficacy of products and conducting disease screening. As the products which are being tested are either not registered for use in South Africa, or not registered for use on either sunflower or soybean, these engagements take place between the company and the researcher to maintain confidentiality (all costs related to the support provided are carried by the company. Funds provided by OPDT are not used in this regard).

Website

The SASRN website (http://sclerotinia.co.za/) was launched as a tool which provides useful information on topics such as scouting for sclerotia in the field, the disease cycle and management strategies. The Knowledge Hub stores all popular media articles written for various agricultural magazines as well as those written uniquely for the website.

Lisa Rothmann was interviewed on AgriScoops, a radio programme for Afrikaans listeners on the 22nd of February 2022. This was the result of a short article being published at SA Grain, with Dr Miekie Human, titled: "Sclerotinia alert: Is 2022 a good year for an outbreak?". It can be found at this link: https://sagrainmag.co.za/2022/02/23/sclerotinia-alert-is-

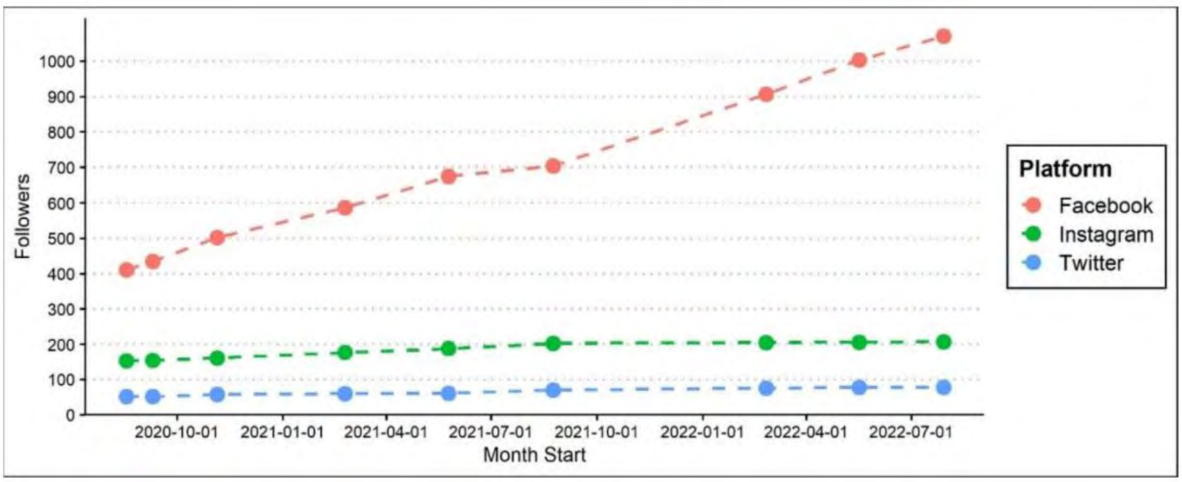
2022-a-good-year-for-an-outbreak-2/

Furthermore, Lisa Rothmann will be uploading “banners” of short information on disease diagnosis, symptoms and sign identification. These have been uploaded:

- http://sclerotinia.co.za/article/weed-hosts-associated-with-sclerotinia-sclerotiorum;
- http://sclerotinia.co.za/article/sclerotinia-sclerotiorum-diagnostics-rolfsii
- http://sclerotinia.co.za/article/sclerotinia-sclerotiorum-diagnostics
- http://sclerotinia.co.za/article/sclerotiorum-and-rolfsii
- http://sclerotinia.co.za/article/sclerotiniaza-pamphlet
- http://sclerotinia.co.za/article/sclerotiniaza-pamphlet-continued

Social media

The social media accounts are updated regularly with diagnostic tips, photos, videos and short articles. A significant increase in Facebook followers and likes has been observed over the last few months. Short videos were posted which were widely viewed and proved popular.



Extension services

- Farmer's days

The University of the Free State attended the annual, in person farmers day in Delmas for the Network and their research in the first week of March 2022. Over 150 producers attended the information day and successful interactions were made, sharing the pamphlets made for the Network.

Producers have contacted the SASRN telephonically, specifically to discuss management options, in lieu of meeting in person. Telephonic contact was also made with producers referred by Grain SA.

Dr Rothmann in collaboration with Annelie De Beer presented their first Farmers Day at the end of March in the Eastern Cape province. Dr Rothmann could not attend in person as planned, due to the change in the dates, although a video recording was sent to share on the day.

Dr Rothmann and Ms Bontleng Bolokwe, an Agricultural Advisor for the North West Department of Agriculture and Rural Development, organised a Producer Information Day in Mooifontein, near Mafikeng, NW. Dr Miekie Human, Grain SA attended with Dr Godfrey Kgatle, Postdoctoral fellow, Plant and Soil Sciences, University of Pretoria who presented the findings of the survey he has been championing. Ms Bolokwe invited ~50 producers she is 'responsible for' and are within a 10 km radius from location of the Information Day. Although, we only presented to the 12 attendees, the day was a success as this was the first interaction the producers had with plant pathology, and specifically requested information about Sclerotinia head rot. Each producer who attended was able to take a pamphlet (or two) about the Sclerotinia Research Network and Sclerotinia diagnosis and management.

We plan to continue with this information day again in the future, with better communication and engagements, to plan the information day during the season with the inclusion of apothecia scouting and disease diagnosis.

- *Sclerotinia* hotline

  Producers, agents and researchers continue to contact the SASRN regarding *Sclerotinia* control options. Many of the queries were related to Sclerotinia head rot of sunflower.

- Extension articles

  A short article was published at SA Grain, with Dr Miekie Human, titled: "Sclerotinia alert: Is 2022 a good year for an outbreak?". Dr Rothmann is writing an article on *S. sclerotiorum* associated with soybean seed for the Oilseed Focus Magazine, this research was funded by Dr Rothmann with internal UFS research funds, although utilising seed from the harvested 2020/2021 season funded by the SASRN funders.

Activities to be continued

It is proposed that the activities as set out in the Community of Practice continue as originally proposed.

Conclusion

As *Sclerotinia* is becoming a more serious issue amongst the producers we are also receiving more attention from producers. A material transfer agreement was set up for the *Sclerotinia* culture collection and this will enable fluid and transparent transfer of cultures between institutions and researchers, further building trust and collaboration.

The website will continue to publish short research articles, as well as in collaboration with collaboration with Pula Imvula to reach emerging producers. Social media sites continue to grow, and members of the public interact with the materials provided.

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

Introduction

Soybean is highly susceptible to *S. sclerotiorum* and the impact of infection on this crop is high. The use of avoidance mechanisms such as upright and open plant structure, less dense canopies and branching patterns, elevated pod set and reduced lodging have been suggested to reduce the damage caused by *Sclerotinia* diseases, however, in an environment that is favourable for disease development these practices are often not sufficient. Therefore, resistant varieties remain the best alternative for *Sclerotinia* disease management. Despite the impact of the disease on crops and the numerous breeding and selection efforts, progress has been limited and acceptable levels of resistance to *S. sclerotiorum* diseases have not been forthcoming (Hoffman *et al*., 2002), especially in South Africa. In South Africa, no known acceptable sources of resistance to *Sclerotinia* diseases are available and knowledge of sources of resistance is limited because of various screening constraints. However, various resistance sources from different countries/regions are available for soybeans to be used in breeding programmes (Zhoa et al., 2015; McCaghey et al., 2017; Demetrijevic & Horn 2018).

Genotypic screening is considered a powerful tool in the identification of *Sclerotinia* resistances genes/QTLs which can lead to the effective control and management of *Sclerotinia* diseases worldwide. DNA markers are employed to select a targeted trait at seedling stage (Foolad and Sharma 2005), decreasing the time it takes to know the phenotype of a plant and reducing labour for the breeder because undesirable plants can be eliminated early in the breeding programme. The DNA markers used are also not affected by the influence of the environment and can be used to identify and select for traits controlled by polygenes through marker-assisted breeding (Jiang 2013).

The aim of this study is to screen South African commercial soybean cultivars for *Sclerotinia* resistance by using both phenotypic and genotypic screening methods. South African commercial soybean cultivars identified as tolerant from a previous project as well as tolerant/resistant cultivars attained from breeding companies and research institutes from abroad (Canada, North Dakota, Argentina and Brazil) will be screened to determine the genotypic compilation of these cultivars with regards to *Sclerotinia* resistance genes/QTLs. Lines showing resistance potential will be subjected to several greenhouse and field trials to confirm the genotypic data generated. The identification of SA cultivars with resistance potential can help with the improvement of soybean production as well as disease management and control.

The four objectives of this study are:

- Selection of potential resistant lines based on the targeted *Sclerotinia* resistant QTLs.
- 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.

Progress

- Selection of potential resistant lines based on the targeted *Sclerotinia* resistant QTLs

Eight soybean cultivars with partial resistance to *Sclerotinia* were obtained from Argentina. Cultivars were genotypically screened using 54 SSR markers. Cultivars had different combinations of the known resistance QTLs and 6 Major QTLs were identified. From literature, it is expected that the combination of 3 major QTL indicates partial resistance. All combinations had at least 3 major QTLs, but more major QTL combinations are desired.

Cultivars with the best combination of targeted *Sclerotinia* resistance QTLs were selected for phenotypic screening under greenhouse and field conditions to validate the tolerance.

- **Greenhouse screening: Completed.** Disease evaluation for this trial was completed in December 2020. The results obtained from all 3 repetitions correlate very well with the genotypic screening.

  A detach leaf assay was done in Feb/March 2021 to confirm the phenotypic validation with the straw inoculation method. This experiment was completed successfully and also confirmed the results obtain from marker data and the phenotypic validation.

- **Field screening: In progress.** Two repetitions of the field trials have been completed and the third will be conducted in November 2022. Thus far, variations have been observed for some cultivars in response to inoculation with the pathogen. Results from the third repetition under field conditions will be important to draw conclusions from the data.

In addition, a cultivar was recently released by the USDA which is described as having complete resistance (this will be the first cultivar with complete resistance to Sclerotinia). Twenty seeds were received, of which five seeds were planted for multiplication and six will be used for adaptation testing. Testing of the USDA cultivar under local conditions will shed light on whether this cultivar is indeed completely resistant to Sclerotinia disease, or whether the observed resistance is due to tolerance and other mechanisms such as disease escape. Testing of this cultivar was significantly delayed as attempts were made since August 2018 to obtain seed, which only arrived in 2022.

➢ Identification and selection of potential resistant lines/cultivars available from South African germplasm

Forty-two local commercially available soybean cultivars were screened, which included 6 cultivars previously identified through phenotypic screening as having partial resistance. Genotypic screening using the same 54 SSR markers (as used for international germplasm) has been completed and indicated that five of the 42 cultivars have potential for tolerance. Two of these were from the six cultivars which were previously identified as partially resistant. Screening revealed different combinations of known resistance QTLs and all combinations had at least one major QTL, although three or more QTLs are desired.

Cultivars with the best combination of targeted *Sclerotinia* resistance QTLs were selected for phenotypic screening under greenhouse and field conditions to validate the tolerance.

- **Greenhouse screening: Completed.** Disease evaluation for this trial was completed in December 2020. The results obtained from all 3 repetitions correlate very well with the genotypic screening. A detach leaf assay was done in Feb/March 2021 to confirm the phenotypic validation with the straw inoculation method. This experiment was completed successfully and also confirmed the results obtain from molecular marker data and the phenotypic validation.

- **Field screening: In progress.** Two repetitions of the field trials have been completed and the third will be conducted in November 2022. Thus far, variations have been observed for some cultivars in response to inoculation with the pathogen. Results from the third repetition under field conditions will be important to draw conclusions from the data.

- Phenotypic validation of resistance using best inoculation method in both greenhouse and field trials

  Pathogen selection for screening trials: Completed.

  Thirty *S. sclerotiorum* isolates from the population genetic studies were selected for screening. After pathogenicity tests, five isolates were selected to proceed with based on level of pathogenicity. The straw inoculation-method was identified as the best greenhouse inoculation method.

- Establish and maintain a culture collection of South African *S. sclerotiorum* isolates

The culture collection is growing and contains isolates collected from more than six different crops from the UFS population genetic studies on *Sclerotinia sclerotiorum*. These isolates were collected across all nine South African provinces, as an isolate was recently obtained from Aliwal-North in the Eastern Cape.

New isolates from various crops are incorporated into the culture collection on a regular basis. Some of the isolates from the culture collection was distributed to other researchers within SASRN to contribute to their research.

The culture collection is updated regularly and a digital recordkeeping is in place. A filing system is in place with the location, morphology and pathogenicity profile of isolates.

Activities still to be completed

The national lockdown resulting from the COVID-19 pandemic resulted in delays in phenotypic validation of genotypic screening. While the greenhouse screening has been completed, the field evaluations still need to be completed. Therefore, we are requesting an extension on this project to complete a third repetition of the field screening. As costs allocated to this activity are still remaining, no additional funds are requested.

Conclusion

The project is progressing well. Sources of resistance in international germplasm has been obtained as well as cultivar from the USDA which has been reported to be completely resistant to disease. Significant delays were experienced with obtaining this USDA cultivar due to phytosanitary **requirements for import. The USDA cultivar was received and multiplication and adaptation trials are ongoing. Furthermore, five local cultivars were identified with potential sources of resistance, which will be confirmed in a third field trial later in this year.**

(c) Project 3: *Sclerotinia sclerotiorum* disease potential and management responses in soybean and sunflower

Introduction

The fungal pathogen *Sclerotinia sclerotiorum* has an intriguing epidemiology as it has the potential to cause plant diseases in more than 500 host species (Bolton, Thomma & Nelson, 2006). In South Africa, primary risk crops are soybean and sunflower, with an increasing risk to canola. The economic importance of many of the crops affected by *Sclerotinia* spp. emphasises the need for effective disease management strategies. Management of these diseases is limited by the extensive host range and duration of survival of sclerotia in soil, as well as the lack of registered active ingredients for chemical control, or available material for conventional resistance breeding. Cultivar selection would be the preferred method of *Sclerotinia* disease management in South Africa, as it is economically viable. 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. Timely fungicide applications, at critical host growth stages, can provide an effective management strategy for *Sclerotinia* diseases. Currently, there are a limited number of registered preventative active ingredients in South Africa for use as fungicides against Sclerotinia.

Currently, no soybean and sunflower cultivars with complete resistance to *S. sclerotiorum* are available, although numerous cultivars have been identified with partial resistance / tolerance locally and internationally (Kim and Diers, 2000; McLaren and Craven, 2008; Calla et al., 2009; Zhao et al., 2015; Andrade et al., 2018; Mbedzi et al., 2019). Host resistance describes the ability of a plant to reduce the ability of the pathogen to infect and colonise tissues, either partially or completely (Politowski and Browning, 1978). In this study we consider tolerance to be influenced by both host genetics and factors beyond plant genetics (such as environmental conditions). Tolerant cultivars therefore are able to tolerate high levels of disease potential before succumbing to the pathogen, thus providing various degrees of risk reduction (McLaren, 1992; 2000; 2002). 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.

To achieve the above aim, the following objectives were identified:

- Develop an artificial inoculation technique for field trials (completed).
- Develop a robust methodology for evaluating cultivar response to *Sclerotinia* infection during field trials (completed).

- Implement above methodology to evaluate the tolerance/susceptibility of soybean and sunflower cultivars to S*clerotinia* in field trials (in progress).

- Test alternative management options (completed).

<u>Progress</u>

- Develop an artificial inoculation technique for field trials.

This work has been completed.

- Develop a robust methodology for evaluating cultivar response to *Sclerotinia* infection during field trials.

This work has been completed.

- Implement above methodology to evaluate the tolerance/susceptibility of soybean and sunflower cultivars to *Sclerotinia* in field trials

  Commercially available soybean cultivars (18) and sunflower cultivars (26) were screened for tolerance to Sclerotinia, from 2017 to 2021, in sequentially planted field experiments. All cultivars needed to be present in each season for inclusion into the modified Finlay-Wilkinson regression analysis, which was used to determine response types based on the relationship between observed disease incidence (%) within a cultivar and disease potential. Only 10 soybean cultivars and 21 sunflower cultivars had sufficient data to be included in the analyses presented here.

  Sclerotinia disease potential is defined as the mean disease incidence across all cultivars within a planting date, in either artificially inoculated or naturally infected plots per crop. Three cultivar reaction types were identified, i.e., high tolerance to increasing sclerotinia disease potential (*b* > 1), low tolerance to increasing sclerotinia disease potential (*b* < 1), and linear relationship with changing sclerotinia disease potential (*b* ≈ 1). The sclerotinia disease potential required to initiate disease onset and the rate of response after onset were also determined. Low levels of tolerance to sclerotinia were recorded in all but two soybean cultivars (DM 5302 RSF; SSS5449 tuc) and four sunflower cultivars (AGSUN 5101 CLP ; LG 5678 CLP; LG 5710; RN 28485) where b > 1.30 and onset potentials of > 10.00%. The regression approach can be used to quantify a cultivar's tolerance level, if an adequate number of disease potentials are included. Planting cultivars with a b > 1.00, a high onset potential and subsequent low response rate could contribute to reducing the risk of sclerotinia diseases.

Amongst all the soybean cultivars, the *b* -parameters and calculated onset potentials ranged from *b* = 0.59 and onset potential = 1.72% in RA 565 R, indicating a highly susceptible response to increasing Sclerotinia disease potential to *b* = 1.97 and onset potential = 12.04% in DM 5302 RSF, indicating a delayed onset response to increasing Sclerotinia disease potential (Table 1).

PAN 7170 was the most susceptible to Sclerotinia head rot potential, with a *b*-parameter of 0.73, a low Sclerotinia disease onset potential of 1.87% and a high response rate subsequent to Sclerotinia disease onset, 1.95% per Sclerotinia disease potential unit. In contrast, LG 5710 had the greatest tolerance with a *b*-parameter of 2.08, a high Sclerotinia disease onset potential of 19.42% and a slow response rate subsequent to Sclerotinia disease onset, i.e., 0.54% per Sclerotinia disease potential unit (Table 2).

These results have been formalised into a peer reviewed paper which has been submitted to *Crop Protection* in June 2022, this will enable a wider readership to understand the escape resistance mechanism associated with South African soybean and sunflower cultivars.

Table 1: Disease screening data of ten soybean cultivars were subjected to the adapted Finlay and Wilkinson (1963) regression methodology. Calculated parameters include the relationship between observed Sclerotinia stem rot and Sclerotinia stem rot potential in soybean cultivars, 5.00% Sclerotinia stem rot onset potential and rate of response at onset. Planting cultivars with a b > 1.00, a high onset potential and subsequent low response rate could contribute to reducing the risk of sclerotinia.

Soybean cultivar	Company	*b*	R^2	Observed Sclerotinia stem rot (%)	Sclerotinia stem rot onset potential (5%)	Rate of response at disease onset
DM 5302 RSF	Don Mario	1.97	0.81	5.42	12.04	0.82
DM 5953 RSF	Don Mario	0.69	0.50	3.62	9.53	0.36
P 61 T 38 R	Pioneer	0.70	0.93	7.41	3.63	0.96
P 64 T 39 R	Pioneer	1.03	0.88	10.19	4.52	1.14
PAN 1521 R	Pannar	0.74	0.75	6.10	5.65	0.66
RA 565 R	Agri-Seed and Sanata Rosa	0.59	0.96	10.18	1.72	1.71
RA 568 R	Agri-Seed and Sanata Rosa	0.99	0.97	10.85	4.03	1.23
RA 660 R	Agri-Seed and Sanata Rosa	1.03	0.92	12.44	3.76	1.37
SSS 5052 (tuc)	Sensako (Syngenta)	0.91	0.97	8.81	3.52	1.30
SSS 5449 (tuc)	Sensako (Syngenta)	2.44	0.90	7.32	11.21	1.09

Table 2: Disease screening data of 22 sunflower cultivars were analysed using the adapted Finlay and Wilkinson (1963) regression methodology. Parameters for the relationship between observed Sclerotinia head rot and Sclerotinia head rot potential in sunflower cultivars, 5.00% Sclerotinia head rot onset potential and rate of response at onset were calculated. Planting cultivars with a b > 1.00, a high onset potential and subsequent low response rate could contribute to reducing Sclerotinia risk.

Sunflower cultivar	Company	*b*	R^2	Observed Sclerotinia head rot (%)*	Sclerotinia head rot onset potential (5%)	Rate of response at disease onset
AGSUN 5101 CLP	Agricol	1.93	0.91	19.79	16.76	0.57
AGSUN 5102 CLP	Agricol	1.15	0.97	29.11	6.61	0.87
AGSUN 5103 CLP	Agricol	0.86	0.94	27.50	3.46	1.25
AGSUN 5106 CLP	Agricol	1.16	0.98	25.50	7.69	0.76
AGSUN 5270	Agricol	0.71	0.96	31.96	1.84	1.94
AGSUN 5273	Agricol	0.79	0.98	19.77	4.03	0.98
AGSUN 5278	Agricol	0.83	0.94	25.81	3.22	1.30
AGSUN 8251	Agricol	1.09	0.98	27.71	6.24	0.87
LG 5626 HO	Link Seed	1.04	0.99	20.01	5.90	0.88
LG 5678 CLP	Link Seed	1.56	0.97	27.14	11.88	0.66
LG 5710	Link Seed	2.08	0.95	21.15	19.42	0.54
P 64 LL 23	Pioneer	0.88	0.98	27.55	3.43	1.28
P 65 LL 02	Pioneer	0.85	0.97	33.10	2.91	1.46
P 65 LL 14	Pioneer	0.86	0.98	36.57	2.70	1.60
P 65 LP 54	Pioneer	1.17	0.98	29.84	6.83	0.86
PAN 7100	Pannar	1.26	0.96	32.26	7.43	0.85
PAN 7102 CLP	Pannar	0.78	0.97	34.25	2.30	1.70
PAN 7156 CLP	Pannar	0.88	0.97	31.62	2.92	1.50
PAN 7170	Pannar	0.73	0.98	31.15	1.87	1.95
RN 28485	Syngenta	1.34	0.96	15.16	11.58	0.58
SY ARIZONA	Syngenta	0.75	0.98	25.06	2.54	1.47

Please note the cultivars recommended to have escape resistance towards *S. sclerotiorum* reflect the genotype-environment interaction of the Delmas and Clocolan environments, and variation may occur if cultivars are planted at other localities.

Data from 2021/2022 season are still being processed, and we look forward to seeing if similar trends are observed across the seasons between the cultivars.

- Test alternative management options

This objective addressed two producer-posed questions regarding sclerotia viability within production systems. The first aim was to simulate the effect of crop stubble burning, through assessing the effect of dry heat temperatures on sclerotial viability. A four factor completely randomised factorial experiments with four replicates were conducted to determine the germination ability of sclerotia from four different weight classes exposed to 125 °C, 150 °C, 185 °C or 200 °C, for 5 min, 10 min or 15 min durations either buried at 5 cm in soil or left on the surface (n = 384). The second aim was to determine the ability of sclerotia to survive in the rumen of cattle and hence the system of postharvest grazing. Faecal samples (n = 104; 10 – 14 days old) of cattle which grazed on *S. sclerotiorum* infected sunflower and relieved themselves, were collected. The first aim's results indicated larger sclerotia survived increasing temperatures and durations more readily than smaller structures. Temperatures exceeding 185 °C yielded all sclerotia non-viable. Sclerotia on the soil surface were less sensitive to increasing temperatures compared to buried sclerotia, most likely due to rapid heat dissipation after heating. Less than 4% of sclerotia in cattle manure were able to germinate, suggesting that allowing cattle to graze on infested field stubble and moving them to potentially uninfested fields poses a reduced risk.

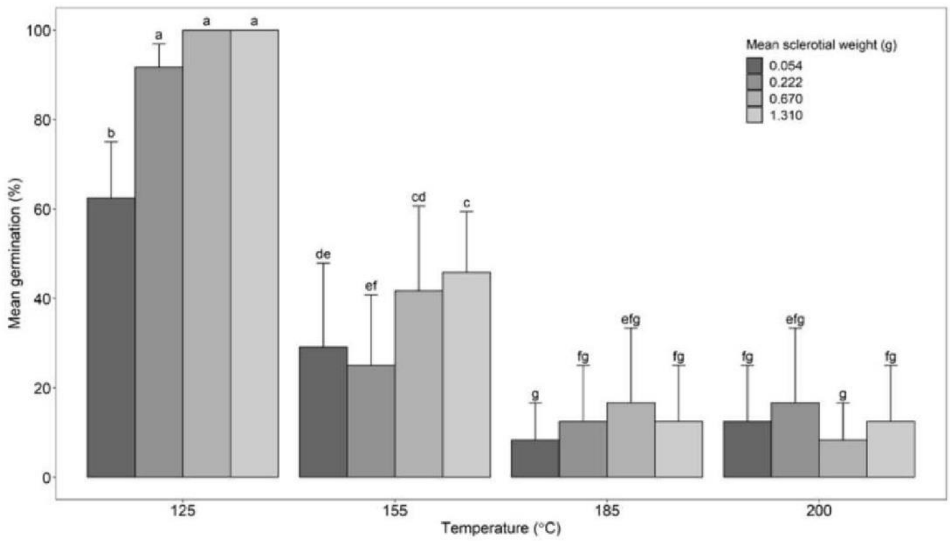


Figure 1: Interactions between the mean germination response (%) of different mean weights of *Sclerotinia sclerotiorum* sclerotia (0.054 g, 0.222 g, 0.67 g and 1.31g) exposed to four temperatures (125 °C, 155 °C, 185 °C and 200 °C). Mean germination (%) with different letter are significantly different (p = 0.05) according to LSD (14.11%). Error bars = Standard error of the mean.

Activities to be continued

Sunflower and soybean field trials will continue in Delmas and Clocolan, with additional disease screening to be conducted in collaboration with Annelie de Beer and Dr Safiah Ma'ali on the soybean and sunflower cultivar evaluations. Continuing with the evaluations will increase the robustness of the analyses, to provide producers with the best possible information for decision-making.

Conclusion

The season was successfully completed, and Marlese Meiring completed her PhD. Dr Meiring found permanent employment elsewhere, and now we have the opportunity to train a new MSc student (who has been identified) in the crucial skills of inoculum generation, field trials, cultivar screening, data analyses and report writing. We are excited to see how the results of this season will compare with previous seasons and to write a popular article with our colleagues at the Agricultural Research Council.

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

Forums and Trusts

During the 2022/23 financial year the Oilseed Industry held five hybrid forum meetings. These meetings were attended by the General Manager, Mr Bernard Schultz. The information of SAGIS was presented to the meetings. All information of SAGIS were made available on the website of SAGIS.

SAGIS' Board of Directors during the 2022/23 financial year

Dr Erhard Briedenhann and Mr De Wet Boshoff (Resigned 31 January 2023) with Mr Ralph Küsel as the alternate director represented the Oil and Protein Seeds Development Trust and oilseeds industry on SAGIS' Board of Directors.

Dr Erhard Briedenhann was elected as the chairperson and Mr Chris Schoonwinkel was elected as Vice Chairperson on the Board of SAGIS.

Financial year 2022/23

Subscription: Main Function (VAT excluded)

A net amount of R17 149 231 was approved by the Members for utilisation during the 2022/23 financial year and the final expenditure was equal to it. This included an amount of R1 325 577 for the replenishment of the Capital Reserve Fund.

The portion of the Oil and Protein Seeds Development Trust was 15.7% or R2 692 429.27 (VAT excluded).

Audit

The audit of the 2022/23 financial statements was conducted by "The Ashton CA (SA) Group Inc." and an unqualified audit report was issued.

General Information

Co-workers in the Oilseeds Industry

The number of returns per commodity in the oilseeds industry, at 28 February 2023, was as follows:

Commodity	February 2021	February 2022	February 2023
Canola	22	25	26
Groundnuts	75	75	72
Soybeans	106	106	106
Sunflower	109	108	107
Total	**312**	**315**	**311**

Product Information

An amount of **R92 550** (VAT excl.) was approved by the Trust for the Product Information. This was sufficient to cover all expenses for the 2022/23 financial year.

The publication dates are available on SAGIS' website. On 28 February 2023, the actual number of returns from registered co-workers was 83 returns for the oilseed industry.

Weekly information

An amount of **R44 678** (VAT excl.) was approved by the Trust for the Weekly Information. This was sufficient to cover all expenses for the 2022/23 financial year.

The publication dates are available on SAGIS' website. On 28 February 2023, the actual number of returns from registered co-workers was 86 returns for the oilseed industry.

Inspection Department

Type of mistakes as well as non-compliance to the statutory measures on the whole grain and oilseeds returns per commodity.

	Mistakes as well as non-compliance to the statutory measures March - February																					
	Returns late/ outstanding		Registration details incorrect		Premises of origin incorrect		Utilization type incorrect		Opening stock quantity incorrect		Receipts quantity incorrect		Sub class and grades incorrect		Utilization quantity incorrect		Closing stock quantity incorrect		Stock variance > 5%		Total	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Canola	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3
Groundnuts	33	22	-	-	5	2	-	-	1	-	4	2	-	-	4	2	5	-	1	-	53	28
Soybeans	39	33	-	-	2	-	1	-	-	-	2	2	-	-	2	1	5	2	2	-	53	38
Sunflower	40	36	1	-	3	2	-	-	1	-	5	1	-	-	3	1	3	1	1	1	57	42
Total	115	94	1	-	10	4	1	-	2	-	11	5	-	-	9	4	13	3	4	1	166	111

Net effect of mistakes as well as non-compliance to the statutory measures found during audits on (under) / over declarations on SAGIS' publications on:

Receipt of whole grain and oilseeds

	March - February											
	Mass over declared		Mass under declared		Total mass declared incorrect		Total received audited		Mass declared incorrect as % of total received		Net effect of (under) / over declared	
	Ton		Ton		Ton		Ton		%		Ton	
	a	b	c	d	e	f	g	h	e : g	f : h	a - c	b - d
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Canola	-	-	-	-	-	-	280 704	156 179	-	-	-	-
Groundnuts	571	522	474	518	1 045	1 040	76 224	76 600	1,4	1,4	97	4
Soybeans	87	-	-	321	87	321	1 782 765	2 596 639	-	-	87	(321)
Sunflower	101	3 073	107	3 073	208	6 146	398 273	1 933 229	0,1	0,3	(6)	-

Oil & Protein Seeds Development Trust & Oilseeds Advisory Committee

Utilization of whole grain and oilseeds

	March - February											
	Mass over declared		Mass under declared		Total mass declared incorrect		Total utilized audited		Mass declared incorrect as % of total utilized		Net effect of (under) / over declared	
	Ton		Ton		Ton		Ton		%		Ton	
	a	b	c	d	e	f	g	h	e : g	f : h	a - c	b - d
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Canola	-	-	-	-	-	-	199 412	111 552	-	-	-	-
Groundnuts	108	4	-	-	108	4	84 633	68 777	0,1	-	108	4
Soybeans	-	-	-	321	-	321	924 860	1 686 009	-	-	-	(321)
Sunflower	-	9	3 675	5	3 675	14	380 527	1 414 822	1,0	-	(3 675)	4

Whole grain and oilseeds stocktaking

	March - February																
Commodity	Physical stock-taking [1)]		Adjusted stock counted (t)		Stock declared on returns (t)		Net effect of under / (over) declared (t)		Difference between stock counted and declared on returns							
			a	b	c	d	a - c	b - d	Under (t)		Over (t)		Under (%)		Over (%)	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Canola	73 990	19 846	75 397	19 809	72 614	19 209	2 783	600	2 783	600	-	-	3,83	3,12	-	-
Groundnuts	22 965	17 864	24 921	20 577	25 193	20 350	(272)	227	-	227	272	-	-	1,12	1,08	-
Soybeans	551 793	672 545	581 219	681 990	584 308	693 099	(3 089)	(11 109)	-	-	3 089	11 109	-	-	0,53	1,60
Sunflower	37 541	269 262	38 840	271 675	38 526	272 483	314	(808)	314	-	-	808	0,82	-	-	0,30
Total	**686 289**	**979 517**	**720 377**	**994 051**	**720 641**	**1 005 141**	**(264)**	**(11 090)**	**3 097**	**827**	**3 361**	**11 917**	**0,43**	**0,08**	**0,47**	**1,19**

Note: For comparison purposes, the physical stock was adjusted to compare it with the stock declared on the return as per month-end.

Oilseeds products

	Mass over declared		Mass under declared		Total mass declared incorrect		Total produced audited [1]		Mass declared incorrect as % of total produced		Net effect of (under) / over declared	
	Ton		Ton		Ton		Ton		%		Ton	
	a	b	c	d	a + c = e	b + d = f	g	h	e : g	f : h	a - c	b - d
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Coconut Oil	-	-	-	-	-	-	50	531	-	-	-	-
Palm Oil and derivatives	-	-	-	-	-	-	259 163	164 759	-	-	-	-
Soybean Oil	-	26	-	93	-	119	229 160	133 837	-	0,1	-	(67)
Groundnut Oil	-	-	-	-	-	-	-	14	-	-	-	-
Sunflower Oil	72	-	-	-	72	-	306 617	249 888	-	-	72	-
Rapeseed / Canola Oil	-	-	-	-	-	-	3 836	31 940	-	-	-	-
Cottonseed Oil	-	-	-	-	-	-	2 000	2 763	-	-	-	-
Corn (maize) Oil	-	-	-	-	-	-	5 449	-	-	-	-	-
Other Oil (Blends or mixes not included in the above oil)	-	-	-	-	-	-	48 057	4 670	-	-	-	-
Cottonseed Oilcake	-	-	-	-	-	-	-	52 616	-	-	-	-
Sunflowerseed Oilcake	-	-	369	-	369	-	336 799	153 306	0,1	-	(369)	-
Coconut Oilcake	-	-	-	-	-	-	-	-	-	-	-	-
Palmnut Oilcake	-	-	-	-	-	-	-	21 943	-	-	-	-
Soybean Oilcake	-	-	-	500	-	500	1 065 900	477 586	-	0,1	-	(500)
Rapeseed / Canola Oilcake	-	-	-	-	-	-	58 503	37 808	-	-	-	-
Biodiesel	-	-	-	-	-	-	-	670	-	-	-	-
Soybean flours and meals	-	-	-	-	-	-	34 878	50 961	-	-	-	-
Soybean full-fat	71	43	-	422	71	465	92 174	94 853	0,1	0,5	71	(379)
Peanutbutter and paste	51	-	-	-	51	-	32 636	5 697	0,2	-	51	-
Textured Vegetable Protein	-	-	-	-	-	-	525	46 977	-	-	-	-

Note: The production refers to the number of tons audited and not to RSA total production.

Conclusion

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

We wish to express our gratitude especially towards the Members of the Oil and Protein Seeds Development Trust for their continued support, financially and otherwise.

3.2.15 INVESTIGATION OF THE AGGRESSIVE, SEEDBORNE NEMATODE SPECIES *ROBUSTODORUS ARACHIDIS* N. COMB. ON GROUNDNUT; Dr S Steenkamp, Mr SS Kwena, E du Randt, Dr A Swart, Dr R Knoetze, ARC Grain Crops Institute, Potchefstroom

The newly discovered nematode *Robustodorus arachidis*, was recovered during 2016 in large numbers from severely damaged hulls and kernels of groundnut from a commercial field in the Vaalharts irrigation Scheme, Northern Cape Province. It was suspected that this nematode was similar to the pod nematode, *Ditylenchus africanus*, which has significant financial implications for the groundnut industry. Pod nematode has a qualitative effect on groundnut, causing downgrading of consignments. Urgent research was therefore needed to study the unknown *R. arachidis* and to determine its damage potential and hence, a threat to the groundnut industry. Without relevant information on this newly discovered nematode, it would be impossible to implement effective and sustainable management strategies. The aims of this study were to establish whether currently, registered nematicides are effective for *R. arachidis* control, to establish the damage potential and economic impact of this nematode and to establish its reproduction potential, survival and host range. Nematicides and crops other than groundnut was evaluated in field trials, the damage potential and economic impact and the survival abilities of this nematode were studied in microplots and the reproduction potential and life cycle of this nematode in the laboratory. Currently, registered nematicides are not effective in keeping this nematode under control. Similar to pod nematode, the main effect of *R. arachidis* on groundnut is qualitative. They cause premature germination and discoloration of the kernels, which leads to the downgrading of groundnut consignments. The economic impact differs from season to season depending on the current prices for each grading class and the loss consignments incur from these. The life cycle of *R. arachidis* is ten days, which means that it can produce a number of generations per summer growing season and that only a small number is needed at the beginning of a growing season to cause damage at harvesting. In the cold winter months or in the absence of water they can go into anhydrobiosis in order to survive the adverse conditions. These anhydrobiosis can recover and still cause significant damage to a follow up groundnut crop. In the absence of groundnut *R. arachidis* can survive on maize. Its effect on this crop is currently unknown.

3.2.16 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 at 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 valuable information on a continuous basis and at no cost to the participants.

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 of 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.

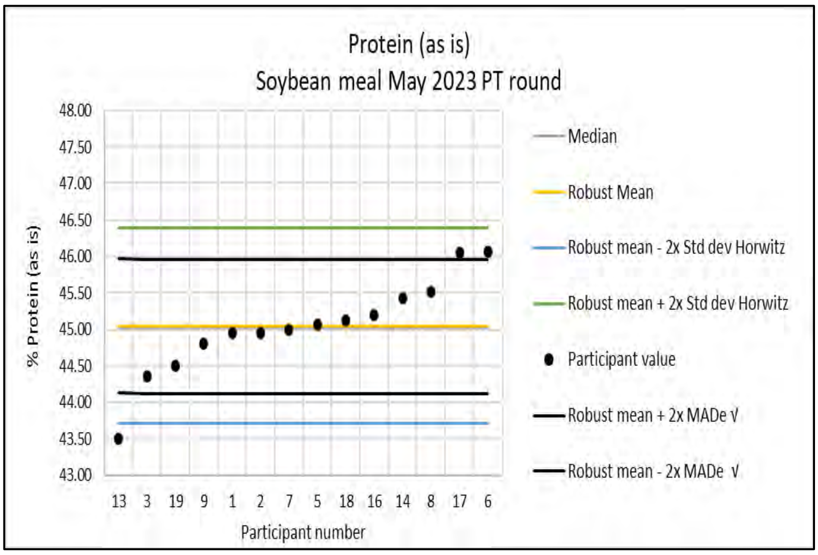
Where applicable, the assigned values are then used in combination with the standard deviation for proficiency to calculate the z-score for each result. Participants receive a report, compiled by the SAGL and each participant has their own uniquely coded results to preserve confidentiality.

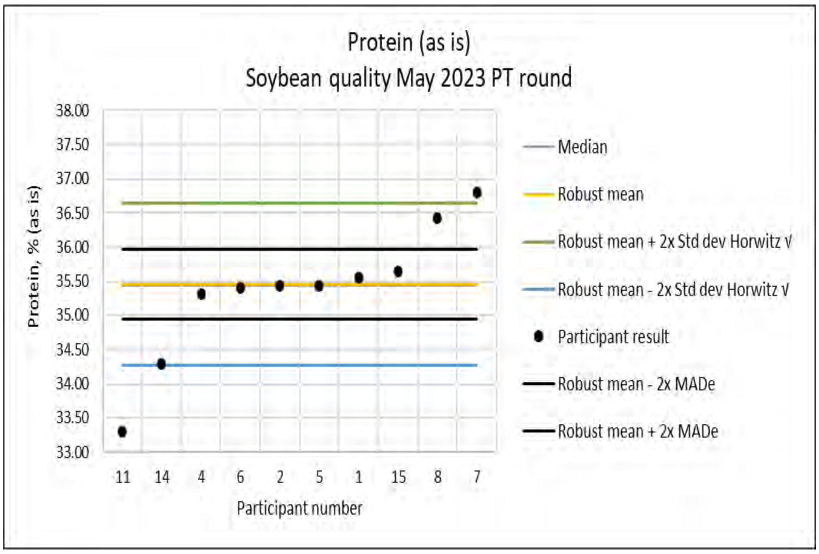
Information on specific methods used by the participants is also included in the report. This provides the participants with additional information on the different methods being used by other testing facilities.

SUMMARY OF RESULTS

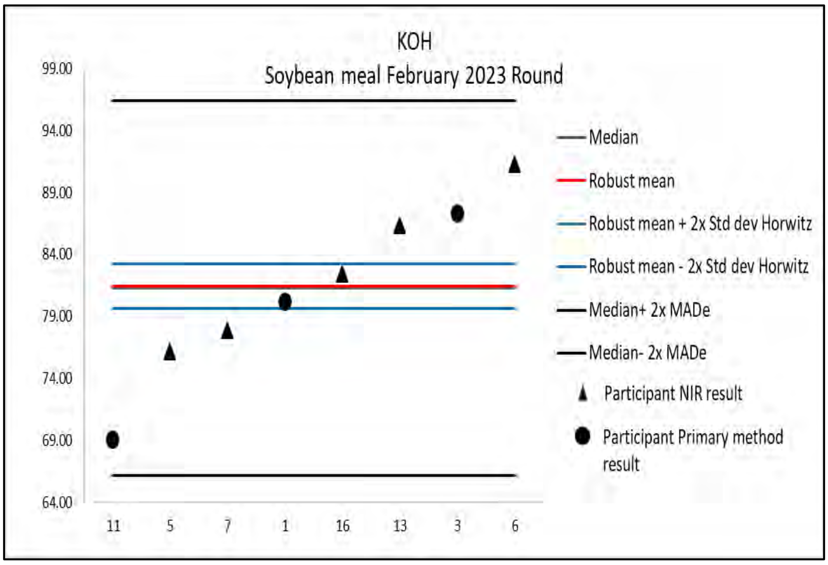
The reporting of the results was standardized to 'as is' values which improved the comparison between the participants.

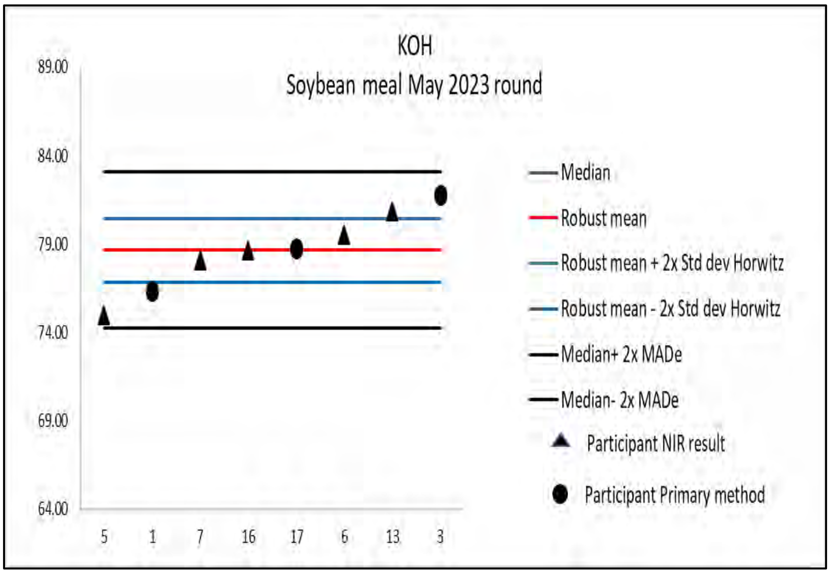
Protein results between the participants correlate well and the protein results of the May 2023 cycle for both soybeans and soybean meal are shown below:





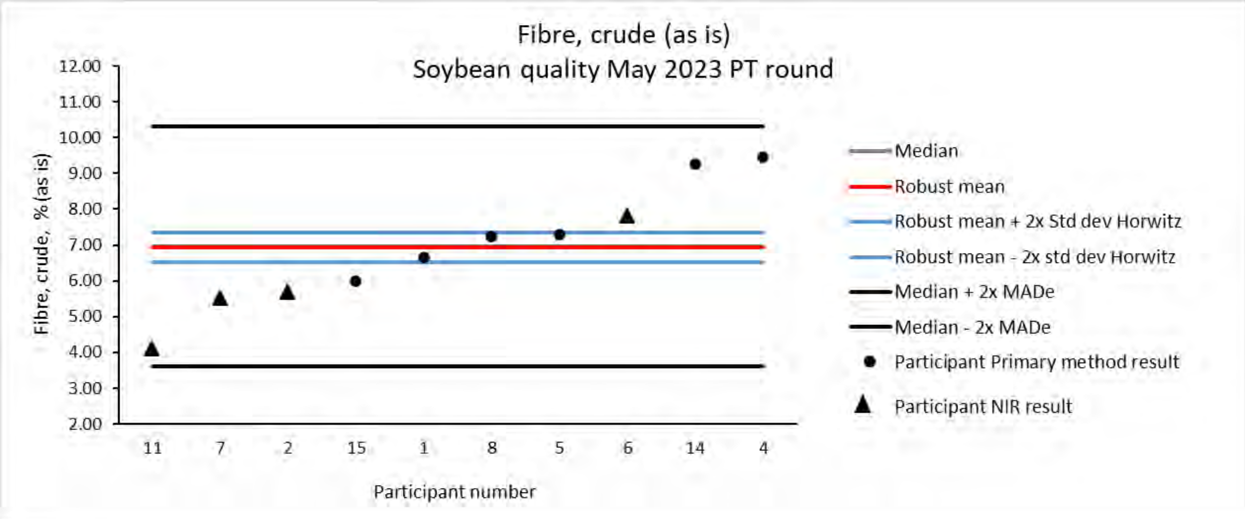
Where necessary, further statistical evaluation is used to analyse the data and final results are presented in the report. Below are examples for the KOH analysis results from the February and May 2023 soybean meal report. Because of the wide spread of analysis results received during the February 2023 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.



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

During the period 2022/2023 the day-to-day tasks were mainly updating existing and adding new content to the OPDT/OAC's website. On 28 February 2023, the OPDT/OAC's website hosted a total of 606 static HTML pages - excluding dynamically created pages – across 15 content sections.

GOOGLE ANALYTICS 4

Google has announced that standard Universal Analytics (UA) will stop processing data starting 1 July 2023 as it will be replaced with the next generation Google Analytics 4, or GA4 for short. New features include mobile app tracking, event-based tracking, better integration with Google products, a customizable interface, cookie-less tracking, and machine learning capabilities. GA4 has a different data model than UA, and it is therefore not possible to transfer historical statistics to the new GA4 property. To build up a traffic history on OPDT/OAC's website, a new GA4 property has been running concurrently with the existing UA property since December 2022.

Visitor statistics

Reporting Year	**Unique Visitors** *Raw values**	**Unique Visitors** *Google values*		
		Visitors	*Pages*	*Pages per visit*
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**

Google values show a decrease in page views and a decrease in unique visitors. Page views decreased by approximately 1423 during the year. The most page views came from the following pages in order of percentage share:

- Home page: 17.5%
- Oil and Protein Seeds Development Trust (OPDT) / Oilseeds Advisory Committee (OAC): 13.2%
- Soybean cultivation in South Africa by Wessel van Wyk: 4.9%
- Soybean categorised project database index: 4.5%
- Soy Oilcake Price Average: 4.3%

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 sector. 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 chain 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 beverage sectors.

- 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 the farm-level, risk analysis via stochastic simulation, the impact of policy decisions, input- and market-related shocks on the farm-level, and the intermediate and long-term projection based on the BFAP sector model output.

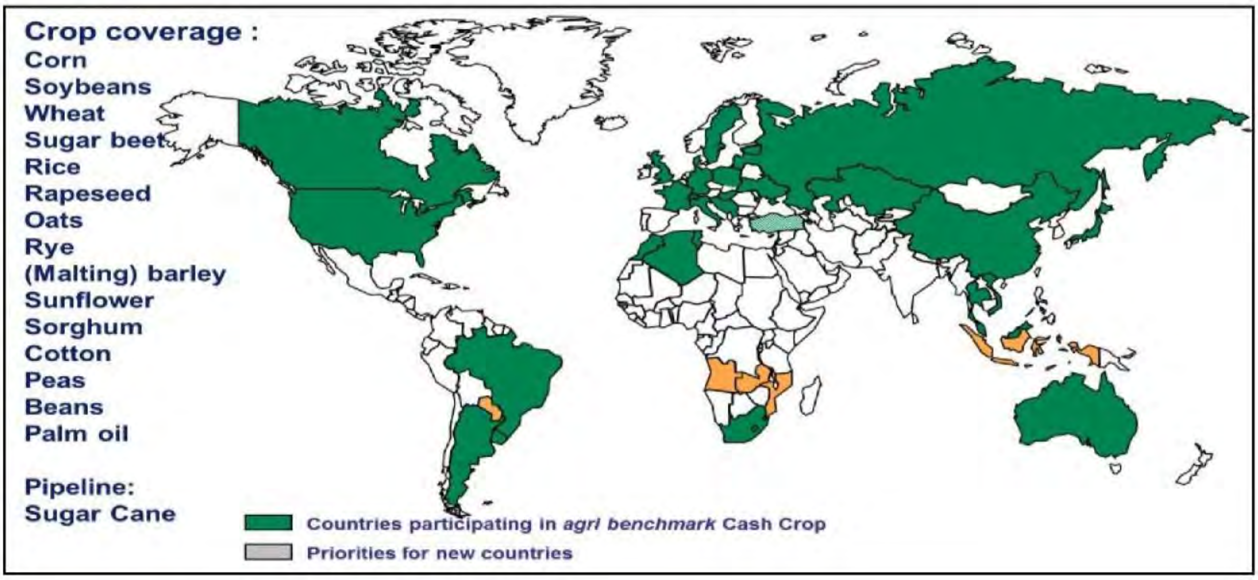
Table 1: BFAP existing network of prototype farms

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 network 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.



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 focused on key summer- and winter crops produced in South Africa's key agro-ecological zones. Given ongoing activities associated with 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 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 of refining model assumptions and to ensure alignment.

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 is presented in the annexure of this proposal.

- Generate a bi-annual report on crop budgets for the subsequent season.

Proposed schedule of reports

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

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);
- Level 3: Projections / Quarterly Updates.

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	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

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	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

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	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

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	Coverage	Description	Coverage	Description	Coverage	Description
Summer	North West	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

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	Coverage	Description	Coverage	Description	Coverage	Description
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	Mooirivier: Level 1-3
			Small-scale maize					x	Bergville: Level 2

Figure 6: KwaZulu-Natal

				PNS		GSA		BFAP	
CROP CATEGORY	PROVINCE / REGION		CROP TYPE	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 Ruêns: Level 1		
			Wheat minimum tillage	x	Bredasdorp / Caledon: Level 1	x	Western Ruêns: Level 1	x	Bredasdorp / Caledon: Level 1-3
			Barley	x	Bredasdorp / Caledon: Level 1	x	Western Ruêns: Level 1		
			Canola	x	Bredasdorp / Caledon: Level 1	x	Western Ruêns: Level 1	x	Bredasdorp / Caledon: Level 1-3
			Oats	x	Bredasdorp / Caledon: Level 1	x	Western Ruêns: Level 1	x	Bredasdorp / Caledon: Level 1-3
			Lupines			x	Western Ruêns: 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; Dr JA Strauss, Western Cape Department of Agriculture

2022 was the 11th year of production on the new trial. Six cash crop systems are tested, including shortened canola rotations and cover crops. A total of 60 plots were planted. The 6 systems tested are replicated 3 times, and all crops within each system are represented on the field each year.

All protocols developed during the annual technical committee meeting in February 2022 were followed, and the integrity of the trial layout was upheld.

Canola production - 44Y90 was planted at Riversdale at 2.5 kg/ha. A total of 38 kg N/ha was applied to each plot. Canola yields at Riversdale averaged 1364 kg/ha. All plots had oil yields above 40%,

Wheat production - SST0166 was planted at Riversdale at 60 kg/ha. A total of 38 kg N/ha was applied to each plot (8 kg N/ha at planting and 30 kg N/ha top-dressing). Wheat yields at Riversdale averaged 3122 kg/ha. This was 80 kg/ha more than in 2021.

Barley production - Kadie was planted at Riversdale at 50 kg/ha. Barley yields at Riversdale averaged 1882 kg/ha. This average yield was 2319 kg/ha less than in 2021.

Lupin production - Lupine plots were planted to bitter lupine SSL10 at a rate of 80 kg/ha. No plots were harvested. Good growth but poor seed set and poor weed control led to the termination of the lupine.

Cover crops - A mixture of peas, lupine and barley was planted in 2022 at 80 kg/ha seeding rate.

Economics - Commodity prices were excellent, slug problems with the canola lowered yields and low protein in a number of the wheat plots lowered the income of these two crops. All systems tested show a positive gross margin above directly allocated production.

3.3.4 RESEARCH ON SOYBEANS TO STUDY NEW PRELIMINARY TREATMENTS WITH DIFFERENT BIOLOGICAL LEAF APPLICATIONS AS WELL AS CHEMICAL APPLICATIONS AND A DEMONSTRATION TRIAL IN A WAGON WHEEL DESIGN; Mr WF van Wyk, Contractor, Protein Research Foundation

2021/2022: Trials conducted on the UP-Experimental farm in Hatfield, Pretoria.

- **Demonstration trial in a wheel design**

  Treatments: Four (3) Cultivars from an MG 4-7 were used. There were 4 rows of each cultivar and 2 entrances to the middle of the trial were kept clean in order to get inside the trial. In one half of the trial, the plant density was kept constant at a planted 250 000 plants/ha while row width went from 1.5m at the outside of the circle to 30cm at the inside of the circle. See Fig 1 below.

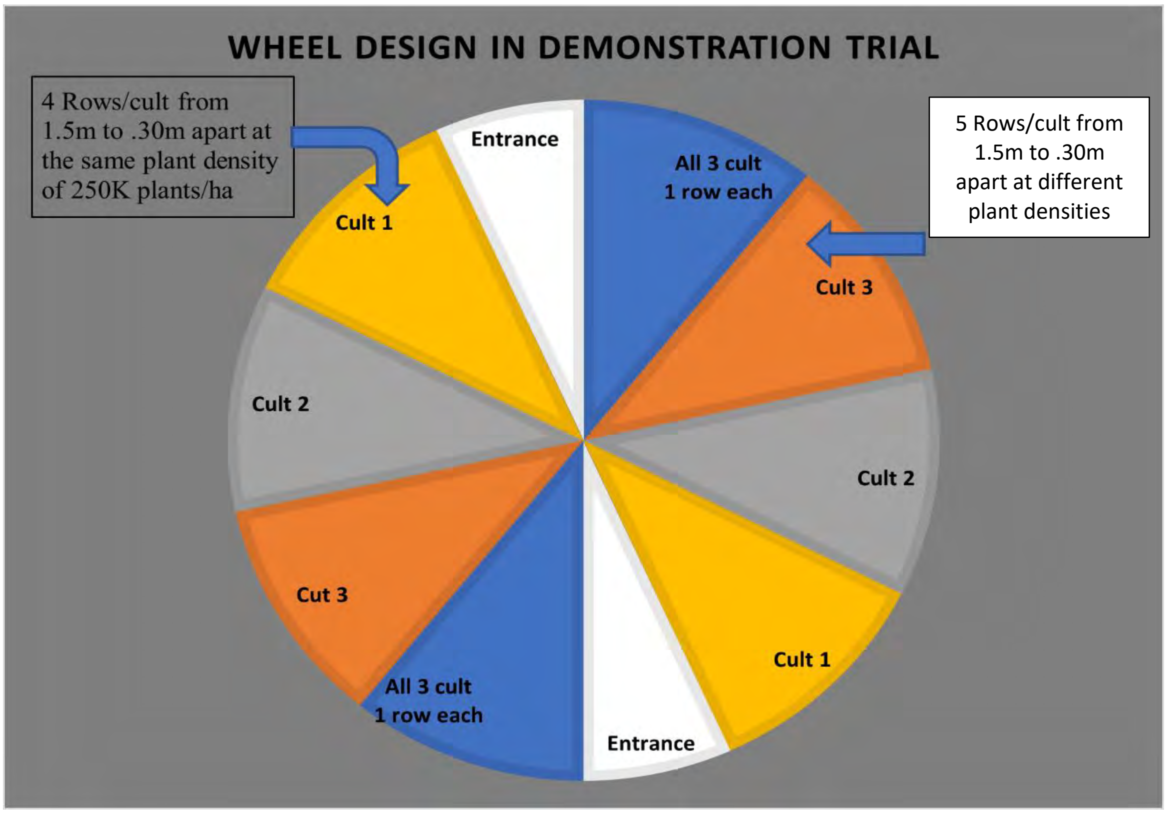


FIG 1. The wheel design which was used to compare different parameters and yield of 3 cultivars at different row widths and plant densities.

On the other halve of the demonstration trial the distance between plants was constant at 8cm from each other which gives 87 719 plants/ha in 1.425m rows and 308 025 plants/ha in .405m rows when planted.

Photo 1. Wheel design trial at 5 weeks

Photo 2. Wheel design trial at 15 weeks

The arrangement of the rows can be seen in Photos 1 and 2 in the wheel design.

In the centre of the “wheel” a circle with a diameter of 2 meters was unplanted to enable one to move from one side of the wheel to the other side by using the two unplanted entrances. The rows were 8m long but only 7 meters were harvested as 7 different treatments because the row width changed from 1.5m at the outside to 0.3m at 1m from the centre. See the Table below for the differences in row width for every 1m distance from the outside to the inside as well as the average row width per meter.

Treatment from outside to inside	Range	Average row width
T1	150 - 135cm	1.425m
T2	135 - 115cm	1.25m
T3	115 - 104cm	1.095m
T4	104 - 85cm	0.945m
T5	85 - 71cm	0.78m
T6	71 - 51cm	0.61m
T7	51 - 30cm	0.405m

Soybeans were harvested, and threshed and all the yield and other data were taken. The aim of this demonstration trial was to establish the correlation between plant density and yield as well as branching and pod height. Plants at harvest were also compared to the number of seeds planted in order to find an explanation for the big differences that sometimes occur between planting and harvesting. The three cultivars used were C1 = DM 5953 (MG 4.4), C2 = PAN 1521 R (MG 5) and C3 = PAN 1644 (MG 6.4)

At one side of the circle, these four cultivars were planted at a rate of 250 000 plants/ha over all treatments. The yield of the MG 4 and 5 cultivars were influenced by the large amount of rain we had from Nov to Dec and the average yield was in the order of 2.4 ton/ha for MG4 and 2.5 ton/ha for MG5. The best yields of 4132kg, 3891kg and 3703kg/ha were achieved with

PAN 1644 R at respectively plant densities of 224 000, 234 000 and 233 000 plants /ha. The row widths at these plant densities were 78, 61 and 94.5cm, respectively.

The treatment which had the least reduced plant density at harvest was at PAN 1644 R in 61cm rows where planting density decreased only 6.55% from the original 250 000 plants/ha to 233 606 plants/ha and a yield of 3.891 ton/ha. The treatment which had the most reduced plant density at harvest was at DM 5953 in 150cm rows where planting density decreased by 34% from the original 250 000 plants/ha to 164 192 plants/ha and a yield of 1.333 ton/ha

At the other side of the circle, the four cultivars were planted with a constant distance between plants of 8cm - in other words, 12.5 plants per running meter. In the wide rows (1.425m) of DM 5953 the harvest plant density should be 87 719 plants/ha but there were only 70 175 plants/ha – a drop of 20% in plant density from planting to harvesting. For the narrow rows (0.405cm) the drop in density was 40%. The drop in density for the wide and narrow rows for PAN 1521 R, PAN 1644 and DM 6.8i R was respectively 12 and 16%, 20 and 19.2% and 18 and 25%. The 3 top yields were achieved at PAN 1521 R (4617kg/ha at 259 259 plants/ha), PAN 1644 R (4123kg/ha at 249 152 plants/ha) and PAN 1521 R (3801kg/ha at 131 410 plants/ha).

- **Additional preliminary research with different treatments that were used are:**

  - Application of kraal manure at 20 tons/ha, sheep manure at 15 tons/ha and poultry manure at 12 tons/ha;

  - 25 cm row spacing with two seeds/position planted every 33.3 cm in the row - gives a density of 240 000 plants/ha;

  - Application of Spoor and Boor on the leaves of soybeans in 45cm rows at R2 (only micro-elements). CULTIVAR - PAN 1521;

- Application of product of Rolfes on the leaves of soybeans in 45cm rows at dosages 0, 1 x dosage and 2 x dosage on Cultivar PAN 1644 R and application at 1 x dosage on Cultivar DM 5953 R;

- Two controls in 45cm rows on cultivar DM 5953 R and one on cultivars PAN 1644 R and PAN 1521 R respectively;

- Application of LAN at R2 at rates of 0, 200 and 300kg/ha on DM 5953;

- Application of Ammonium Sulphate at rates of 0, 100 and 200kg/ha at R2 on DM 5953 R;

- Application of Brandt Smart Quatro containing Molybdenum, Cobalt, Copper, Magnesium and Boron as foliar on PAN 1521 R;

- Application of Green Liquid(Product of Elim Kusmis) containing a broad range of macro- and trace-elements, plant stimulating hormones and enzymes and a stimulant for natural soil micro-flora. This application was on PAN 1644 R.

The treatments were harvested, threshed and post-harvest data were taken. The best yields were at treatment 4 (Rolfes at double dosage on PAN 1644 R with 5485 kg/ha), second best was treatment 8 (Brandt Smart Quatro on PAN 1521 R with 5263 kg/ha) and third best was treatment 4 (Rolfes at single dosage on PAN 1644 R with 4833 kg//ha).

3.2.4 RESEARCH ON SCLEROTINIA WITH EMPHASIS ON CULTIVATION PRACTICES AND TREATMENT WITH BIOLOGICAL PRODUCTS TO REDUCE ITS OCCURRENCE IN SOYBEAN; Mr WF van Wyk, Contractor, Protein Research Foundation

- **TRIALS AT FARMERS;**
- **SCLEROTINIA TRIALS**

Planting of 2 trials at Wonderfontein and Stoffberg.

a. Ploughed trial - Stoffberg

A section of 50m to 100m in length and at least 40m wide was ploughed in a chosen field in August/September at a depth of at least 25cm. A reversed harrow was used to prepare the seed bed without disturbing the soil. Only the 20m at the centre of the ploughed soil was used for data purposes as the remains of the surrounding soybeans that are exposed to sclerotinia will not be spread on the data soil. It also creates room for the farmer to move the planting direction with a few degrees every year as is standard cultivation practice for no-tillage farmers. The cultivar DM 6.8i R was used.

There was no sclerotinia this season and the expectation was that the yields of the plough treatment and control would be the same but the treatment outyielded the control by 500kg/ha. The yield of the control was 3000kg/ha while that of the treatment was 3500kg/ha. The reason for this strange outcome can be found in the fact that there was better drainage and less compaction in the soil.

b. Trial with biological treatments - Wonderfontein

A biological treatment (Brandt Smart Quatro) active ingredient Bacillus methylotrophicus was used as a foliar application when the first sclerotinia was observed. Two weeks later a second application was done and although the amount of sclerotinia was less in the sprayed section the yield was only 180kg/ha more than the control at 3124 kg/ha.

3.3.5 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 not the wettest season, but the rain was spread more evenly during the season. It was the best soybean season the West ever had. This is due to good rainfall and better cultivars. The new Intacta cultivars were some of the best performers the past season. In the past season, the hectares in the North West jumped from 100 000 ha to 155 000ha due to economics and better adapt cultivars for the region.
The trials consist of 32 cultivars from a MG 4.7 to MG 7.1. All the cultivars in the trials were indeterminate except for LS 6851 R were determinate. We had twelve new cultivars in the trial which consist of 2 new RR1 cultivars (PAN 1502 R and PAN 1507 R) and 10 RR2 (Intacta) cultivars (RA 5022 BR, RA 5722 BR, RA 5821R(CT233R), LG602601PR, DM 59160 RSF IPRO, LG 60261PR, RA 6422BR, Y651 RR PRO, RA 6521BR and DM 61163 RSF IPRO).

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

The trials at Schweizer Reneke were planted on 28 October 2022 and 1 December 2022 with the farmer's 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 4558.5 kg/ha. The cultivar with the highest yield was Y 657 (MG 6.5) with 5505.8 kg/ha and the cultivar with the lowest yield was RA 4918 R (MG 4.9) with 3606.5 kg/ha.

The trial at Schweizer Reneke (PD 2) had a mean yield of 4350.1 kg/ha. The cultivar with the highest yield was DM 59R03 (MG 6.0) with 5116.4

kg/ha and the cultivar with the lowest yield was DM 6.8 i RR (MG 6.8) with 3450.0 kg/ha.

The trial at Leeudoringstad was planted on 31 October 2022 and was planted with the planter of the ARC. All these trials were randomised differently.

The trial at Leeudoringstad has a mean yield of 3739.7 kg/ha. Die cultivar with the highest yield was RA 5722 BR (MG 5.7) with 4806.5 kg/ha and the cultivar with the lowest yield was DM 53154 RSF (MG 5.1) with 2960.3 kg/ha.

The Trial at Baberspan was planted on 17 November 2022 and was planted with the planter of the ARC. All these trials were randomised differently.

The trial at Baberspan has a mean yield of 2689.7 kg/ha. The cultivar with the highest yield was DM 6163 RSF IPRO (MG 6.7) with 4003.6 kg/ha and the cultivar with the lowest yield was PAN 1644 R (MG 6.7) with 2034.3 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.

3.3.6 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

The fertilization of soybeans with nitrogen as an additional/supplemental application is gradually becoming an integral part of the management practices of most farmers within the Eastern Highveld. Producers began this management practice with the aim of enhancing their yield by supplying the plant with sufficient nitrogen to finish its growth cycle without experiencing any deficiencies and compromising quality. Most have successfully obtained their target yield, but there is a lot of uncertainty related to the application rate as well as the source that effectively enhances the quality of soybeans while ensuring substantial returns on investment. This research project seeks to determine the optimum application rate and nitrogen source for the successful improvement of soybean production in the Eastern Highveld.

Objectives

The main objective of the project is to determine the benefits of additional nitrogen on soybean yield and quality under different agro-ecological conditions of the Eastern Highveld. Sub-objectives include statistical identification of the optimum rate of nitrogen application that will ensure a substantial return on investment. The inclusion of a nitrogen source consisting of 5% Sulphur will help identify whether Sulphur has a beneficial role on the soybean yield and quality.

Methodology

Agronomic field trials were planted at two locations within the Eastern Highveld, namely Clarens and Grootvlei. A randomized complete block design (RCBD) with four replicates was used for the statistical layout of each of the respective field trials. There were two treatment factors, namely nitrogen source and application rate. The nitrogen sources were Limestone

Ammonium Nitrate (LAN) and Greensulf 35 from Omnia Nutriology. The application rates were an untreated control (0) together with incremental rates of nitrogen at 15, 30, 45, and 60 kg N ha^{-1}. The fertilizer was broadcast using a handheld fertilizer spreader at flowering for uptake at pod filling when nitrogen demands are at their highest.

Data Collection and Analysis

The trials were monitored weekly to identify growth stages and observe any deficiencies or diseases. The primary parameters that were measured are the yield, yield components, as well as quality parameters. The two experimental sites have a GPRS mini weather station that measures different climatic parameters hourly. Leaf analysis was done before the treatments were applied to the experiment and after the treatments were applied to identify any differences that may occur in the concentration of the different nutrient elements, with special attention to nitrogen and Sulphur. The leaves that are sampled for analysis are the uppermost fully developed trifoliate leaves of the different treatments.

Yield and Yield Components

Grain yield: The grain was harvested, weighed, and adjusted to 12,5% moisture content. The yield was then expressed in tons per hectare.
Pods per plant: The number of pods per plant was counted by sampling ten plants in each plot and calculating the average pods per plant.

Number of kernels per pod: The number of kernels per pod were counted from the same plants that are sampled for pods per plant. An average of kernels per pod was calculated by counting 1-kernel, 2-kernel-, 3-kernel- and 4-kernel pods per plant and then dividing by the total number of pods on the specific plants.

Thousand seed-weight: A total of 1000 seeds were counted using a seed counting machine and then weighed. The weight of the seeds was recorded, and the moisture was adjusted to 12%.

Quality Parameters

Protein content: The protein content of the seeds was measured using equipment from Free State Oil (a VKB-owned company). The extractable protein analysis is conducted by the Animal Science laboratory at the University of the Free State.

Oil content: The oil content of the seeds is measured using the same equipment as the latter. The extractable oil analysis is conducted by the Animal Science laboratory at the University of the Free State.

Climate Data

Relative humidity: It is a ratio that is expressed in percent of the amount of atmospheric moisture present relative to the amount that would be present if the air were saturated. This data is not used for the project, but the weather station sends its readings too.

Ambient temperature: These temperature (°C) readings represent the actual temperature as it feels, which is an average of both the minimum and maximum temperature.

Rainfall: The amount of rainfall (mm) was recorded from planting until the crops reached maturity.

Temperatures: Minimum and maximum temperatures (°C) were recorded from planting until the crops reached maturity. These temperature readings were used for calculating growth degree days (GDDs) as well as heat units (HU).

Results

The results of the first production season will be discussed thoroughly in the annual report that will be sent to PRF by the end of August. These results cannot be used as recommendations before the trials for the second production season have been conducted and analysed statistically.

Relevance and impact of proposed outcomes

More farmers in the summer rainfall regions are expanding their soybean production. The area estimates and sixth production forecast of summer field crops shows that the total area where soybeans were planted for the 2020/21 production season was 827 100 hectares and for the 2021/22 season it was 915 300 hectares, which is an increment of more than 10% from the preceding production season (DALRRD, 2022). The production season after the latter realized an increment of more than 19% with the total area planted equal to 1 150 000 hectares for the 2022/23 production season. These increments and expansions promote the ever-growing interest in conducting scientific research on soybeans in the country.

The high fertilizer costs play an important role in the financial viability of supplying additional nitrogen for yield improvement because producers spend a lot of money on large quantities of nitrogen fertilizer and apply it in high quantities but do 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 fertilizer secures higher yields and produces a higher income. The results from this project will assist in the mitigation of risks and ultimately, help producers use their fertilizer wisely and possibly save a substantial amount of money on fertilizer. Agronomists, agriculturalists, and other crop-related research scientists and/or consultants will be able to use the information from this experiment to make recommendations.

Recommendations

The trial needs to be conducted for another production season before any recommendations can be made using the results above. Therefore, it is recommended that the project continues for another production year due to the high value it adds to the soybean industry. In future, a research trial testing the effectiveness of more than two nitrogen sources applied at every growth stage at different application rates needs to be conducted to ensure that the debate about the effective growth stage is investigated scientifically. A trial of that nature should most probably take place for four (4) production seasons or longer. Van Wyk (2016) conducted a trial almost like the one proposed above and he found that it is not economically beneficial to supplement soybeans with nitrogen fertilizer at any growth stage because it does not necessarily produce significant and economically viable yields.

3.4 TRANSFORMATION PROJECTS

3.4.1 GRAINSA FARMER DEVELOPMENT; Pula/Imvula Magazine and Training, Dr S Nngcamphalala, GrainSA

Aim and methodology

In this application, we are requesting funding for Training courses, the Pula Imvula Newsletter, Oilseed production demonstration trials and mentoring for farmers who will be getting production assistance from various private companies/projects, initiated, and managed by Grain SA.

There is a very marked lack of knowledge and practical skills relating to oilseed production, marketing, and agri-business development and if there is to be real development in this sector, information and skills transfer is critical. Through these well designed and appropriate training courses, information transfers through the Pula Imvula Magazine, and the planting of oilseed trials (including hosting farmers' days), Grain SA plans to ensure meaningful capacity development for emerging farmers towards sustainable oil and protein seeds production.

Training

Progress is indeed being made by many developing farmers. In order to farm successfully, indeed farmers need access to land, mechanization and inputs, and most importantly, the skills and knowledge that will enable the farmers to use available resources efficiently. A total of 15 training courses are planned for the 2022/23 season.

The courses are presented to the farmers in their mother - tongue, at a venue close to the farmers. The farmers are provided with a training manual for each course, as well as refreshments. The duration of most of the courses is a week with the morning's sessions being dedicated to the theory and the afternoons for the practical.

Pula Imvula

The Pula Imvula is a monthly newsletter that we prepare and distribute in 5 languages - English, Sesotho, Setswana, IsiZulu and IsiXhosa. The contents of the magazine are published monthly with information that is aligned to the farming operations such that farmers are immediately able to implement any emerging lessons. At least 16000 copies of the magazine are distributed to developing farmers and different industry stakeholders throughout South Africa.

The members of the study groups receive the Pula by post. Unfortunately, the quality of the postal services is often problematic, electronic versions of the magazine is also distributed and available on a monthly basis.

Trials and farmers' days

Farmers need to gain knowledge and experience of alternative crops in their rotations. In this application, we are requesting funds for the purposes of planting Oilseed crop trials where the farmers will be exposed to the planting of Groundnuts, Sunflower, Soybeans and Canola. A total of 10 trials are planned for 2022/23.

Results envisaged

It is envisaged that with this funding we would be able to:

- Transfer meaningful knowledge and skills to developing oil and protein seed producers that will motivate and capacitate them to become efficient, productive and sustainable.

Value for the industry

Grain SA has over 16 000 active developing farmer members, the majority of which are involved in a rotational grain production system including oil and protein seeds. There is also plenty of unused land available. There is significant room for increased oilseed production among developing farmers in South Africa. Grain SA believes that this intervention will increase oil and protein seed production in South Africa with greater value for food and nutrition security while offering more improved and healthy soils to the industry.

Limitations

The COVID-19 pandemic and the related regulations have the potential to complicate training contact sessions. As such, Grain SA will ensure that all facilitated courses are managed in a manner that complies with the safety regulations and ensure that farmers do not miss out on the required skills due to the pandemic. The Pula Magazine will be particularly helpful to continue transferring skills and knowledge with limited contact directly and between farmers.

Publication

Grain SA undertakes to continue to promote the OPDT in the Pula Imvula and SA Grain Magazines.

Trails will be promoted through farmers days and all other project activities will be republicized during the Grain SA Congress and other appropriate public platforms.

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

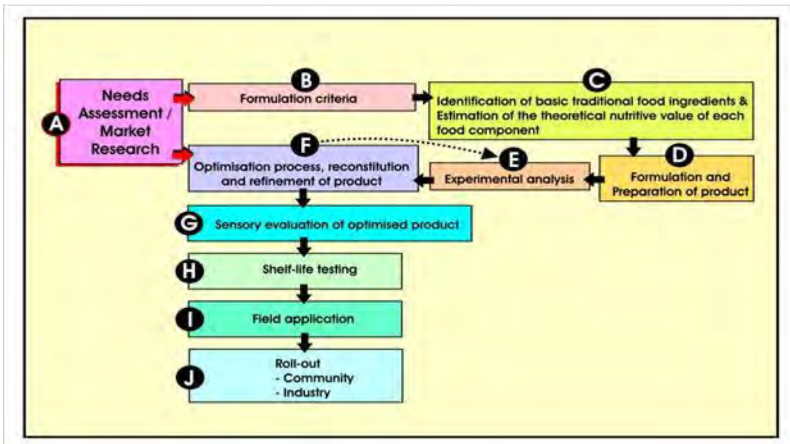
Needs assessment

The data collected during June/July 2021 to determine the type of snacks consumed and needed by consumers were analysed and a manuscript prepared. The manuscript reviewer's comments were addressed and re-submitted to the journal in May 2023.

Ibiyemi T, du Toit C, Oldewage-Theron. Snack consumption frequency of children and adults in the Vaal region of Gauteng, South Africa. HealthSAGesondheid (manuscript HSAG-2181).

Product development

The main goal of this phase was to develop ten nutritious snacks that are affordable and easy to prepare using locally available ingredients. Ten products – one soy rusk, muffin, granola bar, four trail mixes and three brittles - were formulated, biochemically and sensory analysed and shelf-life testing was conducted. Steps A-H have been completed (figure). Thus, the ten soy snack foods development part of the project (Phase 1) was completed during June 2022.



The soy nut machine was moved from the Vaal University of Technology to UFS in 2022 and the soy nuts formed the basis for the soy snack development. The ten developed snacks in this study were of higher nutritional quality than available corresponding snacks in the South African market. The protein content of the soy rusks, soy carrot muffin, and soy cookies was more than twice that of corresponding snacks in the market. Similarly, granola bars, nut brittles, and trail mixes were at least 25% higher in protein than the corresponding snacks. The nutritional composition of the developed snacks also indicated that soy carrot muffins, soy cookies, granola bars, and brittles had dietary fibre content, which was more than twice the corresponding snacks in the market. The South Africa National Department of Health stipulates that a food product containing ? 2.5g/100g of dietary fibre can be considered a source of fibre. At the same time, those with ? 5g/100g of dietary fibre can be claimed as high-fibre food products (FACS, 2016). Based on these guidelines, aside from soy rusks, all our snacks provide >6g/100g of dietary fibre and can be regarded as high-fibre snacks. Furthermore, the developed snacks were lower in added sugar (200% lower), sodium (200% lower), and saturated fat than corresponding snacks in the market.

The cost analysis of the raw ingredients for all ten snacks was between ZAR 3.13 and 3.63 per unit (35 - 40g) price. This price was below the ZAR 3.75 cost of ingredients estimate to ensure the snacks would be at least 20% cheaper than the average snacks in the SA market. This estimate was based on the analysis that 33 - 35% of the developed snacks' final production costs will be the ingredients' cost.

The consumer panel in this study included 143 panelists (81 children and 62 women). Among the developed snacks, soy rusks had the highest overall acceptability. Similar to the soy rusks, nine out of the ten developed snacks in this study were liked (with an average mean score of 4 out of a 5-point hedonic scale) by consumer panelists. Furthermore, the result of the sensory analysis found that trail mix 1, which was neither liked nor disliked, was the least acceptable snack in the study. Trail mix 1 comprised soy nuts, raisins, pumpkin, and sunflower seeds. The overall acceptability of the developed snacks was also evaluated based on ethnicity, educational status, income level, and among children and women. The acceptance of soy rusk and nut/seed brittle was lower among children and panelists who earned below the poverty line. In comparison, the overall acceptance of soy cookies was higher among Blacks/Africans compared to Whites. However, there was no significant difference in the acceptability of most snacks. A possible reason for the indifference in acceptability among children and women is that children consume identical diets and have similar preferences as their mothers. Likewise, the fact that there were insignificant differences in the acceptability of most snacks based on income, ethnicity, and educational status may translate into higher acceptability among the target population in South Africa, irrespective of racial/ethnic background, income level, or academic status. The study results further showed that the panelists were 'slightly likely' to purchase nine of the ten snacks. Comparing purchase intent by ethnicity, income, and educational status, no significant differences in most snacks' purchase intent was observed. Similar to the purchase intent, the women in the study indicated they were slightly likely to prepare nine of the ten snacks and were indifferent about preparing trail mix 3.

The microbial analysis of the snacks indicated the microbial stability of all the snacks after four months of storage except the soy muffins. After one month of storage and microbial testing, the microbial load in the soy muffin sample was more than the acceptable limits. This finding is in line with previous shelf-life studies that have identified 8 to 14 days as the average shelf-life of muffins when stored in an airtight container and produced without additional preservatives (Jadhav et al., 2021; Mout & Bora, 2020).

Overall, nine of the snacks we developed were dry, shelf-stable, microbial-safe products after three months of storage. Previous studies have shown that similar dry and baked products are safe for consumption for at least three to four months when stored correctly in an airtight container (Honi et al., 2017; Nandhini. S et al., 2022). Given that shelf-life of food products is influenced by several factors, including organoleptic, physical, and chemical properties, it will be beneficial for future research and endeavour’s to expand on this study and assess the shelf-life of each of the developed snacks.

The soy snack development formed part of a Texas Tech University PhD student qualification. The study was completed, the thesis submitted, and the student graduated in May 2023.

In addition to the soy snacks, an additional goal was added to the project in 2022, namely: to meet the needs of consumers for plant-based meat products by developing an affordable, fresh soy-based, nutrient-rich (high-quality protein) mincemeat replacement, imitating the flavour, look and texture of 'animal' mincemeat. Three soy meat analogues were developed in 2023 and a preliminary tasting was conducted with the President of SAAFECS at UFS and teachers of BIGE in June 2023.

Next steps

- 2 manuscripts are currently being prepared about the development and sensory analyses of the soy-based snacks;

- Nutritional and sensory analyses, as well as shelf stable testing will be undertaken in the next phase;

- Commercialisation of the soy-based snacks into the informal market sector; and

- Acquisition of a soy cow at UFS to develop “dairy” soy products.

Nutrition education and soy consumption study

The objective of this part of the study was to sensitise parents and children about the health benefits of soy for human health and increased soy consumption to address food insecurity and malnutrition of school children in Ironsyde, Vaal region. A baseline survey for the nutrition education program was conducted during May 2022. During June, the nutrition education program was implemented, and soy and soy recipe books were distributed to the households. A refresher course was implemented, and follow-up measurements were taken in June 2023. Soy nuts were distributed to the parents for informal tasting at the nutrition education during June 2023. The soy nuts were very popular, specifically the chutney flavour.

In addition, the parents tasted the soy milk and soy yoghurt - produced from the soy cow - at the nutrition education program implementation and it was well accepted.

During November soy seeds were distributed to implement a soy garden at the Best is Good Enough Academy (BIGE) in Ironsyde. Unfortunately, the soy could not be harvested due to rabbits destroying the soy garden.

A generator and soy cow were installed, and training was provided by Henry Davies at the Best is Good Enough Academy in Ironsyde, Vaal region during March and May 2023, respectively.

During June 2023, researchers from UFS Department of Sustainable Food Systems and Development visited BIGE for a soy cow demonstration and to brainstorm the way forward for commercialisation.

The soy yoghurt was well accepted by and has been included in the menu of the learners at BIGE.

Next steps

- Data capturing, statistical analyses and manuscript preparation (nutrition education programme);
- Soy garden implementation at BIGE in November 2023;
- Commercialisation of the soy yoghurt into the informal market at Ironsyde;
- Calculating the contribution of soy to the total BIGE menu; and
- Long-term follow-up acceptability of the soy yoghurt and soy inclusions into the BIGE menu.

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

ESDF Team

Head Office

- Henry Davies
- Lizette Taljaard

Project Coordinators

- Gareth Alcock	Northern Natal
- Medi Nkosi	Okhahlamba
- Lwazi Mazwa	Eastern Cape
- Tshepiso Madigwa	Limpopo
- Sithembiso Mhlanga	Mpumalanga
- Sihle Miya	Southern Natal

Department of Agriculture, Land Reform and Rural Development - National Landcare Conservation Agriculture (CA) Farming Project

- Eden Social Development Foundation is part of this program and promotes soy planting that incorporates CA Farming Planting Practices.

- ESDF attended meetings and is part of the District Development Legacy Project implementation of the Soybean Project, phase two, in Mpumalanga.

- ESDF attended and was part of the Conservation Agriculture Exposure Visit and mechanisation training in Newcastle on the Terryson Farm.

Soybean Cultivar Trials (Eastern Cape)

ESDF and Mr Nxolisi Mtyobile (a crop scientist from the Department of Agriculture), in conjunction with Annelie de Beer and Lizette Bronkhorst from the Agricultural Research Council, planted plot trials for a second year. The trial was successful, and the data captured on the National Soybean Trail List.

Schools

ESDF where involved with the planting of Soy at three schools as part of their school Curriculum.

The schools:

- Dimanda High School, Ezixholiseni, Eastern Cape.
- Intumbani Primary School, Okhahlamba, KZN.
- Best is Good Enough Academy, De Deur, Vaaldriehoek, Gauteng.

Soy in Food

- Ezixholiseni, Eastern Cape

- Capricorn, Polokwane, Limpopo
  These two groups had Soy in Food demonstrations after receiving training during previous seasons.

- ESDF installed a SoyCow at the Best is Good Enough academy, De Deur, Vaaldriehoek, Gauteng. The school staff received training on how to produce Soy in Food products. The Soy Yoghurt and Okara biscuits are being distributed to the school children as part of the school nutrition program.

Farmersday

ESDF attended and was part of the Department of Agriculture's Farmers Day held in Southern KZN.

Okhahlamba Agriculture Show

ESDF and the Department of Agriculture organised an Agriculture Show for small scale and developing farmers. The show was hosted in Okhahlamba and was a resounding success. All role players are hoping to establish the show as an annual event.

Visits

The Oil and Protein Development Trust and the National Agriculture Council paid a visit to the ESDF headquarters.

ESDF presented a Soy in Food demonstration and made soy yoghurt, soy nuts and Okkara biscuits.

The group also visited various farmers involved in the ESDF project within the Okhahlamba area.

Planting

Thirteen Planting Training Workshops

KwaZulu-Natal:

Okhahlamba	19 Female & 74 Male Attendees
Newcastle	21 Female & 28 Male Attendees
Dannhauser	12 Female & 24 Male Attendees
Utrecht	13 Female & 22 Male Attendees

Southern KwaZulu-Natal:

Ubuhlebezwe	9 Female & 10 Male Attendees

Hammersdale	12 Female & 1 Male Attendees

Eastern Cape:

Lusikisiki	24 Female & 16 Male Attendees
Tsolo	27 Female & 25 Male Attendees
Nyandeni	37 Female & 29 Male Attendees
Port St Johns	6 Female & 5 Male Attendees

Mpumalanga:

Nkomazi	40 Female & 40 Male Attendees

Limpopo:

Mopani	6 Female & 16 Male Attendees
Marble Hall	19 Female & 33 Male Attendees

Total attendees trained:	**245 Females & 323 Males**

Oil & Protein Seeds Development Trust & Oilseeds Advisory Committee

Where	Application Ha	Raw Material Out Ha	Areas	Department of Agriculture Advisors	Farmers Involved M	Farmers Involved F	Yield Ton	Income R/c
KwaZulu Natal								
Okhahlamba: Farmers	200	275	15	-	18	6	291	R2 240 046,70
Okhahlamba: Departmen	300	352	116	9	136	95	262,25	R1 881 927,39
Estcourt	40	56	16	-	9	7	63,047	R505 086,61
Dannhauser	160	169	25	10	25	9	276,52	R2 205 666,50
Newcastle	485	495	67	17	121	47	278,74	R2 152 582,36
Utrecht	100	111	22	9	19	12	61,27	R488 490,94
Harry Gwala (New)	-	10	11	7	16	28	1,19	R3 936,36
Ixopo (New)	-	18,8	8	-	9	15	18,8	R48 508,08
Paul Pietersburg (New)	-	12	3	3	9	8	7,519	R59 303,66
Total:	1285	1554	284	56	363	227	1260,34	R9 585 548,60
Eastern Cape								
Qumbu		7	7	7	33	37	0,66	R3 719,58
Tsolo		9	8	8	25	30	0,876	R4 812,70
KSD		17	2	1	70	65	1,029	R0,00
Libode	150	16	10	5	18	32	1,254	R5 403,10
Ngqeleni		15	5	5	24	52	1,684	R10 859,06
Lusikisiki		8	2	1	26	47	2,278	R14 715,88
Port St Johns		10	7	6	15	12	0,996	R0,00
Total:		82	40	27	189	255	8,77	R39 510,32
Limpopo								
Capricorn		28	16	13	15	9	6,134	R18 913,93
Sekhukhune		10	3	1	3	-	0	R0,00
Vhembe	80	10	2	1	101	103	1,504	R10 600,31
Waterberg		25	11	5	6	5	0,473	R3 750,00
Mopani		10	4	3	8	16	0,176	R891,12
Total:		83	36	23	133	133	8,287	R34 155,36
Mpumalanga								
Tonga	80	80	25	8	44	53	17,687	R141 685,95
Total:	80	80	25	8	44	53	17,687	R141 685,95
GRAND TOTAL:	**1595**	**1799**	**385**	**114**	**729**	**668**	**1295,08**	**R9 800 900,23**

3.4.4 ADVANCED FARMER INPUT SUPPORT - INSURANCE, SOIL CORRECTION AND MENTORSHIP; Dr Ngcampalala, Grain SA

Overall number of Active Advanced farmers that received support with regard to Soil corrections, Insurance and Mentorship are 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 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.

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

During 2022/2023 season the Oilseeds Protein Development Trust and Oilseeds and Advisory Committee approved input grant funding assistance for the support of 18 developing farmers producing sunflower in the Free State and Northwest Province.

Objective of the project

The objective of the project was to enable farmers to successfully produce sunflower seed commercially and furthermore diversify by including sunflower as part of their production for the season.

Reason it what deemed the project was to be a success.

The farmers are participating under the FarmSol farmer development programme and farm in Free State and Northwest provinces. During 2022/2023 the farmers qualified for non-interest-bearing production loans from Siqalo Foods, including a guaranteed market for the sunflower, the sunflower seeds are delivered to CEOCO who receive the sunflower seed on behalf of Siqalo Foods.

The production loans provided by Siqalo were not sufficient to cover full sunflower production costs. The farmers therefore needed additional funding support of 2,3m to enable them to produce sunflower successfully.

Project duration

1 September 2022 - 30 August 2023.

Sectors in the oilseed industry that could benefit from the project.

The Oilseed Industry and the Agricultural Industry in general, specifically the supported developing farmers.

Name of other contributors in the project

FarmSol, Siqalo Foods, CEOCO, Unigrain, Developing Farmers.

Project outcome

Total of 910 tonnes, with an average of 1.02 tonnes per farmer of sunflower seed is expected to be delivered by 31 August 2023. Through the OPOT intervention profit increased from 3,4m to 5,7m, this is a 60% increase in the profitability of the farmers.

Research project 2: Groundnuts production

The Irrigation scheme in Taung is one of the oldest schemes in the country, it was established in 1939 and covers approximately 1054 hectares of land. The farmers are allocated 10 hectares each in a pivot covering 40 hectares. In the past due to limitations in finding and only relying on SAB for funding, the farmers could only produce Barley in winter and Maize during summer, the mono-cropping resulted in a decline in yields and high weed infestation/weed bank. During the 2022/2023 season, the Oilseeds Protein Development Trust and Oilseeds and Advisory Committee approved grant funding assistance for the support of 08 developing farmers to produce groundnuts in Taung, Northwest Province.

Objective of the project

The objective of the project was to enable farmers to successfully produce groundnuts, control weeds and build up their soils by including groundnuts in their crop production cycle.

Reason it what deemed the project was to be a success

The farmers are participating under the FarmSol farmer development program in Taung Northwest provinces. The Oilseed and Protein Development Trust and Oilseeds Advisory Committee made available R 1,9 million for production support which enabled the farmers to plant a total of 80 hectares. The groundnuts further serve as a good rotation crop in summer and planted in rotation with the Maize (funded by SAB) and Soya (funded by SACTA).

Secured offtake market was secured from SA peanuts, this market is of great advantage for farmers as is based between Hartswater and Taung. SA Peanuts recommended and supplied groundnuts seeds for planting (cultivar AKWA 60_70).

Project duration

1 September 2022 - 30 August 2023.

Sectors in the oilseed industry that could benefit from the project

The Oilseed Industry and the Agricultural Industry in general, specifically supported developing farmers.

Name of other contributors in the project

FarmSol, SA Peanuts, Developing Farmers.

Project outcome

The farmer achieved an average yield of 2,57 tonnes per hectare, and a total income of R 1 052 167 has been achieved. Low quality of the groundnuts was the biggest drawback, this could be attributed to disruptions in irrigation caused by load shedding. To ensure the continuity of the production of groundnuts, 50% of the income is to be paid directly to farmers and 50% carried over to the next season as an additional contribution towards input costs.

Research project 3 - mentorship

To truly commercialise developing farmers, provision of mentorship plays a critical and central role. The farmers need support to ensure that they do the right thing at the right time and there is skills transfer.

Objectives of the project

To support the farmers in this program me 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 duration

1 September 2022 to 30 August 2023.

Sectors in the oil seeds industry that could or should benefit from the project

The Oilseed Industry, developing farmers supported and the agricultural industry in general.

Names of other contributors to the project

FarmSol, SACTA, AB InBev.

Mentorship support

FarmSol boasts a professional, dedicated, and competent team, passionate about farmer development and farmer wellbeing. Direct mentorship and farmer support is provided as below for the supported farmers:

- Northwest Taung (Groundnuts) > Kgadiko Serage & Lebo Masiu
- Free State & Northwest (Sunflower)> Karabo Puswe, Barry Nel, Gift Lebuso & Emmanuel Mafokane.

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