

**PROTEIN RESEARCH  
FOUNDATION**

**DEVELOPMENT PLAN**

**FOR**

**CANOLA**

**2018**

Those who cannot remember the past is doomed to repeat it  
- George Santayana

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## 1. INTRODUCTION

- 1.1 The previous Development Plan was prepared in 2014 and serves as background for this version.
- 1.2 Canola can be grown in all wheat cultivation areas in South Africa. Canola is planted in winter in South Africa, with good results as rotation crop with crops such as wheat, barley and oats.
- 1.3 Currently canola is grown only in the Western Cape on commercial areas of about 75 000 ha to 85 000 ha.
- 1.4 Launch trials determined that canola could be grown successfully under irrigation in the summer rainfall area. Trial yields of 5 tonnes and more per hectare were achieved.
- 1.5 Currently there is no urgent need for producers in the summer rainfall area to include canola in the crop cultivation programme.
- 1.6 Canola involves bio-fumigation characteristics that may be applied successfully in rotation programmes to combat wheat diseases.
- 1.7 Take-all caused by *Gaeumannomyces graminis* and white ear (*Fusarium*) are serious wheat diseases. The benefits of canola as rotation crop could be used with good results for such diseases.
- 1.8 Canola can be used as animal feed and be included in feed rations, in both oilcake form and full-fat form, with good results.
- 1.9 Canola grain contains about 36 to 46% oil and 20 to 24% protein. Canola oilcake contains about 35% protein.
- 1.10 According to estimates, most success would be obtained in the winter rainfall area, as well as the central and northern irrigation areas of South Africa.
- 1.11 At the moment all canola seeds are imported, especially from Australia, with small quantities from Europe. This means that producers do not always obtain seeds that represent the best adjusted cultivars for their areas. This aspect needs to be addressed urgently to make canola production sustainable.
- 1.12 GM canola (Genetically Modified canola) has not been registered for cultivation in South Africa. It must be made available urgently, to allow improved weed control using alternative chemical substances. This will contribute to the expansion of the areas under canola.
- 1.13 As technology transfer remains one of the most important actions to improve canola cultivation, the PRF supports certain researchers at the Department of Agriculture Western Cape (DAWC) and at the Agricultural Research Council

(ARC), as well as at the University of Stellenbosch (US) to remain involved to a lesser or larger degree in actions to promote canola cultivation.

- 1.14 In addition, the PRF has access to Prof André Agenbag to co-ordinate all actions relating to canola. Mr Cumming also assists to convey information in his role as consultant.
- 1.15 The following projects were launched since the publication of the 2014 Development Plan and are described in more detail under the respective programmes of the Technology Plan.
  - 1.15.1 Performance of a dual disc and tine planter, soil quality, residue management and rate of nitrogen placement with seed for nitrogen placement with seed for canola production.  
Dr PA Swanepoel, Mr PJG le Roux and Prof GA Agenbag  
(See Project 2.2.11 – Programme 2.2)
  - 1.15.2 Canola research: Summer rainfall area (Groblersdal, Brits, Beestekraal and Vaalharts).  
Mr WJ du P Jonker and Prof GA Agenbag  
(See Project 2.2.12 – Programme 2.2)
  - 1.15.3 Chemical manipulation of vegetative growth, reproductive growth and development, as well as grain production for canola.  
Prof GA Agenbag  
(See Project 2.2.13 - Programme 2.2)
  - 1.15.4 Canola Yield Competition.  
Prof GA Agenbag  
(See Project 2.2.14 - Programme 2.2)
  - 1.15.5 Nitrogen fertilisation for canola. Time of application and application quantities.  
Prof GA Agenbag  
(See Project 2.3.10 - Programme 2.3)
  - 1.15.6 Canola training days for agricultural advisors and agents.  
Prof GA Agenbag  
(See Project 2.11.1 - Programme 2.11)

## **2. TECHNOLOGY PLAN:**

Canola is a relatively new crop in South Africa. Research Institutions (even the Government, excluding the Department of Agriculture Western Cape) paid little or no attention to research of the crop. The PRF decided to, based on the good characteristics of canola (percentage protein in the oilcake), make available funding for canola research. The research must be aimed at practical applications for producers and users, while only the most important aspects need to be addressed first. The research plan is divided into the following programmes:

- Cultivar development
- Cultivation practices
- Plant Nutrition
- Weed control
- Plant diseases
- Entomology
- Harvest techniques
- Quality aspects
- Economic aspects
- Animal utilisation of products
- Technology transfer

### **2.1 Programme: Cultivar development**

Cultivar development may be subdivided into the following projects:

- Introduction of new cultivars.
- Building up and maintaining a germ plasma bank.
- Developing new cultivars aimed at agronomic requirements, disease and insect resistance, as well as quality requirements.
- Evaluation and characterisation of cultivars according to best adaptation and production under local conditions (dry land, as well as irrigation).

### 2.1.1 Project: Introduction of new cultivars

Until 2009 there were no separate projects under this heading. Three seed companies (K2 Agri-saad, Agricol and Pioneer) introduced this and it was tested as part of the cultivar evaluation projects.

The PRF Board decided, based on the recommendations of a study tour to Australia in 2008, to investigate the possibility of obtaining the services of an impartial institution, such as the Department of Agriculture Western Cape (DAWC) to provide facilities for the PRF to bring in canola material for testing before release as cultivars. The DAWC was open for the suggestion and the first separate project was approved upon request by the DAWC. The trial was planted in 2010 with funding from the PRF.

Currently the canola industry in South Africa depends largely on plant cultivation companies in Australia for the provision of new cultivars. The companies are:

- Pioneer
- Nu Seed
- Pacific Seeds
- Canola Breeders Western Australia (CBWA) discontinued in 2013, but the breeding programme continues at the University of Western Australia with external funding and the support of a German company, NPZ-Lemke.

From Germany, Bayer is also providing cultivars for evaluation in canola elite trials by the DAWC.

Seed companies are willing to have their cultivars and lines tested and evaluated before release in South Africa. The testing and evaluation are done by the DAWC who is also handling the National Cultivar Trials with the support of the Oilseeds Advisory Committee (OAC). (Previously the PRF provided financial support).

Currently the following types are being tested:

- **Conventional canola**

This is *Brassica napus* with a low (less than 2%) erucic acid content in the oil and a low glucosinolate content (less than 30 micromoles per gram) in the oilcake.

- **TT Canola**

This is triazine resistant canola (*Brassica napus*). The triazine resistance (atrazine and simazine) was developed using conventional plant breeding methods. This type may be used where there are problems with herbicide resistant weeds.

- **CL-Canola (Clearfield-type)**

This is canola (*Brassica napus*) that is resistant to Cysure (imazamox). This resistance was also developed using conventional plant breeding methods. This type may be used where there are problems with weeds that are resistant to certain herbicides.

- **Genetically modified canola (GM canola)**

At the moment and on international level, there is canola (*Brassica napus*) that is glyphosate resistant (Roundup Ready ®) and canola (*Brassica napus*) that is resistant to glufosinate ammonium (LibertyLink ®). GM canola offers additional alternative chemical protection against herbicide resistant weeds.

This type of canola is not available in South Africa yet, because GM canola has not been registered in South Africa yet.

- **High oleic acid canola (Monola)**

This is canola (*Brassica napus*) with healthier oil. The name Monola is being used by Nu Seed to differentiate it from ordinary canola.

Canola oil is one of the healthiest oils available and is supported by the Heart Foundation. However, it is possible to further improve the health value. Nu Seed already developed Monola with improved values. The fatty acid content of ordinary canola contains:

|               |       |
|---------------|-------|
| Oleic acid    | = 60% |
| Linoleic acid | = 20% |
| Linolenic     | = 12% |

Whereas as the fatty acid content of Monola contains:

|                |       |
|----------------|-------|
| Oleic acid     | = 66% |
| Linoleic acid  | = 18% |
| Linolenic acid | = 3%  |

- **Juncea Canola**

This is *Brassica juncea* that was grown using conventional plant breeding methods to produce similar quality characteristics (oil and oilcake) as canola. This type is, according to certain opinions, more disease resistant, with a lower shattering rate. The flour is yellow and could also be used in a canine food niche market.

#### 2.1.1.1 Project: Evaluation of advanced canola material in the Western Cape

**Researcher:** Mr PJA Lombard

**Institution:** Department of Agriculture Western Cape (DAWC)

- **Objective:**

- Determining the grain yield of each entry under the conditions at Langgewens (Swartland) and Tygerhoek (Rûens);
- Determining the number of days from planting to flowering and physiological maturity;
- Determining the incidence of diseases for each entry;
- Screening elite materials before entry in the National Cultivar Trials.

- **General:**

- Institutions were invited to submit about 12 entries for evaluation in the elite trials before entry in the National Cultivar Trials;
- This means that new lines/cultivars can be made available sooner for commercial cultivation in South Africa;
- In 2010 this project was conducted as a separate, independent project for the first time. Entries were received from:
  - (a) Agricol (representing Nu Seed and Canola Breeders Western Australia)
  - (b) Pacific Seed
  - (c) Pioneer.

- In 2011, Pacific Seed submitted entries;
- This project is progressing well and a number of lines from the 2010 elite trials were released for the first time in Australia in 2011. They were also released in South Africa and entered in the National Cultivar Trials. The gap between Australia and South Africa in terms of the early availability of cultivars is shrinking all the time;
- As the DAWC also conducts an elite trial involving material submitted by institutions, the joint PRF canola elite trial was terminated in 2011;
- Currently DAWC still conducts a canola elite trial and submissions received from various institutions are entered for the DAWC trial.

#### **2.1.2 Project: Germ plasma bank**

There are no current projects relating to this. This project will be developed only if a local breeding programme were to be implemented, but it is not currently under consideration.

#### **2.1.3 Project: Breeding new cultivars**

The scope of the industry in South Africa does not require additional development of the project. There is no current, sufficient manpower available to handle any development in this regard. The industry is too small to justify it at the moment.

For now it is necessary to rely on the evaluation of cultivars brought in from other countries to be grown in South Africa. (See project 2.1.1.1).

#### **2.1.4 Project: Evaluation and characterisation of cultivars**

This project is essential for promoting any industry and forms the basis for impartial recommendations to producers. The following two (2) projects are being conducted in this regard.

**2.1.4.1 Project: Cultivar evaluation of oil and protein seeds in the winter rainfall region.**

**Researcher:** Mr PJA Lombard  
**Institution:** Department of Agriculture Western Cape (DAWC)

- **Objective:**

- Determining the grain yield of each entry in different environments spread over the Western Cape (Swartland, Rûens and south-western districts);
- Determining the number of days from planting to flowering for each entry;
- Observing the incidence of diseases for each entry;
- Determining the oil and protein content of each cultivar.

- **General:**

- Twelve to twenty entries, including about four to six new entries, are tested annually;
- This project is progressing well. Results of cultivar achievements are published annually in Canola Focus and on the PRF web page/in the database;
- Producers use results to select cultivars;
- The project still continues, but without financial support of the PRF (although it is currently supported by the OAC).

**2.1.4.2 Project: An agronomical evaluation of canola in the summer rainfall area.**

**Researcher:** Dr AA Nel  
**Institution:** ARC IGC

- **Objective:**

- Determining the grain yield and growth patterns of locally available cultivars at various sites under irrigation in the summer rainfall area;
- Observing the incidence of diseases for each cultivar under irrigation;

- Determining the oil and protein contents for each cultivar.
- **General:**
  - This project was terminated at the end of 2007 and the final report was submitted in 2008. The reason for the termination was a shortage of manpower;
  - Yields of more than 4,0 tonnes per hectare were achieved;
  - The project may be continued in future.

### 2.1.5 Summary

- Cultivar evaluation in South Africa receives optimal attention;
- Cultivar recommendations for the Western Cape are published annually (February) in Canola Focus and distributed to producers;
- Since 2010, the company Allgro has planted cultivar trials under irrigation at Groblersdal, Brits (Beestekraal) and Vaalharts. Good yield results are obtained. Other cultivation aspects such as planting date, plant population, rotation, fertilisation etc. will require investigation too;
- The following were also considered:
  - During a study tour to Australia in 2010 it was determined that the international world was fast moving to hybrid cultivation in terms of canola types. The PRF Board decided that South Africa should follow this approach too and focus on the cultivation of hybrid types to achieve higher yields per hectare;
  - Currently most of the entries in the National Cultivar Trials already involve hybrid cultivars involving conventional canola, CL canola and TT canola
  - It was also observed that cultivation genetically modified (GM) canola increased dramatically in Australia and the rest of the world. The PRF Board resolved that testing these types must enjoy high priority aimed at expanding the area under canola in South Africa and effective weed control by implementing an integrated weed control management approach (see 2.4) using different chemicals.

## **2.2 Programme: Cultivation practices**

This programme includes a number of aspects such as:

- Tilling
- Planting date
- Planting method
- Plant density
- Plant depth
- Row widths
- Rotation
- Yield competition

This also includes any combination of these aspects such as:

- Planting date x plant density etc.

Information is available from the following projects:

### **2.2.1 Project: Optimal row width and sowing density of canola.**

**Researcher:** Prof GA Agenbag  
**Institution:** University of Stellenbosch

- **Objective:**
  - Determining the optimal row widths and sowing density of two types of canola cultivars in different areas in the Western Cape;
  - Determining the influence of row widths on seed size (one thousand kernel mass per gram) for two types of cultivars.
- **General:**
  - Project was completed in 2005;
  - Results are available on the PRF web page/in the database.

### **2.2.2 Project: Chemical seed treatment of canola and lupines for control of seedling diseases and insects.**

**Researcher:** Prof GA Agenbag, Dr SC Lamprecht  
**Institution:** University of Stellenbosch and ARC PPRI

- **Objective:**

- Determining the influence of seedling diseases and early insect damage on establishment, survival and production of canola at various plant densities and row widths;
- Determining the efficiency of chemical canola seed treatment;
- Determining the effect of climatic factors on the efficiency of canola chemical seed treatment and possible phytotoxic effects;
- The development of a canola seed treatment strategy in the winter rainfall area.

- **General:**

- Project was completed in 2005;
- Results were published in Canola Focus and recorded on the PRF web page/in the database.

### **2.2.3 Project: An agronomic evaluation of canola in the summer rainfall area.**

**Researcher:** Dr AA Nel  
**Institution:** ARC IGC

- **Objective:**

- Determining the grain yield and growth patterns of canola on different planting dates at different sites;
- Determining the oil and protein content on different planting dates in the summer rainfall area.

- **General:**

- Project was completed in 2004;
- Results were recorded on the PRF web page/in the database.

#### **2.2.4 Project: The salt tolerance of canola.**

**Researcher:** Prof GA Agenbag  
**Institution:** University van Stellenbosch

- **Objective:**

- Determining the salt concentration in the soil that causes canola damage.

- **General:**

- Project was completed in 2007;
- Results were recorded on the PRF web page/in the database.

#### **2.2.5 Project: Promotion of canola as a rotation crop in conservation farming in the Swartland and Rûens by means of a competition for producers.**

**Researcher:** Mr JG Loubser, Mr IFV Slabbert  
**Institution:** Department of Agriculture Western Cape

- **Objective:**

- The promotion of canola production by producers that compete for the highest grain yield and the best gross margin attained;
- The identification of problems relating to achieving the highest grain yields in the Western Cape;
- Technology transfer by farmer groups that visit competition participants to discuss practices.

- **General:**

- Complete results are published annually in a publication distributed to canola producers;
- In this way information is transferred to all;
- The nature of the project, especially the way of reporting was under review;
- The project was terminated and replaced with another project in 2015 (see 2.2.14);

- Results were recorded on the PRF database.

**2.2.6 Project: An investigation into the production dynamics of eight crop rotation systems, including wheat, lupines, canola and pasture species in the Swartland, Western Cape.**

**Researcher:** Dr MB Hardy, Dr J Strauss  
**Institution:** Department of Agriculture Western Cape

- **Objective:**

- Determining the short- and long-term effects of eight of the most appropriate rotation crop systems in the Swartland according to crop yield, weed control, disease suppression, production potential and economic sustainable use of land.

- **General:**

- Project commence in 1999;
- The inclusion of canola in a rotation crop system contributes to a noticeable increase in the wheat grain yield;
- Progress reports are published annually and summaries are recorded on the PRF web page/in the database;
- Although the Department continued with the project the PRF terminated its support in 2011.

**2.2.7 Project: Economic sustainability of short and long rotation production systems in the Southern Cape.**

**Researcher:** Dr MB Hardy, Dr J Strauss  
**Institution:** Department of Agriculture Western Cape

- **Objective:**

- Determining the short- and long-term effects of various rotation crop systems in the Rûens area affecting crop yield, weed control, disease suppression, production potential and economic sustainable use of land.

- **General:**

- The project commenced in 2002.

- The inclusion of canola in the rotation crop system contributes to a noticeable increase in the wheat grain yield;
- Progress summaries are recorded annually on the PRF web page/in the database;
- Yields of other crops are influenced positively by canola;
- Although the Department continued with the project the PRF terminated its support in 2011.

**2.2.8 Project: Evaluation of shortened canola production periods and the use of alternative crops on the sustainability of winter grain production under conservation agricultural practices in the Riversdale flats.**

**Researcher: Dr J Strauss**  
**Institution: Department of Agriculture Western Cape**

- **Objective:**

- Evaluation of six (6) different systems that includes canola at various percentages;
- Agronomic data will be collected to compare systems;
- Financial data will be collected per system;
- Disease data will be recorded per system.

- **General:**

- Project started in 2012;
- Good progress. The fifth (5<sup>th</sup>) year was completed in 2017. The longest system had been completed for the first time;
- Progress reports are published annually and summaries are recorded on the PRF web page/in the database.

### **2.2.9 Project: Evaluation of crop rotation with canola under irrigation.**

**Researcher:** Dr AA Nel  
**Institution:** ARC IGC

- **Objective:**

- Investigating the effects of canola on the yield van follow-up crops, as well as the effects of the rotation crops on the canola yield;
- Determining the measure of nematode suppression by canola, by measuring the scope of nematode infestation for all crops;
- Determining the effect of canola and the other crops on the incidence of diseases;
- Comparing the financial results of the different rotation crop systems.

- **General:**

- Project was completed in 2007;
- There were indications that crops established directly following canola were affected negatively. A possible reason is the allelopathy of canola on other crops, or the bio-fumigation effect;
- Results were recorded on the PRF web page/in the database.

### **2.2.10 Project: The identification of soil parameters as indicators of sustainable dry-land crop production systems for the shale derived soils of the Western Cape: tillage practice, crop rotation, soil quality and crop production.**

**Researcher:** Dr J Labuschagne  
**Institution:** Department of Agriculture Western Cape

- **Objective:**

- The evaluation of the effects of no tillage, minimum tillage and conventional tillage on the physical, chemical and biological characteristics of soil within different rotation crop systems;

- The evaluation and demonstration of the effects of different tilling practices and rotation crop systems on the production and quality of crops such as canola, wheat, lupines and medics, as well as the use thereof as weed control options.

- **General:**

- A summary of progress was recorded on the PRF web page/in the database, showing results for four years;
- The PRF terminated its support in 2011.

#### **2.2.11 Project: Performance of a dual disc and tine planter, soil quality, residue management and rate of nitrogen placement with seed for canola production.**

**Researcher:** Dr PA Swanepoel, Mr PJG le Roux, Prof GA Agenbag

**Institution:** University of Stellenbosch

- **Objective:**

- Evaluate the success of establishing canola using a coulter or disc tiller;
- Evaluate the measure of soil disturbance using a coulter or disc tiller;
- Determine whether soil quality is important when selecting a planter;
- Evaluate the impact of plant rests on the efficiency of establishing the crop.

- **General**

- Project started in 2016;
- During the first year the coulter was more efficient than the disc tiller, irrespective of the quantity of plant residue. More years for investigation and information are required;
- Progress is good and was recorded on the PRF web page/in the database.

**2.2.12 Project: Canola yield potential under irrigation in the summer rainfall region.**

**Researcher: Prof GA Agenbag, Mr WJ du P Jonker**  
**Institution: Protein Research Foundation**

- **Objective:**
  - Determine the optimal planting date for canola in the areas;
  - Determine the most suitable cultivar for the areas.
- **General**
  - Four cultivars representing medium growth time, medium to short growth time, and short growth time were tested;
  - Three planting dates that correspond to crop systems were tested;
  - In 2016 three localities (Beestekraal, Groblersdal and Vaalharts) were used, but were reduced to two (Beestekraal and Groblersdal) 2017;
  - Good yields of 5,5 tonnes per hectare and higher were achieved;
  - Progress was good and information was recorded on the PRF web page/in the database;
  - The project was terminated at the end of 2017, because there was no urgent need for another crop in the crop system.

**2.2.13 Project: Chemical manipulation of vegetative growth, reproductive development and grain yield in canola.**

**Researcher: Prof GA Agenbag**  
**Institution: Protein Research Foundation**

- **Objective:**
  - Evaluation of influence of growth regulators on plant structure and lodging of canola;

- Evaluation of the effect of growth regulators applied at different growth stages and at various plant densities on canola grain yield.
- **General**
  - Project started in 2015 at three localities in the Western Cape;
  - Although no growth regulators have been registered for canola in South Africa, three growth regulators were tested;
  - Under favourable growth conditions, positive canola yield increases were recorded at Altona and Roodebloem;
  - Project was terminated in 2017;
  - Progress was recorded on the PRF web page/in the database.

#### 2.2.14 Project: Canola yield competition.

**Researcher:** Prof GA Agenbag  
Mr C Cumming  
Mr J Loubser  
**Institution:** Protein Research Foundation

- **Objective:**
  - Increase in canola grain yield per hectare by encouraging producers to use own initiatives for cultivation practices
  - Increase in average yield per hectare in the Western Cape.
- **General**
  - Project started in 2015 as a competition. Producers had to enter and comply with specific conditions;
  - Entries are limited. Only a certain number of entries were accepted respectively for the Southern Cape and Swartland;
  - The competition was supported well and the yield per hectare increased. Prizes were awarded to the winners;
  - In the first year the yield per hectare was:

Southern Cape = 3.09 tonnes/ha  
Swartland = 2,66 tonnes/ha

- The competition was continued and results were recorded on the PRF web page/in the database.

### 2.2.15 Summary

- Additional rotation crop studies must be done to verify the results of project 2.2.8;
- More rotation crop systems that includes canola in shorter rotations than only every fourth year, must be tested. Diseases such as *Sclerotinia* and blackleg should be monitored carefully in such systems;
- Trials relating to other cultivation practices, especially the effects of planting date, plant density and planting techniques should be increased;
- Proactive work to determine how to produce healthier oils (high oleic acid types) should be encouraged (see 2.8).

## 2.3 Programme: Plant Nutrition

The fertilising guidelines for cultivation canola in the Western Cape were revised by experts in May/June 2006 and again in 2009/2010.

The most important studies required were identified as the following:

- Nitrogen management including:
  - ❖ Quantity (levels)
  - ❖ Scheduling
  - ❖ Nitrogen carriers
  - ❖ Nitrogen placement
  - ❖ Nitrogen x rotation crop
  - ❖ Nitrogen x cultivars
  - ❖ Nitrogen x planting date
  - ❖ Nitrogen x plant population

❖ Any combination or combinations of the above.

- Sulphur x nitrogen
- Calcium x nitrogen
- Phosphor x Potassium
- Micro-elements

Due to limited manpower and facilities only a few projects are being handled.

### 2.3.1 Project: The nitrogen requirements of canola under irrigation.

Researcher: Dr AA Nel

Institution: ARC IGC

- **Objective:**

- Determining the relationship between nitrogen supply and grain yield, as well as grain quality of canola under irrigation, to provide meaningful nitrogen fertilisation recommendations;
- Determining the nitrogen content of plants to provide guidelines for early identification of nitrogen deficiencies.

- **General:**

- Positive results were observed and a summary of the final report was recorded on the PRF web page/in the database;
- Apart from the method to determine nitrogen requirements based on results achieved with different levels of N application, as well as methods determining soil delivery, this is an alternative method to determine N requirements more accurately.

**2.3.2 Project: Nitrogen levels at different planting dates (Planting dates as separate trials).**

**Researcher:** Mr DJ Hanekom  
**Institution:** Department of Agriculture Western Cape

- **Objective:**

- Determining the effects of different levels of nitrogen on canola grain yield and quality at different planting dates under dry land conditions in the Western Cape.

- **General:**

- Project will not be continued due to resignation of researcher. Project must be addressed again as soon as the necessary manpower has been found.

**2.3.3 Project: The effects of nitrogen placement at different row widths and nitrogen levels on grain yield and grain quality of canola in the Western Cape.**

**Researcher:** Prof GA Agenbag  
**Institution:** University of Stellenbosch

- **Objective:**

- Optimising canola production by determining the optimal interaction between nitrogen placement, row widths and nitrogen levels in the Western Cape;
- Determining norms for soil nitrogen content as guideline for nitrogen fertilisation.

- **General:**

- Project was completed in 2004;
- Interesting results were observed. The results were recorded on the PRF web page/in the database.

**2.3.4 Project: The effects of nitrogen quantities for nitrogen scheduling in the production of canola in the Swartland.**

**Researcher: Mr N Raath**  
**Institution: Kynoch Fertilizer**

- **Objective:**
  - Promoting canola production by determining the optimal interaction between nitrogen quantities and nitrogen scheduling in the Swartland.
- **General:**
  - Project was terminated after one year due to company policy. Should be continued as soon as manpower is available.

**2.3.5 Project: The effect of nitrogen (N) levels on sulphur (S) and calcium (Ca) levels in canola production in the sandy soils of the Swartland.**

**Researcher: Mr N Raath**  
**Institution: Kynoch Fertilizer**

- **Objective:**
  - The promotion of canola production on the sandy Swartland soils by determining the optimal interaction between Nx, Sx and Ca.
- **General:**
  - Project was terminated after one year due to company policy. Should be continued as soon as manpower is available;
  - No results available.

**2.3.6 Project: Nitrogen fertilization of canola based on nitrogen mineralisation and lodging.**

**Researcher: Prof GA Agenbag**  
**Institution: University Stellenbosch**

- **Objective:**
  - Determining nitrogen delivery in soil and supplementation thereof for optimal grain production.
- **General:**
  - Summary of progress report was recorded on the PRF web page/in the database;
  - Final report was published in 2011 and recorded on the PRF web page/in the database.

**2.3.7 Project: Sulphur fertilisation requirements of canola in the production areas of the Western Cape.**

**Researcher: Prof GA Agenbag**  
**Institution: University of Stellenbosch**

- **Objective:**
  - Determine the sulphur (S) requirement for canola grain production in the Western Cape;
  - Determine the effects of sulphur fertilisation on the oil and protein content of canola grain.
- **General:**
  - Good progress was recorded, clearly showing interaction between S and N;
  - Progress reports were recorded on the PRF web page/in the database;
  - Final report was published in 2011 and recorded on the PRF web page/in the database.

### **2.3.8 Project: Sulphur (S) and Nitrogen (N) fertilisation of canola.**

**Researcher:** Prof GA Agenbag  
**Institution:** University of Stellenbosch

- **Objective:**
  - Determine the impact of different sulphur and nitrogen levels on the grain yield of canola.
  - Determine the impact of different nitrogen and sulphur sources on grain yield of canola in the Western Cape.
  - Determine the impact of sulphur and nitrogen levels on the quality of canola in the Western Cape.
- **General:**
  - Trial started in 2012;
  - Interesting results were recorded in the first season;
  - Project is continuing;
  - Compare to project 2.3.5;
  - Results were published in Canola Focus and were recorded on the PRF web page/in the database.

### **2.3.9 Project: Boron requirements of canola.**

**Researcher:** Prof GA Agenbag  
Ms E Kempen  
**Institution:** University of Stellenbosch

- **Objective:**
  - Determining the effects of different levels of boron on growth development and canola grain yield.
- **General:**
  - Trial was conducted in 2012 to 2014;
  - Boron applications increase canola yield on soils with a low boron content;

- Application of 1,0 kg/ha Solibor® is recommended in case of low soil levels;
- Leaf applications should be given at 40 and 60 days after establishment, but no later than flowering stage;
- Results were published in Canola Focus and were recorded on the PRF web page/in the database.

### **2.3.10 Project: Nitrogen topdressing in canola: Time of application and rates.**

**Researcher: Prof GA Agenbag**  
**Institution: University of Stellenbosch**

- **Objective:**

- Determine the efficiency of fertilising applications and time of application on canola in the Swartland and Southern Cape.

- **General:**

- Project started in 2015, but in the first year rains were late (mid-June) and therefore results were insufficient;
- Optimal application level, especially optimal time of application varies between localities and years;
- Important factors are, inter alia, soil rendering ability, moisture provision and expected yield. The cultivation guidelines provide useful formulae to be utilised;
- Results are provided in the “Cultivation Guidelines” and were published in Canola Focus. These were also recorded on the PRF web page/in the database.

### **2.3.11 Summary:**

- It is important to note that there is no crisis in terms of canola fertilisation in the Western Cape. The fertilising guidelines provide a good departure point. Additional work on the identified aspects could refine and strengthen the guidelines.

- Study tours to Australia (2006, 2008 and 2010), as well as Canada (2011), support the planning in terms of the list of aspects prepared in 2006, which are considered the most important.

## **2.4 Programme: Weed control**

Canola is extremely sensitive to broadleaf herbicides used on crops such as wheat. There are indications that substances, particularly sulphenyl urea, that are not applied strictly according to directions, already caused significant damage to, inter alia, canola.

Where rye grass is a problem with wheat cultivation, triazine resistant canola is used as a rotation crop. In such cases, rye grass is controlled using simazine in the canola phase. There are also indications that a denser canola plant population is effective in suppressing weed growth and development.

The following running projects were handled:

### **2.4.1 Project: The effects of weed killers before and after germination on new wheat and canola cultivars (Nov/PP/B4).**

**Researcher:** Mr MI Ferreira

**Institution:** Department of Agriculture Western Cape

- **Objective:**
  - The identification of canola cultivar sensitivity for herbicides.
- **General:**
  - Results are available from the DAWC.

### **2.4.2 Project: Manage weed killer resistance in the Western Cape.**

**Researcher:** Dr PJ Pieterse

**Institution:** University Stellenbosch

- **Objective:**
  - Identification of cases of herbicide resistance
  - Sensitivity for herbicides;

- Effect of rotation crops on the incidence of weeds, especially rye grass.

- **General:**

- Results are recorded on the PRF web page/in the database.

#### **2.4.3 Project: Canola plant density: Effect on the suppression of weeds and canola yields in the Swartland and Southern Cape.**

**Researcher: Dr PJ Pieterse**  
**Institution: University of Stellenbosch**

- **Objective:**

- Determine the effect of plant density on the suppression of weeds (biomass) for different canola cultivars in the Swartland and Southern Cape;
- Determine the effect of plant density on the development, growth and yield of different canola cultivars.

- **General:**

- Trial started in 2012 with the preparation of the site.
- Results were recorded on the PRF web page/in the database.

#### **2.4.4 Project: Chemical options for weed control in GM-canola cultivars.**

**Researcher: Dr PJ Pieterse**  
**Institution: University Stellenbosch**

- **Objective:**

- Determine the efficacy of different glufosinate ammonium dosages on wild radish and ryegrass seedlings in a pot experiment in a greenhouse;
- Determine the efficacy and residual action of glufosinate ammonium, atrazine and imazamox on weeds in Western Cape;

- **General:**
  - Trial started in 2012;
  - Results recorded on the PRF web page/in the database

#### 2.4.5 Summary

- The cultivation guidelines as defined in the Canola Production Manual provide clear recommendations about weed control for canola in the Western Cape. These also include a comprehensive recommendation on handling herbicide resistance. New information is published in Canola Focus from time to time.
- Close co-operation is maintained between the HRAC committee of Crop Life SA and the Cape Working Group.
- Based on recommendations of three study tour reports the Board of the PRF decided that trials with GM canola cultivars should be tested as a high priority matter in South Africa. Thereafter, the registration of GM canola and its cultivation must be promoted in South Africa. It is essential to obtain alternative chemical substances to handle weed problems and limit any build-up of resistance. This will promote the expansion of areas under canola.
- The effects of cultivation practices (plant density etc.) on weed control in canola production must be investigated further (see report: Study Tour to Canada 2011).
- The PRF will support new research on weed control in canola.

### 2.5 Programme: Plant diseases

The most important diseases affecting canola are blackleg (*Leptosphaeria maculans*) and sclerotinia rot (*Sclerotinia sclerotiorum*). Recent observations showed that both diseases pose a significant danger in the Western Cape. As a result, the available capacity (manpower and equipment) at the Department of Agriculture Western Cape and ARC-PPRI at Stellenbosch was tasked with addressing diseases both above ground and soil-borne. Certain projects are under way and others are planned for the near future.

**2.5.1 Project: Chemical seed treatment of canola and lupines for the control of seedling diseases and insects.**

**Researcher:** Prof GA Agenbag, Dr SC Lamprecht  
**Institution:** University of Stellenbosch en ARC PPRI

- **Objective:**
  - Determine the effects of seedling diseases and early insect damage to establishment, survival and production of canola at different plant densities and row widths;
  - Determine the efficacy of chemical seed treatments for canola and lupines;
  - Determine the effects of climatic factors on the efficacy of chemical seed treatment and possible phytotoxic effects on canola;
  - The development of a seed treatment strategy for canola and lupine production in the Swartland and Rûens.
- **General:**
  - Project completed in 2005. Positive results were obtained;
  - Syngenta registered the agent 'Cruiser' for canola seed treatment;
  - Results available on the PRF web page/database.

**2.5.2 Project: Characterisation of *Rhizoctonia* on canola and lupin in cropping systems in the Western Cape Province.**

**Researcher:** Dr SC Lamprecht  
**Institution:** LNR-NIPB

- **Objective:**
  - Characterise *Rhizoctonia* spp. associated with canola in crop rotation systems at Tygerhoek experimental station;
  - Determine the effects of different crop rotation systems on the incidence of *Rhizoctonia* spp. and determine which system reduces the incidence.

- **General:**

- Results were published and particulars recorded on the PRF web page.

### 2.5.3 Summary

- Blackleg posed a significant threat in the 2003 season in the Western Cape. It may be prevented by implementing the right programmes. (See Production Manual).
- The canola elite trials and cultivar evaluation trials should be monitored for the incidence of blackleg.
- *Sclerotinia* poses potential danger for canola in the Western Cape. Research on this disease should be conducted proactively. The disease could be controlled by implementing the correct fungicide application programme. (Production Manual).
- Syngenta registered an agent for seed treatment of canola.
- The scope of the incidence of other diseases will determine the undertaking of any further projects. For the current situation there is sufficient information in the Canola Production Manual on canola diseases in the Western Cape.

## 2.6 Programme: Insect control

Various insects could constitute a pest for canola. The most important are:

- Red legged earth mite = *Halotydeus destructor*
- Winter grain mite = *Penthaleus major*
- Cabbage aphid = *Brevicoryne brassicae*
- Lucerne flea = *Sminthurus viridis*
- Diamondback moth = *Plutella xylostella*
- Boll worm = *Helicoverph spp. (Heliothus spp.)*

From time to time, other soil insects such as cutworm, grain worm, snout beetle, false threadworms, black mealie bug, snails, isopods etc. could also cause problems.

### **2.6.1 Project: Insects and other canola pests.**

**Researcher: Dr GD Tribe**

**Institution: ARC PPRI**

- **Objective**

- Identify the most important soil insects for canola.
- Identify other important pests.
- Evaluate control measures

- **General:**

- Interesting results relating to the control of snails and isopods for canola were shown. Bait presents good results.
- Summaries are available on the PRF web page/in the database.

### **2.6.2 Project: Developing a biological control agent for molluscs (slugs and snails) in South Africa.**

**Researcher: Dr AP Malan**

**Institution: University of Stellenbosch**

- **Objective**

- Identification of nematodes that may serve as snail parasites;
- Production of non-plant parasitic nematodes.

- **General:**

- Trial started in 2013;
- Nemaslug® a product used on a large scale in Europe, is not registered in South Africa;
- Local nematodes were identified and could increase on a significant scale;
- Commercialisation is essential now;

- Results were published and recorded on the PRF web page/in the database.

### 2.6.3 Summary

- Cultivation guidelines as defined in the Canola Production Manual provide information about good control measures and threshold values for insects that live above ground.
- The diamond back moth easily develops resistance to chemical agents. Although this has not happened in South Africa yet, it is essential for experts to prepare an integrated control strategy and to distribute this information to producers.
- Guidelines for the control of snails and isopods using bait was prepared and distributed to producers. It was also published in Canola Focus.
- Results are available on the PRF web page/in the database.

## 2.7 Programme: Harvesting techniques

There are two main harvesting methods: direct harvesting as opposed to swathing, picking up and threshing.

Canola is very sensitive to seed loss. The correct moisture percentage for each technique is extremely important to keep grain loss as low as possible while maintaining high quality (oil and protein content).

### 2.7.1 Project: The efficacy of desiccation, measured in terms of yield and quality, as an alternative to swathing for harvesting canola.

**Researcher:** Mr DJ Hanekom  
**Institution:** Department of Agriculture Western Cape

- **Objective:**
  - Determining the influence of different harvesting techniques at respective harvest dates (moisture percentage) on grain yield and canola grain quality.
- **General:**
  - Project was terminated because researcher resigned. Should be continued when possible;

- A new project was registered (see 2.7.2).

### **2.7.2 Project: Determine grain loss of canola during ripening and harvesting in the Western Cape.**

**Researcher:** Dr J Strauss  
**Institution:** Department of Agriculture Western Cape

- **Objective:**
  - Determine the effects of different harvesting techniques and harvesting dates (moisture percentages) on grain yield and canola grain quality.
- **General:**
  - Project was finalised in 2010. Results show significant losses due to current harvesting techniques. Additional related research is essential for maintaining grain yield and improving the economic competitiveness of canola;
  - Results are shown on the PRF web page/in the database.

### **2.7.3 Summary**

- Harvesting loss is one of the aspects that has a serious detrimental effect on canola production and research on this subject is considered a high priority.

## **2.8 Programme: Quality aspects**

Canola seed contains between 36 and 46% high quality oil and between 20 and 24% protein. Literature shows clearly that the planting date in Western Australia has a significant effect on composition, with the oil content, in particular, being affected dramatically.

In South Africa no research has been conducted on this subject, although this aspect clearly requires more thorough research.

The percentage green grain kernels indicates immaturity. Immature grain could affect the suitability for oil pressing, but initial indications are that it has a negligible effect on the quality of animal feed.

The following aspects require more attention:

- Influence of planting date (environmental factors like temperature, etc.) on oil and protein content.

- Factors causing green grain kernels.
- Effects of sulphur (S) on erucic acid and glucosinolate content at local sites.
- Growing canola with healthier oil content (high oleic acid). The so-called Monola cultivars must be researched. These cultivars must be tested for grain yield and oil quality.

Although canola has the lowest saturated fatty acid content of all plant oils, it could be reduced further by cultivating high oleic acid cultivars.

Currently there are various Monola cultivars available at Nu Seed in Australia. These cultivars may be tested locally for grain yield, but also for oil content, fatty acid composition, heat tolerance, stability, smell and taste.

## **2.9 Programme: Economic aspects**

The economic effects of canola production should be included in every project. These had been included in the three crop rotation projects (see 2.2.6, 2.2.7 and 2.2.8).

In order to determine the comparable economics of canola production at farm level, two projects provide information on the profitability of canola compared to other agricultural crops such as wheat, barley or lupines.

### **2.9.1 Project: The income and cost estimates (Combuds) for canola and other crops in the respective growing areas in the Western and Southern Cape.**

**Researcher:** Mr SG Ferreira, Mr JSG Joubert  
**Institution:** Protein Research Foundation

- **Objective:**
  - Prepare comparable income and cost estimates for canola, lupines, wheat and barley. Each producer may determine estimates by inserting own figures;
  - Annual update of income and cost estimates.
- **General:**
  - Useful information had been obtained and is available on the PRF web page/in the database.

- A do-it-yourself (DIY) facility was created on the PRF web page. It is being used by interested parties;
- If the average canola grain yield could be increased by only 250 kg per hectare, canola could compete with wheat in most growing areas.
- Canola has been established and promoted as a cash crop in its own right.

**2.9.2 Project: The economic contribution of canola as a rotation crop in different crop rotation systems on a typical farming unit in the Swartland and Southern Cape.**

**Researcher: Dr W.H Hoffman**  
**Institution: University of Stellenbosch**

- **Objective:**

- To convert the available crop rotation results of respective crop rotation trials to whole-farming results, using typical farm simulation modelling;
- To evaluate the financial effects of the optimal inclusion of canola in a crop rotation system using a whole-farming model.

- **General:**

- Positive results have been obtained. Although canola itself remains less profitable than wheat, the benefits of canola is overwhelmingly favourable and a crop rotation system achieves up to R371-00 per hectare more than a monoculture wheat system.
- Results are available on the PRF web page/in the database.
- Economic studies about the contribution of canola in crop rotation systems must be expanded as soon as new technologies, such as hybrid cultivars with higher yields and GM canola are implemented.

**2.9.3 Project: Relative profitability of basic rotation crop systems: Swartland.**

**Researcher: Mr SG Ferreira**  
**Institution: Protein Research Foundation**

- **Objective:**
  - Determine relative profitability of various rotation crop systems compared to a wheat monoculture system;
  - Determine the most profitable rotation crop system excluding systems that include medics and the livestock factor.
- **General:**
  - Study was done in 2012;
  - A summary of results is available on the PRF web page/in the database;
  - Of the five rotation crop systems, the system that involved growing canola annually on 25% of the farm surface, showed the best results over a period of ten years;
  - If necessary, the study may be repeated in other areas.

**2.9.4 Project: Comparison of profitability of rotation crop systems with and without canola in the Groblersdal/Brits vicinity.**

**Researcher: Mr SG Ferreira**  
**Institution: Protein Research Foundation**

- **Objective:**
  - Prepare financial results for a rotation crop system with and without canola, including the impact of this on a farm.
- **General:**
  - The project started in 2013;
  - Information shows that incorporation of canola offers a higher gross margin for the farming enterprise;

- The study should be continued with more producers as participants;
- Results are available on the PRF web page/in the database.

## **2.10 Programme: Animal utilisation of products**

Canola may be used in both full-fat and oilcake form for animal feeds. The full-fat form provides between 20 and 24% protein and about 36 to 46% oil, while the oilcake contains about 35% protein and less than 1% oil.

### **2.10.1 Project: Application of feed enzymes to improve the utilisation of sweet lupines, full-fat canola and canola oilcake in diets for chickens and pigs.**

**Researcher: Dr TS Brand**

**Institution: Department of Agriculture Western Cape**

- **Objective:**

- To improve the value of locally produced lupines, full-fat canola and canola oilcake for monogastrics and to test techniques for improving its utilisation.

- **General:**

- Project was completed in 2005.

### **2.10.2 Project: Determine nutritional value of canola and lupines in poultry and pig feeds.**

**Researcher: Prof RM Gous**

**Institution: University of KwaZulu-Natal**

- **Objective:**

- Evaluation of various forms and inclusion levels of canola and lupines in poultry and pig feeds.

- **General:**

- Project was completed in 2002;

- Norms were established for values and inclusion levels;
- Results were published and included on the PRF web page/in the database.

### 2.10.3 Summary

- **Dr Brand's previous work includes:**
  - Guidelines for the ideal inclusion levels of sweet lupines, full-fat canola and canola oilcake in broiler chicken, piglet and growing pig feeds.
  - List of concentrations of the most important nutrients and feeding factors in locally produced lupines, canola, faba beans and narbon beans.
  - The effects of the inclusion of canola, lupines and canola oilcake in feed on the fatty acid profiles of broilers and pigs.
  - Use of canola stubble as grazing for sheep.
- **General:**
  - Summaries of results available on the PRF web page/in the database.
  - Information also available at DAWC.
- **Other work includes:**
  - The effects of canola seed, cotton seed and crushed canola seed on productivity of first lactation Holstein heifers.

**Researcher:** Dr LJ Erasmus  
**Institution:** ARC Animal Feed and Animal Products Institute

- **General:**
  - Results were summarised and are available on the PRF web page/in the database.

## **2.11 Programme: Technology transfer**

Research projects contain information to be conveyed to producers and interested parties by means of media.

However, there are projects aimed at target groups that are launched in certain areas.

### **2.11.1 Project: Canola information days for agricultural advisers and agents.**

**Researcher:** Prof GA Agenbag  
**Institution:** Protein Research Foundation

- **Objective:**
  - Technology transfer of technology and product information.
- **General:**
  - Project started in 2014 and is presented annually in the Western Cape;
  - The interest of agriculturists and advisors is very good and assists in the latest information reaching producer;
  - Results are recorded annually on the PRF web page/in the database.

### **3. MANPOWER PLAN**

The PRF does not employ its own researchers. It uses other institutions to implement projects. The following are the most prominent:

- Department of Agriculture Western Cape (DAWC)
- ARC Institutes
- Stellenbosch University.

The PRF uses the services of contractors that assist on a part-time basis, for technology transfer.

The canola yield competition is successful in transferring information on canola production to producers.

The PRF contractors promote the production of canola by means of the canola production competition, strip demonstrations and direct transfer of information.

Information for agriculturists and advisors render positive results.

#### **4. PROMOTION: CANOLA PRODUCTION**

Different subjects relating to canola production are made available quarterly by being published in Canola Focus, before being distributed to producers. Articles are published in Grain SA, Landbouweekblad, Farmer's Weekly and Landbouburger, but are also announced as part of various radio programmes.

The PRF also uses events such as Information Days to promote canola. Local and international experts and researchers present papers at such events. Regular study tours are undertaken to keep up to date with the latest available technology. These tours are undertaken with the support and funding of the PRF.

A complete new Canola Production Manual was finalised in 2008 and distributed as hard copy and in CD format within the canola industry. A canola production calendar was published in 2010 and distributed to producers. The "Canola Production Manual" was updated in 2014 and again in 2018.

The Canola Work Group meets several times a year to discuss matters of common interest. Representatives of the entire industry are invited to attend meetings.

The PRF web page ([www.proteinresearch.net](http://www.proteinresearch.net)) is used to make available new information on canola production and is accessible to all.

## 5. SUMMARY

- 5.1 Because of the limited research capacity and expertise in South Africa, the PRF has considered whether or not to obtain assistance and expertise from other countries. The visit of Mr Trent Potter (President: AOF) in August 2010 and the visits of Phil Thomas (Brassica Corp. Ltd, Canada) in September 2012, David Bowran in 2014 en John Kirkegaard in 2016 were of great value and the process should be continued.
- 5.2 The Technology Plan is aimed at promoting canola production, particularly in the winter rainfall area (dry land).
- 5.3 In terms of cultivar development, the following applies:
- Significant attention is being paid to the evaluation of cultivars available in South Africa;
  - The development of a local breeding programme is currently not justified due to the scope of the industry;
  - As such the development of a germ plasma bank is not required;
  - Seed multiplication of the best cultivars should be done locally.
- 5.4 Cultivation practices should receive more attention. Aspects such as the methods of establishment, plant population density, planting date, weed control and crop rotation systems require more research.
- 5.5 Fertilisation of canola currently enjoys considerable attention. If all priorities mentioned in 2.3 are attended to, the most important demands will be covered.
- 5.6 Weed control, particularly chemical weed control for canola cultivation is essential. The introduction of GM canola, to make available alternative chemical control measures, is considered a priority. GM canola could contribute to make canola more competitive in areas where herbicide resistance is a problem.
- 5.7 The following diseases pose a danger for canola production in the Western Cape:

Blackleg = *Leptosphaeria maculans*

*Sclerotinia* rot = *Sclerotinia sclerotiorum*

Soil-borne diseases such as *Rhizoctonia* and *Pythium*.

In terms of general soil-borne diseases, a seed treatment agent was tested and registered for use on canola in South Africa.

- 5.8 The Canola Production Manual provides information on good control measures and threshold values for insects that live above ground and feed on canola.

The diamondback moth poses a significant potential danger, as it is known that it easily develops resistance to chemical control. An integrated control strategy is therefore essential and should be available to producers to prevent the possible problems.

- 5.9 Canola harvesting techniques should be investigated further.

- 5.10 Factors affecting canola quality, could enjoy more attention. Aspects that are of particularly importance are:

- Effects of planting date (environmental factors such as temperature etc.) on oil and protein content of canola seed.

Although canola oil is one of the healthiest of all plant oils, it could be improved. Such cultivars are available in Australia and could be evaluated locally.

- 5.11 The economics of canola production needs further investigation. See projects 2.9.1 to 2.9.4.

- 5.12 Utilisation of canola and canola products for animal feeds is always important.

- Projects 2.10.1 and 2.10.2 provide useful information about this;
- Work done by various institutions on canola grain showed that canola in both forms (full-fat and oilcake) may be included in feed rations, with favourable results.

- 5.13 This PRF Development Plan for canola indicates the PRF's vision of the most essential work to be done and work that should be done to support, expand and sustain canola production in South Africa. However, other aspects will be considered for funding, based on merit.

- 5.14 Work that should enjoy first attention is:

5.14.1 Availability of new cultivars, especially aimed at higher grain yield (hybrid cultivars).

5.14.2 Improvement of harvesting techniques and reduction of harvest losses.

5.14.3 Bringing GM canola to South Africa is a high priority.