Vision

The PRF strives to make a significant contribution to the promotion of local production of protein on a competitive basis, in order to satisfy the growing need for protein for animal production purposes which will lead to an increase in the standard of living of all people in the RSA.

Mission

The PRF contributes to the realisation of the vision for the provision and utilisation of protein by means of:

1. The pro-active stimulation and funding of applicable purposeful research in order to fulfil the increasing protein needs for animal nutrition in the RSA.

2. The PRF ascribes to –
   2.1 a balanced, objective approach;
   2.2 a critical awareness of the latest developments regarding the protein supply and utilisation;
   2.3 the promotion of cost-effective research;
   2.4 the dynamic promotion of the implementation of research results;
   2.5 the effective sustained utilisation of natural agricultural resources.
# CONTENTS

1. **INTRODUCTION** ..................................................................................................................3

2. **GENERAL OVERVIEW** ....................................................................................................3

3. **POLICY DECISIONS** .......................................................................................................6

4. **PROTEIN SOURCES** .......................................................................................................8

   4.1. General ..........................................................................................................................8

   4.2. Fishmeal .......................................................................................................................8

   4.3. Oilcake .........................................................................................................................9

      4.3.1 International ...........................................................................................................9

      4.3.2 Locally ...................................................................................................................10

      4.3.3 Projections - 2010, 2020 ....................................................................................11

   4.4. Local protein consumption .........................................................................................11

      4.4.1 General ..................................................................................................................11

      4.4.2 Poultry industry .....................................................................................................12

      4.4.3 Pigs .......................................................................................................................13

      4.4.4 Dairy, etc ...............................................................................................................13

      4.4.5 Other ....................................................................................................................13

   4.5. Local production of protein ........................................................................................14

      4.5.1 General ..................................................................................................................14

      4.5.2 Soybeans ...............................................................................................................14
4.5.3 Canola ............................................................................................................................................. 17
4.5.4 Other ............................................................................................................................................. 19

5. PROJECTS FINANCED IN 2009/2010 .................................................................................................. 19

6. PROJECTS COMPLETED SUCCESSFULLY OR IN WHICH SIGNIFICANT PROGRESS WAS MADE (ANNEXURE I AND II) ........................................................................................................ 20

SEE 6.1 TO 6.30

7. STUDY BURSARIES .......................................................................................................................... 51

8. ACHIEVEMENT AWARDS IN SUPPORT OF THE VISION AND MISSION OF THE PRF ........ 53

9. CONCLUSION ...................................................................................................................................... 54

ANNEXURES

I LIST OF APPROVED PROJECTS FOR 2009/10 .................................................................................. 56

II LIST OF PROJECTS COMPLETED IN 2009 ....................................................................................... 59

III SHORT- AND MEDIUM TERM REQUIREMENTS AND USAGE OF FISH MEAL AND OILCAKE ........................................................................................................................................ 60

IV PRF STRUCTURE .................................................................................................................................. 63
1. INTRODUCTION

The vision and mission of the PRF is of great importance to all South Africans. No other institution in South Africa is involved in implementing foreign exchange savings by replacing imports of protein for animal use, creating job opportunities and simultaneously contributing significantly to food security in South Africa.

The main objective of the PRF, namely to reduce imported protein by producing more protein locally, implies clearly that there is presently insufficient protein being produced in South Africa for animal use, that South Africa is not self-sufficient in terms of livestock products such as meat, eggs and milk, and that there is no food security in terms of these aspects.

With this report, the PRF Board attempts to create a more complete picture of protein for animal use and its effects on protein for human consumption, creating employment opportunities and food security. We believe that those who, as a result of studying this report, assist in promoting the vision and mission of the PRF, would be rendering a special service to all in South Africa.

The lack of sufficient research funding, as well as the ineffective management of these limited funds, makes one wonder whether policy makers are truly serious about food security in South Africa. We are constantly being made aware of Africa’s potential, which is a positive message for the South African economy, but the downside is that the rest of Africa is unlikely to be able to contribute where there are serious food shortages. Famine and suffering, as we have seen in many countries, would increase. If South Africa cannot care for itself, no one else would assist us in times of need.

The PRF trusts that the government departments involved in job creation, import replacement, food security and particularly protein for use not only by animals, but also by the people of South Africa, are aware of the contribution made by the PRF in these important areas, and that we are prepared to assist the Government in all these departments.

2. GENERAL OVERVIEW

Once again, the PRF can look back with satisfaction at what has been achieved during the past year over a wide variety of activities.

The PRF Board represents various disciplines and interest groups that are considered to be of critical importance in terms of current circumstances. Every Board member is a specialist in his own right and could not be easily replaced. During the year, and only the second time in the history of the PRF, a Board member died during his term of office. We mourn the death of Mr
Steve Malherbe, one of the most senior and most respected Board members. The PRF will miss him as a person, as an honoured colleague and friend, but also his experience, knowledge and wisdom.

In order to implement the vision and mission of the PRF the expertise from a large number of disciplines is essential. The list of disciplines includes, *inter alia*, the following:

1. Agriculture
2. Crop models
3. Weed control
4. Crop physiology
5. Soil Science/Plant nutrients
6. Botany
7. Plant cultivation/genetics
8. Biotechnology
9. Biochemistry
10. Plant pathology
11. Microbiology
12. Entomology
13. Nematology
14. Nutrition: Cattle and sheep
15. Nutrition: Dairy cows
16. Nutrition: Pigs and poultry
17. Accounting
18. Economics
19. Agricultural economics
20. Marine biology

Apart from the funded research projects summarised below the PRF finds it necessary to make use of contractors for a variety of tasks that the Trustees do not have time to perform, or where the research institutions like the ARC cannot provide the required manpower. The 2008/2009 research report referred to so-called Plans B and C to circumvent the limited research capacity in South Africa. These resulted in increased use of universities and other institutions that could assist (Plan B) and the utilisation of foreign expertise, made possible by inviting experts from other countries, mainly America, Brazil, Argentina and Australia (Plan C). Visits by South Africans to these countries were also used for information and training.

As mentioned in the 2008/2009 research report, paragraph 3 - “Policy Decisions” the PRF acquired the services of Dr Jan Dreyer who was co-opted as a member of the Technology Committee for a period of one year. However, during the year this appointment was upgraded to a permanent appointment because of his significant contribution to that Committee.

Negotiations with the University of Stellenbosch, particularly through Prof Mohammad Karaan, Dean of the Agricultural Sciences Faculty, were positive and an agreement was entered into, in terms of which Prof André Agenbag will co-ordinate all PRF canola activities in the Western Cape Province. This step rendered immediate positive results, to the benefit of the canola industry.

Co-operation with Embrapa, as well as the University of Viçosa in Brazil and INTA in Argentina, was mentioned in the 2008/2009 research report. The proposed co-operation materialised and during the October/November 2009 planting season a number of cultivars from these
institutions were planted at various localities in South Africa. In some cases, planting was late due to logistical problems. The results of these trials and progress in respect of these agreements will be included in the 2010/2011 research report.

Last year we also referred to the need for a map to determine the surface area available for soybean production in South Africa, as well as a climatological map of regions where soybeans are currently grown. Prof C Blignaut of the University of Pretoria was contracted to handle the first aspect. This map, which will probably be available in 2010/2011, will be particularly useful in promoting soybean production. Two PRF contractors, Messrs Wessel van Wyk and Gawie de Beer, prepared a climatological map in co-operation with colleagues in the soybean industry. This map, which shows regions where soybeans are currently produced, will be refined once the study by Prof Blignaut has been completed.

The Bureau for Food and Agricultural Policies (BFAP) has been very helpful in assisting the PRF to establish a soybean scenario plan for the industry. Preliminary reports have been received and the final report will be available early in 2010/2011. This report is likely to provide information that will dispel many of the misconceptions in the soybean industry.

The PRF continues to maintain a policy of sustained technology transfer at all levels. Well-known experts were invited to some of the Board and working group meetings. Board meetings were addressed, *inter alia*, by Prof R Schulze of the University of KwaZulu-Natal and Prof M Karaan of the University of Stellenbosch. Other speakers at the different working group meetings are mentioned in the specific sub-sections of this report.

As a result of agreements with foreign institutions the PRF, for the first time in its history, invited foreign experts to assist with technology transfer. Dr JFV Silva of Embrapa was invited as a PRF guest to address the NSSA Symposium in South Africa. Similarly, two seed growers from INTA, Messrs Ignacio Vicentin and Luis Salines, as well as Prof F Rodrigues of the University of Viçosa, visited South Africa and met with various experts and working groups.

In an attempt to promote the canola industry, the PRF Board arranged for the chairman of the Australian Oil Seeds Federation (AOF), Mr T Potter, to visit South Africa in 2010/2011. Some PRF Trustees and contractors visited Australia, Argentina, Brazil and China during the year both for business visits and to attend congresses.

Although bio-fuel is not yet an important commodity in South Africa, the PRF considers the future of the bio-fuel industry and its resultant by-products to be of considerable importance. The Board and its working groups are kept up to date with the latest developments in this industry by Dr Lourens du Plessis, a contractor who submits quarterly reports to the PRF on this subject.
The PRF feels that the growth in the soybean industry is a highlight, in spite of the opposing opinion held by Grain South Africa. More particulars and facts about the soybean industry are provided in paragraph 6.5.2 of this report.

Another problem that enjoys continued attention is the reliability of laboratory results. Variation in the results obtained from various laboratories jeopardises the results of the respective research projects. Hopefully this matter will be finalised in 2010/2011.

Following a long period in which there has been a lack of specialist knowledge about soybeans in the ARC, the ARC President undertook to appoint one senior and two junior soybean researchers at the ARC GCI. The PRF and the soybean industry look forward to the implementation of these promises, because it will provide a much needed incentive to the soybean industry.

3. POLICY DECISIONS

The PRF strives to adapt continuously to changing circumstances brought about by the dynamics of a modern society. The degree of success achieved by the PRF is determined by a wide variety of disciplines, described in paragraph 2. This means that the PRF has to be informed of the latest technology, and that it has to adapt to such technology.

The two generic marketing programmes require far more attention than mere input from the respective working groups. Consequently, the Board decided to appoint two ad hoc task teams to attend to these matters exclusively. Experts and co-workers will be co-opted as members of the task teams as and when required.

The composition of the PRF Board enjoyed in-depth attention during the current year to ensure compliance with all current activities. A generic soybean marketing programme was announced last year and the programme is progressing according to plan. This year, the PRF decided to implement a similar canola generic marketing programme and Mr Andries Theron, a leading expert and producer, was appointed as a member of the Board with effect from 1 March 2010, for a period of one year. He will represent the interests of canola on the Board, while Mr Kobus Schonken, well-known and successful canola producer, was appointed as a member of the canola planning task team.

In the previous research report mention was made of a planned investigation into the canola industry by means of a questionnaire, to determine the reasons why not more producers enter this industry. No research institution could attend to the matter immediately so the PRF decided to handle the research internally under the guidance of the vice-chairman, Mr JSG
Joubert. The research has been completed and the findings will be published, with follow-up, in 2010/2011.

The PRF celebrates its 20th anniversary in 2010. Celebration functions will be held in the five most important PRF activity centres, namely, Johannesburg/Pretoria, KwaZulu-Natal, Stellenbosch, Bloemfontein and Potchefstroom. Special functions will be held, involving as many friends and co-workers as possible, to strengthen and renew friendship ties.

The Board also decided to review its long-term awards. The ten year awards were extended to include service awards for 5, 10, 15, 20 and 25 years of service. Board members that received long-term awards during the year are:

- Dr C van der Merwe 5 years
- Mr HJ Diekmann 15 years
- Mr JSG Joubert 15 years
- Dr M Griessel 15 years
- Mr GJH Scholtemeijer 15 years
- The Late Mr SJ Malherbe 15 years

In addition, Mrs M du Preez, was the first staff member to receive a long-term service award, for 10 years of service.

Another milestone was reached with the 100th PRF Board meeting that was held in January 2010. This special event was celebrated with a special dinner. Former Board members were included in the guest list for the occasion.

In an attempt to secure more stability for PRF actions, the Board decided to purchase its own building. Negotiations are at an advanced stage and the outcome will be reported in the 2010/2011 research report.

The Memorandum of Understanding (MOU) with Embrapa was taken a step further when the so-called Material Transfer Agreement (MTA) was signed, and in the case of INTA, the MOU was followed up with the signing of a Material Transfer and Security Agreement. The PRF has set great store on the co-operation agreements with these institutions, and expects results as early as 2010/2011.
4. PROTEIN SOURCES

4.1. General

This research report relates to the period 1 March 2009 to 28 February 2010, whereas the marketing year related to the demand and supply statistics for fishmeal and oilcake, is for the period 1 April 2008 to 31 March 2009. At the time of preparing this report, the statistics relating to the 2009/2010 marketing year were not yet available (See Annexure III).

In terms of the marketing year, from 1 April 2008 to 31 March 2009, the fishmeal demand was 77 500 tonnes and the demand for oilcake was 1 664 927 tonnes. These reflect the quantities consumed mainly in the commercial market. In contrast to the same period in 2007/2008, fishmeal consumption was 55 000 tonnes and oilcake consumption 1 758 185 tonnes, which represents an increase in fishmeal consumption of 22 500 tonnes, or 40.9%, but a decrease in oilcake consumption of 93 258 tonnes, or 5.3%.

International market factors played a significant role, with the price ratio between fishmeal and soya oilcake, as well as the exchange rate, forming the basis of the substitution effects between fishmeal and oilcake. During the first months of 2008 the international soya oilcake price was more than 500 US dollars per tonne, but in the second half of that year the price dropped to below 400 US dollars per tonne. The average price in 2008 was about 450 US dollars per tonne.

In terms of fishmeal, prices quoted in Peru at the beginning of 2008, were just below 1 000 US dollars per tonne, followed by a period during which the price was about 1 000 US dollars, before dropping to below 900 US dollars by the end of 2008. The average international fishmeal/oilcake ratio was about 920 US dollars per tonne. This gave rise to a fishmeal/soya oilcake price ratio of just above two which explains the relatively higher consumption of fishmeal locally. During 2007, the fishmeal/soya oilcake price ratio had been more in favour of soya. During the 2008/2009 marketing year, 48% less fishmeal was consumed locally, this being governed by the amount of locally produced fishmeal and the profitability of selling on the export market.

4.2. Fishmeal

Local production of fishmeal, including that from Namibia, amounted to 82 500 tonnes in the 2008/2009 marketing year. Namibia’s contribution was 7 500 tonnes. Production for the 2009/2010 marketing year is estimated to be 99 500 tonnes. During the reported
marketing year more than 5 000 tonnes of fishmeal was exported and according to estimates about 41 500 tonnes will be exported during the 2009/2010 marketing year.

The average domestic fishmeal price in 2008 was about R7 000 per tonne even going as high as R8 500 per tonne at one stage. In 2009 the average local fishmeal price was about R8 000 per tonne.

As in the past, securing the total allowable catch (TAC) remains a problem. In 2009 only 173 174 tonnes of anchovies were caught despite an allocated TAC of 569 000 tonnes. The sardine TAC of 90 000 tonnes was reached. Non-quota fish (red-eye and others) caught amounted to 48 491 tonnes. The anchovies catch in 2009 was 35% below that of 2008, being only 30% of the TAC. Poor weather conditions and limited production capacity of factories contributed to the situation.

Catches started well in the 2010 season with about 10 to 15% more fish being caught compared with the same period last year. Currently, domestic prices are very high. At a certain point in January 2010, the fishmeal price was as high as R10 000 per tonne, but it is likely to drop to about R7 000 per tonne later in the year. As a result of many factors, including the strong Rand, oilcake prices are relatively low at the moment and it is likely that there will be considerable substitution of fishmeal, using soya oilcake, especially in the poultry industry which is a large consumer of protein.

4.3. Oilcake

4.3.1 International

In terms of international markets, the grain and oilseed prices, as well as product prices were exposed to market variations in 2009. This was mainly due to the bear and bull markets at the time. Bull factors in terms of soya followed the expected shortages of soya and soya products in South America, as well as the longer than expected buying pressure from China. Sentiments that encouraged higher prices included external factors such as the increasing crude oil price. At one stage, investment funds found their way into the grain and, particularly, the soya markets. Factors that dampened the price increases and bull factors were the steps taken by the Chinese to limit liquidity in the market as well as favourable harvest estimates in South America. The soya harvest estimates in the Southern Hemisphere will be about 129 million tonnes, 31.5 million tonnes more than the previous season’s drought-damaged harvest. Large downward pressure on all oilcake prices is expected in the forthcoming season which will continue the downward trend since December 2009. In the April/June 2010 quarter, oilcake prices at the Rotterdam
market will be about 300 US dollar per tonne, 20% lower than the February 2010 prices.

Expected world production of soya oilcake for the period April/September 2010 will increase sharply, by 7.3 million tonnes, compared to that for the previous year. The increased demand for soya oilcake will not keep pace with the increased supply, due to lower poultry and livestock numbers in many countries. The expected consumption of soya oilcake will be 83.2 million tonnes for April / September 2010, 5.8 million tonnes more than the comparative period on 2009, but it will only be realised if soya oilcake were to be offered at significantly lower prices. According to estimates, global consumption of the seven other oilcakes will stagnate between October 2009 and September 2010.

The biodiesel market will have a significant impact on the international oilcake supply. Increased production of biodiesel in South America due to, inter alia, exports from Argentina to the EU and the expected increase of about 33 % in biodiesel consumption in Brazil, will play a significant role. The latter may be ascribed to the Brazilian government’s mandate for the compulsory inclusion of biodiesel that has been increased from 3% to 4% with effect from 1 July 2009.

4.3.2 Locally

As mentioned earlier, oilcake consumption decreased from the 2007/2008 to the 2008/2009 marketing year, reflected by an increase in fishmeal consumption. Oilcake consumption by AFMA members, of 1 093 339 tonnes, was 65.8% of the total used in South Africa in 2008/2009, compared to 62.3% for the previous marketing year. Soya oilcake was the most important component of the total oilcake consumed which, including full-fat soya, was 74% of their total oilcake consumption. AFMA’s total oilcake consumption in the 2008/2009 marketing year, which was about the same as that of the previous year, will, according to estimates, increase by 7.7% to 1 177 095 tonnes in the 2009/2010 marketing year. The joint growth of soya oilcake and full-fat soya for the same period is estimated at 2.3%. A significant increase, of 25.1%, in the use of sunflower oilcake is indicated for AFMA members from the 2008/2009 to the 2009/2010 marketing year.

Of the total local oilcake demand of 1 664 927 tonnes for the 2008/2009 marketing year the local market can provide only 565 181 tonnes. This means that 1 099 746 tonnes, or 66% of the total consumption, had to be imported. Soya oilcake, valued at about R2.6 billion, made up 84.1% of the imported quantity. During the 2007/2008 marketing year, oilcake imports totalled 1 263 628 tonnes, or 71.9% of
the total needs. According to estimates there will be a small improvement in local supply in the 2009/2010 season, but the global quantity to be imported would still exceed 1 million tonnes.

4.3.3 Projections - 2010, 2020

New projections of oilcake needs for the periods 2010 and 2020 are not yet available, but according to expectations the projections for 2015 and 2020 would be available in 2010. The March 2008 projections show that oilcake demand for 2010 and 2020, respectively, amount to 1,918,763 tonnes and 2,681,414 tonnes. At this stage it seems as if the demand for 2010 could have been overestimated. Even if the projections were to be adjusted downwards there remains a large gap between projected demand and local production of oilcake. A positive aspect is the return to soya production currently being experienced in South Africa. In the 2007/2008 production season 282,000 tonnes soya were produced, but in 2008/2009 this increased to a phenomenal 516,000 tonnes, an increase of 83%. It is expected that the harvest for the 2009/2010 production year will be 587,950 tonnes.

4.4. Local protein consumption

4.4.1 General

It is difficult to obtain a more detailed picture of protein use for animal consumption in South Africa. Information is supplied in the form of total usage or, as in the AFMA annual report, by animal species and type of protein. More detail on both aspects would enable the PRF vision and mission to be better understood and appreciated, and would also show how glibly we refer to food security in South Africa.
### TABLE 1: National animal feed production in 2009/2010 (TONNES)

<table>
<thead>
<tr>
<th>Feed type</th>
<th>AFMA feeds plus feeds manufactured using concentrates</th>
<th>National animal feed production</th>
<th>AFMA as % of national production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>884 466</td>
<td>1 629 649</td>
<td>54,27</td>
</tr>
<tr>
<td>Cattle and sheep</td>
<td>761 870</td>
<td>3 339 144</td>
<td>22,82</td>
</tr>
<tr>
<td>Pigs</td>
<td>213 909</td>
<td>932 642</td>
<td>22,94</td>
</tr>
<tr>
<td>Laying hens</td>
<td>827 811</td>
<td>1 148 888</td>
<td>72,05</td>
</tr>
<tr>
<td>Broilers</td>
<td>3 088 618</td>
<td>3 190 754</td>
<td>96,80</td>
</tr>
<tr>
<td>Dogs</td>
<td>12 577</td>
<td>363 222</td>
<td>3,46</td>
</tr>
<tr>
<td>Horses</td>
<td>12 158</td>
<td>132 458</td>
<td>9,18</td>
</tr>
<tr>
<td>Ostriches</td>
<td>11 960</td>
<td>51 800</td>
<td>23,09</td>
</tr>
<tr>
<td>Aquaculture</td>
<td>2 084</td>
<td>2 700</td>
<td>77,19</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5 815 452</td>
<td>10 791 257</td>
<td>53,89</td>
</tr>
</tbody>
</table>

**SOURCE:** Dr Erhard Briedenhann

#### 4.4.2 Poultry industry

The importance of the poultry industry in South Africa cannot be overemphasised. Statistics from the egg industry shows that South Africa consumes only about 130 eggs per capita per annum compared to some countries that consume more than 300 eggs per capita per annum. This offers a huge opportunity for expansion.

The broiler chicken industry has achieved significant success over the past 10 years. In 2000, it took 42 days to produce a broiler of 1,8 kg with a feed conversion of 1,85. In 2009 it took only 35 days to produce a similar broiler, with a feed conversion of 1,68. This figure improves annually. South Africa uses more than 1 billion broilers per annum, being a per capita consumption of 30 kg per annum. It is important to note that 200 million broilers are imported annually, the value of these imports in 2009 amounting to R1,565 billion. This offers a significant opportunity to expand the local broiler chicken industry which could also lead to the consumption of more locally-produced protein and maize, with a commensurate exchange rate saving.

The improved utilisation of protein, one of the PRF objectives, is particularly valid in the broiler industry. This opportunity is discussed briefly in this document.
4.4.3 Pigs

The pig industry in South Africa consumes about 10% of the total national animal feed production. In 2009, global production of pork was 106.5 million tonnes, so it is a very important industry globally, but not locally. According to estimates, global pork production will increase in 2010, the most significant increase likely to be in China where pork production increases by about 2 million tonnes per annum, where an expected 50 million tonnes will be produced in 2010. Pork amounts to 37.8% of the total meat consumption in the world, while poultry amounts to 32.6%, the second most important source of meat in the world.

South Africa continues to import pork, mainly (70%) in the form of ribs that are used in restaurants. It is also reported that local pork producers are spending significant amounts of capital on mechanisation which will lead to an increase in local productivity and increased international competitiveness.

4.4.4 Dairy, etc

From Table 1 it is clear that dairy plays an important role in the consumption of animal feeds. The three largest sources of protein consumed by the dairy industry are sunflower oilcake, soybean oilcake and cottonseed oilcake, comprising more than 90% of the total protein sources used. More information about this branch will be provided in a future report.

4.4.5 Other

As indicated earlier, one of the PRF objectives is to fund research to promote better utilisation of protein. Prof Rob Gous, internationally recognised poultry researcher and PRF Board member, has developed broiler and pig simulation models, using PRF funding, that improve the utilisation of protein in poultry and pigs. The past year was a busy year for Prof Gous as he received an invitation to address a Nutreco Conference in the Netherlands, another in Edinburgh and he also delivered the JM Bell Memorial Lecture at the Western Nutrition Conference in Canada. He visited Australia twice, addressing the Australian Poultry Symposium in Sydney and a PIX 2010 meeting on the Australian Gold Coast. In addition, he presented two papers in New Zealand and spent two weeks at the University of Sao Paulo in Jaboticabal, Brazil. He visits the latter university annually, assisting with training of postgraduate students. The PRF acknowledges Prof Gous’ particular contribution both locally and internationally, in promoting the PRF objectives.
4.5. Local production of protein

4.5.1 General

Although the PRF objectives include the better utilisation of protein by animals, far more emphasis is placed on research directed at producing more protein locally for animal consumption, thereby replacing imported protein. After spending millions of Rands on research relating to various sources of protein the PRF has decided that the only potential and viable protein sources worth pursuing presently are soybeans and canola.

4.5.2 Soybeans

Graph 1 shows the impressive growth of the soybean industry in South Africa over the past 22 years. Before 1997/1998 the industry seldom produced more than 100 000 tonnes soybean per annum and since the establishment of the PRF Soya Task Group in 1996 the industry has never produced less than 100 000 tonnes soybean. As Graph 2 shows, the only year since 1996 in which soybeans were planted on less than 100 000 ha was in the 1999/2000 season.
RSA: Soybean (Commercial)
Production
1987/88 - 2008/09

*Crop estimates committee-figure of 23 September 2009

RSA: Soybean (Commercial)
surface planted
1987/88 - 2008/09

*Crop estimates committee-figure of 23 September 2009
During the 2008/2009 season 237 750 ha soybean were planted to soybeans and a record yield of 516 000 tonnes was achieved. This average yield of 2,17 tonnes per ha is the highest thus far obtained in South Africa. This is the first time since soybeans have been grown in South Africa that the average yield exceeded 2 tonnes per ha and it is the first time that more than 500 000 tonnes soybeans have been produced locally.

According to the Crop Estimates Committee this crop was more than 80% higher than the previous crop, and also almost 120% higher than the average over the previous 10 years, of 234 216 tonnes. The Crop Estimates Committee also estimated that the gross value of soybeans produced during 2008/2009 was R1.623 billion, compared to R1.134 billion for the previous season, an increase of 43%. Indications for the 2009/2010 season are that about 311 000 ha will be planted, with a possible yield of about 580 000 tonnes.

The PRF is proud of the progress made and the potential for further increases in soybean production. In an attempt to give maximum drive to the generic soybean marketing programme, a special soybean planning task team was convened to pay attention to detailed aspects of the programme.

In addition, discussions with seed companies indicated that promising cultivars are being developed with appropriate technology that will be available in South Africa within the foreseeable future. Representatives of two of the three seed companies, Dr A Jarvie at Pannar and Mr W Engelbrecht at Pioneer, addressed the soybean working groups during the past year. The third company, Linkseed, has already undertaken to provide similar information during 2010/2011. This is the first time in the past 14 years that seed companies have openly provided information about developments that will further improve the potential for soybean production in the country.

Progress with the evaluation of a variety of cultivars from INTA in Argentina and from Embrapa and the University of Viçosa in Brazil was described in paragraphs 2 and 3 above.

The PRF contracted Mr Jan du Preez to perform quarterly web studies relating to the latest developments in the soybean industry in the USA, using reports by seed companies and universities, the American Soybean Association (ASA) and the United Soybean Board (USB). The value and quality of this work is appreciated and highly valued.
The rust and Sclerotinia task groups still function effectively, and meetings are well attended.

Probably one of the most important technology transfer techniques used by the PRF to promote soybeans involves cost and income budgets for the respective regions which are calculated and presented annually under the guidance of Mr JSG Joubert, vice-chairman of the PRF. The idea that soybeans are cash crops in their own right may be ascribed directly to this exercise. In addition, the benefits of crop rotation and reduced soil preparation as well as the success stories from producers have placed soybeans irrevocably on the road to success.

Other contributions that have made a difference during the past year include the successful soybean think tank, attended by high profile producers and researchers. Agreements with companies to use the same codes for identification of cultivars, as well as the categorisation of soybean planting areas in identifiable climatic zones, were handled by PRF contractors Messrs W van Wyk and G de Beer.

The soybean rust pamphlet was revised by Dr Pat Caldwell, PRF contractor, while a comprehensive document to promote the production of soybeans was prepared by Mr GduT Keun, PRF Chief Executive Officer and Mrs Erna Harmse, soybean planning task team contractor.

We thank the press, particularly Landbouweekblad, for publishing information about almost all the above incentives, reaching the broad soybean industry and contributing significantly to the success of the soybean industry to date.

4.5.3 Canola

Although production of canola grew for several years, it has stagnated over the past few years. Lupin research funding was cancelled due to the lack of growth, but after serious consideration, taking into account the success of the soybean generic marketing programme, the PRF Board decided to implement a five year programme to regenerate growth in the canola industry, taking into account the international growth pattern and global production that has reached the 60 million tonne mark. An additional incentive is the low and uneconomical wheat price which places that industry under significant pressure.

The 2009 planting was set at 35 060 ha, compared to 34 000 ha in 2008. The expected yield is 40 310 tonnes compared to 30 800 tonnes in 2008.
The PRF Board provided funding, like that for soybeans, for a canola generic marketing programme. As mentioned earlier, Prof André Agenbag of the University of Stellenbosch was contracted to co-ordinate the project, and Mr Johan Loubser will help with various other activities. The PRF also appointed Mr Kobus Schonken, well-known and extremely successful producer of, inter alia, canola, to serve as a member of the canola planning task team. His particular expertise will be used to promote canola production.

The results of the income and cost budgets were refined, and sensitivity analyses showed that an increase of 250 kg of canola per ha could establish it as a cash crop in its own right. In principle, the PRF decided to embark on an advertising programme entitled, “The extra quarter tonne”, but the results will only be noticeable next year.

In Paragraph 3 mention was made of the survey to identify problems and obtain other information relating to the disillusionment within the canola industry, under the guidance of Mr JSG Joubert, and assisted by Prof Agenbag, Mr Loubser and others. The information will be used by the canola planning task team to promote canola production, but more information about this will also only be available next year.

In the same vein, the canola development plan previously prepared by Dr de Kock, was adjusted during the past year to take account of current circumstances, and this was followed by the publication of a canola manual edited by Prof André Agenbag. The manual is available in English and Afrikaans, in book format and on CD. Both are available on the PRF web site.

For some time it has been known that the canola industry in South Africa has had to struggle with older cultivars from Australia. These cultivars are no longer available on the cultivar lists in Australia. Dr J de Kock and others have visited Australia several times recently and during those visits liaison with respective seed companies has been established. There are strong indications that these initiatives will lead to an assortment of new lines and cultivars becoming available in South Africa in the forthcoming season. This should contribute immediately to the “Extra quarter tonne”.

The Canola Focus continues to be published regularly. The PRF sincerely thanks the editorial team under the guidance of Mr Piet Lombard, as well as all co-workers, for their efforts in keeping the contents of this publication both educational and interesting.
4.5.4 Other

Comprehensive agronomic requirements have been suggested to the PRF as guidelines for the production of plant protein for animal use. This has been briefly referred to in paragraph 2 of this report.

The disciplines represented on the Board are determined on the basis of the most urgent needs at any particular time. Input from Board members representing the agronomy portfolio includes, *inter alia*, the following disciplines: agronomy, plant breeding, soil science, plant nutrition, weed science, plant physiology and pathology and entomology. Although the person in office does not need in-depth knowledge of all these disciplines, to serve the needs of the PRF it is necessary to have a working knowledge and to know where to obtain in-depth information.

A range of congresses that should, wherever possible, be attended by agronomists relate to plant pathology, entomology and nematology, as well as the annual symposium on soilborne diseases held in Stellenbosch and the joint congress of the South African Association of Crop Production, the Soil Science Association and the Southern African Association for Weed Sciences, among others.

The PRF also leans heavily on the agronomists to liaise with institutions such as SANSOR, the Fertiliser Association of South Africa, AVCASA and others. They also assume responsibility, to a large extent, for PRF contractors involved in cultivar trials, own research and international soybean trials referred to earlier. Although the research capacity at Universities, Provincial Departments of Agriculture and ARC is limited, the PRF agronomists must liaise with these institutions as far as possible, to keep up to date with the latest developments.

5. PROJECTS FINANCED IN 2009/2010

During 2009/2010, the PRF funded 30 research projects (See Annexure I), three more than the previous year. Three (3) of the 30 projects were new, while 27 were continuations of existing projects. A total of 33 funding applications were received. Two were declined and one was withdrawn.

Eight projects (See Annexure II) were finalised during the year, but the final reports are expected only in the first half of 2010.

For 2010/2011, the PRF received 29 applications. Six of those were new applications. These applications will be described in the next research report.
6. PROJECTS COMPLETED SUCCESSFULLY OR IN WHICH SIGNIFICANT PROGRESS WAS MADE (ANNEXURE I AND II)

6.1 EVALUATION OF ADVANCED SOYBEAN BREEDING LINES: E.N. Ndou, T.A. Masiha

Production of soybeans \([Glycine\ max\ (L.)\ Merr.]\) in South Africa is relatively low and there are many factors that limit production of soybeans in South Africa, for example adaptability to local conditions. The aim of this breeding project was to evaluate genotypes that were developed from the previous programme and to release the best cultivars with improved adaptation and high yields. Twenty-five genotypes from the previous breeding programme and five local check cultivars were evaluated at Bethlehem, Brits, Potchefstroom and Vaalharts during 2008/09 season. The average number of days to 50 % flowering across the locations varied between 54 to 68 days, with a mean of 63 days and there was no significant difference among the genotypes. However, there was a significant difference between the checks and genotypes. The average number of days to physiological maturity across locations varied between 125 in to 136 days. The mean number of days of physiological maturity across genotypes did not differ statistically. The number of days to harvest averaged at 153 days across locations. Genotype GP20-2-22-5 has attained the highest grain yield of 2 056.93 kg ha\(^{-1}\) and genotype TXS99-5-52 was attained the lowest grain yield mean of 1 404.36 kg ha\(^{-1}\), the trial mean grain yield mean 1 761.17 kg ha\(^{-1}\). There was no significant difference across genotypes. Genotypes across locations were not consistent and genotype GP20-2-22-5 was not stable across locations. However, the genotype that was ranked second across location was stable in Potchefstroom, Brits and Vaalharts where it was ranked first, fifth and sixth, respectively. Genotype X environment interactions proved to play a significant role in the success of any breeding programmes for the development of genotypes adapted to a wild range of environments.

6.2 EVALUATION OF PRF-SOYBEAN ELITE LINES UNDER SOUTH AFRICAN CONDITIONS: G.P. de Beer, W.F. van Wyk, Contractors, Protein Research Foundation

INTA – GENOTYPES:
Twenty-five genotypes, which include maturity groups 4 to 7, were planted at six sites in two 75 cm rows of 5 metres long with 3 replications on 7/12/2009. Six (6) local cultivars from Pannar and Link Seed were included as controls.

VIÇOSA – GENOTYPES:
Five genotypes were planted at three sites in two 75 cm rows of 5 metres long with 3 replications on 13/12/2009. Two (2) local cultivars from Pannar and Link Seed were included as controls.
EMBRAPA – GENOTYPES:
Sixteen genotypes were planted at six sites in two 75 cm rows of 5 metres long with 3 replications on 11/01/2010. Four (4) local cultivars from Link Seed were included as controls. Twenty (20) different measurements were taken at each of these genotypes before threshing and five (5) after threshing. It seems that there are some good lines amongst these genotypes.

6.3 NATIONAL SOYBEAN CULTIVAR TRAILS: J.L. Erasmus, H.S.J. Vermeulen, N.N. Mogapi, T.C. Ramstlotlo, ARC-Grain Crops Institute

In the national cultivar trials a total of 18 cultivars were evaluated at selected localities across the soybean production areas of South Africa. An additional 10 cultivars were evaluated at 10 locations in phase-1 trials. Trials were planted at research stations where the necessary infrastructure exists in order to carry out a comprehensive agrometeorological study. Trial sites were also selected in areas where a need for information exists and where the maximum amount of data could be collected. A comprehensive data set was collected on phenological data such as days to flowering, physiological and crop maturity, maximum plant height and minimum pod clearance, lodging, shattering and green stem, relative disease or pest susceptibility, seed characteristics and yield, physical and chemical quality, and soil and weather data. All data from the trials were analysed to calculate yield reliability for cool, moderate and warm production areas. The 2008/09 cultivar evaluation report was approved for publication. Mean seed yield across localities was 2 820 kg ha-1 compared to 2 456 kg ha-1 for the 2007 and 1 717kg ha-1 for the 2006 seasons. The highest average mean yields were obtained at Cedara (4 428 kg ha-1), Greytown (4 347 kg ha-1) and Vaalharts (4 244 kg ha-1). Overall cultivar LS 678 (3 164 kg ha-1) yielded the highest and Ibis 2000 (2 379 kg ha-1) the lowest. The cultivar with the highest protein percentage was Ibis 2000 with 43.73 % and the lowest was PAN 1454 R with 40.97 %. Cultivars that exceeded 5 t ha-1 were LS 6164 R at Vaalharts and Empangeni PD1, PAN 1666 R, PAN 737 R and LS 678 at Greytown and PHB 96 B 01 at Cedara.

6.4 INCREASING SOYBEAN PRODUCTION ON THE HIGHVELD: W.F. van Wyk, Contractor, Protein Research Foundation

Fertilisation
Treatments: Three (3) levels of P (0, 20 and 40kg/ha) and three (3) levels of K (0, 50 and 100 kg/ha)
The trials were harvested and all data were taken but no statistical analyses have yet been done. Large differences occurred between the treatments, as expected.

**Cultivation methods with different rotation systems**

Treatments: Plough (soya, soya – soya, maize – maize, soya), No-till (soya, soya – soya, maize – maize, soya), and disc (soya, soya – soya, maize – maize, soya). In 2009/10 a maize monoculture treatment was added to all three cultivation methods.

The trials were harvested and all data have been collected but no statistical analysis has yet been done. The benefit of soybeans is already apparent on maize after soybeans.

6.5 **EFFECT OF SO2 AND THE INTERACTION ON GROWTH, PHYSIOLOGY AND BIOCHEMISTRY OF SOYBEAN \((GLYCINE MAX)\) AND CANOLA \((BRASSICA NAPUS)\), STUDIED IN AN OTC SYSTEM:** J.M Berner, S. Lindeque, M. Minnaar, P.D.R. van Heerden, G.H.J Kruger, School for Environmental Sciences, North West University, Potchefstroom

Soya (PAN 1666 and LS 6164) plants were exposed to 25, 75 and 150 ppb of sulphur dioxide (SO\(_2\)) in an OTC system. The activities of two stress associated enzymes, lipoxygenase (LOX) and peroxidase (POD) were determined. Lipoxygenase is a key enzyme in the lipoxygenase pathway leading to the production of oxylipins. Oxylipins are secondary metabolites that regulate stress responses and often participate directly in a stress response. Reactive oxygen species are formed during a stress response and needs to be quickly detoxified. Peroxidase is one of many antioxidant enzymes responsible for detoxifying free radicals. The activities of both LOX and POD increased as the levels of SO\(_2\) concentrations increased. A significant increase in these activities could be detected as early as 3 weeks after the start of fumigation. PAN 1666 had significant higher increases in LOX and POD activity Compared to LS 6164. These results suggest that PAN 1666 has a higher level of SO\(_2\) tolerance when compared to LS 6164.

Canola (Rainbow) was exposed to 50, 100 and 200 ppb of SO\(_2\). The effect of SO\(_2\) on the plants was followed by means of chlorophyll fluorescence. The performance index (PI\(_{ABS}\)) is based on the fast phase chlorophyll fluorescence rise. It is a multi-parametric function taking into account all partial processes of primary photochemistry, namely absorption of light energy, trapping of excitation energy and conversion of excitation energy to electron transport. After 5 weeks of fumigation a decline in the PI\(_{ABS}\) was noticed as the levels of SO\(_2\) increased. The activity of antioxidant enzymes POD and ascorbate peroxidase (APX) was determined. A significant increase of POD was observed with the 50, 100 and 200 ppb SO\(_2\) treatments compared to the control. There were no significant differences in the POD and APX activities between the different treatments.
6.6 PHENOTYPIC MARKERS FOR NODULATION CAPACITY OF SOYBEAN CULTIVARS: B.A. Fenta1, S. Driscoll2, C. Foyer2 and K. Kunert1, 1Plant Science Department, Forestry and Agricultural Biotechnology Institute, University of Pretoria, 2Centre for Plant Sciences, Faculty of Biology, University of Leeds UK

The sustainability of grain legume production is severely restricted by drought. To investigate the physiological basis of drought tolerance in soybean the genotypic variation in drought sensitivity was exploited with the aim of defining phenotypic markers that may assist future breeding programmes. Therefore, physiological parameters that characterise the response of soybean plants to drought were characterized and the responses of three soybean cultivars (Prima 2000, A5409RG and Jackson) to the onset and progression of drought imposed by water deprivation were compared using a range of shoot, root and nodule parameters. Results obtained show that the kinetics of soil water loss and drought-induced decline in leaf water potential values are similar in all three cultivars. Also stomatal conductance values declined rapidly following water deprivation in the three cultivars and photosynthesis was progressively inhibited in all three cultivars under drought conditions. However, Prima leaves retained higher photosynthetic CO₂ assimilation rates than A5409RG or Jackson. This was even after 20 days of water deprivation. Further, exposure to drought altered the biomass partitioning between roots and shoots and shoot/root ratios declined significantly in all three cultivars. However, Prima roots and shoots had greater total biomass than those of Jackson or A-5409RG under both well-watered and drought conditions and further drought-treated A-5409RG plants retained the highest shoot to root ratios. Jackson plants had the lowest nodule number per root while A5409RG roots had the highest number. High symbiotic nitrogen fixation (SNF) rates were found only in a relatively narrow range of high leaf water potential values. Drought treatment decreased nodule numbers by about 90% and SNF declined to near zero values. Correlations between SNF and photosynthesis rates, and SNF and shoot fresh weight were further found. From the experiments, we conclude that while drought severely inhibits SNF in all three cultivars, Prima has a robust photosynthetic capacity that sustains more vigorous growth and higher rates of biomass accumulation despite severe limitations in soil water availability. Data have been submitted for publication in Journal of Experimental Botany.

6.7 ESTABLISHMENT OF AN EARLY WARNING SYSTEM FOR SOYBEAN RUST: M. Craven, G.P. de Beer¹, T.M. Ramusi, A.S. de Beer, ARC-Grain Crops Institute, ¹Protein Research Foundation

Due to the destructive nature of soybean rust and an apparent lack of adequate resistance to the disease an effective disease management system is required until resistant cultivars become available. Disease scouting in order to detect the pathogen as early as possible is an important key to an effective management programme. Since the 2005/06 season the
ARC-Grain Crops Institute (ARC-GCI) together with the Protein research Foundation (PRF) and other co-workers such as PANNAR, the department of agriculture of KwaZulu-Natal (KZN) and a number of soybean producers have attempted to create a soybean-rust-early-warning system that is based on trap-crop trials, also referred to as indicator plots. Data generated during this study contributed to the confirmation of a general seasonal trend of soybean rust movement from east to west in all soybean production areas in South Africa. A screening protocol was also established that will be used for the monitoring of soybean rust development in future.

This past season rust was first detected at Dirkiesdorp, Vryheid and Cedara (15 January 2010) followed by Greytown (28 January 2010), Normandien and Morgenzon (8 February 2010), Greylingstad (16 February 2010), Kinross and Kestell (16 March 2010) and finally at Potchefstroom (23 March 2010).

6.8 DETERMINING THE EPIDEMIOLOGICAL VALUE OF RESISTANCE TO RUST CAUSED BY *PHAKOPSORA PACHYRHIZI* IN SOYBEAN LINES: N.W. McLaren, C. Botha, University of the Free State

Soybean cultivars and alternative lines were evaluated in the field (Cedara) for soybean rust resistance. Three planting dates were used spaced approximately two weeks apart. Plants were dependent on natural infection. Subsequent to when infection was first noted, plants were scored using the criteria of the percentage infection and percentage defoliation and the two criteria were pooled to determine the total affected leaf area. Lines (PI 603909A and PI 606376 had overall the lowest rust severity ratings (mean = 2.5%) while PI 567616 and PI 603166 had higher defoliation percentages and rust severities than the other germplasm evaluated. These genotypes have been planted in the greenhouse to corroborate data.

A short, medium and long season variety i.e. PAN 1545RR, SNK 500 and LS 678 respectively, were planted over five selected planting dates at Cedara to determine the relationship between host physiology and disease susceptibility. Mean rust severity ratings ranged from 5% in SNK 500 to 25% in PAN 1454 RR. However, PAN 1454 RR is a short season variety and tended to escape the effects of the disease more readily than SNK 500 and LS 678.

An aim of this study is to identify physiological markers associated with variations in the response of soybeans to the rust pathogen, notably those associated with delayed disease onset and reduced rate of disease development. Leaves were sampled at R3 growth stage to extract intercellular wash fluids. Leaves were washed and dried and placed in a vacuum tube with sodium acetate buffer (pH 5.2) and vacuumed for 5 minutes. Leaves were then
dried and placed in centrifuge tubes. These were centrifuged at 2000 rpm for 10 min at 4°C. The intercellular fluids were placed in Eppendorf tubes and placed in the freezer until further use. These fluids as well as sampled leaves will be used for the determination of PR proteins (β-1,3-glucanase, peroxidase and chitinase), enzymes (PAL, peroxidase), total and specific phenols and total carbohydrates. Analyses of these compounds are currently being conducted.

Blocks of SNK 500 (susceptible) were planted and different levels of Urea and LAN were applied to the soil. Noticeable differences in the time of disease onset and final rust severity ratings was recorded between treated and control plots. Higher ratings were observed in plots with low fertilizer concentrations and control plots. Control plots with no fertilizer added and an absence of rhizobium showed higher disease severity ratings and a faster rate of defoliation indicating that host vigour and extended periods of cellular activity plays a role in delaying disease onset and rate development. N-treated plots are also being used as a source of variation in determining the role of proteins, enzymes, phenols and carbohydrate concentration in relation to rust development as well as variation in photosynthetic activity (chloroplast fluorescence) compared to the control plots with no amendments.

6.9 THE USE OF SILICON TO CONTROL SOYBEAN RUST (*PHAKOPSORA PACHYRHIZI*) AND OTHER RELATED STUDIES: D. Visser, P. Caldwell, University of KwaZulu-Natal

**Effect of root application of potassium silicate to control soybean rust**

*Aim:* To determine the effect of root application of silicon on the control of soybean rust

**Materials and Methods:** For pot trials, soybean seed (LS 6161) will be planted in pots and placed in a glasshouse. Si (0, 100, 500, 1000, 1500 and 2000 mg/\(\ell\)) will be applied by drenching pots for 4 weeks. pH and KCl controls will be included. Plants will be artificially inoculated and placed in the dew chamber for 24 hrs. Thereafter plants will be placed in a Conviron and rated for number of pustules per lesion and lesion size 21 days post inoculation.

For field trials soybean seed (LS 6161) were planted at Cedara (2009/2010) in 3 x 1.75 m plots. The treatments were as follows: uninoculated control, Punch C, Punch C and 2000 mg/\(\ell\), half strength Punch C and 2000 mg/\(\ell\), half strength Punch C, 1000 mg/\(\ell\), 2000 mg/\(\ell\) (2 applications), and 3 slow release silicon fertilizers at 3 rates each. Soil samples were taken before Si was applied and after the last Si application and analysed for Si concentration. Plants were rated for percentage disease and the AUDPC calculated. Yield was also determined.
An accelerated ageing test on the seed from the field will also be conducted. 36 seed from each treatment will be removed and tested according to the International Seed Testing Association (ISTA), to determine whether the use of root applied silicon will increase the storage life of soybean seed.

**Status:** Pot trials are still to be conducted during November/December 2010 (over the summer season). Field trials in the 2007/2008 season have been conducted at Baynesfield and analysed. The trial has since been amended and completed (2008/2009 season) at Cedara. Further amendments have been made and the trial completed (2009/2010 season) at Cedara. The AUDPC’s have been calculated, and the trial has been harvested and the yield is currently being determined for the 2009/2010 season. The trial will be repeated in the following season (2010/2011) at Cedara. Special accelerated aging equipment is currently being built for seed testing. This test should be conducted within the next month.

**The effect of foliar application of potassium silicate on the control of soybean rust**

**Aim:** To determine the effect of foliar application of potassium silicate on the control of soybean rust

**Materials and Methods:** For glasshouse trials, soybean seed (LS 6161) will be planted in pots and placed in a glasshouse. Potassium silicate (0, 250, 1000 and 2000mg/l) was applied using a hand sprayer until runoff at the V4 growth stage. A pH and KCl control were included, as well as a Punch C control, and two slow release silicon fertilisers. 24 hours after silicon application, plants were inoculated with uredosporers and placed in the dew chamber for 24 hrs. Plants were then moved to a Conviron for the remainder of the trial. Plants will be rated for number of pustules per lesion and lesion size 21 days post inoculation.

For field trials, soybean seed (LS 6161) was planted at Cedara (2009/2010) in 3 x 1.75 m plots. Plants were sprayed till runoff with silicon at 0, 1000, 2000 and 4000mg/l. A drench of 1000mg/l and a Punch C control were also included. Treatments were applied at the V6, R1 and R4 growth stages. Soil samples were taken before Si was applied and after last Si application and will be analysed for Si concentration. Plants were rated for percentage disease and the AUDPC calculated. Yield was also determined.

An accelerated ageing test on the seed from the field will also be conducted. 36 seed from each treatment will be removed and tested according to the International Seed Testing Association (ISTA), to determine whether the use of foliar applied silicon will increase the storage life of soybean seed.
Status: A field trial has been conducted in the 2009/2010 season at Cedara. The trial has been harvested and the yield is currently being determined. The trial will be repeated in the following season (2010/2011) at Cedara. An initial greenhouse trial has been conducted, and plants will be rated in the middle of June, and a further trial will be conducted once the results from the initial trial have been obtained. Special accelerated aging equipment is currently being built for seed testing. This test should be conducted within the next month.

**Uptake and distribution of silicon in soybeans**

*Aim:* To determine the level and distribution of deposited and soluble silicon in the different parts of the soybean plant using a hydroponics and drench setup.

*Materials and Methods:* For deposited silicon, soybean seed (LS 6161) were grown in hydroponics (ideal conditions) and glasshouse (drench – field conditions). Silicon was applied for 6 weeks (0, 50, 100, 150, 200, 250, 300, 400 and 500 mg/l and 0, 50, 100, 250, 500, 1000, 1500 and 2000mg/l respectively. Plants were harvested under four different categories: root, stem, young leaves and old leaves, and digested using the Microwave Accelerated Reaction System (MARS). Samples were then analysed using the Inductively Coupled Plasma Optical Emission Spectrophotometer (ICP-OES) for silicon, calcium, potassium, phosphorus and manganese. For soluble silicon, the trial was run as above, but plant leaves were harvested, and 1g of fresh crushed leaf tissue ultrasonified (to disrupt cells) in 10ml water, and left to shake overnight at 4ºC. Samples were then centrifuged twice, and the supernatant removed and analysed using ICP-OES (as above).

*Status:* Due to problems with the torch on the ICP, analyses still has to be conducted with a new specialized torch that has been purchased. This will take place in the winter months of 2010. Electron microscopy/EDX is still to be conducted. The soluble silicon trial has been conducted, and will be analysed in the next few months.

**The economics of the use of silicon to control soybean rust**

Still to be determined.

**The physiological effects of silicon on soybeans subjected to cold stress**

Still to be done.
6.10 GENERATING MANAGEMENT ORIENTATED MAPS FOR LONG-TERM SOYBEAN RUST SUSCEPTIBLE AREAS IN SOUTH AFRICA: L van Niekerk, P. Caldwell, University of KwaZulu-Natal

Soybean rust (SBR), caused by the fungus *Phakopsora pachyrhizi* Syd. is a real threat to soybean crops in South Africa. Its ability to spread rapidly and its potential to severely reduce yields have earned it the reputation as the most destructive foliar disease of soybeans. SBR has been reported in South Africa every year since its arrival in 2001. While extensive research had been done on the epidemiology and fungicide application requirements in South Africa, no work into the long term climatic vulnerability of soybean production areas to SBR had been done. This meant soybean producers do not know whether SBR is a threat in their areas. Through this research a SBR algorithm was developed using readily available climate data, viz. temperature and rainfall, to create a daily index specifying the climatic vulnerability of SBR infection. The algorithm was applied to a 50 year historical climate database, and a series of maps was created illustrating the long term vulnerability of different areas to SBR infection. These maps allow soybean producers to understand the climatic vulnerability of their area to SBR infection. Time series graphs were created for selected key soybean production areas to allow soybean producers to distinguish periods of high and low climatic risk during the season. This may help with decisions regarding the planting times, the maturation rate of different cultivars as well as the timing and application of fungicides. The framework for a near real time forecasting system was created outlining how the system could amalgamate recently recorded and forecasted weather data, run it through the SBR algorithm and provide a near real time, as well as forecasted vulnerability, based on the climatic conductivity for SBR infection. Anticipated limitations and difficulties on developing the forecasting system are also outlined.

6.11 STUDY OF INOCULATION AND DISEASE EVALUATION TECHNIQUES FOR SCLEROTINIA STEM ROT OF SOYBEAN: N.W. McLaren, C. Botha, University of the Free State

In 2008/2009 soybean cultivars and lines were planted in Greytown at Pannar for field evaluation of resistance to Sclerotinia stem rot. No disease was observed. These cultivars and alternate sources of germplasm were therefore evaluated in the greenhouse. Plants were grown to V3 growth stage and inoculated using the spray mycelium method. A plastic tent was placed over the inoculated plants to maintain a high RH and to promote infection. After 6 days the tent was removed and disease was scored using a rating scale for leaf damage and wilting severity. Means for leaf damage rating ranged from 2.6 to 4.3 on a 0-5 rating scale, with Dundee the most susceptible of the cultivars evaluated. Cultivars PAN 1583 R, PAN 1652 and LS 6162 R showed various levels of resistance to the disease. Similarly, wilting severity means range from 36.6 to 86.6 % and PAN 1652, PAN
1583 R and LS 6162 R had the lowest wilting severity. LEX 2257 R had the highest wilting severity of 86.6% followed by Dundee with 83.3%.

During the 2009/2010 season, soybean lines and commercial cultivars were again planted in field trials at Pannar in Greytown for Sclerotinia stem rot evaluation. Four planting dates were used, spaced approximately two weeks apart to ensure environmental diversity during the critical susceptible stage of plant development. At flowering plants were inoculated using a colonized sorghum grain method. Plants were scored approximately 4 weeks after inoculation for disease incidence. These evaluations indicated that PHB 96 B01, PHB 95 B 53 and LEX 1235 R had highest disease incidence during the first planting. During the second planting, PHB 96 B 01, PHB 96 B 53, LEX 1235 R and IBIS 2000 showed greatest disease incidence. Data will be used to determine disease potential x observed incidence response graphs for risk analyses. These cultivars will also be planted in the greenhouse to corroborate data.

Field data also served to add to a weather database being developed with the aim of defining more precisely those conditions that favour disease development and the development of a risk analysis model.

Pathogenicity tests with *S. sclerotiorum* isolates were conducted on two soybean cultivars in the greenhouse, i.e. SNK 500, a susceptible cultivar and Egret a moderately resistant cultivar. Plants were inoculated using the spray mycelium method, covered to ensure high humidity and nine days after inoculation bags were removed. The severity of leaf damage, degree of wilting and the number of dead plants were recorded daily using a 0-5 and percentage rating scale. Analyses of variance revealed that the isolates of *S. sclerotiorum* significantly affected the severity of leaf damage on the two cultivars evaluated. Mean values ranged from 2.5 to 4.0 and isolate 7 (Kinross) produced the highest leaf damage rating. When wilting incidence was evaluated a significant difference was observed between the 18 different isolates evaluated. A significant host x pathogen interaction was also recorded indicating that isolates may be at least partially adapted to specific host genotypes. Isolate 7 once again resulted in the highest degree of wilting (mean = 80.0 %) compared to isolate 15 with a mean of 30.0 %.

A modified method of an oxalic acid assay by Tu (1989) was conducted on the two soybean cultivars to determine whether oxalic acid tolerance could be correlated with host response to *S. sclerotiorum*. Oxalic acid is associated with pathogenesis. Primary leaves were excised and the petioles were immediately submerged in a Petri dish containing water. Each leaf was subsequently assigned to a vial with the specific test-concentration of oxalic acid and the leaf was maintained at room temperature for 72 h. The percentage of leaf area with brown rot symptoms were assessed daily for 3 days. Eight concentrations were evaluated ranging from 0.5 mM to 80 mM. At 0.5 mM, no
significant differences between the two cultivars were observed. When the concentrations increased however, SNK 500 showed more browning and necrosis than Egret. At 40 mM oxalic acid, SNK 500 had an average of 61.8 % browning at day 1, 71.5 % at day 2 and 78.1 % at day 3. When compared with Egret, 37.5 % browning was observed at day 1, 49.0 at day 2 and 58.1 % at day 3. This indicated that oxalic acid plays a primary role in Sclerotinia stem rot development, especially when the disease is present in a susceptible cultivar.

6.12 CONTROL OF RHIZOCTONIA SOLANI AND PYTHIUM SPP. ON SOYBEANS (GLYCINE MAX), LUPINS (LUPINUS SPP.) AND CANOLA USING TRICHODERMA AND SILICON: R. Bosse, S. Jadoo, P. Mzimela, P. Caldwell, Discipline of Plant Pathology, School of Agricultural Science and Agribusiness, University of KwaZulu-Natal

*Rhizoctonia solani* and *Pythium* spp. are the causal organisms of seed and seedling diseases of many crops. They are known as sub-lethal pathogens causing reduced germination and yield. Silicon (Si) has been shown to act as a component in plant resistance against abiotic and biotic stresses. Resistance to pathogens is associated with a high deposit of Si in the leaf where it forms a mechanical barrier on the epidermal cells, impeding pathogen penetration. Silicon has also been shown to activate host defence responses.

The aim of this trial was to investigate the growth promotion activities of Si, applied in the form of potassium silicate, and *Trichoderma* (Eco-T®) on soybeans, lupins and canola. The control of *R. solani* and *Pythium* was also investigated. Inoculated barley seeds were used in the pathogen control trial but no pathogens were used in the growth promotion trial. Five treatments were investigated, i.e., 200 mg l⁻¹ Si plus KOH (to balance the potassium ions in the potassium silicate), Eco-T®, 200 mg l⁻¹ Si plus Eco-T®, a control and KOH (as a control to investigate the possible pH effects of the potassium silicate). Pot trials were used to measure the shoot biomass of the plants, while rhizotrons were used to measure root area, root biomass and root length.

Results showed that the combination of 200 mg l⁻¹ Si plus Eco-T® gave the best results for all crops investigated. Growth promotion studies showed that the application of 200 mg l⁻¹ Si and Eco-T® resulted in a significant increase in shoot biomass (22.45 g), root area (14.66 cm²), root biomass (0.22 g) and root length (143.25 cm) compared to the control (14.64 g, 7.32 cm², 0.15 g and 105.17 cm), respectively. Similar results were found in the *Pythium* control trials where the application of 200 mg l⁻¹ Si and Eco-T® also showed a significant increase in shoot biomass (19.74 g), root area (9.77 cm²), root biomass (0.093 g) and root length (140.93 cm) compared to the inoculated control (9.09 g, 5.74 cm², 0.047 g and 81.75 cm), respectively. For the *Rhizoctonia* control trials this pattern was repeated with
similar results as application of 200 mg/l\textsuperscript{1} Si and Eco-T\textsuperscript{*} also showed a significant increase in shoot biomass (20.45 g), root area (8.98 cm\textsuperscript{2}), root biomass (0.094 g) and root length (131.2 cm) compared to the control (7.45 g, 5.05 cm\textsuperscript{2}, 0.032 g and 65.89 cm), respectively. It appears that Eco-T\textsuperscript{*} protects the seed against \textit{Rhizoctonia} and \textit{Pythium} before root development, but once roots develop, the Si taken up by the plant prevents pathogens penetrating the root area.

Lupins and canola showed similar results where applications of 200 mg/l\textsuperscript{1} Si and Eco-T\textsuperscript{*} resulted in the greatest increase in root and shoot biomass, root length and root area and the best control of \textit{R. solani} and \textit{Pythium}, compared to the control.

\textbf{6.13 SUPERSOYA COMPETITION, KWAZULU-NATAL: C. Havenga, Contractor, Protein Research Foundation}

The Super Soya Competition in KwaZulu-Natal is now in its twentieth year and interest and support are still on the increase. This season it was decided to join the Northern and Southern competitions again as one combined competition. The Bergville-Winterton area had the biggest number of entries with 26, followed by Newcastle-Dundee with 17 and Vryheid-Paulpietersburg with 14 entries.

The most important aspect of this competition is the opportunity which it creates to exchange knowledge and experience of different production practices and to evaluate them according to the results obtained. Here farmers, scientist and advisors have the opportunity to exchange ideas, knowledge and experience.

Yields in the past season’s Super Soya competition varied between 1.83 and 5.75 tons/ha. The average yield was 3.32 tons/ha which is considerably better than the previous season’s 2.8 tons/ha. The average irrigation yield was 3.6 tons/ha which is only slightly higher than the average dryland yield of 3.23 tons/ha. The highest yield obtained from a dry land field was 5.75 tons/ha was.

In general the protein content of the soybeans was satisfactory to very good, ranging from 35.5 to 40 \% (dry matter basis) with an average content of 39 \%, which is slightly lower than the previous season’s 39.9 \%. Only one land yielded a crop with a protein content of less than 37 \% (DM basis). The long term average protein contents of the Super Soya entrants is shown in Table 1, where it can be seen that since 1997 the average protein content exceeded the acceptable minimum protein content of 37 \%.

Oil content ranged from 16.4 to 21.2 \% on a dry matter basis. The average oil content this past season was 19.1 \% which is slightly lower than the previous season (Table 1).
A summary of the average yields, protein and oil content and break-even yields since the start of the Super Soya Competition is given in Table 1.

Table1: Historical yield, protein content data

<table>
<thead>
<tr>
<th>Season</th>
<th>Average Yield (tons/ha)</th>
<th>Average Protein %</th>
<th>Break-even yield tons/ha</th>
<th>Number of Entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989/90</td>
<td>1.69</td>
<td>1.14</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>1990/91</td>
<td>2.35</td>
<td>35.8</td>
<td>1.13</td>
<td>21</td>
</tr>
<tr>
<td>1991/92</td>
<td>2.10</td>
<td>38.3</td>
<td>0.99</td>
<td>18</td>
</tr>
<tr>
<td>1992/93</td>
<td>2.12</td>
<td>35.3</td>
<td>1.09</td>
<td>23</td>
</tr>
<tr>
<td>1993/94</td>
<td>2.92</td>
<td>38.9</td>
<td>1.18</td>
<td>26</td>
</tr>
<tr>
<td>1994/95</td>
<td>2.52</td>
<td>35.7</td>
<td>1.29</td>
<td>25</td>
</tr>
<tr>
<td>1995/96</td>
<td>2.31</td>
<td>36.9</td>
<td>1.32</td>
<td>33</td>
</tr>
<tr>
<td>1996/97</td>
<td>3.01</td>
<td>38.7</td>
<td>1.04</td>
<td>42</td>
</tr>
<tr>
<td>1997/98</td>
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<td>38.8</td>
<td>1.54</td>
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<tr>
<td>1998/99</td>
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<td>39.5</td>
<td>1.69</td>
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</tr>
<tr>
<td>1999/00</td>
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<tr>
<td>2000/01</td>
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<tr>
<td>2002/03</td>
<td>3.03</td>
<td>40.7</td>
<td>1.84</td>
<td>29</td>
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<tr>
<td>2003/04</td>
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<td>41.9</td>
<td>1.54</td>
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<tr>
<td>2004/05</td>
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<td>40.6</td>
<td>1.84</td>
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<td>2005/06</td>
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<td>1.15</td>
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<tr>
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<td>0.98</td>
<td>46</td>
</tr>
<tr>
<td>2007/08</td>
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<td>39.9</td>
<td>0.82</td>
<td>50</td>
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<tr>
<td>2008/09</td>
<td>3.32</td>
<td>39.0</td>
<td>1.55</td>
<td>57</td>
</tr>
</tbody>
</table>

The average pre-harvest production cost of participants almost doubled and increased by R1996 /ha from the previous season’s figure. The break-even yield of 1.55 ton/ha is the highest during the past 4 seasons (Table1).

Participants entered twenty (20) different cultivars and 91 % of these were Roundup Ready cultivars.

During recent years more and more farmers moved away from the use of mould board and disc ploughs towards chisel ploughs and disc harrows. Minimum tillage and No-till is becoming a more popular way of growing soybeans and was practiced this past season by 69 % of the participants. One participant ploughs his fields with a mould board plough
and the rest of the participants (28%) cultivate their fields with a chisel plough or disc harrow.

This competition creates an opportunity to record and evaluate the results of production practices thereby identifying production problems which then may lead to research projects to solve these problems.

6.14 CULTIVAR EVALUATION OF OIL AND PROTEIN SEEDS IN THE WINTER RAINFALL AREA:
P.J.A. Lombard, Institute for Plant Production, Western Cape Department of Agriculture

During 2009 the climatic conditions were favourable for crop production in the Swartland. However the yield was not as good as expected. Dry weather and strong winds occurred during harvest time which resulted in seed losses. The climatic conditions in the Southern Cape were even less favourable; four trials were written off due to bad and uneven germination.

The Department of Agriculture Western Cape planted 14 canola cultivar trials in 2009. The average trial yield in the Swartland was less than in 2008 (1.664 ton/ha compared to 2.45 ton/ha in 2008). The yield varied between 1.46 ton/ha (Langgewens 2) and 1.938 kg/ha at Malmesbury. The conventional cultivar Garnet was the top producer in the Swartland (2.148 ton/ha). The yield of 3 hybrid cultivars did not differ significantly from Garnet. The three cultivars were 44Y06, AGA Max and the “Clearfield” hybrid cultivar 45Y77. The Triumph Jardee TT (1.737 ton/ha) (hybrid TT cultivar) was the top producing TT cultivar in the Swartland. The yield of Garnet was not significantly better than Thunder TT, Bravo TT or Triumph Jardee TT.

The average trial yield in the Southern Cape varied between 1.571 ton/ha at Klipdale to 1.954 ton/ha at Tygerhoek 1. The conventional cultivar Garnet was the top producer in the Southern Cape (1.571 ton/ha). The yield of 3 hi-bred cultivars, AGA Max, Hyola 61 and the “Clearfield” cultivar 45Y77, did not differ significantly from Garnet. The top producing TT cultivar was Thunder. However the yield of Thunder did not differ significantly from Triumph Jardee TT, ATR Cobbler or Tornado TT.

6.15 ASSESING CANOLA SEED LOSSES DURING SEED RIPENING AND HARVESTING IN THE WESTERN CAPE PROVINCE: J.A. Strauss, Institute of Plant Production, Western Cape Department of Agriculture

Many producers have observed considerable crop losses in canola due to a combination of natural shedding (including as a result of inclement weather conditions during ripening)
and losses during harvesting. Potential yields as indicated from numerous cultivar evaluation trials are seldom achieved. Field observations during 2009 have indicated losses of 722 kg/ha on average. At the current price of canola, a loss of 722 kg of seed could mean a potential income loss of more than R2093/ha. Avoidable seed losses currently exacerbate the perception that canola production is less profitable than wheat production. This study comprises a replicated field trial that included two harvesting techniques (swathing and direct harvesting), and the use of an anti-pod shatter agent in a completely randomized blocks design; and a survey of seed losses on farms where both harvesting methods are used. The second year of the survey of the commercial farms showed losses of 33% and 37% for the two methods respectively. Losses of 28% (directly harvested) and 12% (swathed) were recorded in the statistical trial. The bulk of these losses occurred during the harvesting process. In the past season the effect on strong winds during the ripening stage was also shown clearly in the statistical trial, where up to 900 seeds per container were counted in the straight canola plots.

6.16 N-FERTILIZATION OF CANOLA BASED ON N-MINERALISATION AND N LEACHING: G.A. Agenbag, University of Stellenbosch

Research to evaluate the response of canola to increasing N application rates of 0 to 120 kg N ha\(^{-1}\) and methods of application (broadcasted compared to banded) was continued with field trails at Langgewens-, Elsenburg-, Welgevallen- and Roodebloem Experimental Farms during 2009. Unfortunately the experiment at Welgevallen had again to be abandoned due to very wet and flooded conditions. Soil analysis were done at all localities before planting, while plant analysis were done at Langgewens and Elsenburg at 90 days after planting on plots receiving either no nitrogen or 90 kg N ha\(^{-1}\).

At Elsenburg sub-optimal soil pH (<5.0 pH\(\text{KCl}\)) values were recorded, while all localities recorded low soil S (<6.0 mg kg\(^{-1}\)) contents. Because superphosphate (12% S) was used as source of P fertilizer, approximately 15 kg S ha\(^{-1}\) was applied at all localities. In spite of this, plant analysis at 90 days after planting at Langgewens and Elsenburg showed sub-optimal S contents (<0.5%). In comparison to general norms for Na (300-5000 mg kg\(^{-1}\)) high plant Na contents were found at both localities with values as high as 11 000 mg kg\(^{-1}\). In contrast to Elsenburg, plant Na-content at Langgewens increased with increasing N application rates. The soil carbon content (% C) varied between 0.35% at Langgewens; 0.63% at Elsenburg and 1.51% at Roodebloem. N-mineralization during the period 0-40 days after planting in the 0-20 cm soil profile was calculated as 54.8 kg N ha\(^{-1}\) at Langgewens; 73.5 kg, N ha\(^{-1}\) at Elsenburg and 76.7 kg N ha\(^{-1}\) at Roodebloem. Although plant N-contents at 90 days after planting were higher with the 90 kg N ha\(^{-1}\) application rate, N-contents of plants receiving no fertilizer nitrogen were still adequate (higher than the norm of 0.35%).
Due to differences in rainfall and already discussed differences in N-mineralization potential of the soil, grain yield again differed largely between localities. At Langgewens where the nitrogen supplied by the soil during the period 0-40 days after planting was calculated as 54.8 kg N ha\(^{-1}\), a grain yield of 1182.9 kg ha\(^{-1}\) was produced without any N-fertilizer added. At Elsenburg and Roodebloem N-mineralization potentials of 73.5 kg N ha\(^{-1}\) and 76.7 kg N ha\(^{-1}\) were calculated, while yields of 2130.0 and 1379.2 kg ha\(^{-1}\) were produced without any N-fertilizer added. In contrast to other localities only 1.0 m\(^{2}\) from every plot was cut during the physiological mature stage, dried and thrashed under laboratory conditions to prevent bird damage and yield losses before harvesting at Elsenburg. These practices, together with better growing conditions and deeper soils may be the reasons for higher than expected yields at Elsenburg.

At all localities grain yields increased with increasing N-fertilizer rates and the highest yields of 1513.2 kg ha\(^{-1}\) at Langgewens, 1949.5 kg ha\(^{-1}\) at Roodebloem and 3155.2 kg ha\(^{-1}\) at Elsenburg were obtained with nitrogen application rates of 90-120 kg N ha\(^{-1}\). Agronomical efficiencies of N applications (kg yield increase per kg N applied) varied between 2.9 at Langgewens, 4.8 at Roodebloem and 8.5 at Elsenburg. Band placed N-fertilizer were more efficient compare to broadcasted applications and yields were between 3.0 and 8.4% higher with similar N-application rates. The best results at Langgewens and Roodebloem were obtained when N was applied not later than 60 days after planting, while yields at Elsenburg were increased with a N application at 90 days after planting.

6.17 S-FERTILIZER REQUIREMENTS OF CANOLA PRODUCED IN THE PRODUCTION AREAS OF THE WESTERN CAPE: G.A. Agenbag, University of Stellenbosch

Experiments with three S application rates (0, 15 and 30 kg S ha\(^{-1}\)) in combination with 5 N application rates (0, 30, 60, 90 and 120 kg N ha\(^{-1}\)) were conducted during 2009 on four localities, but one (Welgevallen experimental station) was terminated due to very wet and flooded soil conditions. On the remaining localities the S-content of the soil varied between 2.2 mg kg\(^{-1}\) at Elsenburg, 2.8 mg kg\(^{-1}\) at Langgewens and 3.2 mg kg\(^{-1}\) at Roodebloem, which were all less than the required 6 mg kg\(^{-1}\) needed for the production of canola. Calculated N mineralization potential during the first forty days after planting ranged between 54.8 kg N ha\(^{-1}\) at Langgewens; 73.5 kg N ha\(^{-1}\) at Elsenburg and 76.7 kg N ha\(^{-1}\) at Roodebloem.

Grain yields increased on all localities with an increase in N application rate. At Langgewens, yields increased from 889.5 kg ha\(^{-1}\) where no nitrogen was applied to 1439.0 kg ha\(^{-1}\) with an application rate of 120 kg N ha\(^{-1}\). At Roodebloem, yields increased from...
1122.9 kg ha\(^{-1}\) with no nitrogen applied to 2101.9 kg ha\(^{-1}\) with an application of 120 kg N ha\(^{-1}\), while yields at Elsenburg increased from 2260.0 kg ha\(^{-1}\) with no N application to 3682.6 kg ha\(^{-1}\) with 120 kg N ha\(^{-1}\). In contrast to other localities, only 1.0 m\(^2\) was cut during the physiological mature stage, dried and thrashed under laboratory conditions to prevent bird damage and yield losses before harvesting at this locality. These practices together with better growing conditions and deeper soils may be the reasons for high yields at Elsenburg. No clear yield responses to S application rates were obtained. In general, yields tend to increase with higher S application rates and significant interactions between N and S, found at all localities’, indicated better responses to S at high compare to low N application rates. Chemical leaf analysis at 90 days after planting, however showed S deficiencies (<0.5%) at all localities irrespective of S application rate. Higher S application rates and/or split applications should therefore be investigated.

6.18 OPTIMAL SOIL TILLAGE METHODS AND N-FERTILIZER RATES TO BE USED IN A WHEAT/CANOLA/WHEAT LUPIN AND WHEAT MONOCULTURE CROP ROTATION SYSTEM IN THE SWARTLAND PRODUCTION AREA: G.A. Agenbag, University of Stellenbosch

In this trial on Langgewens Experimental Farm, the effect of soil tillage methods on soil fertility and crop yields has been studied for the past 30 years and that of two crop rotation systems for more than 15 years. Different nitrogen application rates have been evaluated since 2000.

Both wheat and canola crops were grown during 2010, but yields were generally low due to very severe weed infestations. On average canola yields (1429 kg ha\(^{-1}\)) were slightly higher than that of wheat (1331 kg ha\(^{-1}\)) grown in monoculture, because of more efficient weed control with simazine used in the triazine tolerant canola crop. Canola responded better to increased nitrogen applications compared to wheat. On average, grain yield of canola increased from 864.7 kg ha\(^{-1}\) with an application of 20 kg N ha\(^{-1}\) to a yield of 1863.7 kg ha\(^{-1}\) with an application of 100 kg N ha\(^{-1}\). In the case of wheat, similar increases in nitrogen application rates resulted in yield increases from 1171.0 kg ha\(^{-1}\) on average to 1573.7 kg ha\(^{-1}\). Due to more efficient mechanical weed control and higher soil N-mineralization rates, conventional soil tillage systems, which include mould board ploughing, resulted in the highest yields of 2070 kg ha\(^{-1}\) (on average) when wheat was produced in monoculture. On average conventional tillage also resulted in the highest yield of 2157.7 kg ha\(^{-1}\) in canola. The highest canola yield of 2840 kg ha\(^{-1}\) was however obtained when 100 kg N ha\(^{-1}\) was applied in a system of minimum tillage (applying a shallow cultivation with a chisel plough before planting).
6.19 MANAGEMENT OF HERBICIDE RESISTANCE IN THE WESTERN CAPE: P.J. Pieterse, University of Stellenbosch

The main objectives of the project are to determine the level of herbicide resistance and the efficacy of other herbicides in weed samples sent in for testing as well as to investigate the effect of different cropping practices on ryegrass numbers in crop fields. During the 2009 season 24 weed samples were tested for herbicide resistance and it was found that four samples showed resistance to a single herbicide, six samples showed resistance to more than one herbicide from the same group (mode of action) whilst 14 samples showed resistance to herbicides from more than one group. It was shown beyond doubt that certain wild oat populations have resistance to glyphosate and resistance in Calomba daisy (Stinkkruid) to a mixture of MCPA and bromoxylin was noted for the first time. The investigation into the effect of different production practices (tillage and rotations) on the numbers of ryegrass plants in fields on the Langgewens experimental farm was continued.

In July 2009 it was found that plots that received a mouldboard plough treatment had between 80 and 90% less ryegrass than plots receiving other tillage treatments. Minimum till plots showed the highest numbers of ryegrass and no till plots showed the second lowest ryegrass numbers. Similar results were obtained when a survey was made in September 2009 although the differences between the treatments were smaller with the mouldboard plough plots showing between 50 and 75% less ryegrass. Regarding rotational cropping systems, no differences between wheat monoculture and wheat rotations with other grain crops (canola and lupins) could be observed regarding ryegrass numbers. All rotations that include an annual pasture component however had between 90 and 95% less ryegrass plants than the pure grain systems. These results show that production practices can play a role in managing ryegrass problems in the presence of herbicide resistance.

6.20 AN INVESTIGATION INTO THE PRODUCTION DYNAMICS OF EIGHT CROP ROTATION SYSTEMS, INCLUDING WHEAT, CANOLA, LUPINS AND PASTURE SPECIES IN THE SWARTLAND, WESTERN CAPE: J.A. Strauss, M.B. Hardy, S.J.A. Laubscher, Institute for Plant Production, Western Cape Department of Agriculture

Despite low rainfall and dry soil conditions in April/early-May climatic conditions during 2009 were favourable for dry-land crop and pasture production at Langgewens. Average rainfall was experienced over the growing season (April to October) and rainfall following late planting (mid May) was well distributed. A total rainfall of 306 mm was recorded for the period April to October. The wide-spread, high rainfall events that occurred in the Swartland, during November (data not shown) did not affect the yields recorded at the trial site as the crops had been harvested before they occurred.
**Wheat production** - Management protocols developed by the Technical committee were followed but adjusted during season as a function of variable climatic conditions. Mean wheat yield over all systems was 3490 kg/ha. This is approximately 400kg/ha less than the “adjusted” yield for the 2008 season. As has been recorded over almost all seasons (2005 was an exception) there were differences in yield among the different crop sequences. Wheat yields following legume pasture were on average greater than wheat yields in all other systems.

Data collected to determine number of ears per plant indicated that an average of 1.8 ears per plant were obtained over all crop sequences. It was clear from the data that ear density (ears m⁻²) and the number of ears per plant, were greater where wheat followed a legume pasture than when wheat followed wheat. Most of the grain delivered to the silo fell in the B1 or B2 class.

**Canola & lupin production** - Canola was planted on the 11th and 12th of May. Three weeks later some of the camps planted to Thunder TT and one camp planted to 44Y06 showed very poor or no emergence at all. After closer inspection of these camps a few possible causes were identified including poor seed vigour, snails and diseases and it was decided to replant these camps on the 10th of June.

The actual yields obtained during harvesting (“straight”) ranged from 492 kg/ha to 1992 kg/ha. On average, actual canola yield after medic pasture (1428 kg/ha, including a camp that was replanted) was higher than the average canola yield after wheat (801 kg/ha)

The average actual yield of canola over all plots was 945 kg/ha and the average crude protein (% CP) over all plots was 21.8 % and the % oil content averaged 33.46 % (Elenburg lab).

Average lupin yield over the three plots that were harvested was 587 kg/ha. Camp 40/1 was not harvested. The possible explanation for the poor yields could be ascribed to the dying off of lupins due to water-logging. In addition a severe ryegrass infestation in these camps would also have contributed to the poor yield. The average crude protein content of lupin seed was 27.24%.

**6.21 ECONOMIC SUSTAINABILITY OF SHORT- AND LONG-ROTATION CROP/PASTURE PRODUCTION SYSTEMS IN THE SOUTHERN CAPE**: M.B. Hardy, J.A. Strauss, W. Langenhoven, Institute for Plant Production, Western Cape Department of Agriculture

2009 was the 8th year of production. The trial comprises two main components namely: short-rotation systems that are being tested at Tygerhoek experimental Farm at
Riviersonderend and long-rotation systems that are being tested on farms in the Riversdale and Swellendam districts respectively. 2009 was the 3rd year of the 2nd 5-year cropping phase that is being tested at the Riversdale and Swellendam sites.

All trial areas were planted and managed according to the planned protocols (including appropriate weed, disease and insect control measures).

Both the Riversdale and Swellendam site received adequate rainfall during the season, which resulted in very good wheat (both sites) and barley (Swellendam) yields. The canola and lupin plots at Swellendam however did not reflect the rainfall season at the Swellendam site, while lupins planted at Riversdale did splendidly.

At Tygerhoek poor soil moisture delayed planting until early to middle May. During the months of June, July and October received rainfall above the long-term average for the site, while the rest of the growing season saw below average rainfall. Al crops however showed good returns on yield.

**Wheat production** – Wheat was planted at all three sites (SST 027).

Yield at the Riversdale site varied between 3.6 and 4.2 tons/ha. This yield reflects the favourable soil moisture conditions at the research site despite the relatively low rainfall during the latter part of the season.

Grain harvested at the Swellendam site averaged 1431 kg/ha. This reflected the good rainfall received.

At Tygerhoek the average wheat yield was 3306 kg/ha⁻¹ over both replicates. Although the season started late, the above-average yields received in June, July and again in October helped to ensure a favourable harvest.

Grain was classed as B2 at both the Riversdale, B3 at Swellendam and B1 at the Tygerhoek site.

**Barley production** – Barley (SST 564) was planted at the Swelledam and Tygerhoek sites.

Average yield at the Swellendam site was 1606 kg/ha.

At Tygerhoek barley yields ranged from 2.4 to 3.7 tons ha⁻¹. These yields were higher than those of the 2008 season.
Oats production – Oats (Pallinap) was planted only at Tygerhoek. Seed production ranged from 2.8 to 3.5 tons ha\(^{-1}\).

Canola production – Canola (Jade) was planted at Riversdale. Although an adequate stanch was obtained a mistake in herbicide application resulted in all canola plots being killed off, with no resulting harvest.

Jade was planted at Swellendam at 3kg seed/ha and with 20kgN/ha at planting.

Canola (Thunder) was planted at Tygerhoek. A seeding rate of 3.3 kg/ha was used and a total of 80 kg N/ha was applied to each plot (20kg N/ha at planting and 60kg N/ha top-dressings).

Canola yields at Swellendam averaged 435 kg/ha. These yields were not reflective of the season and could be due to poor germination at the start of the season and harvest losses.

The average canola yield over all plots at Tygerhoek was 1362 kg/ha, which is excellent in comparison to the expectations of the region. Very strong winds and heavy rain during the ripening period resulted in heavy losses.

The oil percentage of the canola ranged from 39% to 41%.

Lupin production – Lupins (Mandelup) were planted at the three sites. The Riversdale site produced yields ranging from 1.8 to 2.4 ton/ha. At Tygerhoek yields varied from 2050 to 2860 kg/ha. The Swellendam site saw heavy losses during the harvest process. Yield at the site averaged 645 kg/ha. Losses were calculated at an average of 500kg/ha. The heavy losses could be attributed to harvest timing.

Economics – The financial analysis program that was discussed in the previous report was completed during 2008 and is now being used to complete Gross Margin analyses of all years not included in the COMBUD data bases. The 2007, 2008 and 2009 data sets for Tygerhoek have been captured and we are busy verifying the results.

6.22 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: J. Labuschagne, Institute for Plant Production, Department of Agriculture, Western Cape

The aim of this project is to quantify the effects of tillage practice and crop sequence on soil physical and chemical properties, and soil biological activity towards gaining a better
understanding of soil parameters that will promote sustainability in crop production systems on the shale derived soils of the Western Cape.

Tillage treatments and planting
Tillage treatments were done timorously at the Tygerhoek site, resulting in relatively firm seed beds before planting the minimum and conventional-till treatments. At the Langgewens site however, ploughing of the conventional-tillage treatment was late resulting in a relatively loose seedbeds that caused problems with achieving constant planting depth on the minimum and conventional-till treatments.

The weed (ryegrass) problem on the zero-till treatments continued during the 2009 wheat production season. Relative low weed populations in all treatment combinations allowed harvesting of the wheat and canola crops at Langgewens and all crops at Tygerhoek. The lupin at Langgewens was sprayed with a non-selective herbicide as the lupin crop was overgrown by weeds (regardless of tillage treatment) as a result of waterlogged areas and *Phytophthora*. This herbicide application was delayed as late as possible (just before viable weed seed were produced) to ensure maximum “crop effect” on the soil in the lupin plots.

Climatic conditions
Climatic conditions during 2009 were relatively good for dry-land crop production on both Tygerhoek and Langgewens. At Tygerhoek and Langgewens 322.6 and 333.1 mm of rainfall were measured respectively for the period April to October 2009. Temperatures remained mild on both sites.

Crop production data
Seedling/plant densities
Relative low seedling/plant densities for wheat were recorded at both sites. The wheat crops at both sites recovered, in particularly Tygerhoek, and recorded mean ear bearing tiller counts of between 182.87 and 262.10 tillers/m². At Langgewens the canola plots were replanted (10 June), but due to the short growing season did not allowed enough time for optimum vegetative growth and reproductive development. The lupin plant count of 40.75 plants/m² at Langgewens was slightly lower than the 45 plants/m² aimed for at planting. Waterlogged conditions and *Phytophthora* caused damping off of lupin plants at Langgewens followed by weed infestation. To combat viable weed seed production it was decided to spray the lupin crop at Langgewens using a non-selective herbicide.

Grain yield
As a result of low plant populations, waterlogged conditions and the incidence of *Phytophthora* in the lupin crop at Langgewens, weed populations increased and it was decided to spray all lupin treatments at Langgewens as well as the zero-till treatments at
Tygerhoek with a non selective herbicide. A mean lupin yield (excluding the zero-till treatment) of 1903.07 t/ha was recorded at Tygerhoek. The mean canola yield at Langgewens was extremely low at 434.43 kg/ha. A relative low mean yield of 1418.26 kg/ha was recorded at Tygerhoek. Wheat yields were lower than expected. The zero-till treatments recorded the lowest (2409.28 kg/ha) and the no-till the highest (2952.43 kg/ha) grain yields at Tygerhoek. The same response was noted for Langgewens with the zero- and no-till treatments producing 1746.28 and 2858.03 kg/ha respectively.

**Thousand seed weight**
As a result of the relative short canola growing season at Langgewens, the 2.209 g thousand seed weight recorded was considerably lower than the 3.9503 g recorded for Tygerhoek. Although differences between tillage treatments were recorded at Tygerhoek, no trend was observed. The thousand seed weight (TSW) of wheat (SST 027) was at similar values for both sites with no definite trend observed.

**Grain quality**
Tillage practice did not influenced hectar litre mass or protein content of wheat at Langgewens. Except for the zero- till treatment at Tygerhoek, that resulted in lower (P=0.05) grain protein content, were no differences found between the tillage treatments tested. No trend regarding the effect of tillage treatment on hectar litre mass was found for the Tygerhoek site.

**Base-line studies** — various base-line studies has been completed and will provide comparative background information for use in future detailed investigations of soil chemical, physical and microbiological dynamics. These studies included collection of 1) soil chemical and physical data 2) soil microbial diversity and enzymatic activity 3) nematode populations 4) weed seed banks and 5) soil-borne diseases.

**Concluding remarks**
The project is progressing according to the research proposal and protocols. The severe ryegrass problem, especially in the zero-till wheat treatments, is being managed without compromising the integrity of the treatments and their potential effects on the physical and chemical status of soils. Short-term effects of tillage system, crop sequence and site on crop yields should become more apparent over time.
6.23 (A) ENHANCEMENT OF CANOLA AS A ROTATION CROP WITHIN A CONSERVATION SYSTEM IN THE DRY LAND AREAS OF THE SWARTLAND USING A COMPETITION BETWEEN PRODUCERS: I.F. Slabbert, Western Cape Department of Agriculture

Sixteen farmers entered the Canola Competition in the Swartland. Information from all sixteen competitors could be used.

Although the first rains were somewhat late for a good Canola potential, favorable weather conditions persisted until September. However, the rainfall during August was below average. Thus, the average yield of the participants was 1.29 ton/ha, which was 0.05 ton less than in the previous year (2008).

Mr. Dirk Lesch from Malmesbury was the participant with the highest yield (1.86 ton/ha). Dirk Lesch was also the participant with the highest gross margin (R1309/ha).

The runners-up were from Moorreesburg, namely Mr. Albertus Truter (1.75 ton/ha) and from Porterville, Mr. Jacques Louw (R1262/ha).

Canola was more profitable than wheat during 2009. However, the gross margin for Canola was on-average R1000/ha lower than in 2008 mainly because of the lower price.

(B) ENHANCEMENT OF CANOLA AS A ROTATION CROP WITHIN A CONSERVATION SYSTEM IN THE DRY LAND AREAS OF THE SOUTHERN CAPE USING A COMPETITION BETWEEN CANOLA PRODUCERS: J.G. Loubser, Contractor, Protein Research Foundation

Twenty four canola producers entered the Southern Cape Canola competition in 2009. The information from all the entrants was processed and included in the report. The results were released and discussed on the 2 March 2010 at the annual Overberg Agri Pre-planting Information Day at Rietpoel near Caledon.

Moist to dry soil conditions prevailed during the planting season from mid April until mid May, followed by good rains during June and July. During August and September the rainfall was good, except for the eastern production areas at Swellendam. During August and September moisture stress was experienced in these areas.

The average canola producers’ price was R2,903 per ton, the average yield was 1.640 tons per hectare and the average gross margin R1,315 per hectare.

The Theunissen Family Trust of the farm Haarwegrivier near Rietpoel was the participant with the highest yield of 2.773 tons per hectare and the best gross margin of R5,220 per hectare.

Mr. Andrew Beukes of the farm Vrede near Caledon was the participant with the second highest yield of 2.270 tons per hectare.
Mr Adriaan Steyn of the farm Wankie near Swellendam was the participant with the second best gross margin of R3,331 per hectare.

6.24 INSECT AND OTHER PESTS OF CANOLA: G. Tribe, A. Lubbe, ARC-Plant Protection Research Institute

The main trial consisting of 6 treatments and 5 replications carried out on two farms in the Caledon district showed once again that the main culprits responsible for the loss of seedlings were isopods. Each treatment had 5 melthoid traps under which the numbers of isopods and slugs were counted, and 4 demarcated areas (1 x 0.5 m) in which the number of seedlings was recorded at weekly intervals. There was a negative correlation between the number of isopods and the survival of seedlings. Slug pellets containing a combination of 30g/kg metaldehyde + 20g/kg carbaryl broadcast at a rate of 8kg/ha at planting was most effective in protecting seedlings. Cruiser treated seed plus slug pellets broadcast at planting did not increase the survival rate of seedlings, while metaldehyde treated seed was ineffective. The number of slugs recorded during this period was so low that no conclusions as to their response to the treatments could be drawn.

In a second trial 6 slug pellet formulations were tested against a Control by placing 8 gms of one or other of the formulations under 84 individual traps where the number of dead or alive slugs, isopods and other insects were monitored weekly. Snail Nail, Sluggem and Snail bait were extremely effective in attracting and killing both slugs and isopods when compared with the Controls. There was no significant difference in the ability of a special formulation with an increased level of carbaryl (30g/kg metaldehyde + 30g/kg carbaryl) in the number of slugs or isopods killed. The 50g/kg metaldehyde formulation (Clartex) was less effective in killing slugs and did not kill isopods.

Weekly monitoring of 120 melthoid traps on the farms Roodebloem and Speelmansrivier for slugs of all 4 species revealed that they were not randomly distributed. The indigenous *Oopelta polypunctata* was found only under the traps at Speelmansrivier (2%) where fynbos occurred at the edge of the field and they were active only late in the season and therefore posed no threat to canola seedlings. The slug species which predominated in numbers on both farms (58.7% + 62.2%) was the exotic *Deroceras panormitanum* which peaked in numbers from late August and was still present at harvesting. *Milax gagates* appeared early in the season and peaked in numbers between late July until the end of August and constituted 41% of the slugs at Roodebloem and 14% at Speelmansrivier. *Deroceras reticulatum* was almost exclusively found (21.4%) at Speelmansrivier. When the total numbers of all four species of slugs are combined at weekly intervals over the season, slug numbers increased rapidly in the last week in May and remained active at this level until the end of August after which their numbers decreased just as rapidly. This
activity peak coincided with bouts of rainfall and lower temperatures as would be expected. However, isopod activity indicated that they were less dependent on rainfall and were active early in the season (April); their numbers under the traps decreased during bouts of rainfall and peaked between July and October although weekly numbers fluctuated more widely at the end of the season as conditions began to dry out.

The parasitism rate of the diamondback moth (*Plutella xylostella*) was 18.8% which has remained at similar low levels for the last three years. The late-larval parasitoid *Diadegma mollipla* accounted for 65% of this parasitism. Damage by the cabbage aphid *Brevicorne brassicae* was negligible because it was brought under control within two weeks by the parasitoid *Diaeretiella rapae*. Numbers of the cabbage stem weevil *Ceutorhynchus pallidactylus* per canola stem decreased to an average 0.3 as opposed to 17.8 in 2008.

6.25 CHARACTERIZATION AND MANAGEMENT OF RHIZOCTONIA ON CANOLA AND LUPIN IN CROPPING SYSTEMS IN THE WESTERN CAPE PROVINCE: S.C. Lamprecht, ARC-Plant Protection Research Institute

Several methods with potential for the management of *Rhizoctonia* diseases of canola and lupin including plant resistance, fungicide seed treatment and biological control using binucleate *Rhizoctonia* anastomosis groups (AGs) were evaluated under glasshouse conditions. Screening included the examination of resistance of eight canola and eight lupin cultivars/selections to damping-off and hypocotyl/root rot caused by the multinucleate *Rhizoctonia solani* AG-2-1, 2-2, 4 and 11. All canola cultivars were highly susceptible to AG-2-1, although they differed in their reaction. Spectrum and 44C73 were more resistant to AG-4 than the other canola cultivars. On lupin, *R. solani* AG-2-2 and 4 were most virulent, and the cultivar Cedara 6150 and selection E16 were most resistant to AG-2-2, while Cedara 6150, E16, Mandel-up and Quillinock were more resistant to AG-4 than the other cultivars/selections. The *Lupinus luteus* selections, E80.1.1.2 and E82.1.1 were most susceptible to AG-2-2, 4 and 11. Seed treatment with the fungicides, Cruiser OSR (a.i. difenconazole, fluudioxonil, metalaxyl-M, thiamethoxam) and SA-combination (a.i. iprodione, metalaxyl, thiram) significantly increased survival of canola (cvs Muster, Rocket and Thunder) and lupin (cultivar/selection Cedara 6150, E82.1.1 and Mandelup) seedlings, decreased hypocotyl/root rot and improved the percentage healthy seedlings, with SA-combination being significantly more effective than Cruiser. Application of the binucleate *Rhizoctonia* AGs (A, Bo, K and I) significantly increased the survival of lupin seedlings inoculated with *R. solani* AG-2-2 and 4, and AG-I and K significantly improved survival of canola in the presence of AG-4. A low inoculum ratio of the binucleate AGs [1:1 (multinucleate AG :binucleate AG)] was less effective than a high inoculum ratio [1:10 (multinucleate AG :binucleate AG)]. It appeared that AGs-A, Bo and I were more effective than AG-K in protecting lupin from infection by *R. solani*. This is the first report of the
potential of binucleate AGs to protect canola and lupin seedlings against infection by multinucleate AGs. Results obtained in this study will significantly contribute to management strategies that can be employed against Rhizoctonia diseases of canola and lupin in the Western Cape province of South Africa.

6.26 THE EFFECT OF RAW FULL FAT SOYBEANS VERSUS HEAT-TREATED FULL FAT SOYBEANS ON THE FEED INTAKE, FEED EFFICIENCY RATIO AND GROWTH RATE OF FINISHING OSTRICHES: T.S. Brand, B.B. Aucamp, Institute for Animal Production, Western Cape Department of Agriculture

Soybeans are a well-known protein source for farm animals, but are well-known for the fact that they contain the anti-nutritional factor trypsin inhibitor, which is known to interfere with the effective working of certain digestive enzymes. Trypsin inhibitor is however inactivated by heat treatment. The study was done to determine to what extent the inclusion of raw soybeans in ostrich diets will affect their performance. Under a free choice situation diets containing respectively heat-treated full fat soybean meal, raw full fat soybean meal or a 50:50 mixture of full fat/raw soybean meal as protein source were fed to finishing ostriches, while the intake of the respective diets was recorded. In a production study, finishing ostriches received diets with the same ingredients, while the most important production parameters were recorded. Feed intake under a free choice situation tended (P=0.10) to be higher for the diet containing heat-treated soybean meal compared to the diets containing either the 50:50 mixture of raw and heat-treated soybeans or the raw soybean meal containing diet. The feed intake of birds receiving the heat-treated soybeans containing diet was significantly higher (P<0.05) than that of birds that received either the 50:50 mixture of raw and heat-treated soybeans or the raw soybean meal containing diet. The growth rate of the three groups of birds were respectively 130 g/bird/day (heat-treated soybean containing diet), 82.3 g/bird/day (50:50 mixture of raw and heat-treated soybeans) and -47.9 g/bird/day (raw soybean meal containing diet). Feed conversion ratios were similarly negatively affected by the inclusion of raw soybeans in the diets. The data revealed that the inclusion of raw soybeans as protein source in ostrich diets will adversely affect the primary production parameters and is therefore not recommended.

6.27 DEVELOPMENT OF A SIMULATION MODEL TO OPTIMISE THE FEEDING OF BROILER BREEDER HENS DURING LAY: R.M. Gous, Animal and Poultry Science, School of Agricultural Sciences and Agribusiness, University of KwaZulu-Natal

The objective of this research project is to produce a simulation model that can be used by nutritionists to optimise the feeding of broiler breeders. A considerable amount of
research has been conducted at the University of KwaZulu-Natal on broiler breeders, mainly concerned with the effect of photoperiod on the attainment of sexual maturity and subsequent laying performance. This, together with the mathematical model describing laying patterns, potential egg production and egg weight that has been developed here, has enabled us to develop a simulation model that describes the potential egg output of broiler breeders during lay. Describing potential performance is the first step in being able to model the effect of food composition and allocation on the laying performance of broiler breeders.

The model simulates the response of a population of broiler breeders to a daily allowance of a feed of specified composition for up to 280 days from sexual maturity. Assumptions for protein partition rules are that maintenance has highest priority, yolk protein deposition second and albumen protein third. All events are timed within a 24-hour day assuming that feeding is at one time in the morning. By making use of published theories and results the model will become sufficiently accurate to be used in designing feeds and feeding programmes for broiler breeders, thereby conforming to the PRF principle of the dynamic promotion of the implementation of research results. It is hoped that this model will convince broiler breeder producers in South Africa that they are currently feeding excessive amounts of both energy and protein to their hens, the consequences being lower egg production, higher egg weights, excessive fat deposition and lower enterprise profitability.

6.28 AMINO ACID AND PROTEIN UTILIZATION OF BROILER BREEDER HENS FED MAIZE-SOYA DIETS: M. Ciacciariello, Animal and Poultry Science, School of Agricultural Sciences and Agribusiness, University of KwaZulu-Natal

For a broiler breeder hen to maximize the utilization of dietary amino acids and protein offered to her, the amounts of these nutrients and energy supplied in her daily ration must meet her requirements for these nutrients for maintenance and egg production, but should not be more than marginally in excess of those requirements. Because the nutritionist makes decisions about the amount of food to be supplied to the hens daily, it is imperative that the requirements for these nutrients are accurately predicted and measured. Because so little research has been conducted on these birds, many questions still arise regarding the calculation of the daily nutrient requirements of these hens, such as the need to provide nutrients for growth, for thermo genesis and for feathering, whether the supply of energy can be reduced in cold weather, and whether they can make use of body lipid reserves for a period when energy supply is lower than demand.

The major objectives of the research in the past year have been to measure the response of broiler breeder hens to a range of environmental temperatures as a means of
determining their nutrient requirements for maintenance and of overcoming heat stress during the summer months, and of the effects on performance over the entire production period of feeding a range of dietary protein and energy levels that either change or remain the same as the laying period progresses. Measurements taken have included the deep body temperatures of individuals to determine the extent to which this varies during the day, for example after the feeding period and during periods of rest. The results will be used to improve our understanding of the nutrient requirements of these birds over the entire laying period.

6.29 QUESTIONNAIRE RELATING TO CANOLA PRODUCTION: I F Slabbert, Department of Agriculture, Western Cape, JG Loubser, PRF contractor, GA Agenbag, University of Stellenbosch.

Questionnaire pertaining to canola production
The primary goal of the study was to determine, by means of questionnaires, why existing canola producers don’t plant larger areas of canola. A second questionnaire aimed to determine why other producers do not plant canola. Questionnaires were completed by visiting the farms of 65 producers in the Swartland (35 canola producers and 30 producers that do not cultivate canola) and 64 producers in the Southern Cape (34 canola producers and 30 that do not cultivate canola).

All the information was captured on Excel spreadsheets and summarized. This summary showed comparative results for canola producers and non-producers of canola in the different farming areas.

In the Swartland and the Southern Cape regions 10.93 % and 9.59 % of the workable dry land of canola producers respectively is utilised for the cultivation of canola.

The potential for the expansion of canola production is the highest in the Swartland. This is due to the fact that only 15.81 % of the workable dry land is used for the production of medics. On the other hand 47.08 % of the workable dry land in the Southern Cape is utilised for the production of lucerne. Expanding canola production in the Southern Cape will require current canola producers to plant canola more frequently than once every four years. Focusing on recruiting new canola producers will have to made a priority.

The importance of planting canola is in the advantages obtained for crop rotation and increased grass weed control which is found in such systems.
Producers who do not plant canola maintain that problems regarding the harvesting of canola, the precariousness of yields and economic factors are the main reasons why they don't sow canola.

Producers who do sow canola also identified losses incurred with the harvest of canola as the main problem. The problem with snails in the Southern Cape was also stated as an important issue.

Current canola producers in both regions are positive about the canola industry and are planning to cultivate larger areas of canola.

6.30 INCOME AND COST BUDGETS: J.S.G. Joubert, Protein Research Foundation

During the reporting year, economic and technical/biological information was obtained from agricultural businesses, but also by means of group discussion sessions within the areas where information could not be obtained from agricultural businesses.

In the Swartland area of the winter rainfall region, information was obtained using the group discussion method. It involves expert producers in terms of area and particular expertise about the crop branch involved. They are invited to render input. The group discussions take place in co-operation with other experts involved with the Department of Agriculture, and agriculture businesses. In the Southern Cape and Overberg/Ruens area, all the information was obtained from agricultural businesses. For these two areas, income and cost estimates for barley were calculated for the first time. There is a distinction between the types of systems (where the information is available). In the summer rainfall areas, all income and cost estimates in Mpumalanga and KwaZulu-Natal were obtained using the group discussion methods. The rest of the information was obtained from agricultural businesses. Income and cost estimates for wheat in the VKB area were included for the first time, because it is considered an important competing crop in the area. There is a distinction between processing systems in these cases too. Sensitivity analyses are included for canola in the winter rainfall area and soya in the summer rainfall area, for inclusion in all budgets.
In terms of the summer rainfall area, crop estimates were prepared for the following areas:

Mpumalanga  -  Kinross
-  Middelburg
-  Groblersdal (Irrigation)

North West  -  Brits / Koedoeskop / Makoppa (Irrigation)
-  Koster
-  Lichtenburg / Coligny
-  Zeerust

Eastern Free State  -  VKB-area

KwaZulu-Natal  -  Karkloof
-  Vryheid
-  Bergville (Irrigation)

In terms of the Winter rainfall region in the Western Cape, crop budgets were prepared for the following areas:

Western Cape  -  Moorreesburg
-  Malmesbury
-  Porterville
-  Caledon / Rivieronderend
-  Bredasdorp / Napier
-  Swellendam / Heidelberg

The information contained in the income and cost estimates typically reflect situations under normal climatic conditions. They do not represent an average for a particular area. It contains information per hectare, showing gross income, variable income and gross margins. Existing and prospective producers may use the information to prepare budgets for their own enterprises, particularly in the decision-making process. The PRF feels that the information made available at significant effort and costs, is being underutilised. In future, the matter will be addressed, to allow better utilisation of the information in the technology transfer process.
6.31 PRF Website

The PRF web site is a very important communication tool. Relevant information is made available to role players and those requiring subject-specific information.

Links to other web sites remain an important way to promote the PRF and in this reporting year new links were established with two important institutions. The PRF succeeded in securing a link with “National Variety Trials”, an Australian web site, as well as the “Iowa State University” web site, the latter being involved with a great deal of research relating to soybeans.

The database which was loaded on the web site in 2007 enjoys high priority. Due to the hard work of our administrative staff, particularly Ms Du Preez, large amounts of historical data, previously stored elsewhere, are now being included on our database.

Search engines remain the most important source of reference to the PRF web site. More than 60% of people looking for our web site are referred by search engines. In certain cases, this figure has been as high as 70%. The importance of search engines varies from month to month, but those that are shown regularly as a source of reference are Aardvark, Google, SABA and SAGIS. From 2004 to 2008 the number of visitors increased significantly, with a slight decline in the number of visitors during the current reporting year. The figures below show the number of annual visitors:

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<td>8 484</td>
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In the next reporting year, a dedicated effort will be made to market the web site, particularly aimed at the marketing campaigns that the PRF has launched in terms of soya and canola.

7. STUDY BURSARIES

The PRF makes available study bursaries to deserving candidates to obtain a Masters’ Degree or Doctorate. In the case of a Masters’ Degree, the candidate’s field of study must be compatible with the PRF vision, mission and broad guidelines, while funding for a Doctorate is
considered only if the field of study involves a major PRF priority. Such a field of study must be submitted for approval. It must comply with all criteria and, according to the Technology Committee, must be a field of priority.

The PRF considers study grants an important tool to achieve its objectives. It should create capacity in graduates, allowing them to contribute to scientific research of a high quality. This is particularly aimed at research that will promote the production of protein for animal use, as well as the optimal utilisation of that by animals.

Students are also encouraged to publish research results in co-operation with their study leaders. The students should, upon completion of their studies, publish the results as scientific articles and popular articles in recognised journals or magazines. The management summaries (abstracts) of each thesis or dissertation must be published on the PRF web site.

The PRF aims to award a maximum of eight bursaries each year. At least two of these should be new bursaries.

Bursaries for Masters’ studies may be awarded over a period of two study years, while this is extended to three years for doctoral studies. The PRF bursaries committee received fourteen (14) applications for the 2009 academic year. Seven (7) of these were approved and four (4) of the seven were new applications. The value of each bursary is R35 000 per annum. Bursaries for the 2009 academic year were awarded to the following students:

**MSc - Studies**

1) Mr TL Khetani (Second application): “An evaluation of the effects of feed restriction on protein intake and its consequences on egg composition and incubation success in broiler breeder hens”, University of KwaZulu-Natal.

2) Ms PT Mabulwana (Second application): “Determination of drought stress tolerance among soybean varieties by morphological and physiological characteristics”, University of Limpopo.

3) Mr SB Ruck (First application): “The effect of protein in the diet of broiler breeders on egg fertility and hatchability”, University of KwaZulu-Natal.

4) Ms J Patel (First application): Broiler breeder nutrition, University of KwaZulu-Natal.

5) Mr TR Olivier (First application): Monogastric nutrition, University of Stellenbosch.
6) Mr EJ van der Westhuizen (First application): Animal (Meat) Science, University of Stellenbosch.

**PhD - Studies**

Ms BK Theeruth (Second application): ‘Evaluating an optimisation routine for the profitable feeding of growing pigs’, University of KwaZulu-Natal.

**Completed thesis and dissertations received**

During this reporting year, the following dissertations and papers were received from bursary holders who had completed their studies.

1) Mr W Visagie, Essential amino acid requirements of goats, MSc, University of Stellenbosch.

2) Ms M Kritzinger, The effects of probiotics in gut health and protein utilisation in poultry, MSc, University of Stellenbosch.

3) Ms MR Modiba, Use of fermentation technologies to develop *Jatropha curcas* seed meal into animal stock feed, MSc Animal nutrition, University of Limpopo.

4) Ms BK Theeruth, Selecting a suitable mathematical function to describe the time course of anorexia during pathogen challenge, MSc, University of KwaZulu-Natal

5) Mr DB Strydom, The economic impact of maize-based ethanol production on African Animal feed industry, MSc, University of the Free State.

**8. ACHIEVEMENT AWARDS IN SUPPORT OF THE VISION AND MISSION OF THE PRF**

Apart from financial donations for research, technology transfer and bursaries, the PRF also provides for five (5) categories of achievement awards. The achievement awards relate to the following categories:

- Best doctoral dissertation;
- Best Masters’ paper;
- Best scientific article;
• Person that made a substantial contribution to promote the PRF vision and mission; and

• A Board member that contributed significantly to promote the PRF activities.

The winners of the first four categories receive an amount of R6 000, plus a certificate, while the winner of the fifth category receives a certificate and appropriate gift. The first two categories serve to encourage post-graduate students to focus on high quality research that will promote the PRF objectives, while the third serves as incentive to encourage researchers to publish research results. The fourth category is aimed at recognising exceptional achievement to promote the PRF objectives, focusing on technology transfer. The fifth category is aimed at recognising Board members who play a meaningful role in PRF activities over a long period.

No nominations were received in terms of doctoral dissertations. The following awards were awarded to deserving recipients:


2) Best article in scientific magazine: Dr PDR van Heerden, “Regulation of respiration and the oxygen diffusion barrier in soybean protect symbiotic nitrogen fixation from chilling-induced inhibition and shoots from premature senescence”. Newcastle University

3) Person that contributed significantly to promote the PRF objectives: Mr F Joubert, Producer in the Riversdal area.

4) A Board member that rendered a meaningful contribution to the PRF activities: Mr GJH Scholtemeijer.

All the awards were handed to the candidates at appropriate functions.

9. CONCLUSION

Any enterprise requires professional assistance from a wide variety of spheres in order to function successfully. We thank our auditors, lawyers, those with maintenance contracts and those without contracts who have helped the PRF to function successfully. We thank you with gratitude for your contribution.
The PRF receives so much help that it is difficult to mention everyone who has contributed, but we thank all co-workers, researchers, consultants, contractors, peer review evaluators, the broad press and in particular all friends of the PRF for their overwhelming contribution without which the PRF could not hope to achieve as much success.

The challenges of the PRF objectives for the Board are comprehensive and often made difficult due to circumstances beyond our control. These circumstances include economic change, climate change and policy amendment at all role players (from the Government to individual contractors). At times such events are beneficial, but sometimes they are detrimental to the PRF initiatives. For this reason we conduct an annual survey of the status quo and consider the latest rules that place new pressure on the Board of Trustees. The total number of Board members is limited in terms of the PRF Trust Deed and therefore almost every Board member is utilised to the full. I personally thank every Board member for their dedication and support in helping the PRF to succeed. The quality of input has always been, and remains, almost perfect.

This report gives some idea of the unbelievable amount of work that is generated by the PRF in producing the high quality products required by the different industries and role players. None of this would have been possible without the loyalty and dedication of the PRF staff under the guidance of Mr Gerhard Keun, without whom a successful team would not have been possible. We extend our grateful thanks and appreciation to this team.

There is no lack of enthusiasm in the PRF, and I trust that we will continue to achieve even greater heights in the future with the continued help of everyone involved.

GJH SCHOLTEMEIJER
CHAIRMAN
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<td>Mr EN Ndou</td>
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<td>2</td>
<td>Evaluation of PRF-Soybean elite lines under South African conditions</td>
<td>Mr GP de Beer and Mr WF van Wyk</td>
<td>Protein Research Foundation</td>
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<td>3</td>
<td>National soybean cultivar trials</td>
<td>Mr JL Erasmus</td>
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<td>4</td>
<td>Increasing soybean production on the Highveld</td>
<td>Mr WF van Wyk</td>
<td>Protein Research Foundation</td>
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<td>5</td>
<td>Effect of SO$_2$ and the interaction on growth, physiology and biochemistry of soybean and canola, studied in an OTC system</td>
<td>Prof PDR van Heerden</td>
<td>North West University, Potchefstroom</td>
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<td>6</td>
<td>Phenotypic markers for nodulation capacity of soybean cultivars</td>
<td>Prof K Kunert</td>
<td>University of Pretoria (FABI)</td>
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<td>7</td>
<td>Establishment of an early warning system for soybean rust</td>
<td>Mr M Craven and Mr GP de Beer</td>
<td>ARC-Grain Crops Institute and Protein Research Foundation</td>
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<td>8</td>
<td>Determining the epidemiological value of resistance to rust caused by <em>Phakopsora pachyrhizi</em> in soybeans lines</td>
<td>Prof NW McLaren</td>
<td>University of the Free State</td>
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<td>9</td>
<td>The use of silicon to control soybean rust (<em>Phakopsora pachyrhizi</em>) and other related studies</td>
<td>Prof P Caldwell</td>
<td>University of KwaZulu-Natal</td>
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<td>10</td>
<td>Generating management orientated maps for long-term soybean rust susceptible areas in South Africa</td>
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<td>University of KwaZulu-Natal</td>
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<td>Study of inoculation and disease evaluation techniques for <em>Sclerotinia</em> stem rot of soybean</td>
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<td>University of the Free State</td>
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<td>Control of <em>Rhizoctonia solani</em> and <em>Pythium</em> spp. on soybeans (<em>Glycine max</em>), lupins (<em>Lupinus</em> spp.) and canola using <em>Trichoderma</em> and silicon</td>
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<td>Prof P Caldwell</td>
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<td>13.</td>
<td>Super Soya Competition, KwaZulu-Natal</td>
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<td></td>
<td>Mr C Havenga</td>
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<td>14.</td>
<td>Cultivar evaluation of oil and protein seeds in the Winter rainfall area</td>
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<td>Mr PJA Lombard</td>
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<td>15.</td>
<td>Assessing canola seed losses during seed ripening and harvesting in the Western Cape Province</td>
<td>Department of Agriculture, Western Cape</td>
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<td>Dr J Strauss</td>
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<td>16.</td>
<td>N-fertilization of canola based on N-mineralisation and N leaching</td>
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<td>Prof GA Agenbag</td>
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<td>17.</td>
<td>S-fertilizer requirements of canola produced in the production areas of the Western Cape</td>
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<td>18.</td>
<td>Optimal soil tillage methods and N-fertilizer rates to be used in a wheat/canola/wheat/lupin and wheat monoculture crop rotation system in the Swartland production area</td>
<td>University of Stellenbosch</td>
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<td>19.</td>
<td>Management of herbicide resistance in the Western Cape</td>
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<td>Dr PJ Pieterse</td>
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<td>20.</td>
<td>An investigation into the production dynamics of eight crop rotation systems, including wheat, canola, lupins and pasture species in the Swartland, Western Cape</td>
<td>Western Cape Department of Agriculture</td>
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<td></td>
<td>Dr JA Strauss and Dr MB Hardy</td>
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<td>21.</td>
<td>Economic sustainability of short- and long rotation crop/pasture production systems in the Southern Cape</td>
<td>Western Cape Department of Agriculture</td>
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<td></td>
<td>Dr MB Hardy and Dr JA Strauss</td>
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<td>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</td>
<td>Dr J Labuschagne</td>
<td>Western Cape Department of Agriculture</td>
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<td>23.</td>
<td>(A) Enhancement of canola as a rotation crop within a conservation system in the dry-land areas of the Swartland using a competition between canola producers</td>
<td>Mr IF Slabbert</td>
<td>Western Cape Department of Agriculture</td>
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<td>(B) Enhancement of canola as a rotation crop within a conservation system in the dry-land areas of the Southern Cape using a competition between canola producers</td>
<td>Mr JG Loubser</td>
<td>Protein Research Foundation</td>
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<td>24.</td>
<td>Insect and other pests of canola</td>
<td>Dr G Tribe</td>
<td>ARC-Plant Protection Research Institute</td>
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<td>25.</td>
<td>Characterization and management of Rhizoctonia on canola and lupin in cropping systems in the Western Cape Province</td>
<td>Dr SC Lamprecht</td>
<td>ARC-Plant Protection Research Institute</td>
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<td>26.</td>
<td>The effect of raw full fat soybeans <em>versus</em> heat-treated full fat soybeans on the feed intake, feed efficiency ratio and growth rate of finishing ostriches</td>
<td>Prof TS Brand</td>
<td>Western Cape Department of Agriculture</td>
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<td>27.</td>
<td>Development of a simulation model to optimise the feeding of broiler breeder hens during lay</td>
<td>Prof RM Gous</td>
<td>University of KwaZulu-Natal</td>
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<td>Amino acid and protein utilization of broiler breeder hens fed maize-soya diets</td>
<td>Dr M Ciacciariello</td>
<td>University of KwaZulu-Natal</td>
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<td>29.</td>
<td>Questionnaire relating to canola production</td>
<td>Mr IF Slabbert, Mr JG Loubser, Prof GA Agenbag</td>
<td>Department of Agriculture, Western Cape, PRF contractor, University of Stellenbosch</td>
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<td>30.</td>
<td>Income and cost budgets</td>
<td>Mr JSG Joubert</td>
<td>Protein Research Foundation</td>
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<td>Mr EN Ndou</td>
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<td>An evaluation of crop rotation with canola under irrigation</td>
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<td>Dr AA Nel</td>
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<td>Dr AA Nel</td>
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<td>Lupin seed production</td>
<td>ARC-Institute for Grain Crops</td>
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<td>Mnr JW Lodewyckx</td>
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<td>A comparison of the response to dietary protein by the Cobb and Ross broiler strains used in South Africa</td>
<td>University of KwaZulu-Natal</td>
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<td>Prof RM Gous</td>
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<tr>
<td>Salt tolerance of canola</td>
<td>University of Stellenbosch</td>
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<td>Prof GA Agenbag</td>
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<td>A comparative study on the growth and yield response of soybean to treatment with different bio-products</td>
<td>University of the Free-State</td>
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<td>Prof JC Pretorius</td>
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<td>Calibration of near infrared spectrometry for amino acid analysis in animal feed</td>
<td>University of KwaZulu-Natal</td>
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<td>Dr M Ciacciariello</td>
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<td>Requirements/Sales</td>
<td>77 500</td>
<td>58 000</td>
<td>70 000</td>
<td>1 664 927</td>
<td>1 743 137</td>
<td>1 700 000</td>
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<td>Available/Produced</td>
<td>82 500</td>
<td>99 500</td>
<td>101 500</td>
<td>565 181</td>
<td>701 030</td>
<td>747 441</td>
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<tr>
<td>Shortage/Imports</td>
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<td>-41 500</td>
<td>-31 500</td>
<td>1 099 746</td>
<td>1 042 107</td>
<td>952 559</td>
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2010/2011 - Estimate
Source: Fishing industry; AFMA Chairman's Report 2009/2010


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<tr>
<td>AFMA Members</td>
<td>74 345</td>
<td>57 680</td>
<td>40 523</td>
<td>1 093 339</td>
<td>1 218 476</td>
<td>1 279 717</td>
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<td>Non-AFMA Members</td>
<td>3 155</td>
<td>320</td>
<td>29 477</td>
<td>571 588</td>
<td>524 661</td>
<td>420 283</td>
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<td>Total</td>
<td>77 500</td>
<td>58 000</td>
<td>70 000</td>
<td>1 664 927</td>
<td>1 743 137</td>
<td>1 700 000</td>
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</table>

Source: AFMA Chairmans Report 2009/2010

* Non-AFMA Members figures can also include unused stocks


<table>
<thead>
<tr>
<th>RAW MATERIALS</th>
<th>TOTAL (TON) 2008/2009</th>
<th>INCLUSION RATE (%)</th>
<th>TOTAL (TON) 2009/2010</th>
<th>INCLUSION RATE (%)</th>
<th>TOTAL (TON) 2010/2011</th>
<th>INCLUSION RATE (%)</th>
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<tr>
<td>Sunflower oilcake</td>
<td>248 854</td>
<td>4.53</td>
<td>313 922</td>
<td>5.97</td>
<td>287 584</td>
<td>5.43</td>
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<td>Groundnut oilcake</td>
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<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
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<tr>
<td>Soya oilcake</td>
<td>716 143</td>
<td>14.18</td>
<td>701 055</td>
<td>13.19</td>
<td>752 928</td>
<td>13.73</td>
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<tr>
<td>Full fat soya</td>
<td>92 474</td>
<td>1.83</td>
<td>164 840</td>
<td>3.10</td>
<td>183 884</td>
<td>3.35</td>
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<td>Cottonseed oilcake</td>
<td>19 886</td>
<td>0.39</td>
<td>18 739</td>
<td>0.39</td>
<td>19 852</td>
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<td>Full fat cottonseed</td>
<td>4 902</td>
<td>0.10</td>
<td>4 779</td>
<td>0.09</td>
<td>6 192</td>
<td>0.11</td>
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<tr>
<td>Canola oilcake</td>
<td>2 147</td>
<td>0.04</td>
<td>2 834</td>
<td>0.05</td>
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<td>0.09</td>
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<td>Full fat canola</td>
<td>31</td>
<td>0.00</td>
<td>618</td>
<td>0.01</td>
<td>1056</td>
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<td>Copra and Palm kernel</td>
<td>4887</td>
<td>0.10</td>
<td>7655</td>
<td>0.14</td>
<td>6224</td>
<td>0.15</td>
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<td>Maize germ oilcake</td>
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<td>0.09</td>
<td>4033</td>
<td>0.08</td>
<td>5160</td>
<td>0.09</td>
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<td>Total oilcake</td>
<td>1 093 339</td>
<td>21.65</td>
<td>1 218 476</td>
<td>22.93</td>
<td>1 279 717</td>
<td>23.34</td>
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<td>Total maize products</td>
<td>2 844 879</td>
<td>52.46</td>
<td>2 900 624</td>
<td>54.58</td>
<td>2 985 747</td>
<td>50.34</td>
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<td>Total fish meal</td>
<td>74 345</td>
<td>1.47</td>
<td>57 680</td>
<td>1.09</td>
<td>40 523</td>
<td>0.74</td>
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Source: AFMA Chairmans Report 2009/2010

AFMA rawmaterial usage April 2010-March 2011

Note: Total oilcake in Table 3 include all oilcake and not only specific oilcake items listed in table 3

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<td>2008/2009</td>
<td>75 000</td>
<td>98 000</td>
<td>100 000</td>
<td>7 500</td>
<td>1 500</td>
<td>1 500</td>
<td>82 500</td>
<td>99 500</td>
<td>101 500</td>
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<tr>
<td>2009/2010</td>
<td>-5 000</td>
<td>-41 500</td>
<td>-31 500</td>
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Source: AFMA; SA Fishmeal Marketing Company


<table>
<thead>
<tr>
<th>Year</th>
<th>Oil Cake:</th>
<th>Local Oil Cake Production (TON)</th>
<th>Imported Oil Cake (TON)</th>
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<tr>
<td></td>
<td>Groundnuts oilcake</td>
<td>1 0 0</td>
<td>Sunflower oilcake</td>
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<tr>
<td></td>
<td>Soya Cake</td>
<td>103 520</td>
<td>387 500</td>
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<tr>
<td></td>
<td>- Full fat</td>
<td>88 000</td>
<td>148 320</td>
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<tr>
<td></td>
<td>Beans</td>
<td>93 600</td>
<td>30 000</td>
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<tr>
<td></td>
<td>Cotton Cake</td>
<td>51 500</td>
<td>20 000</td>
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<tr>
<td></td>
<td>- Full fat</td>
<td>30 000</td>
<td>20 150</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>Canola</td>
<td>21 560</td>
<td>17 050</td>
</tr>
<tr>
<td></td>
<td>Lupins</td>
<td>14 000</td>
<td>18 000</td>
</tr>
<tr>
<td></td>
<td>Copra &amp; Palm Kernel</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>565 181</td>
<td>701 030</td>
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Source: AFMA Chairman’s report 2009/2010
Estimate - 2010/11. The projected local production figures for soya and cotton reflect full fat and oil cake.
### TABLE 6: OIL SEED AND GRAIN PRODUCTION IN THE RSA (TON)  

<table>
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<tr>
<td>White maize</td>
<td>4 187 400</td>
<td>4 315 000</td>
<td>7 480 000</td>
<td>6 775 000</td>
<td>7 822 400</td>
</tr>
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<td>Yellow maize</td>
<td>2 430 600</td>
<td>2 810 000</td>
<td>5 220 000</td>
<td>5 275 000</td>
<td>5 220 600</td>
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<tr>
<td>Sorghum</td>
<td>96 000</td>
<td>176 000</td>
<td>255 000</td>
<td>276 500</td>
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<tr>
<td>Groundnuts</td>
<td>74 000</td>
<td>58 000</td>
<td>88 800</td>
<td>99 500</td>
<td>87 865</td>
</tr>
<tr>
<td>Sunflower</td>
<td>520 000</td>
<td>300 000</td>
<td>872 000</td>
<td>801 000</td>
<td>516 265</td>
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<tr>
<td>Soya beans</td>
<td>424 000</td>
<td>205 000</td>
<td>282 000</td>
<td>516 000</td>
<td>560 950</td>
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<tr>
<td>Cotton seed</td>
<td>25 962</td>
<td>19 525</td>
<td>17 378</td>
<td>15 658</td>
<td>14 576</td>
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<tr>
<td>Wheat</td>
<td>2 105 000</td>
<td>1 905 000</td>
<td>2 130 000</td>
<td>1 958 000</td>
<td>1 570 980</td>
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<tr>
<td>Canola</td>
<td>36 500</td>
<td>38 150</td>
<td>30 800</td>
<td>40 350</td>
<td>39 650</td>
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Source: National Crop Estimates Committee; Third production forecast for winter crops (21 October 2010) and Final crop estimate for summer crops for the 2010/11 marketing year (23 September 2010); Cotton South Africa.

### TABLE 7: OIL SEED AND GRAIN SUPPLY IN THE RSA (TON)  
(2010/2011 MARKETING SEASON)

<table>
<thead>
<tr>
<th>CROP</th>
<th>Opening stock</th>
<th>Imports to RSA</th>
<th>Production</th>
<th>Total supply</th>
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<tbody>
<tr>
<td>White maize</td>
<td>1 362 000</td>
<td>0</td>
<td>7 822 400</td>
<td>9 184 400</td>
</tr>
<tr>
<td>Yellow maize</td>
<td>769 000</td>
<td>0</td>
<td>5 220 600</td>
<td>5 989 600</td>
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<tr>
<td>Sorghum</td>
<td>93 000</td>
<td>6 000</td>
<td>220 093</td>
<td>313 093</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>44 000</td>
<td>0</td>
<td>220 093</td>
<td>313 093</td>
</tr>
<tr>
<td>Sunflower</td>
<td>266 000</td>
<td>40 000</td>
<td>516 265</td>
<td>822 265</td>
</tr>
<tr>
<td>Soya beans</td>
<td>113 000</td>
<td>4 000</td>
<td>560 950</td>
<td>677 950</td>
</tr>
<tr>
<td>Wheat</td>
<td>715 000</td>
<td>1 400 000</td>
<td>1 694 920</td>
<td>3 809 920</td>
</tr>
<tr>
<td>Canola</td>
<td>8 100</td>
<td>0</td>
<td>42 000</td>
<td>50 100</td>
</tr>
</tbody>
</table>

Source: Opening stock, import and production figures obtained from Grain South Africa.

### TABLE 8: AREA PLANTED TO OIL SEED AND GRAIN CROPS IN THE RSA  

<table>
<thead>
<tr>
<th>CROP</th>
<th>Ha planted 2005/06</th>
<th>Ha planted 2006/07</th>
<th>Ha planted 2007/08</th>
<th>Ha planted 2008/09</th>
<th>Ha planted 2009/10</th>
<th>Ha planted 2010/11</th>
</tr>
</thead>
<tbody>
<tr>
<td>White maize</td>
<td>1 033 000</td>
<td>1 624 800</td>
<td>1 737 000</td>
<td>1 489 000</td>
<td>1 719 700</td>
<td>1 522 300</td>
</tr>
<tr>
<td>Yellow maize</td>
<td>567 200</td>
<td>927 000</td>
<td>1 062 000</td>
<td>938 500</td>
<td>1 022 700</td>
<td>946 200</td>
</tr>
<tr>
<td>Sorghum</td>
<td>37 150</td>
<td>69 000</td>
<td>86 800</td>
<td>85 500</td>
<td>86 675</td>
<td>86 600</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>48 550</td>
<td>40 770</td>
<td>54 200</td>
<td>54 550</td>
<td>57 450</td>
<td>59 800</td>
</tr>
<tr>
<td>Sunflower</td>
<td>472 480</td>
<td>316 350</td>
<td>364 300</td>
<td>635 800</td>
<td>397 700</td>
<td>515 150</td>
</tr>
<tr>
<td>Soya beans</td>
<td>240 570</td>
<td>183 000</td>
<td>165 400</td>
<td>237 750</td>
<td>311 450</td>
<td>390 000</td>
</tr>
<tr>
<td>Wheat</td>
<td>805 000</td>
<td>764 800</td>
<td>632 000</td>
<td>748 000</td>
<td>642 500</td>
<td>558 100</td>
</tr>
<tr>
<td>Canola</td>
<td>40 200</td>
<td>32 000</td>
<td>33 260</td>
<td>34 000</td>
<td>35 960</td>
<td>34 832</td>
</tr>
<tr>
<td>Total</td>
<td>3 244 150</td>
<td>3 957 720</td>
<td>4 334 960</td>
<td>4 223 100</td>
<td>4 273 235</td>
<td>4 112 970</td>
</tr>
</tbody>
</table>

Source: National Crop Estimates Committee: Intentions to plant Summer crops 2010/11 Production season (21 October 2010)
Estimated area to plant Winter crops 2010 production season (21 October 2010)

### Table 9: NOTE ON MARKETING SEASON  
FOR SUMMER AND WINTER CROPS

<table>
<thead>
<tr>
<th>Crops</th>
<th>Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>White maize</td>
<td>May - April</td>
</tr>
<tr>
<td>Yellow maize</td>
<td>May - April</td>
</tr>
<tr>
<td>Sorghum</td>
<td>April - March</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>March - Feb</td>
</tr>
<tr>
<td>Sunflower</td>
<td>Jan - Dec</td>
</tr>
<tr>
<td>Soya beans</td>
<td>Jan - Dec</td>
</tr>
<tr>
<td>Wheat</td>
<td>Oct - Sept</td>
</tr>
</tbody>
</table>
ANNEXURE IV

PRF STRUCTURE

CEO +
ADMINISTRATION

FINANCE
COMMITTEE

CONTRACTORS

PRF BOARD

EXECUTIVE

TECHNOLOGY
COMMITTEE

WORKING
GROUPS

SOYBEAN WORKING GROUP

CANOLA WORKING GROUP

SOYBEAN RUST WORKING GROUP

SCLEROTINIA WORKING GROUP

SOYBEAN PLANNING TASK TEAM

CANOLA PLANNING TASK TEAM

MARKETING
COMMITTEE

BURSARY SUB
COMMITTEE

63