PROTEIN RESEARCH FOUNDATION



2022-2023

RESEARCH REPORT

PROTEIN RESEARCH FOUNDATION

Vision

The PRF strives to make a significant contribution to the promotion of local production of protein on a sustainable basis, in order to satisfy the growing demand for protein for animal production purposes as well as the optimal utilisation thereof, which will lead to an increase in the standard of living of all people in the Republic of South Africa.

Mission

The PRF contributes to the realisation of its vision for the provision and utilisation of protein by means of the pro-active stimulation and funding of applicable purposeful research, as well as the promotion and implementation of such research results by means of technology transfer, in order to fulfil the increasing demand for protein as well as its optimal utilisation in the Republic of South Africa for animal nutrition.

The PRF subscribes to…….

- A balanced, objective approach, which is sensitive to the developmental needs of the RSA.
- A critical awareness of the latest developments regarding protein supply and utilisation.
- The promotion of cost-effective research.
- The dynamic promotion of the implementation of research results.
- The effective sustainable utilisation of natural agricultural resources.
- The reduction of foreign exchange payable for imports and creation of job opportunities by replacing imported protein as far as possible with locally produced protein.

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PROTEIN RESEARCH FOUNDATION
RESEARCH REPORT 2022-2023

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1. INTRODUCTION

During the 2022-2023 financial year the Board of Trustees once again succeeded in their efforts to achieve the objectives of the Trust as set out in the Trust Deed.

- Objectives of the Trust

The founding objectives and requirements of the Trust are to place the reserve funds earmarked for the financing of protein research, as provided for in Section 20(5) of the Agricultural Research Act of 1990, as well as all future donations provided for in Section 20(5)(c) of the Agricultural Research Act of 1990, in trust for research purposes to be allocated in the Republic of South Africa, as the Trustees may determine from time to time, for the purpose of research in either of the following fields:

(a) Protein Research

Research on protein sources destined for animal feed either of animal origin or from oilseeds and other protein rich plants.

(b) Oilcake Research

Research related specifically to the oilseed protein value chain.

1.1 Board of Trustees

The Trust is administered and managed by a Board of Trustees convened from various disciplines. During the 2022-2023 year the Board comprised of the following Trustees:

Mr AP Theron	-	Expert	:	Representative - Organised Agriculture - Producer of Protein Crops (Chairperson)
Dr E Briedenhann	-	Expert	:	Representative - Oilseeds Processors and Representative - Animal Feed Manufacturers (Vice-Chairperson)
Prof RM Gous	-	Expert	:	Discipline - Protein Consumers
Mr GT du T Keun	-	Expert at the discretion of the Board		
Prof FH Meyer	-	Expert	:	Discipline - Agricultural Economics

(i) General Overview

During the reporting period 1 March 2022 to 28 February 2023, the Trust met six (6) times. Two (2) of the meetings were combined with those of the Technology Committee.

During the period under review, R 5 217 119 was approved in respect of research projects, technology transfer and bursaries.

The trust fulfilled the duties of funding and managing research projects and technology transfer, which form part of the core business of the PRF as set out as objectives in the Trust Deed. Furthermore, facilitation of the Soybean Value chain discussions continued, which made an important contribution to the Soybean Industry.

(ii) Financial Overview

(a) Investment and Management of Trust Funds

Two (2) portfolio managers, Foord and Old Mutual Wealth, manage the PRF Trust funds.

The performance of the respective portfolio managers is monitored and reviewed constantly. Apart from regular discussions, the Fund Managers are requested to deliver a presentation to the Board of Trustees at least once annually.

(b) Audit

Ashton Chartered Accountants are currently charged with auditing the financial affairs of the PRF.

As in the past, the auditors once again issued an unqualified audit report. The report noted the efficient operation and management of the affairs of the PRF by all concerned.

Together with the auditors, the financial and administrative systems, and specifically the financial reporting systems, are reviewed and upgraded in order to ensure financial stability and corporate governance.

1.2 Executive Committee

During the reporting period 1 March 2022 to 28 February 2023, the Executive Committee met six (6) times.

The Executive Committee may be considered an extension of the Board and provides recommendations relating to policy matters. The committee is also responsible for financial and marketing matters.

The Executive Committee consisted of the following members:

Mr AP Theron	-	Chairperson, Chairperson of the Board
Dr E Briedenhann	-	Vice-Chairperson of the Board and Chairperson of the Technology Committee
Prof FH Meyer	-	Board Member

1.3 Technology Committee

During the reporting period 1 March 2022 to 28 February 2023, the Technology Committee met four (4) times. Two (2) of the meetings were combined meetings with those of the PRF Board.

The Technology Committee consisted of the following members:

- Dr E Briedenhann (Chairperson)
- Mr AP Theron
- Prof RM Gous
- Prof FH Meyer
- Dr J Dreyer (Co-opted Member)

The functions of the Technology Committee are as follows:

- The Technology Committee is one of four Board standing committees and reports directly to the Board.

- The Technology Committee is responsible for evaluating and selecting all research projects, promoting technology transfer, visiting researchers and research projects, identifying gaps and new topics related to research projects, and identifying new sources of supply and utilisation of protein for animal feeds.

1.4 Soybean Working Group

During the reporting period 1 March 2022 to 28 February 2023, the Soybean Working Group met four (4) times.

The functions of the Soybean Working Group involve the following:

- Discussion of industry matters in the interest and to the benefit of the Soybean industry.
- Identification of research projects and technology transfer to the benefit of the Soybean industry.

1.5 Canola Working Group

During the reporting period 1 March 2022 to 28 February 2023, the Canola Working Group met three (3) times.

The functions of the Canola Working Group involve the following:

- Discussion of industry matters in the interest and to the benefit of the Canola industry.
- Identification of research projects and technology transfer to the benefit of the Canola industry.

1.6 Canola Planning Committee

During the reporting period 1 March 2022 to 28 February 2023, the Canola Planning Committee met four (4) times.

The functions of the Canola Planning Committee involve the following:

- Discussion of industry matters and recommendations to the PRF committees as these relate to research, technology transfer, liaison and any other action required for the promotion of canola production.

1.7 Soybean Value Chain

During the reporting period 1 March 2022 to 28 February 2023, the Soybean Value Chain met three (3) times.

The PRF is responsible for the facilitation of these discussions. Various actions were identified that were to the benefit of the Soybean Industry.

2. DISCIPLINES REPRESENTED ON THE BOARD

In the Trust Deed provision is made for representatives from various disciplines which may include the following:

- Animal feed manufacturers' industry
- Oilseed crushing industry
- Fish meal manufacturers' industry and marine research
- Plant Production
- Organised Agriculture
- Agricultural Economics

3. LIST OF PROJECTS FINALISED DURING 2021-2022

Four (4) projects were finalised during the year, but the final reports are expected only in the first half of 2022.

3.1 **Dr E Briedenhann** - “Lupin”, Protein Research Foundation.

3.2 **Mr WF van Wyk** - “The influence of potassium on the growth and yield of soybeans”, Protein Research Foundation.

3.3 **Mr WF van Wyk** - “The use of cultivar practices in soybeans to avoid Sclerotinia infection”, Protein Research Foundation.

3.4 **Mr C Cumming** - “PRF Canola Yield Competition.”

4. PROJECTS FINANCED 2022-2023

4.1 CANOLA TECHNOLOGY TRANSFER; Mr C Cumming, Contractor, Protein Research Foundation

The information day planned for 2022 was presented in February 2022 at the Rũens College, Klipdale.

A total of 53 attendees were present and the event was concluded with a sumptuous lunch provided by the College personnel.

4.2 AN EVALUATION OF CONTINUOUS CASH CROP PRODUCTION (INCLUDING SMALL GRAINS, CANOLA AND OTHER ALTERNATIVE BROADLEAF CROPS) UNDER CONSERVATION AGRICULTURE PRINCIPLES ON THE HIGH POTENTIAL SOILS OF THE RIVERSDALE FLATS; Dr JA Strauss and W Langenhoven, 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 - Bitter lupin SSL10 was planted 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 lupin trial.

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 showed a positive gross margin above directly allocated production.

4.3 PROJECTED PROTEIN REQUIREMENTS FOR ANIMAL CONSUMPTION IN SOUTH AFRICA: D Strydom and W de Jager, University of the Free State, E Briedenhann, Protein Research Foundation

This is an annual project where the protein requirements are forecast and documented. The APR model uses its own calculations in collaboration with BFAP data. The model is currently (2022) up to date. However, there is some need for a review by a nutritionist to ensure that the min/max bounds in the model are still relevant. The 2023 year will be completed before the end of January 2024.

4.4 INCOME AND COST BUDGETS FOR SUMMER AND WINTER CROPS IN SOUTH AFRICA; 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-term 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 the Table 1.

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

Farm-level modelling

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

Table 1: BFAP existing network of prototype farms

Summer Grains	Winter Grains	Oilseeds	Small-scale	Sugarcane	Potatoes	Horticulture	Pig Network
Western Free State: maize	Overberg: Wheat	Eastern Free State: Soybeans	KwaZulu-Natal: Traditional producers	KwaZulu-Natal: Northern Coastal Dryland	Eastern Free State: Dryland	Western Cape: Apples	Western Cape integrated farm
Northern Free State: maize	Overberg: Barley	Eastern Free State: Sunflower	KwaZulu-Natal: Grain Developmen t 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	
Mpumalang a: maize (budgets)	Swartland: Wheat, barley & canola: 2019	Mpumalang a: 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.

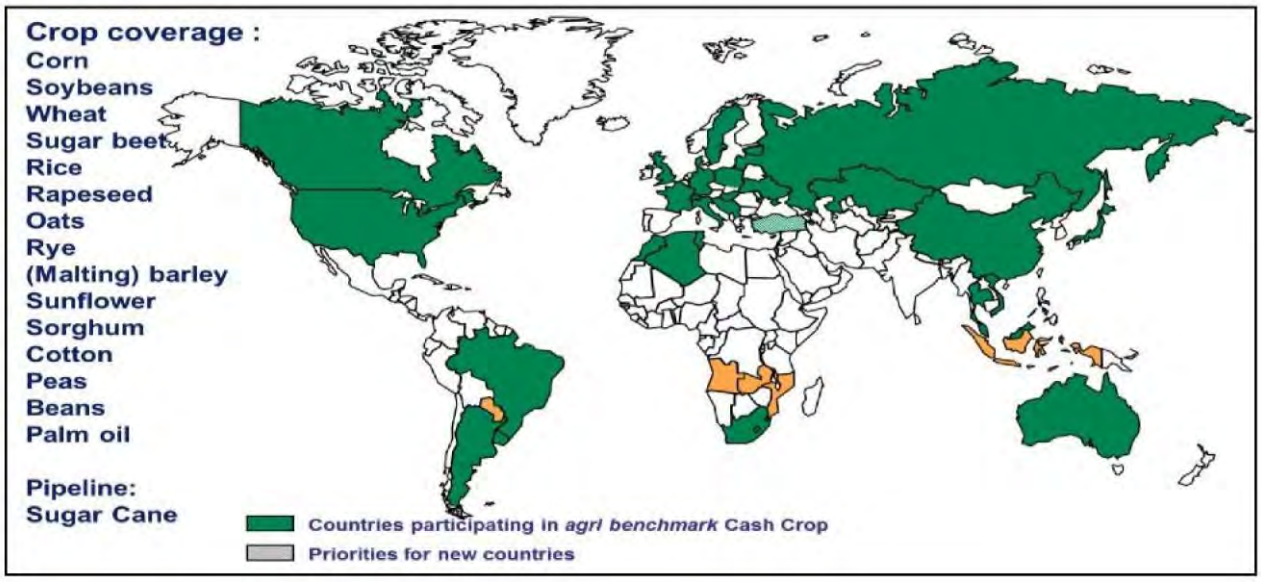


Figure 1: agri benchmark cash crop network

Objectives & key deliverables:

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

The main objective of this collaboration and project is to consolidate these efforts and 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 to refine 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 agribusinesses. 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

4.5 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; 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: Three (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 access the trial. In one half of the trial, plant density was kept constant at a planted 250 000 plants/ha while row width decreased from 1.5 m at the outside of the circle to 30 cm inside the circle. See Fig 1 below.

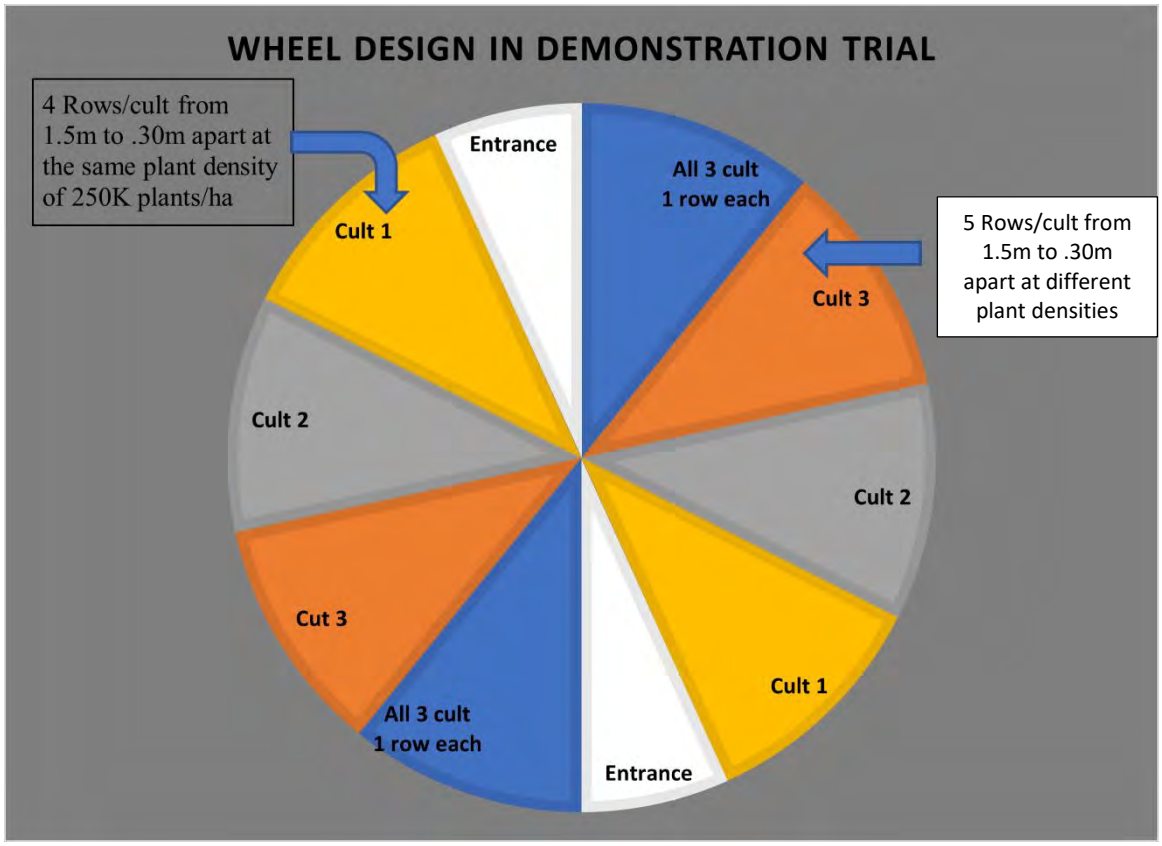


FIG 1. The wheel design which was used to compare different parameters and yield of 3 cultivars at different row widths and plant densities.

The distance between plants in the other half of the demonstration trial remained constant at 8 cm resulting in 87 719 plants/ha in 1.425 m rows and 308 025 plants/ha in 0.405 m 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 m was unplanted to enable one to move from one side of the wheel to the other by using the two unplanted entrances. The rows were 8 m long but only 7 m were harvested as 7 different treatments because the row width changed from 1.5 m at the outside to 0.3 m at 1 m from the centre. See the Table below for the differences in row width for every 1 m 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 – 135 cm	1.425 m
T2	135 – 115 cm	1.25 m
T3	115 – 104 cm	1.095 m
T4	104 – 85 cm	0.945 m
T5	85 – 71 cm	0.78 m
T6	71 – 51 cm	0.61 m
T7	51 – 30 cm	0.405 m

Soybeans were harvested, then threshed, after which 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 large 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)

On one side of the circle, these three 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 that fell from Nov to Dec. Average yield was approximately 2.4 ton/ha for MG4 and 2.5 ton/ha for MG5. The best yields, of 4132, 3891 and 3703 kg/ha were achieved with PAN 1644 R at plant densities of 224 000, 234 000 and 233 000 plants /ha, respectively. The row widths at these plant densities were 78, 61 and 94.5 cm, respectively.

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

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

- **<u>Additional preliminary research with different treatments</u>:**
  - 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 – resulting in a density of 240 000 plants/ha;
- Application of Spoor and Boor on the leaves of soybeans in 45 cm rows at R2 (only micro-elements). CULTIVAR - PAN 1521;
- Application of product of Rolfes on the leaves of soybeans in 45 cm rows at dosages 0.1 x dosage and 2.0 x dosage on Cultivar PAN 1644 R and application at 1.0 x dosage on Cultivar DM 5953 R;
- Two controls in 45 cm 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 300 kg/ha on DM 5953;
- Application of Ammonium Sulphate at rates of 0, 100 and 200 kg/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 Kunsmis) 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 yield was on 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 was treatment 4 (Rolfes at single dosage on PAN 1644 R with 4833 kg//ha).

4.6 RESEARCH ON SCLEROTINIA WITH EMPHASIS ON CULTIVATION PRACTICES AND TREATMENT WITH BIOLOGICAL PRODUCTS TO REDUCE ITS OCCURRENCE IN SOYBEAN; WF van Wyk, PRF Contractor

- **TRIALS ON FARMS**
- **SCLEROTINIA TRIALS**

Planting of 2 trials at Wonderfontein and Stoffberg.

a. Ploughed trial - Stoffberg

A section of 50 m to 100 m in length and at least 40 m wide was ploughed in a chosen field in August/September at a depth of at least 25 cm. A reversed harrow was used to prepare the seed bed without disturbing the soil. Only the 20 m at the centre of the ploughed soil was used for data collection 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 out-yielded the control by 500 kg/ha. The control yielded 3000 kg/ha while that of the treatment was 3500 kg/ha. Possible reasons for this outcome are better drainage and less compaction of 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 sclerotinia was first observed. A second application followed two weeks later, and although the sclerotinia incidence was lower in the sprayed section, yield was only 180 kg/ha higher than the control, of 3124 kg/ha.

4.7 CULTIVAR EVALUATION OF SOYBEANS IN THE WESTERN DRY LAND PRODUCTION AREA OF SOUTH AFRICA; 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 has ever experienced. This is due to good rainfall and better cultivars. The new Intacta cultivars were some of the best performers this past season. The number of hectares planted in the North West jumped from 100 000 to 155 000 due to economic circumstances and better adapted cultivars available 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. Twelve new cultivars were included in the trial which consisted 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 using 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 4559 kg/ha. The cultivar with the highest yield was Y 657 (MG 6.5) with 5506 kg/ha and the cultivar with the lowest yield was RA 4918 R (MG 4.9) with 3607 kg/ha.

The trial at Schweizer Reneke (PD 2) had a mean yield of 4350 kg/ha. The cultivar with the highest yield was DM 59R03 (MG 6.0) with 5116 kg/ha and the cultivar with the lowest yield was DM 6.8 i RR (MG 6.8) with 3450 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 3740 kg/ha. Die cultivar with the highest yield was RA 5722 BR (MG 5.7) with 4807 kg/ha and the cultivar with the lowest yield was DM 53154 RSF (MG 5.1) with 2960 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 2690 kg/ha. The cultivar with the highest yield was DM 6163 RSF IPRO (MG 6.7) with 4004 kg/ha and the cultivar with the lowest yield was PAN 1644 R (MG 6.7) with 2034 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 5521 kg/ha. The cultivar with the highest yield was DM 53154 RSF (MG 5.1) with 6580 kg/ha and the cultivar with the lowest yield was PAN 1555 R (MG 5.7) with 4183 kg/ha. This trial also had a lot of rain but it was spread more evenly.

4.8 DATA-INTENSIVE FARM MANAGEMENT (DIFM) PROJECT IN SOUTH AFRICA; M Delport, BFAP

The latest season (2022/23) has just been concluded in the summer region featuring 4x Soybean trials and 5x Maize trials on 5 farms. These farmers have been cooperating with this project since 2019.

In addition, two farms in the Western Cape winter production region have been added to the program: 1x Wheat and 1x Canola trial fields near Caledon in the Southern Cape and 2x Wheat fields in the Swartland region.

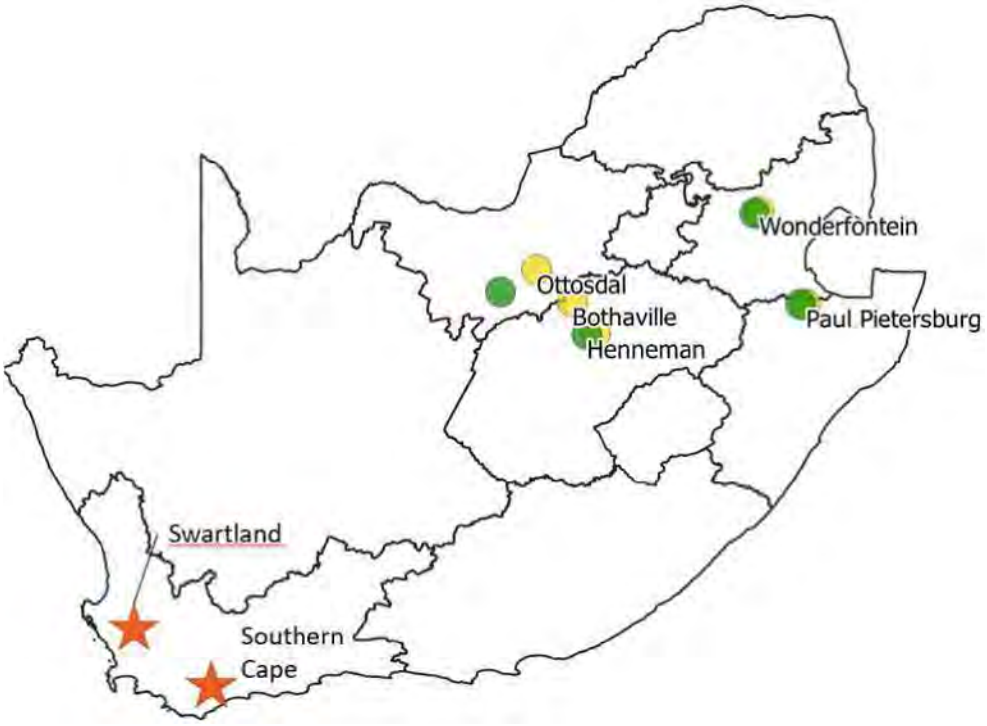


Figure 1: DIFM trial locations

Results Summary

Results from the DIFM pilot phase are presented below.

The maize trial results presented in Table 1 were collated from various farms for the latest season. Note, that in most of these locations, the four pilot project seasons were exceptional wet rainfall and the timing thereof. They can all be classified as above-average wet, and good yielding seasons. This is likely a key driver for the recommendations for high optimal seeding rates and high fertilizer rates.

In all the trials it was found that a higher (sometimes the maximum included in the trial treatments) seeding rate and fertilizer rate would be recommended as a profit-maximising flat rate application. With profit differences/impact of between R1692 and R3749 per hectare.

Table 1: Summary of Maize Trial Results

Province	Production region	Planting Date	Seeding rate (plants per ha)		Fertilizer rate (kg/ha)		Profit difference (R/ha)
			Status quo	Optimal	Status quo	Optimal[1]	
KwaZulu-Natal	Paulpietersburg	09-11-2022	65 000				
Free State	Henneman	22-10-2022	18 000				
Province	**Production region**	**Planting Date**	**Seeding rate (plants per ha)**		**Fertilizer rate (kg/ha)**		**Profit difference (R/ha)**
			Status quo	**Optimal**	**Status quo**	**Optimal[1]**	
KwaZulu-Natal	Paulpietersburg	09-11-2022	65 000				
Free State	Henneman	22-10-2022	18 000				
Free State	Henneman	10-2022	25 000		***Very poor execution, analysis to be completed last.***		
Mpumalanga	Wonderfontein	10-11-2022	52 000				
North West	Ottosdal	29-11-2022	25 000				

1 Optimal is defined as profit maximizing, given the in-season input and output prices.

Mostly, the soybean trials focus on seeding rate treatments with only a few farmers adding fertilizer variations to the trial. The results vary significantly and in the Wonderfontein and Paulpietersburg cases, multiple profit-optimisation rates are observed from the fitted yield response curve leading to mixed conclusions. This shows that the timing of rainfall and the accompanying farm and crop management decisions can impact the outcomes severely.

Again, one needs to take into account, that these findings are presented for exceptionally wet seasons and that these trials need to be repeated for average and drier conditions as well in order to make recommendations that take climate risk into account.

Table 2: Summary of soybean trial results

Province	Production region	Planting Date	Seeding rate (plants per ha)		Fertilizer rate (kg/ha)	
			Status quo	Optimal	Status quo	Optimal[1]
Free State	Henneman	22-10-2022	250 000	250 000	Urea: 0	66
					Superphosphate: 120	0 (min)
North West	Schweizer-Reneke	24-10-2022	300 000	270 000	NA	NA
KwaZulu-Natal	Paulpietersburg	15-11-2022	285 000	240 000	NA	NA
Mpumalanga	Wonderfontein	19-11-2022	280 000			

1 Optimal is defined as profit maximizing, given the in-season input and output prices.

The analysis for the 2022/2023 trial data was still in progress at the time of writing and can be reported on more completely in a few months' time.

The wheat and canola trials were successfully planted during May and June 2023. However, the canola trial site experienced extremely wet conditions and resulting in severe waterlogging, which will likely affect the data and trial quality. The wheat trials are growing well, and further analysis can only commence during harvesting from October 2023 onwards.

In April 2023, a PhD (Agronomy) candidate at Stellenbosch University was appointed to work on the trial operations part-time, while her topic is centered on the DIFM trial data, evaluating how precision agriculture can inform on-farm crop management practices and demonstrating the value of the trial data, in conjunction with soil chemical and physical analyses. Three academic papers are planned throughout the course of her studies.

Timeframe for the project: 2023 - 2025

Table 1 represents the proposed timeline for project deliverables. The project will commence upon signature of the service level agreement. The standard payment terms for BFAP are 50% upon signature and 50% upon delivery of the final project output.

Table 1: Proposed Project Timeline (Activities for each year: 2022/2023 – 2024/2025)

	Action	Region	Sep-Oct	Nov - Dec	Jan - Feb	Mar - Apr	May - Jun	Jul - Aug
Activity 1: Setting up of field trails	University of Illinois & SA team	Summer						
		Winter						
Activity 2: Planting of field trials	SA team	Summer						
		Winter						
Activity 3: In-season monitoring	SA team	Summer						
		Winter						
Activity 4: Capturing and processing of yield data	University of Illinois & SA team	Summer						
		Winter						
Activity 5: Developing and compiling Research Outputs	SA team	Summer						
		Winter						
Activity 6: Reporting to farmers and clients	SA team	Summer						
		Winter						

4.9 ESTABLISHING THE CLIMATIC FACTORS FOR MAXIMUM CANOLA YIELD (GENETIC YIELD POTENTIAL) AND MODELLING CANOLA YIELD AND SPATIAL SUITABILITY UNDER PRESENT AND FUTURE CLIMATE CONDITIONS IN THE WESTERN CAPE; SJE Midgley, Western Cape Department of Agriculture

Progress is reported here for 2023, the first official year of the research project. However, project preparation and student enrolment were begun in 2022, and this report covers both years.

The PhD Agric student, Mr AA le Roux, successfully developed and presented his project proposal to Stellenbosch University and the Western Cape Department of Agriculture Research Project Committee. The project is now formally registered at both institutions.

A systematic literature review on the effects of climate change on canola growth, phenology, production and oilseed yield was conducted. A draft review article was written for submission to an international peer-reviewed journal in 2023.

The phytotron at Stellenbosch University was prepared for the first controlled environment canola pot trial. Systems for irrigation/fertigation, lighting and automated climate and soil water content monitoring were installed. The first trial was initiated in July 2023, studying six cultivars representing three cultivar types and two growing season lengths. Constant factors are day/night light regime and current temperature regime at Langgewens Research Farm, and current atmospheric CO_2 concentration.

Langgewens canola trial production and weather data for 2011-2022 were collected and sorted, ready for statistical analysis.

Mr le Roux attended an online course on “Introduction to APSIM” (Agricultural Production Systems Simulator Model) which he will use for the crop-climate modelling.

Outputs included one poster presentation at a national scientific conference, two oral presentations at industry days, and participation in a panel discussion at a climate change and agriculture youth convention. One media article showcased the project and student.

4.10 IS ADDITIONAL NITROGEN BENEFICIAL TO SOYBEANS (*GLYCINE MAX.* L) IN DIFFERENT AGRO-ECOLOGIES OF THE EASTERN HIGHVELD?;

B Nkutha,

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 in 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 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 was 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. These data are 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 through 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 was 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 to conduct 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.

4.11 PRF WEBSITE; M du Preez and Y Papadimitropoulos, Protein Research Foundation and Tigme.com

The main tasks performed during 2022/2023 were to update existing and add new website content. On 28 February 2023 the Protein Research Foundation website hosted a total of 1,313 static pages (excluding dynamically created pages, for example the Research Database section).

Google analytics 4

Google has announced that the current Universal Analytics (UA) will stop processing data starting 1 July 2023. It will be replaced with the next generation Google Analytics 4, or GA4 for short, which is built with AI-powered solutions such as behavioural and conversion modelling. New features include better integration with Google products, a customizable interface, mobile app tracking, event-based tracking, cookie-less tracking, and machine learning capabilities. Since GA4 utilises a different data model than UA, it will not be possible to transfer historical statistics to the new GA4 property. To prevent statistical losses, a new GA4 property has been running concurrently with the existing UA property since December 2022.

ICB Calculator App

During 2021/2022 the online browser web app received approximately 169 launch requests and the Google Play Store statistics show approximately 16 active installations. *(The number of downloads the desktop received cannot be calculated at this stage)*

Website Visitor Statistics

Reporting Year	Unique Visitors *Raw values**	Unique Visitors *Google values*		
		Visitors	*Pages*	*Pages per visit*
2004	1 691			
2005	3 285			
2006	4 552			
2007	5 404	3 041	10 838	2.79
2008	11 104	5 274	18 829	2.82
2009	10 194	6 610	27 341	3.18
2010	11 812	6 054	23 347	2.98
2011	12 357	5 511	24 258	3.29
2012	16 306	6 909	28 206	3.12
2013	54 739	8 767	34 284	2.97
2014	54 590	10 189	39 363	3.03
2015	35 653	12 519	45078	3.60
2016	31 674	8 733	53 811	4.47
2017	47 373	6 901	20 514	2.18
2018	38 049	10 041	24 873	1.90
2019	45 787	10 444	23 628	1.78
2020	27 317	9 632	24 169	1.93
2021	25 905	12 096	24 176	1.66
2022	**29 278**	**13 074**	**22 570**	**1.52**

Google values show a decrease in page views and an increase in unique visitors. Page views decreased by approximately 1606 during the year. The most page views came from the following pages in order of percentage share:

- Home page: 17.5%
- Soybean Categorised Projects Index: 3.6%
- Cassava characteristics and utilisation: 2.4%
- Interesting facts about soybeans: 2.3%
- Interesting facts and information snippets about canola: 2.1%

YouTube visitor statistics

Reporting Year	YouTube statistics		
	Views	*Watch time (hours)*	*Subscriber gain*
2014	611	28	+2
2015	1 900	74	+4
2016	8 400	256	+21
2017	23 000	568	+78
2018	35 000	716	+195
2019	27 900	660	+151
2020	27 600	670	+163
2021	19 400	570	+161
2022	**29 200**	**916**	**+247**

The Protein Research Foundation's YouTube channel has grown to almost 904 subscribers by the end of 2022.

The most watched video:

- Soybean Cultivation: 01 Introduction - Wessel van Wyk: 11,400 views
- Soybean Cultivation: 09 Soil cultivation and seedbed preparation - Wessel van Wyk: 2,194 Views

5. STUDY GRANTS AND BURSARIES

The PRF bursary scheme was approved in 1994 and the first bursary for postgraduate studies was awarded for the 1995 academic year. We are proud to look back on a period of 27 years during which 89 bursaries were awarded to deserving candidates for Masters' and Doctorate studies. The aim of the bursary scheme is to train deserving candidates in the scientific method to allow them to contribute to high quality scientific research after completing their studies. This includes, in particular, research aimed at promoting the production of protein for animal consumption.

Students are also encouraged to publish their research results in scientific journals, popular magazines or both. Management summaries of theses and manuscripts are published on the PRF website and database.

Bursaries for Master's studies are awarded for a period of two years and three years in the case of Doctorate studies. Bursaries awarded for the current year were approved by the Technology Committee and were the following:

5.1 MSc Studies

5.1.1 **Mr L Matthews** (Second application). "Effects of livestock integration into cropping systems on productivity of canola and the cropping system's global warming potential", University of Stellenbosch.

5.1.2 **Ms M Du Plessis** (First application). "The effect of gypsum form on soil amelioration", University of Stellenbosch.

5.1.3 **Mr AB Folscher** (First application) "Investigating pathways of infection of Leptosphaeria spp. causing blackleg of canola in the Western Cape", University of Stellenbosch.

5.2 PhD Studies

5.2.1 **Ms HM Screuder** (Second application). “Characterisation and management of Leptosphaeria spp. causing blackleg of canola in the Western Cape”, University of Stellenbosch.

5.3 Completed theses received

During the year under review, the following theses were received from bursary recipients who had successfully completed their studies.

5.3.1 **Ms IR Crouse** - “Nitrogen fertilizer management strategies for canola (Brassica napus L.) under conservation agricultural practices in South Africa”.

5.3.2 **Mr DDV Lötter** - “Seed viability versus vigour of canola Brassica napus L.) cultivars in South Africa and the impact on establishment.

6. ACHIEVEMENT AWARDS TO PROMOTE THE PRF VISION AND MISSION

Each year the PRF recognises individuals for their special contributions in support of the vision and mission of the PRF.

Awards are categorised as follows:

- Best Doctoral thesis;
- Best Masters thesis;
- Best article published in a scientific journal;
- An individual or organisation that has made an exceptional contribution in promoting the vision and mission of the PRF; and
- A Board Member who has contributed significantly in promoting, over a period of time, the activities of the PRF.

No awards were made during the year.

7. CONCLUSION

It is with true gratitude that the PRF presents this research report. The results achieved fall within the requirements and objectives set by the PRF. This requires recognition of a large number of institutions and individuals.

The success is based on the hard work and dedication of PRF Board Members and staff, but definitely also the work done by co-workers and contractors. We also express unqualified appreciation to local and international co-workers, researchers and institutions, the press, fund managers, auditors, lawyers and webmasters. 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.

ANDRIES P THERON
CHAIRPERSON

ANNEXURES

I LIST OF APPROVED PROJECTS IN 2020-2022

Latest approved new and continued research projects (proteinresearch.net)

II PRF STRUCTURES

https://www.proteinresearch.net/index.php?page=about-us

III LIST OF BURSARY APPLICATIONS: 1995 - 2022

Bursaries awarded since 1995

IV LIST OF RESEARCH PROJECTS: 1976 - 2022

Research projects since 1976-2021