PROTEIN RESEARCH FOUNDATION



2018-2019

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 2018-2019

TABLE OF CONTENTS

1. INTRODUCTION 4

2. DISCIPLINES REPRESENTED ON THE BOARD 9

3. LIST OF PROJECTS FINALISED DURING 2017-2018 11

4. PROJECTS FINANCED 2018-2019 12

5. STUDY GRANTS AND BURSARIES 45

6. ACHIEVEMENT AWARDS TO PROMOTE THE PRF VISION AND MISSION 46

7. CONCLUSION 47

ANNEXURES 48

I LIST OF APPROVED PROJECTS IN 2018-2019 48

II SHORT- AND MEDIUM-TERM DEMAND AND USAGE OF FISHMEAL AND OILCAKE 48

III PRF STRUCTURES 48

IV LIST OF BURSARY APPLICATIONS: 1995 - 2019 48

V LIST OF RESEARCH PROJECTS: 1976 - 2019 48

1. INTRODUCTION

During the 2018-2019 financial year the Board of Trustees once again succeeded in their efforts to achieve the Trust's objectives 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 2018-2019 year the Board comprised 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)
Mr GJH Scholtemeijer	-	Expert at the discretion of the Board		
Dr J de Kock	-	Expert	:	Discipline - Plant Production
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 2018 to 28 February 2019, the Trust met six (6) times. Two (2) of the meetings were combined with those of the Technology Committee.

During the period under review, R6 288 581 was approved in respect of research projects, technology transfer and bursaries.

Apart from funding and management of research projects and technology transfer, which form part of the core business of the PRF as set out as objectives in the Trust Deed, much time was spent in reorganising the structure of the Foundation to streamline its work and to introduce measures to limit unnecessary expenditure on allowances and remuneration.

Some of the most important issues were:

- To combine the Executive, Finance and Marketing Committees into a single entity known as the Executive Committee;



- To standardise the reimbursive allowances and introduce daily allowances and honoraria to better manage the finances and generate savings;

- To reduce the number of Trustees on the Board of Trustees to five;

- To address the bursary scheme and make provision for a prestige bursary; and

- To embark on an image-building exercise.

(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 are monitored and reviewed constantly. Apart from regular discussions, the Fund Managers are requested to deliver a presentation to the Board of Trustees at least annually.

(b) Audit

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

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

1.2 Executive Committee

During the reporting period 1 March 2018 to 28 February 2019, 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 2018 to 28 February 2019, 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
- Mr GJH Scholtemeijer
- Dr J de Kock
- Prof RM Gous
- Prof A Agenbag
- Dr J Dreyer

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 relating 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 2018 to 28 February 2019, the Soybean Working Group met three (3) times. Meetings of the Working group were combined with the meetings of the Sunflower, Soybean and Soyfood Forums.

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 2018 to 28 February 2019, 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 2018 to 28 February 2019, the Canola Planning Committee met five (5) times.

The Canola Planning Committee consisted of the following members:

- Mr AP Theron (Chairman)
- Dr E Briedenhann
- Mr C Cumming
- Prof GA Agenbag

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.

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

(a) Protein consumers

(i) South African Poultry Association (SAPA)

The Poultry Industry had to weather a very bad year, with imports of broilers and mechanically deboned meat continuing to plague the broiler industry, and with avian influenza infections necessitating the culling of 4,7 million laying hens resulting in shortages of table eggs and the threat of imported eggs taking over this industry also.

SAPA has been split into two independent organisations, each with its own board and general manager. The general manager of the Broiler Organisation is Izaak Breitenbach, and of the Egg Organisation, Mogala Mamabolo. AVI Africa was not held this year, but will be held in 2020 and every second year thereafter. In the alternate years the AGM's of the two organisations will be regionalised.

Total production of poultry meat for 2018 was 1,748 million tons, 96% of which was from commercial broiler production. The gross value of primary agricultural production from poultry meat was R48 billion, an annual increase of 8,9%. The average feed price increased by 2,3% and the producer price by 4,7%.

Annual poultry imports totalled 566 210 tonnes, an increase of 9 333 tons. Of this, 95% represented chicken imports. This amounts to 32% of domestic poultry production, down from 34% in 2007. About 13% of these imports were from the EU, whilst Brazil (46%) and the USA (28%) contributed the bulk of imports of frozen bone-in portions into South Africa.

Egg prices increased by 32% in the first quarter of 2018, compared with the same time the previous year, as a result of the devastating outbreak of avian influenza. Added to the burden confronting egg producers was the severe drought that was experienced in the Western Cape during the year. Farmers have largely repopulated their facilities and the national flock is back to a total of about 24 million hens.

(ii) South African Pork Producers' Association (SAPPA)

The pork industry in South Africa was badly affected by an outbreak of Listeriosis which caused the pork price to drop by 30 to 40%. About 50% of pork sold in the country is used for processed meats and this is the sector that was hit by the outbreak, leading to more pigs being sold on the fresh meat market, contributing to the drop in price.

3. LIST OF PROJECTS FINALISED DURING 2017-2018

Five (5) projects were finalised during the year, but the final reports are expected only in the first half of 2019.

3.1 **Dr KS Yobo** "Studies on *Lecanicillium muscarium* as a microparasite of the soybean rust fungus, *Phakopsora pachyrhizi,* and its use as a biocontrol agent against soybean rust", University of KwaZulu-Natal

3.2 **Prof GA Agenbag** "Chemical manipulation of vegetative growth, reproductive development and grain yield in canola", University of Stellenbosch

3.3 **Prof GA Agenbag** "Nitrogen topdressings in canola: time of application and rates", University of Stellenbosch

3.4 **Dr N Goosen** "Development and evaluation of protein and phosphorous feed ingredients from fish processing by-products", University of Stellenbosch

3.5 **Drs YT Tewoldemedhin and SC Lamprecht** "Management strategies for soilborne soybean diseases in South Africa", ARC Research Institute for Plant Protection

4. PROJECTS FINANCED 2018-2019

4.1 GRAIN YIELD COMPETITION FOR CANOLA 2018; C Cumming, Contractor, Protein Research Foundation

Due to more favourable climatic conditions in April and May in the Swartland most canola was planted in moist soil. This was a marked improvement on the previous two seasons, where first seasonal rains only fell later. Above average rain was measured in June, resulting in good wetting of the sub-soil. Although rainfall for July, August and September was slightly below average, the lower than average temperatures experienced was favourable for canola production.

This all resulted in above average yields in most of the Swartland with yields in excess of 3 ton/ha being realised for the first time in the yield competition. The competition winner, Melt van der Westhuizen, Moorreesburg district, harvested 3,437 ton/ha average over 34 hectares with the cultivar Diamond.

Two other contestants, Koos Blanckenberg from Klipheuwel and Sakkie Rust from Tulbagh also had yields of over 3 ton/ha. The average yield of the 15 contestants from the Swartland was 2,893 ton/ha.

The Southern Cape had very little summer rain and only received the long term average rain in March. April and May were relatively dry and early indications were that an unfavourable season was on the cards. For this reason, only five (5) contestants entered for the canola competition in the Southern Cape. June, July and August received near average rainfall and good rains fell in September. Coupled with this, temperatures remained below average for August and September, resulting in a remarkable recovery of the canola generally. The winner in the Southern Cape for the third year in a row, Pieter Beukes from Caledon, averaged 2,96 ton/ha. Four of the five contestants averaged over 2 tons/ha with an average yield for the five (5) Southern Cape contestants of 2,49 ton/ha despite an unfavourable first half of the season.

4.2 CANOLA TECHNOLOGY TRANSFER 2018; C Cumming, Contractor, Protein Research Foundation

The Protein Research Foundation (PRF) recognises the importance of empowering their partners in the latest and most important technology regarding canola production so as to convey uniform and meaningful information to canola producers. These partners include agri-business representatives (co-op technical personnel, agro-chemical agents, seed and fertiliser representatives and Department of Agriculture personnel). For this reason canola information days are organised annually by the PRF. At the end of February 2019 the fifth annual information day was presented in Moorreesburg. Attendees requested that canola producers, especially newer entrants to canola production, be allowed to attend the day. In total sixty one (61) personnel and twenty five (25) canola producers attended the day.

Subjects covered included cultivar choices, planting techniques, economy of crop rotation and correct determination of harvest timing. Herbicide residue problems, projections for oilseed futures as well as bee friendly production practices were also covered.

4.3 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; JA Strauss and W Langenhoven, Western Cape Department of Agriculture

2018 was the 7th year of production on the new trial. Six cash crop systems were 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 2018 were followed and the integrity of the trial layout was upheld.

Riversdale received very little summer rainfall, which resulted in a very dry start to the 2017 production season. Only 65mm fell from January to the end of April. In 2017 a new weather station was installed at the research site which is managed by the Department of Agriculture. A total of 128mm was received from April to the end of September.

Wheat production - SST0127 was planted at Riversdale at 65 kg/ha. A total of 38 kg N/ha was applied to each plot (8kg N/ha at planting and 30kg N/ha top-dressing). Wheat yields at Riversdale averaged 1885ha. This was 441 kg/ha more than in 2017.

Canola production - Diamond was planted at Riversdale at 3,5 kg/ha. A total of 38 kg N/ha was applied to each plot (8kg N/ha at planting and 30kg N/ha top-dressing). Canola yields at Riversdale averaged 1662 kg/ha with all plots showing oil yield of over 40%.

Barley production - Hessekwa was planted at Riversdale at 65 kg/ha. Barley yields at Riversdale averaged 2515 kg/ha. This average yield was 1304 kg/ha more than in 2017. All plots were classified as malting grade.

Lupin production - A bitter lupine mixture was planted at a rate of 100 kg/ha. No lupine plots were harvested due to poor germination and weed problems in the very low rainfall year.

Cover crops - Saia oats and field peas were planted at Riversdale at 25 kg/ha and 80kg/ha, respectively. No other input cost was incurred during the season except the herbicide cost to kill the cover crop following the information day.

Economics - Although 2018 proved to be a poor production year, all systems tested show a positive gross margin above directly allocated production costs.

4.4 PERFORMANCE OF A DUAL DISC AND TINE PLANTER, SOIL QUALITY, RESIDUE MANAGEMENT AND RATE OF NITROGEN PLACEMENT WITH SEED FOR CANOLA PRODUCTION; PA Swanepoel, PJG le Roux and GA Agenbag, University of Stellenbosch

Handling crop residue during plant operations is a challenge to conservation agriculture (CA) farmers worldwide. It remains unclear which tools are most effective in which conditions. Canola *(Brassica napus L.)*, an oilseed crop widely used in rotation with cereals, is particularly sensitive to seedbed conditions, and thus may be influenced by residue loads and the choice of seed-drill openers. To identify optimal planting practices, this study compared the performance of disc and tine openers on canola establishment, growth, and yield under differing residue loads in a Mediterranean-type climate region. Soil disturbance caused by disc and tine openers was evaluated to assess their effect on seedbed conditions; and the interacting effects of the openers with different residue loads were investigated. Tine openers and low crop residue loads resulted in the best ($P>0.05$) canola establishment. However, canola at reduced plant populations compensate in both biomass and gain yield, so that no yield differences resulted from different opener types, and only small yield differences occurred between residue loads ($P>0.05$).

Seed-drills are used in no-tillage systems to place seed directly in soil. Fertilisers are commonly placed in various regions of the seed-furrow, in a single pass with seeding. Various furrow-openers exist, all with unique seed and fertiliser placement characteristics, particularly positioning of fertiliser in relation to the position of the seed. Seedling damage may occur if seed and fertiliser placement is not appropriate for the particular crop. Canola (*Brassica napus*) seed is small, resulting in seedlings susceptible to injury by fertilisers. A study was conducted to evaluate the effect of in-row nitrogen placement with a seed-drill fitted with single and double chute tine openers, and disc openers. The study was carried out in a Mediterranean-type climate region in South Africa over two years. Single and double chute tine openers and disc openers were evaluated in terms of their influence on fertiliser placement in relation to seed. A control treatment was included where no N was placed with seed in the row, but rather broadcast. Plant establishment was reduced by 48% in both years when canola was established with disc openers with N placement with a tine opener

(P<0.05). Tine openers were most successful in establishing an acceptable plant population. This was also supported by data collected for biomass production and leaf area index throughout the season. No yield differences were observed (P>0.05). It was concluded that the application of N in the band at the same position as the seed is a risk. Tine openers, either with a single or double seed chute, that separate seed and fertiliser, resulted in the best canola performance.

4.5 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

Introduction

The Protein Research Foundation (PRF) has as its main objective the replacement of imported protein with domestically produced protein. After many years of investigating numerous alternatives, the focus changed mainly to soybeans and canola, where the largest impact could be made.

The growth in the domestic availability of oilcake is a good measure by which the PRF could ascertain if it was achieving its objectives, by way of supporting the industry with research, new technology and technology transfer. The targets that will need to be met in the future for the PRF to continue to emulate the great progress that has been made thus requires projections of future oilcake demands as well as projections of self-sufficiency requirements, and when this goal is likely to be met.

To accurately measure this progress various models were developed and used over the years. A new model has been developed.

The new model methodology

Collaboration between the University of the Free State's Agricultural Economics department, the PRF's existing APR model and BFAP, created a successful new model that can accurately calculate current protein requirements and project future requirements under various scenarios.

The model considers changes in per capita consumption of meat, milk and eggs as projected by BFAP, as well as population growth. The quantity of meat, milk and eggs that are predicted to be imported and exported are also considered. Projected future prices of major raw materials are incorporated as well as the availability of raw materials, mainly those that are derived as by-products from various agricultural processing industries.

The genetic improvement of animals has a substantial impact on productivity, therefore changes in animal performance is an important factor that the model incorporates. The model calculates the quantity of feed required as well as raw material breakdown for these feeds.

There are several animals that are not producers of meat, milk and eggs that consume a substantial amount of animal feed including protein. The feed consumption of these animals, including protein materials, also needs to be accounted for.

The new model offers this ability by making use of least cost linear programming, and considering transport costs of raw materials across various regions of the country to formulate the actual feeds required by all animals in South Africa, given the constraints of which quantity of raw materials will be domestically available. The result is an accurate prediction of protein requirements and projection of protein requirements both domestically and imported.

The growth in the domestic availability of oilcake is a good measure by which the PRF could ascertain if it was achieving its objectives, by way of supporting the industry with research, new technology and technology transfer. The targets that will need to be met in the future for the PRF to continue to emulate the great progress that has been made thus requires projections of future oilcake demands and what will be required to obtain self-sufficiency, as well as when this goal is likely to be met. The APR model in collaboration with BFAP data is used to calculate these projections.

Results

Current scenario

Based on the current per capita consumption of animal products it is estimated (using the APR Model) that the requirement for animal feed in South Africa is as follows:

Table 1: National animal feed production 2018

Feed Type	National feed consumption (ton)
Dairy	2 421 756
Beef & Sheep	3 433 951
Pigs	880 623
Layers	1 053 808
Broilers	3 258 449
Pet foods	343 952
Horses	138 303
Ostriches	112 117
Aquaculture	5 314
Total	**11 648 273**

In terms of oilcake consumption, the most consumed oilcake is still soya oilcake followed by sunflower oilcake.

Table 2: Oilcake usage for 2018

Oilcake type	National consumption (ton)
Soya oilcake	1 150 521
Sunflower oilcake	429 375
Canola oilcake	63 000
Palm Kernel	33 075
Soya Full Fat	212 662
Cotton Full Fat	36 000
Canola Full Fat	3 246
Total	**1 927 879**

On the local market, South Africa progressed in terms of substituting imported soya oilcake with local oilcake. South Africa produced 69% of the total requirement in 2018, in 2008 this was only at a 20% level. The projection for 2021 is at 89% and will increase to 95% in 2027.

Table 3: Historical usages of soya oilcake (Local and imported soybeans processed in South Africa)

Year	Local soya oilcake (ton)	Total soya oilcake (ton)	Local %
2001	121 140	598 070	*20*
2002	141 520	616 593	*23*
2003	120 000	705 352	*17*
2004	119 280	616 596	*19*
2005	92 080	740 558	*12*
2006	210 000	849 678	*25*
2007	303 280	1 115 280	*27*
2008	253 200	1 261 791	*20*
2009	181 600	1 111 172	*16*
2010	251 840	1 083 640	*23*
2011	301 600	1 291 069	*23*
2012	347 760	1 271 341	*27*
2013	469 360	1 197 978	*39*
2014	565 280	1 232 687	*46*
2015	765 287	1 254 120	*61*
2016	768 800	1 218 001	*63*
2017	871 913	1 267 098	*69*
2018	766 795	1 150 521	*69*

In terms of total oilcake the local share in consumption increased from 37% in 2007 to 82% in 2018. It is projected that the local share will increase to 82% in 2021 and 94% in 2027.

Table 4: Historical usages of Total oilcake (Local and imported oilcake)

Year	Local Oilcake (ton)	Total Oilcake (ton)	Local %
2001	454 192	1 021 862	*44*
2002	482 448	1 149 224	*42*
2003	472 312	1 210 396	*39*
2004	489 413	1 121 460	*44*
2005	416 736	1 212 593	*34*
2006	572 231	1 414 338	*40*
2007	608 370	1 635 525	*37*
2008	494 557	1 758 185	*28*
2009	565 181	1 664 927	*34*
2010	701 030	1 743 137	*49*
2011	624 912	1 857 391	*34*
2012	766 927	1 856 360	*41*
2013	760 321	1 877 671	*40*
2014	913 356	1 889 979	*48*
2015	1 197 604	1 914 330	*63*
2016	1 238 120	1 965 291	*63*
2017	1 300 865	1 798 372	*72*
2018	1 441 527	1 649 498	*87*

Growth in requirements for animal products

In order to calculate the consumption figures of the different species it is very important to determine the demand. The demand was calculated by means of using the following macro variables in combination with animal feed conversion ratios growth figures:

- Population growth
- Per capita consumption growth
- Imported animal products
- Exported animal products

Table 5: Projections of feed and oilcake requirements to the year 2021 and 2027

	Feed (ton)	Oilcake (ton)	Soya Oilcake (ton)
2018	11 628 789	1 649 498	1 150 521
2021	12 561 132	1 764 946	1 307 338
2027	13 372 018	1 826 894	1 287 638

As explained earlier, soya oilcake remains the dominant protein source in South Africa. This dominance has increased over time and will continue to do so. Soya oilcake in 2010 made up 40% of oilcake requirements, this increased to 70% in 2018 and is predicted to stabilise at 71 % in 2021. Table 5 indicates that soya oilcake consumption will decrease from 2021 to 2027, mainly due to BFAP's projection that poultry imports will increase with 63% from 2021 up to 2027.

Poultry feeds make up only 39% of total feed consumed in South Africa. This market share of total feed is predicted to remain constant until 2020. Most oilcake is however used in this sector with the share of 84% of soya oilcake usage currently in this sector expected to remain relatively stable up to the year 2027.

Local Soya Oilcake Production

The increase in local oilcake production from locally produced soybeans will make South Africa increasingly self-sufficient in protein requirements.

Table 6: Local vs imported soya oilcake

	Local Soya Oilcake (From local soybeans) ton	Local Soybean Production (required) ton	Total Soya Oilcake Requirements ton	Local Soya Production (required) ton self-sufficiency	% Local
2018	980 860	1 226 075	1 150 521	1 438 151	85
2021	1 172 228	1 465 285	1 307 338	1 634 173	89
2027	1 228 798	1 535 998	1 243 233	1 554 041	98

Oilcake requirements in South Africa are estimated at 1 649 498 tons in 2018 versus a local production of 1 441 527 tons locally produced, or 87% of requirements (Table 4). The soybean requirement of 1,2 million tons excludes the 238 000 ton full fat soybeans and 30 000 ton for human consumption required.

Soya oilcake produced in South Africa in 2018 provided 85% of the country's soya oilcake requirements (Table 6).

According to the model, feed requirements will increase to 13 372 018 tons in 2027 and 12 561 132 tons in 2021. The soya oilcake requirement will be 1 307 338 tons by the year 2021 and 1 243 233 by 2027 (Table 5). There is a decrease in requirements which can be attributed to an increase in feed conversion ratios.

Estimates indicate 98% self-sufficiency by 2027 and 89% by 2021. In terms of soybeans, this can be attributed to an increase in production of soybeans as estimated by BFAP. (Table 5).

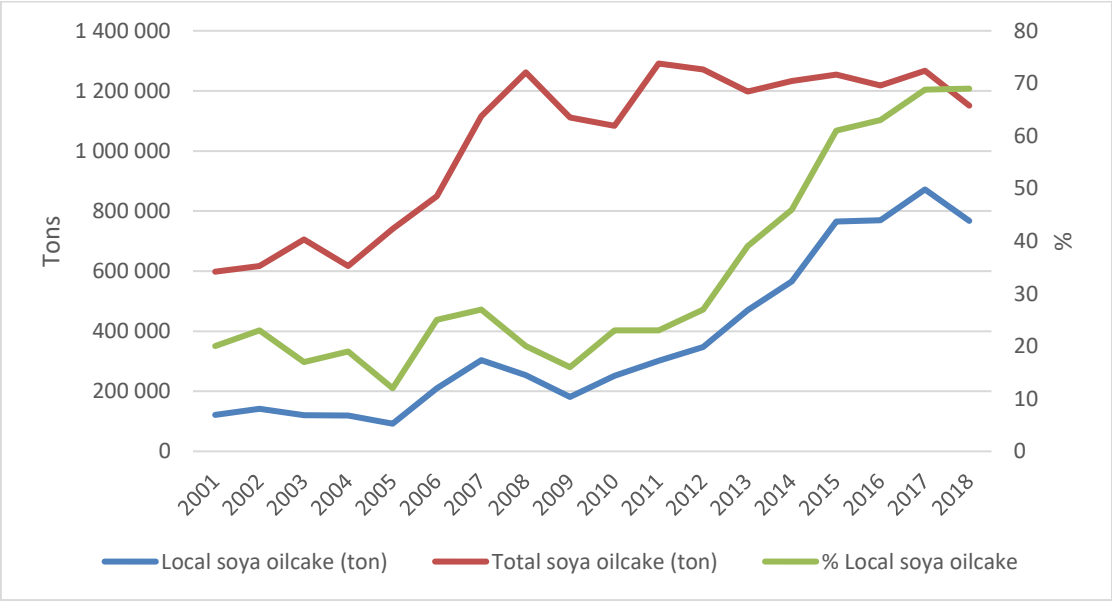


Figure 1: Growth in self-sufficiency in terms of soya oilcake

Although beef and sheep combined is the largest consumer of animal feed, the poultry sector plays a major role in oilcake and particularly soya oilcake usage. Growth and sustainability in the poultry industry will play a major role in oilcake requirements.

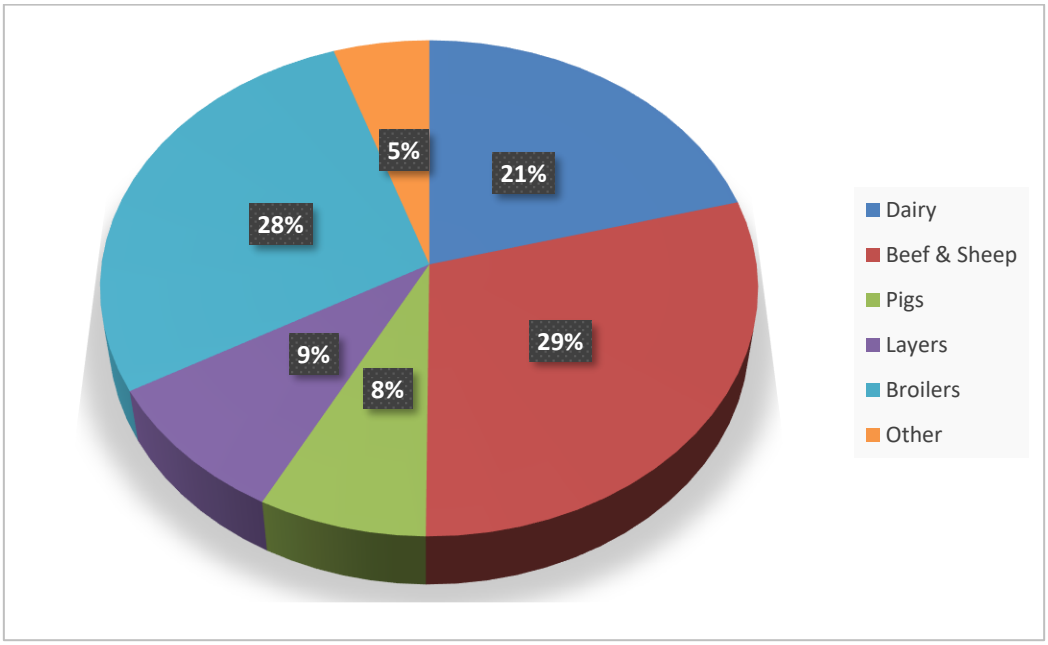


Figure 2: Specie feed consumption

Table 7: National animal feed production 2020 and 2026

Feed Type	National feed consumption 2021 (Ton)	National feed consumption 2027 (Ton)
Dairy	2 538 634	2 762 097
Beef & Sheep	3 770 587	4 131 534
Pigs	981 688	1 138 128
Layers	1 116 578	1 163 747
Broilers	3 498 788	3 393 667
Other	654 857	782 845
Total	**12 561 132**	**13 372 018**

Table 8: Oilcake usage projection 2021 and 2027

Oilcake	2021 Ton	2027 ton
Soya oilcake	1 307 388	1 287 638
Sunflower oilcake	356 299	362 300
Canola oilcake	63 000	125 064
Palm Kernel	37 710	42 993
Soya Full Fat	147 302	159 000
Cotton Full Fat	36 000	65 086
Canola Full Fat	3 246	5 345
Total	**1 950 945**	**2 047 426**

Conclusion

Animal feed consumption in South Africa decreased drastically in 2017. This was mainly due to the lag effect of the drought but more importantly to the outbreak of bird flu within the borders of South Africa. In 2018 there was a slight recovery on feed consumption. However, given the major increase in production of local soybeans, self-sufficiency increased drastically. In terms of total oilcake consumption, South Africa is at a level of 87% self-sufficiency. This is expected to increase towards 2027, indicating the progress South Africa is making in substituting imports.

Table 9: Self-sufficiency of total oilcake and oilcake

	2018	2021	2027
Total Oilcake	87%	90%	94%
Soya Oilcake	85%	89%	98%

4.6 RESEARCH REMEDIAL MEASURES TECHNIQUE, SOYA PLANTINGS, BOTHAVILLE AND RUSTENBURG, SOUTH AFRICA; SA Oosthuyse, Hort Research SA

The Remedial Measures Technique was applied to a soya section (stand) on each of two farms - one farm in the Rustenburg region, and the other in the Bothaville region. The farms in question are owned or managed by:

(a) Jan Botma (jan@bhv.co.za), contact number: 0823880700, in the vicinity of Bothaville.

(b) Ferdi Meyer (ferdi@bfap.co.za), contact number: 0827776892, in the vicinity of Rustenburg

Sampling was completed in April 2019. In applying the method on the analysis results obtained from the samples, remedial measures for the coming season (2019-2020) are to be determined.

Plant and Soil sampling:

From each stand, of which there are two, twenty soil samples and twenty plant samples were taken from 20 sites well distributed throughout the identified stands sections. This was done just prior to harvest, to assess soil nutrient concentrations and other soil variables, as well as variables relating to plant performance (growth and yield).



Fig. 1 Plant and soil samples being taken from the stand near Rustenburg

The soil and tissue samples are to be sent to SGS laboratory in Somerset West for a comprehensive analysis. From each soil sample a number of parameters are to be analysed for, these relating to soil fertility, chemistry and texture. Tissue nutrient concentrations are also be determined.

Plant parameters to be quantified

From the plants at each site, the following are to be quantified after the plants had been sectioned and dried: number of pods, pod weight, bean weight, bean shell weight, root weight, leaf weight, stem weight, weight of 20 beans, number of beans and whole plant weight.

Data analysis

The data are to be subjected to multivariate analysis, where the soil and leaf analysis variables were stipulated as independent variables, and the plant quantifications as dependent variables.

Activities of the prior season: 2018-2019

The following was found after data analysis in 2018:

The technique was carried out on the farms of Ferdi Meyer (Rustenburg) and Jan Botma (Bothaville). There was a difference in method, in that plants and soil were removed from the plantings once the beans were close to maturity. Groups of plants differing in size were removed along a line through each stand. Soil occupied by the roots was also removed. This was done at 20 sites per stand. The plants were analysed for performance parameters, including bean yield, pod yield, root dry weight and, plant dry weight. Application of the technique yielded the following results:

(a) Ferdi Meyer, Rustenburg

Here bean yield was strongly related to and positively correlated with exchangeable soil potassium levels. Cation exchange capacity and soil manganese levels also correlated with bean yield. The indication was that magnesium levels in the soil were negatively affecting performance. High soil magnesium concentration is an inherent problem of the growing region. The effect of increasing soil K to 200 kg/mg is to be assessed next season, as well as the application of micro-nutrient adherents to the potassium granules applied.

(b) Jan Botma, Bothaville

The soil at this stand is practically sand. In considering bean yield, the analyses indicated a relationship with cation exchange capacity and soil zinc levels. Coated (adherent) micro element granule fertilizer application is to be recommended, as well as spreading fertilisation over the growing period, in view of poor nutrient retention by the soil (sand). The effect of these adjustments is to be assessed next season.

Problems encountered regarding application and valuation of effects during 2019:

Jan Botma: Severe drought and adverse weather conditions gave rise to Jan Botma's inability to carry out the recommendations for the 2018-2019 season – to provide a stand that could be evaluated for a yield increase. We recommend that we proceed again in taking data during 2019 to determine the yield enhancing measures required for the 2020 crop.

Ferdi Meyer: Problems relating to the time of obtaining soil lab analysis results (those reflecting soil nutrient status levels after winter cropping of wheat) prevented timeous pre-plant application of potassium. We recommend that we proceed again in taking data during 2019 to determine the yield enhancing measures for the 2020 crop.

In both instances the results for the Remedial Measures Technique obtained during 2018 were clear in their indication of measures to be taken to increase bean yield. Moreover, the results made clear sense in the consideration of soil nutrient balance and textural analysis research findings already established in the literature.

The original proposition was that the research be carried out for at least 3 seasons. In terms of this, we still have one season for evaluation (2019-2020).

4.7 THE INFLUENCE OF PLANTING DATE AND ROW WIDTH ON RECOMMENDED PLANTING DENSITY AND YIELD OF SOYA BEANS IN THE NORTH EASTERN FREE STATE; JP van Zyl, Department of Agricultural Development, VKB

Aim of the research project

The aim of the project is to develop guidelines for adapting planting density according to varying planting dates and differential maturity classes for soya beans. It can be seen as an aspect of precision farming in the North Eastern Free State that was ignored in the past and will thus have to be fine-tuned.

Procedures

Detailed information was provided with the detailed progress report.

Participating farmers and trial localities:

- Trial 1: Izak Dreyer (Vrede Ascent)
- Trial 2: Jaco van Dyk (Vrede/Memel)
- Trial 3: Jan Nell (trial was abandoned)
- Trial 4: SW Graaff (Frankfort/Jim Fouche)

The following trials were planted:

Unfortunately, only one trial could be planted due to low rainfall during planting time.

1. Trial 3: SW Graaff

   - 2x row widths: 0.30 m and 0.60 m

   - 1x planting date: Late (27 November 2018)

   - 4x plant densities: 150 000, 250 000, 350 000, 400 000 plant/ha

   - 4x cultivars

   - SSS 4945 (MG 4.5)

   - SSS 5449 (MG 5)

   - SSS 6560 (MG 6)

   - DM 5953 RSF (MG 4.7)

Summary

Plant population

Plant populations of 150 000 plants/ha produced satisfactory yields. For all four maturity classes, 350 000 plants/ha produced the highest yields. There is a suggestion that later planting dates with higher plant populations result in higher yields than at a lower plant population.

Row width

Narrow rows in general produced higher yields than wide rows, yet for maturity class 4.5 the wider rows yielded higher. It seemed that the effect of narrow rows was better at 400 000 plants/ha for all maturity classes, except for the 4.5 maturity class.

Planting date and maturity class

The effect of planting date and maturity class could not be compared to an early planting date, but due to the late planting date the shorter maturity classes (4.5 and 4.7) yielded higher than the medium (5) and long maturity class (6).

4.8 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) was founded in 2004 with the purpose of informing decision-making by stakeholders in the agro-food, fibre and beverage complex through independent, research-based policy and market analyses. BFAP is a non-profit company with an advisory board consisting of representatives from the affiliated universities as well as the private and public sector. The company is managed by a Board of Directors. BFAP has a distinguished history of partnerships in the South African agricultural sector, providing exclusive advanced analysis and insights of both primary and secondary agricultural markets to public and private sector. In addition to publication of the annual baseline outlook, its integrated analytical framework has been applied in a number of research projects supporting the agricultural sector at large. Such projects include an evaluation of the possible contribution of the agro-industrial complex to employment creation for the National Planning Commission, an analysis of the long term impact of mining on food security in South Africa and an assessment of the impact of proposed minimum wages for farm workers in South Africa. Furthermore, the training of individuals in specialized strategic decision-making and analytical techniques remains a key priority, ensuring the provision of high quality human capital to support the greater South African agricultural industry.

Over the past decade BFAP has developed into a well-positioned global virtual network linking individuals with multi-disciplinary backgrounds to a coordinated research system that informs decision making within the Food and Beverage sector. The core analytical team consists of independent analysts and researchers who are affiliated with the Department of Agricultural Economics, Extension and Rural Development at the University of Pretoria, the Department of Agricultural Economics at the University of Stellenbosch, or the Directorate of Agricultural Economics at the Provincial Department of Agriculture, Western Cape. Recently, BFAP also signed a Memorandum of Understanding to increase collaborative research with the University of Fort Hare. This proposal motivates a partnership that will enable the PRF to benefit not only from the expertise and information systems of a diverse local group, but also gain access to a much broader international network including institutions such as the Food and Agricultural Policy Research Institute (FAPRI), the Food and Agricultural Organization (FAO) of the United Nations, the Organisation for Economic Cooperation and Development (OECD), the agri benchmark group at the Thünen Institute in Germany and the Regional Network of Agricultural Policy Research Institutes (ReNAPRI) in Eastern and Southern Africa.

The BFAP Farming Systems Analysis Program

The program: The BFAP farming systems analysis program 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 Farming Systems Analysis Program 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.

(a) 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 projections 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: 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: Midlands	Limpopo: Irrigation	Western Cape: Pears	KwaZulu-Natal integrated farm
Eastern Free State: maize	Northern Cape: Wheat	Northern Free State: Sunflower		Mpumalanga: Irrigation	KwaZulu-Natal: Seed		North West integrated farm
Northern Cape: maize	Northern Cape: Barley	North West: Sunflower			Sandveld: Irrigation		
Mpumalanga: maize (budgets)		Mpumalanga: Soybeans (budgets)					
North West: maize		Overberg: Canola					

(b) 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.

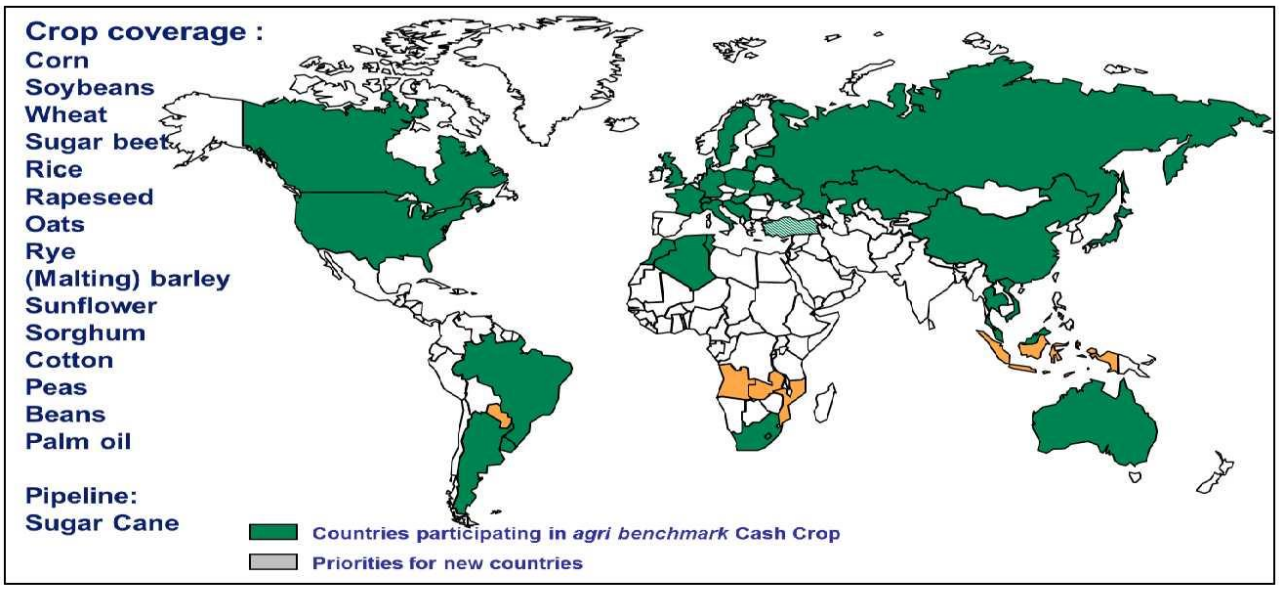


Figure 1: agri benchmark cash crop network

Objectives & key deliverables:

The Protein Research Foundation (PRF), Grain South Africa (GSA) and the Bureau for Food and Agricultural Policy (BFAP) currently have their individual cost of production programs which focusses on the key summer- and winter crops produced in South Africa's key agro-ecological zones. Given the existing activities associated within the organisations and the extent of the coverage of South African agricultural production, it is envisaged that by collaboration and integration of existing activities by PRF, GSA and BFAP will add immense value to the individual organisations' annual output. The main objective is hence to consolidate the three programs, generate comprehensive crop income and cost budgets for the key summer- and winter growing regions and lastly to generate sensitivity analysis for these crops based on the latest macroeconomic trends, BFAP Baseline underlying assumptions and international- & domestic updates. Please refer to annexure of this proposal for detailed regions and proposed crops.

				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

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

4.9 THE INFLUENCE OF WEED AND HERBICIDES ON THE GROWTH AND YIELD OF SOYBEANS; WF van Wyk, Contractor, Protein Research Foundation

INCREASING SOYBEAN PRODUCTION ON THE HIGHVELD

2018/2019: Trials conducted on the UP Experimental farm in Hatfield, Pretoria.

- Potassium trial

  Treatments: Four (4) levels of K (0, 100, 200 and 300kg/ha) were administered and incorporated into the soil pre-planting. Potassium was also applied at 100kg/ha in the middle of every second pair of rows at a depth of 20cm concentrated in a band. A sixth treatment was where 100kg K/ha was applied, but the plots were not planted with soybeans. The plots were kept free of weeds throughout the growing season.

The trial was harvested, threshed and all post-harvest data were taken.

Potassium analysis was done before planting and after harvesting to compare removal figures as well as the necessary quantity (kg/ha K) to increase soil K with 1 mg/kg.

All the results will be given in the progress report.

- Weed control trial

  Four (4) treatments were applied namely no weed control, only pre-emerge control with diclosulam and alachlor, no pre-emerge control with glyphosate applied at 4 weeks and no pre-emerge control with glyphosate applied at 8 weeks. The trial was harvested, threshed and all post-harvest data were taken.

Al the results will be given in the progress report.

Additional or Demonstration trials as started in 2018-2019

- The potassium and weed control trials needed only 14 sprinklers to irrigate but the minimum amount is 18 sprinklers because of a pressure issue on the pipe system at the UP farm. The researcher decided to plant more soybeans in order not to waste water on unplanted soil. Additional (demonstration) treatments could therefore be conducted without increasing the budget because all the trials were planted on one day and also harvested on one day.

<u>Additional treatments that were used are</u>:

- 25 cm row spacing with two seeds/position planted every 33,3cm in the row - gives a density of 240 000 plants/ha;
- Plant density of 200 000 plants/ha in 45cm rows (soybeans were planted at 300 000 plants/ha and thinned to 200 000 plants/ha after emergence);

- Plant density of 155 000 plants/ha in 45cm rows (soybeans were planted at 300 000 plants/ha and thinned to 155 000 plants/ha after emergence);
- Plant density of 110 000 plants/ha in 45cm rows (soybeans were planted at 300 000 plants/ha and thinned to 110 000 plants/ha after emergence);
- Growth points of soybeans removed with slasher at 15cm height above the soil when plants were 30cm tall (R1). Plant density of 290 000 pl/ha;
- Application of Spoor en Boor on the leaves of soybeans in 45cm rows at R2 (only micro-elements);
- Application of Groenwoema on the leaves of soybeans in 45cm rows at R2 (micro-elements and N, P and K);
- Leaf application of MAP-tegnies at R5;
- Liquid inoculant next to the row at R4 followed by irrigation;
- 42 N applied as Ammonium Sulphate at R5;
- 84 N applied as Ammonium Sulphate at R5;
- 126 N applied as Ammonium Sulphate at R5;
- Control in 45cm rows and plant density of 290 000 plants/ha;
- Cultivar PAN 1623 R (MG - 6.2) planted on 11.1.2019;
- Cultivar DM 5953 rsf R (MG - 4.2) planted at 11.1.2019;

4.10 CULTIVAR EVALUATION OF SOYBEANS IN THE WESTERN DRY LAND PRODUCTION AREA OF SOUTH AFRICA; GP De Beer and WF van Wyk, Contractors, Protein Research Foundation

The past season was one of the driest planting seasons that the west ever had.

The plan was to plant cultivar trials at Schweizer Reneke, Hoopstad, Hertzogville and Bossies (Between Delaryville and Sannieshof). The first rain in this region fell in the beginning of January 2019, which is too late to plant soybeans.

Only the trial at Schweizer Reneke was planted on 3 January 2019 but couldn't be used because of a poor plant population.

4.11 THE USE OF CULTIVATION PRACTICES IN SOYBEAN TO AVOID *SCLEROTINIA* INFECTION; WF van Wyk, Contractor, Protein Research Foundation

Planting of 2 cultivars (DM 5953 - short season grower and PAN 1623 - long season grower) with 3 different planting dates at Wonderfontein and Stoffberg.

(a) Trial at Mr Piet Prinsloo from Stoffberg

Three (3) planting dates namely 5 October 2018, 12 November 2018 and 13 December 2018 were used. Planting was done with an Apache no-till planter in no-till conditions under irrigation. Trial was damaged by hail with 60 percent on 19 December but recovered well so that data could be used. No *Sclerotinia* was observed here. Rainfall data and temperatures were taken as well as the dates on which the different planting dates were in the different reproductive stages (R - values). These values still have to be incorporated into graphs and all the other data will also be included in the progress report.

(b) Trial at Mr Gerrit Roos from Wonderfontein

Three (3) planting dates namely 12 October 2018, 5 November 2018 and 12 December 2018 were used. Planting was done with a John-Deere minimum-till planter in minimum-till conditions under dryland. *Sclerotinia* developed in February and infections appeared on the long season grower (PAN 1623 R) at different degrees of severity. The short season grower (DM 5953) showed no infections at all the different planting dates. Rainfall data and temperatures were taken as well as the dates on which the different planting dates were in the different reproductive stages (R - values). These values still have to be

incorporated into graphs and all the other data will also be included in the progress report.

4.12 DETERMINATION OF CANOLA HARVEST YIELD LOSSES; C CUMMING, Contractor, Protein Research Foundation

The PRF Canola Planning Committee approved efforts to determine losses incurred by producers during the harvesting process in the 2018 season. Co-operators monitoring the harvesting process in the Canola Yield Competition, primarily in the Swartland, would assist in the process.

Ten plastic containers, 21,4cm^2 in size, were purchased and distributed to those identified to assist. Initially the idea was to determine losses volumetrically, which would have made it possible to calculate the losses (kg/ha) in the field, but it soon became apparent that the amount of grain collected in the containers was not sufficient to measure volumetrically. Samples were then placed in plastic bags to be weighed to determine actual yield losses.

All the harvesting, with the exception of two producers in the Swartland, was done on windrowed canola at the combining of the windrow.

The data realised at the end of the season is summarised below:

Izanè Crous:

- Koos Blanckenberg, Philadelphia. Harvested 11.10.2018

  John Deere S780 Cv. 44Y90

  Yield loss determined to be less than 0,02 ton/ha

- Gert Claassen, Moorreesburg. Harvested 29.10.2018

  John Deere S680 Cv. 44Y90

  Yield loss determined to be less than 0,02 ton/ha

Johann Laubser:

- Jannie du Toit, Hopefield Harvested 16.10.2018 (Harvested direct)

  Claas 580 Lexion Cv. Hyola 559TT

  Yield loss 1,22g/container = 26,1g/m^2 = 261 kg/ha

- John Slabber, Moorreesburg. Harvested 18.10.2018

  Case 2388 Cv. Hyola555TT

  Yield loss 0,8g/container = 17,12g/m^2 = 171,2 kg/ha

- Franco Koch, Moorreesburg. Harvested 17.10.2018 (Harvested direct)

  Case 2388 Cv. 44Y89

  Yield loss 8,82g/container = 188,855g/m^2 = 1 888 kg/ha (sample 1) down to less than

  200 kg/ha (sample 4) as producer kept adjusting settings between samples.

- Flip van Schalkwyk, Piketberg. Harvested 8.10.2018

  Case 2388 Cv. Diamond

  Yield loss 1,975g/container = 42,265g/m^2 = 422,65 kg/ha

Chris Cumming:

- Franco le Roux, Napier. Harvested 23.10.2018

  Case 11 8120 Cv. 44Y90

  Combine spreads chaff the same width as cutting width. First 3 samples taken on side of combine and final 2 taken under combine.

(a) Yield loss 5,55 g/m^2 = 55,5 kg/ha

(b) Yield loss 4,625 g/m^2 = 46,25 kg/ha

(c) Yield loss 5,55 g/m^2 = 55,5 kg/ha

(d) Yield loss 23,125 g/m^2 = 231,25 kg/ha

(e) Yield loss 18,5 g/m^2 = 185 kg/ha

- Pieter Beukes, Caledon. Harvested 26.10.2018

(a) Claas 480 Tucano, b) John Deere 9660STS, c) Claas Lexion.Cv. 44Y91

(b) Yield loss 19,425 g/m^2 = 194,25 kg/ha

(c) Yield loss 56,425 g/m^2 = 542,25 kg/ha

(d) Yield loss 28,675 g/m^2 = 286,75 kg/ha

Ruan Schutte:

Roodebloem Research Farm, Caledon. Harvested 25.10.2018

Claas Lexion 470 Cv. 44Y90

(a) Yield loss 1,12g/container =23,968 g/m^2 =239,68 kg/ha

(b)	1,01	21,614	216,14
(c)	1,31	28,034	280,34
(d)	1,55	33,17	331,70

<u>Summary:</u>

Many of the evaluations conducted indicate that between 200 and 300 kg/ha losses were incurred in the harvesting process. In some isolated cases the losses were substantial, indicating that producers would benefit from some assistance with information regarding limiting losses. Because small amounts of seed collected in the container (1g in container translates to 21,4 g/m^2 in the containers used = 214 kg/ha or over R1000/ha) give the impression of

acceptable losses, it would be beneficial to producers to have some means of determining losses infield. Photos to illustrate the levels of losses in an ice cream container could give a rough indication which could be used for infield comparisons.

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

Period: 1 March 2018 to 28 February 2019

This year - in addition to the normal page content updates - the focus was mainly on:

- standardising the spelling of key terminology; and
- implementing best practices using HTML markup

across the 17 sections and 1,032 HTML pages (excluding dynamically created pages) that make up the website of the Protein Research Foundation.

PHP 7.2

The website utilises several programming languages to output page content to internet browsers, for example HTML, PHP, JavaScript and MySQL. In preparation for the world-wide PHP upgrade scheduled for September 2019, the PHP programming was audited to ensure compatibility when the server on which the PRF's website is hosted switches over to the new version of PHP.

Because the website was first launched more than10 years ago, there were several instances where older, deprecated PHP functions and variables had to be replaced with newer, more secure ones.

Visitor statistics

Reporting Year	Unique Visitors	Unique Visitors		
	*Raw values**	*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**

Google values shows an increase in page views and a significant increase in unique visitors. Pages per visit decreased slightly. The most pageviews came from the following pages in order of percentage share:

1. Homepage, 15.66%
2. Soy oilcake price average, 6.3%
3. Guidelines for executive summaries, 3.54%
4. Biofuels government policy, 2.55%
5. Biobrandstof inleiding, 1.85%

The future of the PRF website

Its capacity as a provider of valuable information to both producers and researchers via the web, places the PRF in the perfect position to offer more interactive functionalities to visitors who are more and more immersed in 3D worlds where content is displayed in digitally created environs.

The PRF is also in the process of developing an android application in respect of the income and cost budgets.

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 23 years during which 77 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 Masters' 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 Bursary Committee (a sub-committee of the Marketing Committee) and were as follows:

5.1 MSc Studies

5.1.1 **Mr E du Toit** (Second application). "Developing nitrogen fertiliser management strategies for canola under conservation agriculture practices in the Western Cape", Stellenbosch University

5.1.2 **Ms J van der Merwe** (Second application). "Evaluation of canola oilcake as an alternative locally-produced protein source for slaughter ostriches", Stellenbosch University

5.1.3 **Ms L Jordaan** (Second application). "The use of chemicals and polymer coatings to increase the non-degradable protein fraction of a variety of locally produced protein sources", Stellenbosch University

5.1.4 **Ms P Mbedzi** (Second application). “Initial screening of Soybeans for Simple Sequence Repeats conferring resistance to *Sclerotinia sclerotiorum*”, Stellenbosch University

5.1.5 **Mr JP van Zyl** (First application). “Effect of plant population, maturity groups and row width on soybean yields in the North East Free State”, University of the Free State

5.2 PhD Studies

None

5.3 Completed theses received

During the year under review no theses were received from bursary recipients.

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;
- A Board Member who has contributed significantly in promoting, over a period of time the activities of the PRF;

During the year under review, an award was presented to Dr E Strydom in the category Best Doctoral thesis. The award was presented at an appropriate event during the year under review.

No other 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 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.

ANDRIES P THERON
CHAIRPERSON

ANNEXURES

I LIST OF APPROVED PROJECTS IN 2018-2019

https://www.proteinresearch.net/index.php?page=projects-awarded-archive#2018

II SHORT- AND MEDIUM-TERM DEMAND AND USAGE OF FISHMEAL AND OILCAKE

https://www.proteinresearch.net/index.php?page=protein-statistics-2019-february

III PRF STRUCTURES

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

IV LIST OF BURSARY APPLICATIONS: 1995 - 2019

https://www.proteinresearch.net/index.php?page=bursaries-awarded-last-year

V LIST OF RESEARCH PROJECTS: 1976 - 2019

https://www.proteinresearch.net/index.php?page=projects-awarded-archive