PROTEIN RESEARCH FOUNDATION

25 years

The development of the PROTEIN RESEARCH FOUNDATION

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VISION

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

MISSION

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

The PRF subscribes to:

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

PROTEIN RESEARCH FOUNDATION

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ADDENDA

1 PREFACE


Gerhard JH Scholtemeijer

The year 2015 heralds a special milestone for the Protein Research Foundation (PRF) as it celebrates its 25th anniversary. The government established the organisation in 1990 and imposed a pure research mandate specifically in terms of protein for animal nutrition. Over the years there has been much speculation by many institutions regarding the activities of the PRF, but I trust that this comprehensive issue will answer all the questions and I am hopeful that it will paint a clear and inspirational picture of the PRF's actions over the past 25 years. As a matter of fact, I believe that it will clearly illustrate the PRF's exemplary contribution in terms of its vision and mission which has been to the benefit of all of us in South Africa.

The origins of the PRF may be traced as far back as 1970, but the history is unluckily not very well documented for the years to 1990. The main sources of protein in South Africa were the local sunflower production and fishmeal produced in South Africa and Namibia. Fishmeal was relatively inexpensive and the inclusion levels established by animal feed manufacturers were much higher than the internationally accepted norms.

The animal feed industry acknowledged that more soya meal could be used instead of fishmeal but this was however, not available in South Africa. The protein supply position in South Africa became a significant discussion point and the government played a leading role in these discussions. A key point is the fact that the fishmeal industry made available the first funds which were aimed at researching the promotion of local soybean production. In 1972 the USA had already produced 35 million tons of soybeans while Brazil and Argentina had only produced 3,2 million tons and 100 000 tons respectively. By comparison, South Africa had produced a mere 4 600 tons in that year.

The gap between locally produced protein for animal nutrition and the total protein demand in South Africa grew annually. The Protein Advisory Committee (PAC), which had been convened in 1976, made little impact on the growing shortfall. In 1990 the PAC was replaced by the Protein Research Advisory Committee (PRAC), which is currently known as the PRF. The PRAC started working with great enthusiasm by considering a wide variety of possible protein sources and funding research that related to those sources.

In 1999, the following paragraph appeared in the Protein Research Trust's (PRT) Research Report: 'During the past ten years, funds were allocated to research projects aimed at the following potential protein sources: Abattoir by-products, such as blood meal, carcass meal and poultry by-products, cottonseed, fodder trees, feather meal, urea products, yeast protein supplements, triticale, medics, groundnuts, cowpeas, pigeon peas, sunflower, sub-tropical legumes, single-cell protein etc.' Various experiments and nutritional trials were conducted on these protein sources.

Meanwhile, until 1996, significant quantities of fishmeal were imported and increasing quantities of soya oilcake were also being imported because of the price benefits.

Unfortunately both interest and assistance from the government waned as the gap between locally produced protein for animal feeding and the total local demand grew by the day. Researcher training and research funding were low on the government's list of priorities. There was however a growing concern because an insufficient supply of protein for animal nutrition will result in an insufficient supply of protein (meat, milk, eggs) for human consumption.

The PRF vision and mission clearly states:

VISION

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

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- The promotion of cost-effective research.
- The dynamic promotion of the implementation of research results.
- The effective sustained utilisation of natural agricultural resources.
- The reduction of foreign exchange payable for imports and creation of job opportunities by replacing imported protein as far as possible with locally produced protein.

By 1996 the PRF had realised that it was essential to focus on specific commodities to launch its actions successfully.

The PRF acknowledges the work of all South African researchers who have made significant contributions over the past 25 years. Some of these individuals continue to make contributions while others have now retired. Despite the low numbers of young researchers nowadays, there are nonetheless a few who have already left their mark in the field and we hope to see many more of their positive contributions in the future. We honour every role-player and each contribution made towards advancing the interests of the PRF and assisting us to make an indelible impact on the sector.

Furthermore there have been many other contributors who have not necessarily been involved in research or in the publishing of articles, but who nonetheless have rendered contributions of great importance. As such, the PRF established an award to acknowledge 'an individual that contributed in a special way to promote the PRF vision and mission'. Over the years there have been many disappointments and empty promises, but it is seldom that we have not devised a Plan B or C. The enthusiasm of our co-workers has always inspired the PRF to make new plans for action. For the PRF, the solution has also been to network with hundreds of national

The PRF's head office in Rivonia, Gauteng

and international experts to support PRF actions and efforts towards realising our goals. In addition, the PRF has been blessed with Board members who were not only experts in their own right, but who have also served long terms of office with diligence and dedication.

We have often searched for answers locally, only to find the answers internationally. There has been very little negativity from our international counterparts and we have formed long-term professional and personal friendships. The direct and indirect benefits of the PRF's international relationships, including presenting and hosting the World Soybean Research Conference (WSRC) IX 2013, cannot be quantified, but the value may never be underestimated.

The PRF has learnt much over the years and every year brings new insights and knowledge. We thank and acknowledge everyone involved.

Continued adaptation to rapidly changing circumstances, including the new approaches of large international chemical and seed companies to offer a one-stop comprehensive client service to producers, will have a significant impact on several industries, including those of soybeans and canola. Many of these companies have already established a presence in South Africa. The PRF will do everything in its power to make those unique opportunities available to the South African soya and canola producers.

The production of canola and soybeans has come a long way. In 1990, the PRF basically started from scratch since no canola had previously been grown and only between 60 000 and 80 000 hectares had been under soybeans. At the time, the international area planted under canola comprised just less than 20 million hectares while soybeans was grown on just less than 60 million hectares. The use of fishmeal declined and eventually became insignificant, although sunflower remained consistent. In the 2014/2015 soybean season the magic 1,0 million ton mark was exceeded when 687 300 hectares yielded 1 059 850 tons whilst in 2014 canola yielded 121 000 tons on 95 000 hectares.

It is unarguable that today soybeans and canola are the lifebuoys of the animal feed industry and are thus under the spotlight of the PRF. If we can retain the goodwill of all existing role-players for the next five years, there is no reason why the PRF will not achieve its 2020 targets. Those targets are:

- Soybeans – 2,5 million tons on more than one million hectares.
- Canola – 250 000 tons on 150 000 hectares.

Over the next decade the PRF will continue to strive towards making South Africa self-sufficient in terms of protein for animal feeding by 2025.

Gerhard JH Scholtemeijer
Chairman

2.1 Congratulations from DR RD BIGALKE

In this milestone year of the PRF's 25th anniversary, we can look back on a quarter of a century of many highlights of which we may be proud and justifiably enjoy these festivities and celebrations.


Dr Rudolph Bigalke

ORIGINS OF THE PROTEIN RESEARCH FOUNDATION

The body we now know as the Protein Research Foundation (PRF) was founded by the former Department of Agricultural Development (DAD) in 1990. Initially the name was the Protein Research Advisory Committee (PRAC). Its predecessor was merely known as the Protein Advisory Committee (PAC), established by the former Department of Agricultural Economics and Marketing. That initial committee provided advice for almost 15 years before it was replaced by PRAC in 1990. The move was significant because of its particular mandate to specifically conduct protein research.

The PRAC composition was determined by the top DAD management. The committee members were nominated from amongst the members' principals in the private and public sector. Dr RD Bigalke of the DAD was appointed as the PRAC Chairman. In 1998 the Protein Research Trust (PRT) resolved to change the composition of the Trust in order to benefit from the expertise in the broader community of research, industry, operational and organised agricultural sector parties as council members.

Dr Bigalke resigned as Chairman in 2000 and was succeeded by Mr GJH Scholtemeijer, who is still the chairman today.

The PRF aimed to promote intensive soybean and canola production and today the statistics are testimony to their success. The hectares planted under soybeans increased from 134 150 ha in 2001, to 516 500 ha in 2013, representing an increase of almost 400%. The total harvest in 2014 comprised 948 000 tons compared to only 516 000 tons in 2009. Without a doubt, it makes the soybean industry the fastest growing industry within the local agricultural sector in the past six years. Of significance is that this growth has also stimulated growth in a secondary sector with the establishment of local processing plants and crushing capacities being developed.

In the case of canola, 121 000 tons were produced on 95 000 hectares in 2014 while 79 650 tons had been produced on 34 000 hectares in 2012. To date the highest average yield per ha was the 1,79 tons seed achieved in 2012. As such, the target of 75 000 tons on 50 000 hectares by 2015, had already been achieved. In 1992 the corresponding figure was only 400 tons on 400 hectares. This means that in the case of canola, the production growth achieved has been phenomenal. The PRF deserves far more credit in this regard than any other institution that has been involved in the process.

HOW WERE THESE REMARKABLE RESULTS ACHIEVED?

The PRF vision and mission rest on two main pillars:

- Promoting appropriate, objective research in favour of locally produced protein and utilisation of such protein.
- Implementing such research results through technology transfer to provide for the increased protein demand in animal feeds.

The results were achieved by implementing, particularly, the following actions:

- Promoting cost effective research by providing financial support.
- Dynamic promotion of the implementation of research results.

In practice it means that the PRF and its predecessors have been actively involved in financing research projects at research institutions such as those at the Agricultural Research Council and the universities from the very beginning.

The practical application of research results have been supported for over almost two decades through, among others:

- Demonstration plantings of various cultivars of the respective crops.
- Guided technology transfer by especially appointed experts.
- Yield based producer competitions.

Some of the very first overseas tours undertaken, involved studying the storage and transport of canola seed in Australia, because of its comparative dry climate. The information obtained was applied fruitfully within the fast expanding local industry.

During the same period, an agreement was reached with Prof Wallace Cowling in Australia. The agreement was aimed at increased co-operation to resolve the problems experienced in the lupin industry. The pattern of international co-operation remains an important element of the PRF backbone.

Currently, valuable international co-operation in terms of soybean research and development is shared with the USA, Brazil, Argentina and China. PRF representatives have attended various international and local congresses and information days either as delegates or speakers. Similarly, researchers from the above-mentioned countries have also visited South Africa in similar capacities, as guests of the PRF.

Other key contributions include study grants of which 63 have been awarded since 1995, achievement awards have been given in six categories and a successful generic marketing programme relating to soybeans and canola that was launched. The impressive success which the PRF has achieved in terms of its objectives enjoys continued international industry and media acknowledgement. Presenting and hosting the WSRC IX 2013 (World Soybean Research Conference IX 2013) in Durban, was an achievement that placed the PRF in the international spotlight. At that congress, Mr Scholtemeijer was elected as a member of the 'Continuation Committee' of the WSRC.

FUTURE VISION

Since its inception the PRF has been a future focused organisation. Its mission and targets/objectives have always been determined strategically. Its vision has always been

Did you know?

In 2001 there were two soybean cultivars that were glyphosate resistant while today there are almost no cultivars without this resistance.

Soybeans were first traded on Safex in 2002.

to contribute materially to the enormous local demand for protein for animal feeding and to close the huge gap with local production by steadily replacing imports. This vision demanded a dramatic increase in local protein production and more efficient protein utilisation, aimed at a general increase in prosperity as an eventual bonus.

The PRF's action plans have always been adjusted according to demand. Board committees have kept the PRF management in touch with changing circumstances and new requirements. The use of working groups for priority crops such as soybeans and canola, task teams to develop solutions for provocative challenges and by appointing experts to manage technology transfer and to plan and participate in farmer information days, are all part of the PRF *modus operandi*.

It has always been PRF policy to set itself challenging targets as is reflected in the soybean and canola production successes. Today the PRF continues to pursue such visionary targets and for this it deserves the highest accolades.

I am particularly grateful for the opportunity to congratulate the PRF on the many important milestones it has reached over the past 25 years. I have no doubt that its ability to adapt remains fluid enough to go on from strength to strength.

Dr Rudolph Bigalke

2.2 Congratulations from the CHIEF EXECUTIVE OFFICER


Gerhard Keun

Twenty-five years is an important milestone which calls for congratulations as well as a moment to use the opportunity not only to remember the past, but also to plan for the future wisely.

At such a time, it is a privilege to remember the origins of the PRF with a hint of nostalgia.

Although the current objectives of the PRF may be traced back to as early as 1973, the contributions of funding and subsidising imported protein had been suspended by 1989. For this reason the PRF Board decided to adjust the official founding date for the PRF to 1990, since that is when the objectives changed to pure research objectives.

The new objectives also involved new technology and new insights. The PRF was transformed to survive the new challenges.

The PRF achieved tremendous growth and established goodwill in the industry and has always strived to provide the best services and support, for which I salute them.

I wish the PRF good fortune on the road ahead. I believe that the Trustees and staff will pro-actively anticipate the future based on realities and in view of the challenges, determine priorities and plan meaningfully for the future.

Congratulations. The twenty-five years marks a magnificent milestone.

Gerhard Keun
Chief Executive Officer

Did you know?

As early as 1972, the Animal Feed Manufacturers Association (AFMA) informed government that as much as 150 000 tons of soya meal could be used instead of fishmeal.

3.1 LET'S START AT THE VERY BEGINNING

ABOUT THE PRF

Certain objectives of the Protein Research Foundation (PRF) and its predecessors, including the funding of research to achieve specific objectives, date back to 1973. Before 1990, certain other objectives had to be achieved using specific funds, but those were terminated in 1989 to make way for a pure research function and related matters like technology transfer. Those were determined formally in 1990, with the establishment of a research institution now known as the Protein Research Foundation.

In the earlier 1970s, the fishmeal industry sold a significant quantity of fishmeal onto the international markets, but fishmeal was classified as a strategic product and local requirements had to be met first, before any fishmeal exports could be considered. The Fishmeal Association was particularly critical of animal feed producers, because of the high quantities of fishmeal included in animal feed. This animosity was no secret and almost gave rise to court actions in 1971 and 1972. Fishmeal producers alleged that soybean oilcake could be used to alleviate the huge pressure on the fishmeal demand. As early as 1972, the Animal Feed Manufacturers Association (AFMA) informed government that as much as 150 000 tons soya meal could be used instead of fishmeal.

AFMA indeed experienced a particular shortage of locally produced oilcake in 1973. They reported the problem to the Department of Agricultural Economics and Marketing, and shortly afterwards a meeting was convened between the Department of Agricultural Economics and Marketing, the Department of Trade and Industry, representatives of the animal feed industry and representatives of the fishmeal industry. The objective of the meeting was '...to discuss the protein supply position of the Republic with reference to the availability of oilcake and fishmeal in view of a potential global protein shortage, as well as a possible shortage in the Republic'. This followed on a decision made on 22 December 1972, to establish a so-called 'Subsidised Procurement Fund', funded from levies on fishmeal and oilcake. The meeting confirmed the decision and agreed to submit such recommendations.

The fishmeal price was increased by R44 per ton on 6 March 1973. The increase included a levy of R7,50 per ton fishmeal on 125 000 tons. This levy was the start of the so-called Fishmeal Levy Fund, which was a voluntary fund. The objective of the fund was to subsidise imported fishmeal.

The meeting also decided to set aside R500 000 of that fishmeal levy for a separate research fund, namely the Protein Research Fund. The research funds were to be used to promote the production of protein material for animal nutrition, with particular emphasis on the increased production of soybeans and soya cake. As such then, it formed the origins of the current PRF and its research assignment and its dates back to 1973. In 1973, the Minister also decided, in terms of the Marketing Act, to charge an oilcake levy to subsidise oilcake imports. That was the origin of the so-called Oilcake Levy Fund. Thus two funds were established to stabilise prices and one fund was established to fund research.

The subsidisation of imported protein hardly ever materialised. During 1976, about 6 000 tons of fishmeal was subsidised at R20 per ton but any subsequent subsidisations were rare. There is very little information available about this. Increased imported volumes grew rapidly and subsidisation from available funds would probably have had little or no effect.

In an attempt to make more oilcake available in South Africa for animal feed, the Oil Seeds Board established a so-called Sunflower Parity Scheme. The most important condition was that all the oil which was produced in terms of that scheme had to be exported, but the oilcake had to remain in South Africa. Although this measure provided some relief, sunflower oilcake could never truly replace fishmeal or even soybean oilcake.

In terms of the oilcake levy to fund the so-called Oilcake Levy Fund, the oil processing industry charged an additional levy of R7 per ton of oilcake sold. These amounts were also paid into the fund, but eventually this burden was borne by the animal feed manufacturer, individual mixers or the end-user – as was actually also the case with the fishmeal levy.

During the same meeting between the two departments and the two interest groups in 1973, the meeting decided to convene a so-called Protein Study Group to investigate matters relating to protein materials for animal feeding and submit recommendations to government. There is very little information available about the activities of the study group between 1973 and 1976.

In 1976, the Protein Study Group was converted into the Protein Advisory Committee (PAC). The most important role-players were the Departments of Agriculture and Environmental Affairs (Fisheries), the Oilseed Control Board, the Fishmeal Industry, the Animal Feed Industry, the Oil Processing Industry and the South African Agricultural Union.

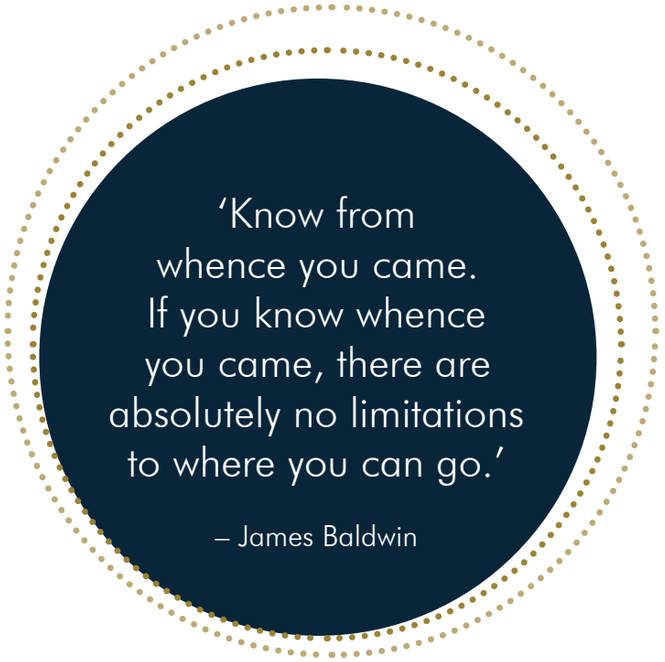
Until 1978, not much research was conducted. In his 1978 AFMA Chairman's report, Mr GJH Scholtemeijer stated, 'In view of the increasing problems relating to the availability of fishmeal, it is essential for the farming industry in South Africa to give serious consideration to the stimulation of soybean production'. As a consequence, the PAC included 'The Encouragement of Soybean Production' as a standing item in its agenda.

In 1983, Dr JG Cloete published a document, 'Memorandum of Protein Supply for Animal Production' and submitted recommendations to the PAC. Some of the most important recommendations were to strengthen the Protein Research Fund. The recommendation included the investment of a capital amount of R2,5 million, so that the interest and dividends could be utilised for research purposes. In 1985, the Minister approved payment of the levy funds into the research funds to increase the capital to R3 million. Brief information on the appropriation of funds for research purposes from July 1973 to 1990 is available on the PRF website. From the project list (see addendum) it is clear that many overseas visits were funded from the various funds with Dr Cloete being the first recipient of funds as early as 1976. Capital equipment and even the construction of certain buildings were also funded. The fishing industry was by far the single biggest beneficiary of the available funds, alongside the CSIR who received funds for research on single cell protein production (which came to nothing) but very little attention was given to soybeans.

On 10 May 1990 a meeting was convened of a so-called 'Interim Arrangement Committee for the Protein Research Fund'. In terms of a letter from the Director General of the Department of Agriculture, Dr Frans van der Merwe, the Protein Fund, including the Fishmeal and Oilcake Research Funds, had to be transferred to an 'Agricultural Research account'.

PRT TRUSTEES 1994
Front: Mr Jan du Preez,
Dr Gawie Bredell,
Ms Lorraine Terblanche (secretary),
Dr Rudolph Bigalke (Chairman)
and Mr Gerhard Scholtemeijer

Back: Mr Deon Joubert,
Dr Munro Griessel,
Messrs Steve Malherbe,
Hans van der Merwe,
Dr Roger Finlayson,
Messrs Barry Hundley and
Martiens Prinsloo



In addition, the interim arrangement committee and the Minister decided, '...to establish a Trust fund, with the Protein Research Advisory Committee (PRAC) forming the Board of Trustees'.

On 4 December 1990, the Protein Research Advisory Committee held its first meeting under Chairmanship of Dr RD Bigalke. The first meeting resolved, *inter alia*, that the members of the committee would report in writing on the short- and long-term protein needs and research requirements. This matter is still being attended to today.

The first PRAC consisted of ten Board members, plus a secretary. Only one meeting was convened in 1990. In 1991 and 1992, two meetings were convened annually. Three meetings were convened in 1993, four in 1994 and thereafter, six meetings were held each year. From inception, all the work was conducted by the Board members and a secretary, while departmental facilities were used including Dr Bigalke's office and the board room in the building that later housed the Agricultural Research Council (ARC). After resolving several difficult issues, the Trust, as had been anticipated by the interim arrangement committee and the Minister, was established in 1994 and the first meeting of the Protein Research Trust was convened on 9 November 1994 (see Extract 1 on page 32 - 33).

Although the current objectives of the PRF date back to 1973, contributions to funding and subsidising of imported protein were suspended in 1989, as was pointed out above. Accordingly, the PRF Board decided that the official PRF founding date would be backdated to 1990, as the objectives changed to pure research from then on. The first Annual General Meeting was convened on 12 July 1991. When the Chairman, Dr Bigalke, reported on the activities for the first year, one of the most important PRAC objectives highlighted was the need 'to determine the short- and long-term demand for protein to be used in animal feeds in South Africa regularly'.

In the 1992 Annual Report, it is mentioned that the year started on a high note because of a strategic planning session held on 18 and 19 February 1992. The PRAC vision and mission were formulated at that meeting. Over the years they have not changed materially and they are still valid today. A total of 66 funding applications were received and 38 of those were approved. One of the outstanding applications related to a request for about R1,5 million to provide funding for research equipment for the research vessel, SAS Algoa, which was part of the Sea Fisheries Research Institute fleet at the time.

The CSIR indicated that the results of the single cell protein project had been used by Transvaal Suiker Beperk (TSB), but that it had since been moved onto the backburner because the TSB had determined other priorities.

Funding for the current Agricultural Research Council-Grain Crops Institute (ARC-GCI) national soybean cultivar trials started in 1992 and these are still funded by the PRF today.

At that stage, the PRAC was considered an official committee of the newly established Agricultural Research Council (ARC) and its Annual Report was published under the auspices of the ARC.

In 1993, 51 funding applications were received and 28 of those were approved.

'An important project funded for the first time during that year, was the modelling project of Prof RM Gous of the University of Natal. The objective was improved utilisation of dietary protein to utilise the protein sources available in this country more effectively.'

'Research on fodder trees, the development of soybean cultivars with a better seed quality and the reasonable fundamental research on biological nitrogen binding for soybeans' also deserve special mention because of the dramatic breakthrough potential of these projects.

It is important to include a quote from that year's PRF Annual Report: '(The) ARC requested PRAC to consider handling the Protein Fund apart from ARC's budget and to handle the Protein Fund as a trust fund.'

'(The) PRAC accepted the proposal and agreed that the PRAC Board would act as Trustees.'

'It is envisaged that the Trustee Board, a legal entity, would replace the PRAC. The Trustee Board would act in its own right, totally independent from ARC. However, ARC remains willing to provide the Trust with administrative support.'

Another request that would have long-term consequences was submitted by the Oil and Protein Seed Centre Potchefstroom relating to the financing of the soybean research programme. This involved a suggestion that operational costs of the Soybean Research Programme of the ARC-GCI will also be funded. Similarly it was decided in principle that the PRAC would provide grants to a limited number of post-graduate students in the field of protein research.

Dr Bigalke concluded his 1993 Annual Report saying, 'During the past year PRAC started to realise one of its main objectives, namely to provide appropriate pro-active objective driven research in favour of stimulating protein supply for animal feed. As it is probably its most important objective, it will strive diligently to achieve that objective.' Those words were wise indeed and remain very apt today.

The year 1994 was very important in the history of the PRF. A total of 42 funding applications were received and 33 of those were approved.

'An interesting new project that was funded is the Soybean Promotion Campaign of the Cedara Agricultural Development Institute in Natal. A part of the promotion involves comparative yield trials at various trial farms. The results are used for technology transfer and as visual material during the promotion campaign.

'The loss of valuable protein and oil during the dehusking of sunflower seed and possible solutions for the problem are being investigated by the Council for Scientific and Industrial Research (CSIR). PRAC also helped to fund its first canola (rape seed) project. The project was launched by the Elsenburg Agricultural Development Institute, assisted by input from the ARC.'

During the course of the year the Oilseeds Board also attempted to expand the objectives of the PRF by including the promotion of protein for human consumption. The matter, however, was not approved.

The first two study grants of R12 000 per candidate were also awarded. The one was awarded to Ms E Upton to do her MSc in Agriculture and the other to Mr G Schreuder to complete his PhD studies.

The PRF also decided to present awards for exceptional achievements that are in line with its vision and mission. Three award categories were identified:

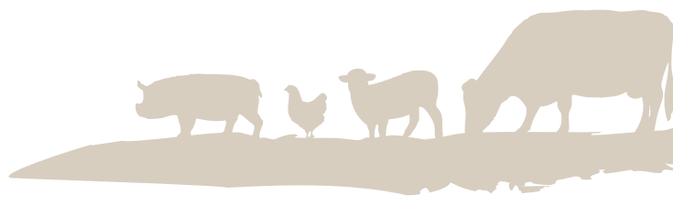
- Best Masters thesis.
- Best Doctoral thesis.
- Best article published in a scientific journal.

During 1995 the first and only award was presented to Dr BJ Willemse in the category for Best PhD.

Did you know?

The Protein Research Foundation was established as a pure research foundation in 1990.

It was the Fishmeal Association who wanted soybean oilcake to be used in animal feed so they could be free to export their product.



Four Board meetings were held during 1995. Project applications for funding totalled 39, of which 31 were approved. Emphasis on the promotion of locally produced protein of plant origin continued. An outstanding project by Dr MPW Farina which promised very good results for the future was the effect of molybdenum on soybean yields and quality. At virtually all locations where the trial was repeated, yields were notably higher. The exceptions to the rule however, emphasised that further research on molybdenum was required.

Canola trials in the Western Cape Province indicated that this commodity could be produced with great success. From some cultivars, yields of more than 2 t/ha were achieved, with the highest yield being 3 t/ha.

The Think Tank that was held during May 1995 resulted in the re-organisation of the PRT into a committee system. The Chairman of the Board became the Chairman of the Executive Committee. Other members of the Executive Committee were the Chairmen of the Finance, Technology and Marketing Committees respectively, namely Mr GJH Scholtemeijer, Dr M Griessel and Mr JSG Joubert. Dr GS Bredell was also co-opted onto the Executive Committee. Applications for bursaries which had lagged picked up during 1995 and seven bursaries were awarded.

As already indicated, prominence was given to the production of protein, particularly from a vegetable origin, for animal nutrition. However, the knowledge that imported protein would possibly reach the R1 billion mark in 1997, resulted in an ever greater sense of urgency for the PRF.

Considerable attention was given to the four crops to which the PRF had accorded its highest priority namely soybeans, lupin, canola and cotton. In order to obtain first-hand information on these crops in the international arena, Dr Griessel and Mr Scholtemeijer paid brief visits to various institutions in the USA, Brazil and Argentina. The purpose of the visits was to study aspects of research and production of soybeans and constituted the first direct negotiations with both Institute Nacional de Technologae Agropecuaria (INTA) of Argentina and Empresa Brasileira de Pesquisa Agropecuaria (Embrapa) of Brazil – contacts which have had an exceptional influence on the success of the PRF in later years.

A Soybean Think Tank, held on 2 August 1995, which was attended by many interested parties representing a wide variety of disciplines, led to the formation of a Soybean Working Group in 1996.

In 1996, 44 applications for funding were received, of which 39 were funded.

In order to determine success, measurable goals were defined by the working group and accepted by the PRT.

The most important goal was to have 100 000 hectares established under soybeans by the 1998 planting season producing an average yield of 2 t/ha. One of the most important reasons for the initial success of soybeans, in addition to the deregulation of the maize industry, is the fact that a member of the working group, Nedan Oil Mills, had indicated a price of R1 200 per ton guaranteed before the planting season of 1996. This assured the producers of a market and a fair price. The immediate result was that soybeans was suddenly viewed as a cash crop in its own right and not only as a crop to be planted in rotation with maize, mainly for the benefit of the maize crops.

Various simulation models received attention, notably the Van Zyl Model which was named after Prof J van Zyl of Pretoria University. It was envisaged that with the assistance of Prof Van Zyl and the ARC, the model would be operated commercially in 1997.

The PRT made financial assistance available to Prof WL Nieuwoudt from the University of Natal, to update his existing simulation model. The model was directed at determining the demand for protein for the years 2000, 2010 and 2020. The departure point of this model is a projection of the demand for and use of meat, eggs, milk, etc which was then converted to the demand for protein to produce these products.

Two simulation models were developed by Prof Gous with the PRT's financial assistance which he indicated would be ready for practical application during 1996. These models were the so-called EFG Broiler model and the Amino Acid Optimisation System (AAOPT) for laying hens.

In 1996, the Board of the PRT also decided to introduce a fourth category of awards, namely, an award to an individual who had made an exceptional contribution to the promotion of protein production in South Africa.

In view of the ever increasing gap between locally produced protein and imported protein, the PRT decided to accord higher priority to the production of protein than projects that are directed at better utilisation of existing protein sources. Furthermore it was decided to reduce the financing of basic research done on the four protein-rich crops that had been identified, namely soybean, lupin, canola and cotton, in favour of research directed at the solution to problems, the creation of opportunities and accordingly, the local production of more protein. This decision was corroborated by the fact that in 1996/1997, the use of oilcake was approximately 275 000 tons more than had been anticipated. Likewise the demand for fishmeal had decreased since 1994/1995, due to world-wide shortages and very high prices on the international market.

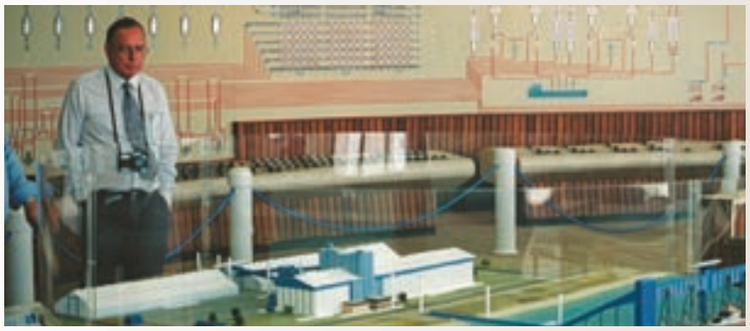
In pursuance of the ostensibly successful model applied in the soybean industry, the PRT decided to take the same route in the lupin industry. A Lupin Think Tank was held on 20 November 1996 at Elsenburg Agricultural Development Centre and objectives in terms of area and yield, for a three-year period, were identified.

The canola future looked very rosy but regrettably, problems in respect of marketing and quality hampered the momentum that canola production had developed. Both the PRT and Elsenburg Agricultural Development Institute remained optimistic about the canola project and agreed that a special canola promotion campaign should be launched during 1997.

The PRT confirmed that it would concentrate in particular on the promotion of the cultivation of the identified protein-rich crops. The driving force was provided with the establishment of the Soybean Working Group which made a priority of setting its objectives. As a result of the success achieved with soybeans, and the assistance from working group activities, similar initiatives were launched with regards to lupins and canola. A Lupin Working Group was founded on 2 April 1997, at Stellenbosch, and a Canola Working Group on 2 September 1997.

Several commodity trusts such as the Maize Trust and the Oil and Protein Seeds Development Trust (OPDT), were established during 1997, in terms of the provisions of the Marketing Act.

The year 1998 heralded many changes for the PRF. The new constitutional dispensation with its provincialisation of the agricultural function and the new Agricultural Marketing Act,

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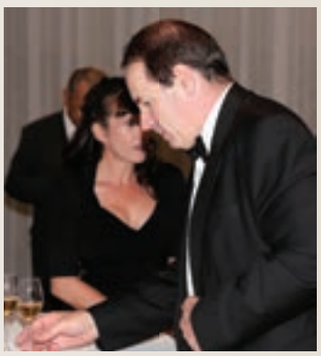











» Building relationships

which saw to the abolishment of the marketing boards, had far reaching implications for the composition of the PRF. After careful consideration, the PRF decided that in future Board members would be appointed after being nominated by nominating institutions in the disciplines concerned, instead of by principals. The Board was also restructured to be comprised of a maximum of 14 and a minimum of seven trustees.

More responsibility was given to the Technology Committee, after a decision by the Board that it should accept the primary responsibility for peer evaluation of research projects, as well as for other PRF actions in which scientific ability or achievement is to be evaluated, including appraisal for achievement awards. It was also decided that the Technology Committee would in future handle the screening of all project applications and make recommendations to the Board regarding applications, which in the opinion of the committee should be funded.

The PRF also decided that in the future much more attention should be given to the marketing of its activities. This gave rise to a first media function, as well as several radio and television interviews, articles relating to the co-operation between the PRF and the relevant research institutions, as well as heightened publicity in the popular agricultural press.

Up until 1997, the PRF had for several years participated in the NAMPO Harvest Day in co-operation with the ARC-GCI. During 1998, the PRF presented its own independent exhibition, in order to further publicise its commitment among producers and also to promote the production of protein of vegetable origin.

During 1998, the PRF experienced increasing problems in the Western Cape mainly with regards to lupin production. Anthracnose was identified on a large scale in the lupins in the southern and western parts of the Western Cape and, due to the threat posed by this devastating disease, the PRF decided to sponsor a visit by a plant pathologist and an expert in the lupin industry to Australia and New Zealand.

In a further attempt to combat anthracnose in lupins, the PRF made research funds available to the division of Food Science and Technology of the CSIR, to genetically modify lupins, by the insertion of two potential anti-fungal genes into the genome. This eventually led to the formation of an Anthracnose Working Group, consisting of specialists in the field. Unfortunately, no positive results were forthcoming as is indicated in chapter 6.

The PRF made substantial progress through co-operation with the Department of Agriculture, Western Cape (DAWC), who started with cultivar evaluation trials of lupin and canola at short notice in 1998. Six localities were identified where 25 different canola and lupin cultivars were grown with three replications.

The initial marketing and quality problems with canola were overcome and the working group felt that a potential market for more than 100 000 tons was possible. However, the greatest problems faced by the canola industry were inadequate storage space and successful storage. The working group requested a special meeting between the Executive Committee of the PRF and the so-called group 14 co-operatives, to thoroughly consider the storage problems. In order to further overcome the problem of marketing canola, the PRF funded a range of nutrition experiments which were conducted by Prof Gous from the University of Natal, Pietermaritzburg, with a view to utilising canola in full-fat form for broilers. Results of this project turned out to be positive and once again, the working group envisaged that in 1998, approximately 30 000 hectares could be planted with canola, with a potential production of 100 000 tons of canola, by the turn of the century.

The Lupin Working Group commenced its work with great enthusiasm and held five meetings as well as a special meeting

with members of the Association of Veterinary and Crop Associations of South Africa (AVCASA), when a variety of current problems were addressed. In addition, it was accepted that although lupins was not a new crop to the Western Cape, the concept of the production of sweet lupins for commercial use was indeed a new approach.

With this in mind, the PRF contracted the services of Mr Herman Agenbag, previously employed at Elsenburg and one of the most knowledgeable persons regarding lupin cultivation in the Western Cape.

In the summer rainfall area, lupin production started small in Mpumalanga and later extended to the Eastern Free State and the cooler areas of KwaZulu-Natal. Anthracnose likewise ruined the potential as explained in chapter 6 about lupin production.

The Super Soybean Competition in KwaZulu-Natal, which was funded by the PRF and held in conjunction with the KZN Department of Agriculture, proved to be a great success for over 20 years. There is little doubt that this project contributed to the early success and stability of soybean production in this province.

The PRF involvement in cotton production proved to be a less successful effort. After discussions with various cotton mills, the KZN Department of Agriculture and the ARC-Tobacco and Cotton Research Institute, it was decided that the gap between the demand for cotton fibre on the one hand and the cotton oilcake by-product was too far apart, especially since the other industries did not necessarily serve the objectives of the PRF.

At the end of 1998, the price of imported fishmeal elevated to R4 000 per ton, as opposed to the R2 971 per ton it had been twelve months earlier. This situation put additional pressure on the PRF to launch research actions and other activities that could improve the provision and utilisation of local protein resources. Progress with soybean planting and production was a positive sign and the PRF felt that their particular actions in this regard had yielded success.

Since its inception, the PRF had had the privilege of making use of the office facilities and part-time, seconded administrative assistants provided by the ARC on a compensatory basis. However, the PRF's activities had increased to such an extent that in 1999, it was decided to appoint its own full-time administrative staff and occupy an equipped office. An office in the same building which housed AFMA in Rivonia, Sandton, was selected for this purpose.

These offices were occupied in May 1999. In 2005, the PRF and OPDT decided to move to larger premises which they rented jointly and finally in 2010, the PRF decided to purchase its own building to house both the PRF and OPDT/Oilseeds Advisory Committee (OAC). The building is well-equipped with space for working groups, Board meetings and smaller group discussions.

The successful appointment of Mr Herman Agenbag as a lupin specialist ultimately led to the addition of canola to his portfolio. In addition, the PRF decided to appoint a lupin and soy contractor each for KwaZulu-Natal and Mpumalanga and towards the end of the year another contractor was appointed in the Eastern Free State.

In view of the anthracnose problem in South Africa, which was threatening to get out of control, the PRF decided to co-operate with a research institution in Western Australia concerning anthracnose resistance in lupins, pertaining both to the development of resistant cultivars, as well as bio-technological research.

Did you know?

The first funds for the Protein Research Fund came from a levy on fishmeal sales.

AFMA Chairman, Mr Scholtemeijer, first emphasised the urgency of stimulating soybean production in 1978.

The PRF felt that if this initiative was successful, it would both eliminate unnecessary duplication and also co-ordinate research on an international level. Although the results of this co-operation were not exceptional, it formed the foundation for similar projects of international co-operation, which to this day, serves the PRF well.

In the same vein, international assistance was sought when Zimbabwe experienced a first serious occurrence of soybean rust. In view of this, the PRF decided to sponsor a specialist on soybean rust, Dr S Shanmugasundaram, the Director of International Programmes at the Asian Vegetable and Research Development Centre (AVRDC) in Taiwan, to visit South Africa and Zimbabwe in 1998, to inform local researchers of the disease.

The PRF could not understand why Zimbabwe produced more soybeans than South Africa. Accordingly in 1999, a Board meeting was held in Zimbabwe where a visit was paid to the research unit at Agricultural Research Trust (ART) farms, as well as to a local, prize-winning soybean producer. The answer to our question was very simple: During the bush war, terrorists had stolen maize from the producers on a large scale, which was not the case with soybeans.

In the meantime, the demand for a bigger supply of locally produced protein for animal feed increased. In 1998, a total of 83 560 tons of fishmeal was substituted with oilcake – an equivalent of more than 125 000 tons of soy oilcake. Fortunately, the production of soya in 1998 exceeded all previous records in South Africa and made a considerable contribution towards a saving of foreign currency spent on importing oilcake.

One of the PRF Board meetings in 1999 was held in Bloemfontein where a visit was paid to Prof Herman van Schalkwyk, then Chairman of the Department of Agricultural Economics at the University of the Free State (UFS). He indicated that he intended to apply for the funding of a project on the economic potential of lucerne production in South Africa. Since lucerne requires plenty of water and therefore irrigation, the PRF was approached by Agrelek, who became a joint financier of the project, since it was also of great interest to them to see the lucerne industry expand.

The research results of this project on lucerne indicated that there was very little room for expansion of the lucerne industry. Lucerne was produced on approximately 200 000 - 240 000 hectares and yielded just more than 3 million tons per annum. In view of the fact that producers had already indicated that they were not interested in expanding the hectares under lucerne, the PRF decided to stop further funding of lucerne research projects.

In 1999 alarming figures were presented to the PRF. The projected level of oilcake consumption for the year 2000 had already been surpassed by 19,5% by 1999. Furthermore, the local production of oilcake was 20% lower than the

PRF BOARD AND STAFF AS WELL AS EX-BOARD MEMBERS AND STAFF AT 10 YEAR CELEBRATION IN 2010

Front: Dr J de Kock, Messrs JCG du Preez, JSG Joubert (Vice-chairman), GJH Scholtemeijer (Chairman), Drs GS Bredell, M Griessel and Mr JF van der Merwe

Middle: Mss J Bean (staff), E Harmse (staff), L Terblanche (ex-staff), MM du Preez (staff), MJ van der Walt (staff), Mr BR Hundley and Dr AC van der Merwe

Back: Messrs FAS Potgieter, HJ Diekmann, Prof RM Gous, Messrs CJ du Plessis, MA Prinsloo and G Keun (CEO)

projected figure for 2000. With these figures in mind, the PRF decided to take stock of its activities after the first ten years of research funding.

After several years of funding research of a large variety of potential protein sources, the PRF decided to give preferential attention to four crops, to which the PRF had accorded the highest priority, namely soybeans, lupins, canola and cotton. A wide variety of nutritional experiments were also conducted with some of these protein sources in various rations. Although the PRF was continuously on the lookout for new sources, such as faba beans and lucerne, it decided that it was preferable to concentrate and make a success of a few sources only, before branching out into others.

Funding of cotton research was discontinued in 1998, while in 1999, the PRF decided to only fund research projects related to fishmeal, soybeans, lupins and canola, whilst the viability of the lucerne industry was also being investigated at that time. After the discontinuation of the lupin and lucerne projects, only soybean and canola research projects were funded.

The PRF also decided to have a clearer definition of 'protein products'. It decided that a protein product is a product that has a content of 25% or more protein.

In 1999, faba beans were brought to the attention of the PRF. The conventional faba bean cultivars contained 25% protein, although it had come to the PRF's attention that certain cultivars with a protein content as high as 35% had also become available. An agreement was reached with Elsenburg to obtain the new faba bean cultivars and plant experimental plots in order to learn more about this crop. However, Mr Agenbag, the PRF contractor, responsible for lupins, canola and faba beans, decided to retire in December 2007. At the same time, the Department of Agriculture, Western Cape indicated that they did not have sufficient manpower to carry on with the faba bean project and accordingly, the Board of the PRF decided that no further funds for work on faba beans would be made available after 28 February 2008.

It should also be noted that in 2002, in conjunction with the Department of Agriculture Western Cape, a Super Canola Competition was started in order to promote the production of canola. For more details of this project, see chapter 5.

'During 2005, the first indications were given that South Africa would become involved in the production of biofuels.'

The PRF was constantly looking for opportunities to spread its wings. Technology transfer was very high on the priority list and after the decision to have a PRF exhibition at NAMPO, the PRF also searched for opportunities to present an exhibition of its work in the Western Cape Province. An annual event in the Swartland was the Swartlandse Kleingraan Ontwikkelingsgroep (SKOG) Day, which was sponsored by a partnership between the Department of Agriculture Western Cape and the Co-ops, Moorreesburg Koringboere Beperk (MKB) and Porterville Landboukoöperasie (PLK). They welcomed the PRF as a full partner and accepted that the PRF would very strongly support the development of canola and lupins.

It became more obvious annually, that the funding of agricultural research was becoming increasingly more problematic and support from the ARC was dwindling. Accordingly, the PRF and the OPDT as well as the OAC agreed to co-operate in an attempt to spread the financial burden of research. Such co-operation resulted in avoiding any overlap on the one hand and also eliminated gaps in research on the other. Co-operation was initiated with the joint financing of two soybean research projects, since soybeans was the only product at that stage that the two organisations had in common.

In 2000, Dr Bigalke, who had chaired the PRF since inception, decided to retire. Mention must be made of the fact that

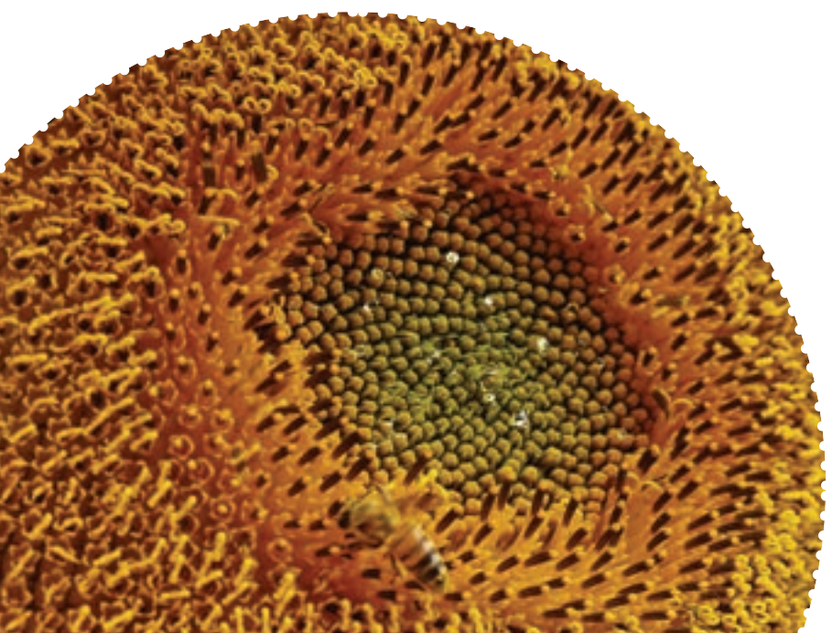
the PRF had gone from strength to strength under his leadership in those ten years. Mr Scholtemeijer was elected as his successor and the new Chairman, and he still holds this position today.

The last fishmeal research project initiated by Pioneer Fishing was also shelved in 1999. Finally, the PRF and Pioneer Fishing decided to totally scrap the project. A decision was later taken by the PRF to stop all funding of fishmeal research. During the 1999/2000 season, soybean production dipped below 100 000 tons per annum for the first time in three years. This was also, however, the last time that soybean production dipped below the 100 000 ton mark.

In 2001, the international debate on biotechnology had spilt over into South Africa, especially since Genetically Modified Organisms (GMO) products had appeared on the South African market. Specific mention must be made of the first GMO soybean seed that was commercially planted in South Africa during this year. Scientific support in South Africa was however sadly lacking and for the first time, the ARC turned down a research project with real merit due to a shortage of manpower. This created great concern, and this is still the case today.

In 2001, Asian Rust was reportedly identified for the first time on soybeans in KwaZulu-Natal. Action taken by the PRF to limit the spread is reported on in chapter 4.2.

The various commodity trusts established in 1997 prompted the PRF to change its name from the Protein Research Trust (PRT) to the Protein Research Foundation (PRF) in 2002, to avoid any possible confusion with the newly established commodity trusts.



The most important of all events pursuing the transfer of technology since 2000, has undoubtedly been the creation of the PRF web page. This massive project was done under the guidance of Mr JSG Joubert, Chairman of the Marketing Committee, ably assisted by PRF staff, notably Ms M du Preez. More detail on this highly successful action is reported on in chapter 9.

The big disappointment of this period was the decision to discontinue all research work on lupins in the summer rainfall area. Despite efforts from many institutions and several million rands later, no significant progress in the battle against anthracnose was made. Activities with lupin still continued in the Western Cape Province.

A positive aspect at this time however, was the registration of Simazine®. This herbicide was already being used successfully internationally, but had not been registered in South Africa. The PRF joined forces with several organisations to successfully have Simazine registered in South Africa, which made a big contribution to the greater success experienced in the production of both canola and lupins. Another highlight in 2003 undoubtedly, was the business plan for canola, which was drafted by Dr J de Kock. Dr De Kock also undertook to update the Canola Manual on a regular basis, and we are sincerely grateful to him for this.

In 2004/2005, results of protein production indicated that the local production of oilcake would only supply 30% of local requirements despite the fact that from 1992 to 1998 the increase in the local production of oilcake totalled 258%. Since 1998/1999 however, there had hardly been any increase in production.

Although commodity prices had dropped considerably across the board, from March 2004, it was quite apparent that the prices of maize and wheat had dropped more seriously than that of canola and soybeans. This meant that more producers would start looking at soybeans. In 2005/2006, soybean production was 240 570 tons, which meant the 200 000 ton mark had been exceeded for the first time.

After 1997, when many functions were passed onto the provinces from the central government, the PRF experienced a mixed bag from no co-operation to very good co-operation with the provinces. Co-operation with KwaZulu-Natal came to a virtual halt due to constant changes at a senior level, which made continuous co-operation impossible. Proposed projects

PRF 2014
Front: Mr Andries Theron (Vice-chairman), Dr Munro Griessel, Mr Gerhard Scholtemeijer (Chairman), Mr Deon Joubert and Dr Jos de Kock

Back: Ms Maria du Preez, Dr Erhard Briedenhann, Mr Gerhard Keun, Prof Rob Gous, Mr Joe Diekmann, Dr Ferdi Meyer, Mr Frans Potgieter and Ms Erna Harmse

with the Eastern Cape and the Free State never got much further than the paperwork. Co-operation with the Northern Cape was very good and continued, but the potential for soybeans and canola in this province was limited. Co-operation with Mpumalanga was relatively good, but then again constant changes of senior management rendered co-operation virtually impractical.

Co-operation with the Western Cape was superb from inception and is still exceptional in 2015. This is also discussed in chapter 7.

Various researchers and research institutes received Thripp funding, as a result of their co-operation with the PRF. Prof Gous (UKZN) and Dr T Brand (DAWC) received continuous Thripp funding whilst in 2005, the University of Stellenbosch received Thripp funding amounting to R500 000, following the creation of a Canola Production Manual compiled by Prof André Agenbag. Other recipients of Thripp funding were: Prof D Berger (UP), Drs J de Ronde (ARC) and D Oelofse (ARC), Ms B Campbell (CSIR) and others. This implies that many institutions received direct and indirect benefits because of the co-operation with PRF and PRF funded projects.

Three of the PRF projects deserve special mention, since two patents and a provisional patent were registered in collaboration with the ARC. The PRF wishes to acknowledge Dr De Ronde for her work which resulted in the first patent, as well as Dr C Minnie, whose work led to the provisional registration of another patent. A lupin project lead to a patent by Dr Oelofse, registered in 2004.

In 2005, Dr De Ronde qualified for a grant of R6 million from the Innovation Fund to further biotechnological research on soya which she had previously been conducting with funding from the PRF. The soybean industry was very positive that this work could assist in creating drought-tolerant cultivars, but unfortunately this research did not bear fruit as was anticipated.

In a further effort to promote soybeans and canola during 2006, the PRF accepted that positive news on potential profitability would greatly assist in convincing producers of the viability of both products. The Deputy Chairman of the PRF, Mr Deon Joubert, had vast experience with 'combuds' during the many years that he served as an agricultural economist in the National Department of Agriculture. More information on the PRF's 'Income and Cost Analysis' is contained in chapters 4 and 9. This innovation was one of the most effective tools of technology transfer, to convince producers that canola and/or soybeans should be incorporated into their crop rotation systems.

The project on income and cost budgets was rather comprehensive, as it covered four districts in Mpumalanga, four districts in the North West Province, four districts in the Free State and three in KwaZulu-Natal. With regards to the winter rainfall area, income and cost budgets for canola, wheat and lupins were drawn up for five different districts. Great co-operation was forthcoming from the co-operatives in the Western Cape. This project eventually led to the 'Do-it-yourself', which has become a very popular feature on the PRF webpage.

The PRF also took the Soybean Rust Task Team under its wing in 2005 which had been a part of the ARC since the arrival of rust.

During 2005, the first indications were given that South Africa would become involved in the production of biofuels. Many different projects covering a wide spectrum were discussed.

The great enthusiasm for bioethanol from maize was hotly debated and the PRF took cognisance of details concerning this from work done in the USA. The by-product Distillers Dried Grain and Solubles (DDGS) was studied in principle by the PRF, since it is a protein source, according to the definition of the PRF. In view of the potentially large volumes of protein for animal nutrition that would be forthcoming if maize was used for bioethanol, the PRF sent a mission abroad to study the details of such a protein source. Two Think Tanks were organised and research conducted by Prof Gous was the direct result of the study tour abroad. For this same reason, the PRF contracted Dr Lourens du Plessis to supply the Board with the latest information concerning biofuels every quarter. He was also contracted to assist the staff in updating the details on the website with regards to previous research dating back to 1976.

A major concern for the PRF arose in 2006 following the release of a document by several seed companies which stated that no new soybean cultivars would be released in South Africa unless local producers halted the practice of retaining grain for seed. The PRF regarded this statement in a very serious light and various solutions came to the fore during a Think Tank on this topic. This attitude from the seed companies initiated the PRF Soybean Elite Trials, which were followed by PRF Canola Elite Trials. Read more about this in chapter 4.

The development of the Nieuwoudt-McGuigan model which has already been referred to above was initiated by the PRF. The APR-model (Animal Products Requirements) formed the basis of a PhD thesis by Dr Erhard Briedenhann, which was funded by the PRF. The latter model was specifically used to determine the total protein consumption per animal species. At the same time, the PRF was introduced to the Bureau for Food and Agricultural Policy (BFAP)-model from the Department of Agricultural Economics at the University of Pretoria, which included a large number of variables and also had a sizeable application. The liaison with BFAP was the beginning of a long-standing relationship and co-operation, which has greatly benefitted the PRF.

Although the development of soybean production was becoming increasingly positive, Grain SA expressed its concerns about the availability of crushing capacity. During 2006, a facility with a crushing capacity of 100 000 tons of soybeans was established. Several smaller oil-mills were also established, mostly with a view to getting involved with the production of biodiesel, while Sasol also expressed their interest in biodiesel production based on soybeans to the PRF. The year 2007 was heralded in with the long-awaited policy decision by government on biofuels, which most importantly excluded the use of maize as raw material for biofuels. Soybeans and canola were both mentioned as potential raw materials. Unfortunately no progress has been made with biofuels to date.

The decrease in research capacity at the ARC continued unabated, which was a cause of great concern to the PRF. Accordingly the PRF decided to arrange a Soybean Think Tank together with a few soybean producers, researchers and some PRF trustees. A direct result of the think tank, led to a programme of better communication within the soy industry. Initially a dedicated soybean magazine was considered as a means of keeping all role-players in the industry informed on a regular basis. It was eventually agreed that the PRF would appoint a dedicated contractor to co-ordinate all the relevant information required, whilst Grain SA undertook to publish this information in its monthly magazine, *SA Grain*. In a nutshell, two problems were identified, namely a lack of a sufficient numbers of researchers on the one hand and insufficient transfer of both technology and information.

The ever changing composition of the market of protein for animal nutrition, kept the pressure on the PRF. The late Mr SJ Malherbe mentioned in 2008 that whereas in 1995 the consumption of fishmeal had amounted to 283 000 tons, only 40 000 tons had been sold during that year.

With the problems experienced in the lupin industry and the fact that no growth was forthcoming, the PRF Board decided that no further funding would be made available for lupin research after 31 December 2008.

In 2008, it became abundantly clear to the PRF that its support base was steadily dwindling as a result of political and economic factors. The PRF had no choice but to devise a Plan B, as well as a Plan C, to support the two industries that were selected, namely canola and soybeans. Despite many promises from the ARC still no support was forthcoming for the soybean industry.

Several PRF Board members and contractors were exposed to the international soybean industry, by means of various study tours to the USA, South America and Australia, which were undertaken by those identified by the PRF, who would benefit from the increased exposure.

The PRF partially sponsored an international conference 'Silicone in Agriculture' in 2008 in South Africa. Contact was made with Prof F Rodrigues from the University of Viçosa in Brazil, as well as Prof M Liang from China, who both played an important role in the soybean elite trials. This is discussed in more detail in chapter 3.2.

In view of the ever increasing activities of the PRF, the Board conducted an audit on knowledge available and knowledge required to execute the matters on the PRF table. In order to give additional support, the PRF co-opted Dr Jan Dreyer, well-known and nationally acclaimed agronomist, onto the Technology Committee in 2008. A similar agreement was also negotiated in 2008 with Prof Mohammad Karaan of the University of Stellenbosch, to make Prof André Agenbag, also a nationally acclaimed agronomist in winter cereal crops, available to the PRF, for bigger incorporation into the canola promotion activities, especially in the Western Cape.

The dwindling number of researchers at institutions, universities and the provinces resulted in serious international isolation becoming a given fact. In addition to the threat by the soybean seed companies, the soybean breeding programme at the ARC was also terminated. Accordingly, the PRF decided to seek assistance in South America, especially in Brazil and Argentina. Missions to various institutions were well received and possible co-operation was enthusiastically supported. The first Memorandum of Understanding (MOU) was signed in January 2009, with Empresa Brasileira de Pesquisa Agropecuária (Embrapa), (Brazil) whilst negotiations were also underway with Instituto Nacional de Tecnología Agropecuária (INTA) (Argentina) as well as the University of Viçosa (Brazil).

The first seed received from the University of Viçosa and Embrapa, was planted during the planting season of 2009/2010.

Following a visit to China, the PRF managed to conclude a MOU and Material Transfer Agreement (MTA) with two institutions in China and also received cultivars to test in our Elite Trials.

All these aspects and more were included in a so-called generic marketing programme for both soybeans and canola, which really gave the impetus that the PRF activities needed. This is discussed in more detail in section 3.2.

Another aspect which was regarded as high priority was the aim to determine the surface area available for soybean production in South Africa, as well as to draw up a climatological map of the regions where soybeans can be grown. Prof C Blignaut from the University of Pretoria was contracted to handle the first aspect. The study revealed that the total existing area under both dryland and irrigation conditions, which is suitable for commercial soybean production, is estimated at more than 2,6 million hectares, of which more than 2,4 million hectares is dryland.

One of the most important decisions ever taken by the PRF Board probably concerns the World Soybean Research Conference, which takes place every four years. In 2009, the conference was held in Beijing, where it was decided that WSRC IX 2013, would be held in South Africa. It transpired that the original applicants were totally unable to take responsibility for such a huge event and the PRF Board decided to step in and take full responsibility for this event.

The Board also resolved to allow Mr Scholtemeijer to accept the position as Chairman of the Organising Committee. In addition, the Board resolved to allow Dr De Kock to accept his nomination as Chairman of the Technical Committee. Both were assisted, with Board approval, by members of the Board, especially the Technology Committee and very importantly, the PRF members of staff.

The Chairman of the Continuing Committee of WSRC IX 2013, Dr Daniel Ploper from Tucuman (Argentina), visited South Africa as a guest of the PRF so that he could be provided with accurate information by all the role-players. Despite very bad experiences with two event organisers, the PRF finally managed to pull off this huge event successfully and both the PRF and the South African Soybean Industry benefitted tremendously from the exposure. It opened doors for the PRF to meet leading soybean scientists from around the world, as well as interact with many institutions and international companies involved in world soybean production. Messrs W Engelbrecht and Scholtemeijer were elected to the Continuing Committee for WSRC X 2017.

In 2006, the PRF decided to add an additional category of achievement awards especially for Board members, intended to acknowledge outstanding contribution over many years to the PRF activities. In 2007, the Board decided to present this achievement award to Mr SJ Malherbe, in 'Recognition for his outstanding contribution during an uninterrupted period of 25 years, as member of the Protein Advisory Committee – 1982 - 1990; Protein Research Foundation – 1990 - 2007'. In 2008, similar awards were made to the PRF Vice-chairman, Mr Joubert as well as Dr Griessel, Chairman of the Technology Committee, both who had been founder members of the PRF. Another founder member of the PRF, the Chairman, Mr Scholtemeijer, received the same award in 2009, Dr De Kock, Chairman of the Technology Committee, in 2011 and Mr GTDT Keun, Board Member and Chief Executive Officer, in 2012.

In 2010, the PRF decided to fund two generic marketing programmes, one for soybeans and the other for canola.

Did you know?

The PRF has always believed it is not necessary 'to reinvent the wheel' and so they have networked eagerly with foreign experts.

This networking has resulted in excellent co-operation and cross-sharing of ideas.

That year also saw the final conclusion of the PRF funded lupin research projects due to a total lack of growth of that industry. This led to serious introspection of the canola industry which had basically been stagnant since 2003. A grace period of five years was given to the canola industry to prove its growth potential. This was supported by very positive and dedicated input from the PRF Board. Various appointments formed the backbone of the canola generic marketing programme by the PRF. Reference has already been made to Prof Agenbag, whilst the Board also decided to appoint Mr Andries Theron to the Board. Mr Theron is well-known in agricultural circles, a canola producer and also presently Vice-chairman of the Board.

For several years the finger was pointed at inferior canola cultivars with an Australian origin planted in South Africa. Since this was regarded as the prime cause of the stagnation of the canola industry for many years, the PRF decided to pay a visit to the most important and leading seed companies in Australia. The PRF was well received by all the companies and a first MOU was signed with Pacific Seed, while several other companies promised co-operation. A very successful visit was also paid to the Australian Oil Seeds Federation (AOF) with whom an on-going relationship was established. Elite Trials, similar to that of the soybeans, were immediately implemented with the assistance of the Department of Agriculture, Western Cape in 2010. In 2011 a similar project was initiated by the Department of Agriculture, Western Cape, which is still ongoing.

Based on the success and the impact study to determine the potential of soybean production in South Africa, the PRF decided to request a similar study relating to canola. The decision led to an agreement in 2012 with Dr Mark Hardy, a well-known researcher previously employed by the Department of Agriculture, Western Cape. The research project was entitled: *Determination of the area of arable land suited to canola production in the Western Cape*. The summarised results were as follows:

- traditional grain areas – 743 506 hectares
- new and marginal areas – 42 788 hectares
- miscellaneous areas – 12 372 hectares

Following these results from Dr Hardy, as well the tremendously increased figures of canola production, the PRF decided to lift the moratorium placed on the canola industry and to give its unqualified, full support. In 2013, the canola crop of 112 000 tons exceeded the 100 000 ton mark for the first time to be followed by 121 000 tons on 95 000 hectares in 2014.

Soybeans, however, stole the limelight in the 2014/2015 season when the magic one million ton target was exceeded one year ahead of PRF projections.

It is a well-known fact that the agro-industrial complex is characterised by a volatile decision-making environment, where the reigns of exogenous drivers beyond the control of industry stakeholders determine the future outcome of the industry. The soybean and canola industries are currently the fastest growing industries in the South African agricultural sector, which makes the institutional and research environment even more challenging for an organisation like the PRF. Stakeholders are faced with an increasing number of challenges not only at primary farmer level, but also within the value chains which are rapidly expanding, and it is not always obvious where research efforts can and should be intensified. With this in mind, the emphasis has moved from more research and less technology transfer to increasingly more technology transfer.

The arrival of several large international seed companies, as well as the active involvement of chemical companies, is very good news for both industries, and the PRF and their efforts in this connection.

Although international co-operation is still sought in foreign countries with local representatives of foreign companies, it is most heartening that many countries of the world can now be consulted in South Africa in the knowledge that South African aims are taken to management and Board meetings internationally. With all this in mind, the PRF has little doubt that its aim of:

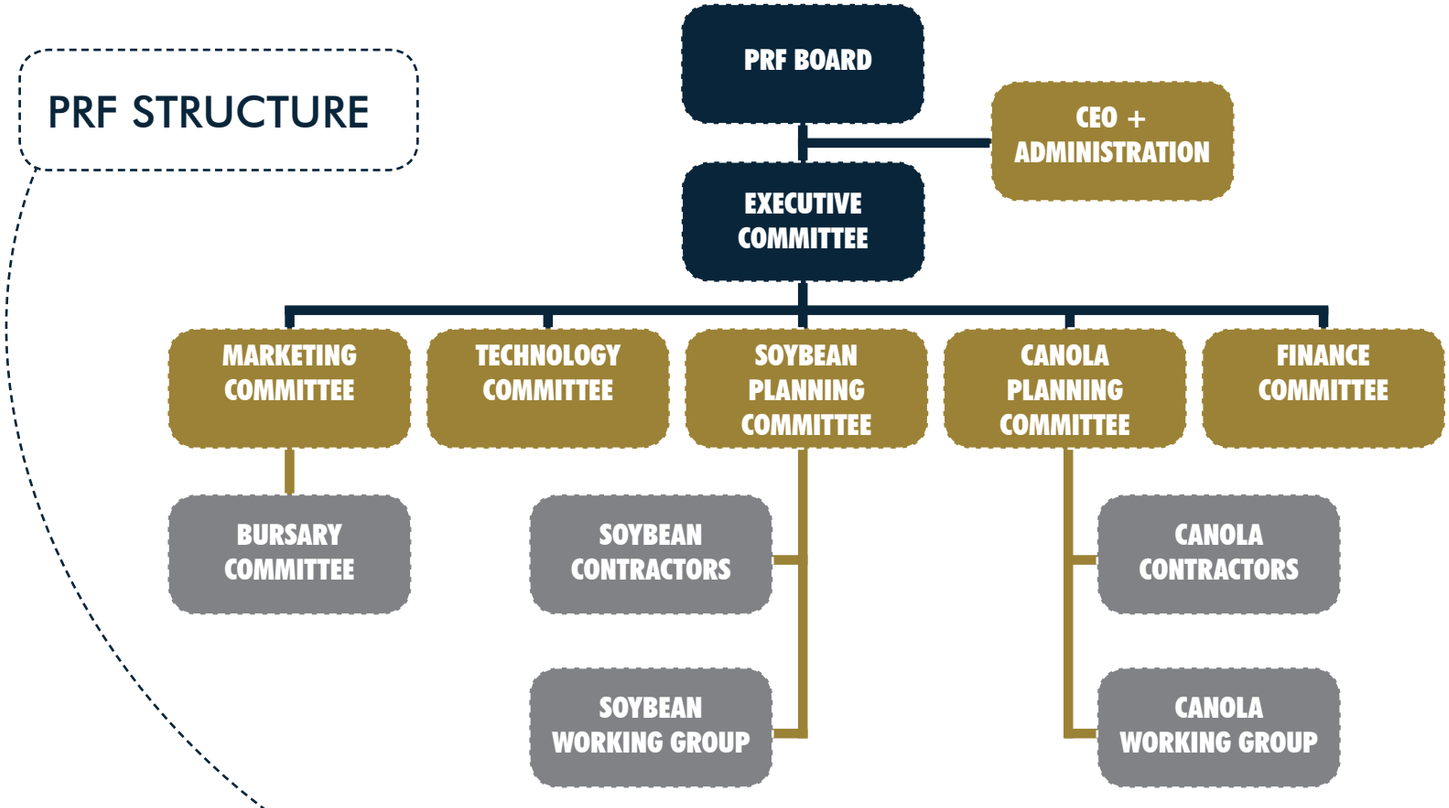
- Soybeans – 2,5 million tons on more than one million hectares;
- Canola – 250 000 tons on 150 000 hectares;

will be reached in 2020.

The PRF strives to adapt continuously to changing circumstances brought about by the dynamics of a modern society. It is the aim of the PRF to stay abreast with the latest technology in a wide variety of disciplines and then to adapt to such technology.

Gerhard JH Scholtemeijer

PRF STRUCTURE



EXTRACT 1

PROTEïENNAVORSINGSTRUST

NOTULE VAN DIE EERSTE VERGADERING VAN DIE PROTEïENNA-VORSINGSTRUST (PNT) GEHOU OP 9 NOVEMBER 1994 IN DIE RAADSAAL VAN DIE LNR, SCHOEMANSTRAAT 1058, PRETORIA OM 09:30

1. VERWELKOMING

Die Voorsitter heet die teenwoordiges welkom en rig veral 'n spesiale woord van verwelkoming aan die lid van die trustee en secundi wat vir die eerste keer bywoon, naamlik mnre Prinsloo, Liebenberg (secundus) en Diekmann (secundus).

Die volgende persone word geluk gewens met hul verjaarsdae: dr Bredell (7 November), mnr Hans van der Merwe (4 November) en mnr Deon Joubert (3 Desember).

Met die registrasie van die PNT op 28 Oktober 1994 verval die PNAK en sal dié komitee voortaan bekendstaan as die Raad van Trustees van die Proteïennavorsingstrust. Vandag is dus die eerste vergadering van dié Raad en volgens die trustakte, klousule 16.2 moet 'n Voorsitter nou uit die geledere verkies word. Verder word in klousules 10.1 en 10.2 vereis dat daar jaarliks 'n algemene jaarvergadering (AJV) gehou word waartydens die finansiële verslae ter tafel gelê word. Aangesien die AJV 'n formaliteit is wat vinnig afgehandel kan word kan dit tydens die volgende vergadering plaasvind nadat vooraf daarvan kennis gegee is. Dr Bigalke word egter nou reeds algemeen verkies as die Voorsitter van die PNT vir die volgende jaar. Die Voorsitter van die Raad van Trustees is normaalweg ook die Voorsitter van die AJV.

2. PRESENSIE

2.1 Teenwoordig

Dr R D Bigalke	-	Departement van Landbou (Voorsitter)
Dr G S Bredell	-	Landbounavorsingsraad

First meeting of the PRF

EXTRACT 1

Mnr J C G du Preez	-	Oliesaderaad
Dr R M Finlayson	-	SA Oliepersersvereniging
Dr M Griessel	-	SA Veevoervervaardigers
Mnr S Malherbe	-	SA Vismeelprodusentevereniging
Mnr G J H Scholtemeijer	-	Kundige deur Trustees benoem
Mnr M A Prinsloo	-	SALU
Mnr C J Bester	-	Departement van Landbou (Secundus)
Mnr L H P Liebenberg	-	SALU (Secundus)
Mnr M J Diekmann	-	SALU (Secundus)
Me L Terblanche	-	Landbounavorsingsraad (Sekretaresse)

2.2 Verskonings

Dr L Botha, mnre J S G Joubert, J F van der Merwe en B R Hundley.

3. GOEDKEURING VAN EN TOEVOEGINGS TOT DIE SAKELYS

Sommige trustees moet vroeg vertrek daarom word die volgorde van die sakelys effens gewysig alhoewel die sake nie in die gewysigde volgorde genotuleer word nie.

4. NOTULE VAN DIE VERGADERING VAN 23 AUGUSTUS 1994

4.1 Goedkeuring van die notule

Die notule word met die volgende wysigings aanvaar.

- bladsy 1, item 1, tweede paragraaf - vervang "Ter-blanche" met Terblanche in die derde reël.
- bladsy 4, vierde paragraaf - skrap "terme van" in die eerste reël.
- bladsy 13, item 5.4, derde paragraaf - vervang "1994/94" met "1993/94" in die tweede reël.

First meeting of the PRF (continued)

3.2 FOREIGN INVOLVEMENT

– global networks and support

ABOUT THE PRF

Foreign involvement from the Protein Research Foundation (PRF) with scientists abroad or visits from scientists to the PRF, became an accepted norm soon after the formation of the PRF. In the research report of 1996, the following paragraph appeared: '…considerable attention is given to the four crops to which the Protein Research Trust (PRT) has accorded the highest priority, namely soybeans, lupins, canola (rapeseed) and cotton'. In order to obtain first-hand information, two members of the PRT Board, accompanied by a specialist researcher from the Agricultural Research Council (ARC), paid brief visits to Zimbabwe, the USA, Brazil and Argentina.

The purpose of these visits was to study aspects of research and production of soybeans and cotton in Zimbabwe and of soybeans and lupins in the Americas.

The different chapters in this volume often refer to foreign excursions or visits by foreign scientists to South Africa. One such occurrence was in 1997, when it became known that anthracnose had once again been detected. The PRT immediately convened a meeting of experts and it was decided to send Mr H Agenbag (PRT) and Dr S Koch (ARC) to Australia where it was determined that anthracnose was already being managed successfully.

On this tour Dr Koch made contact with Prof Wallace Cowling who subsequently visited South Africa in the following year. He has since become a good friend of the PRF and has made 16 lupin cultivars available to the PRT for trial purposes and to be compared annually with his own results in Australia. Even though this co-operative study did not yield positive results, Prof Cowling remains a friend of the PRF to this day and visits to Australia always include meetings with him.

Likewise in the chapter on Soybean Rust (SBR) in South Africa, it is noted that several South African delegates were sent to Zimbabwe to gain insight into the latest developments in the control of the disease. Mention is also made of the visit by the Director of the International Programmes at the Asian Vegetable and Research Development Centre (AVRDC) in Taiwan, Dr S Shanmugasundaram, who was sponsored on a visit to South Africa by the PRF.

The principle was always the same. Seldom did any invited scientist(s) turn down the invitation to visit South Africa, and seldom has it ever happened that a PRF-sponsored South African scientist was not welcomed to a foreign institution.

In the chapter on canola, it is reported that as early as 1998, the PRF was requested to give immediate attention to the problems being experienced in the canola industry regarding handling and storage. The PRF made contact with the Australian Oilseeds Federation (AOF) and explained the dilemma we were experiencing. Without any hesitation, the AOF arranged an extensive programme for a delegation to visit Australia and obtain first-hand information. The AOF remains a regular item on the itinerary whenever visiting Australia.

In the chapter on canola, mention is made of the problems that the South African Canola Industry has experienced with regards to quality canola seed with an Australian origin. During the first visit to the Australian seed companies, the PRF delegation was well received and supplied with ample information. The first Memorandum of Understanding

Dr Jos de Kock, Prof Fabricio Rodrigues,
Messrs Frans Potgieter and Gawie de Beer

Mr Mario Devani, Drs Francois Koekemoer, Daniel Ploper,
Messrs Roean Wessels and Gerhard Scholtemeijer

Mr Gawie de Beer, Dr Jan Dreyer, Mr Gerhard Scholtemeijer,
Dr Norman Neumaier, Ms Maria du Preez,
Dr Marcelo de Oliveira and Mr Gerhard Keun

(MOU), with regards to sourcing seed for testing within the PRF Elite Trials, is also dealt with in this chapter. The PRF sincerely appreciates the willingness of Pacific Seeds, which was the first company to assist the PRF with canola seed, later followed by Pioneer (Australia) and Bayer (Europe).

The major thrust towards foreign involvement is linked to the PRF soybean activities. It is noted in other chapters within this volume, that in 2006 several leading seed companies issued a press statement threatening that new soybean cultivars would not be released in South Africa, unless the practice of 'farmer-saved seed' was abandoned. The experience gained from overseas excursions in 1996 to the USA, Brazil and Argentina, referred to above became the cornerstone of the PRF's actions in ensuring that this threat did not cause any permanent damage to the blossoming South African soybean industry.

In 2008, the PRF took a policy decision to engage in an international liaison and co-operation programme with countries abroad. This followed after a Think Tank, held during April 2008 and was the result of declining funding available to research institutions as well as the threats from the seed companies. The decision was to give broader international exposure, not only to researchers, but also to PRF co-workers and Board members. It was decided, mainly in the light of the dramatic progress in soybean production that had been made in the previous two decades, to liaise with Argentina and Brazil. Immediate visits were undertaken to Brazil and Argentina, with several follow-up visits in the years thereafter.

A MOU was signed with Embrapa in Londrina, Brazil in January 2009, whilst negotiations with INTA in Argentina were well in progress. The initial goal with the proposed Elite Soybean trials was to test South American soybean cultivars and lines with specific characteristics, during the 2009/2010 season, together with encouraging the exchange of researchers to the advantage of both parties. In the meantime, the PRF and the OAC sponsored two speakers to the international congress in South Africa on *Silicone in Agriculture*. We met with Prof F Rodrigues from the University of Visçosa in Brazil and also Prof Y Liang from China. Details of the follow-up visits to these two gentlemen are referred to below.

The co-operation with Embrapa as well as the University of Visçosa, both from Brazil and INTA from Argentina,

materialised during planting time in October 2009. Although some plantings were delayed due to logistical problems, the most important aspect was that the Elite Soybean programme could get off the ground.

The MOU with Embrapa was taken a step further with the signing of a Material Transfer Agreement (MTA) and similarly, in the case of INTA, the MOU was followed up with an MTA. More details on the Elite lines planted, are as follows:

- **INTA-genotypes:** 25 genotypes which included maturity groups 4 - 7 were planted at six sites in 2 x 75 cm rows, of 5 m long with three replications. Six local cultivars were included as controls. These trials were inspected by two scientists from INTA, namely Messrs I Vicentin and L Salines.
- **Visçosa-genotypes:** Five genotypes were planted at three sites with three replications each. These trials were inspected by Prof Rodrigues from the university.
- **Embrapa-genotypes:** 16 genotypes were planted at six sites with three replications. These were inspected by Drs N Neumaier and M de Oliveira.

A total of 20 different measurements were taken of each of these genotypes before threshing and five after threshing. It was quite clear that there were some very good lines amongst these genotypes. Although some lines were received from China and were planted for three years, the China project never really took off and has subsequently been cancelled.

In 2010 the first discussions concerning the World Soybean Research Conference (WSRC IX 2013), which was allocated to South Africa for 2013, took place (see more details in chapter 4.1) between the Chairman of the PRF, Mr Scholtemeijer, and the Chairman of the WSRC Continuing Committee, Dr Ploper, also Chief Executive of Estación Experimental Agroindustrial Obispo Colombres, (EEAOC).

These deliberations lead to discussions concerning the PRF Elite Trials where international soybean lines are tested in South Africa by the PRF for adaptability to South African domestic conditions. Dr Ploper immediately showed interest and the necessary agreements were signed. Thereafter, cultivars from EEAOC arrived in time for the planting season of 2010/2011. Eleven genotypes were received and planted in the same fashion as the other Elite Trials.

Co-operation with Uruguay has only recently been signed and the first four cultivars were planted in the Elite Trials in 2014. Likewise co-operation with Bayer (South America) resulted in 20 cultivars being tested. This example of international co-operation is of great importance to the PRF and has once again proved that international co-operation is available if requested.

The first lines that were tested in these Elite Trials have subsequently been registered as cultivars and will be planted in the national cultivar trials of 2015/2016, by their owners and local agents, to the great delight of the PRF. Undoubtedly, there are many more to come in the immediate future.

Many seed companies have entered the market in South Africa, since the threat of the local seed companies, discussed above. The Elite trials *per sé* will no longer be repeated and the second phase of such international co-operation lies in cultivars which show tolerance and/or resistance to the problematic areas experienced in South Africa namely rust, root-knot nematodes, Sclerotinia, drought tolerance, etc.

The success with international co-operation in the past indicates the appropriate route to follow to the benefit of both the soy and canola industries for the future. The new approach of chemical and seed companies will be taken into consideration and the PRF will render assistance where necessary as is already the case with some international groups.

The PRF wishes to thank its staff, contractors and Board members who have been involved in the successful venture, but particular thanks are due to our foreign partners who were prepared to make available not only their material but also their knowledge – something which is sorely lacking in the South African research fraternity at present.

Dwindling research and information from South African scientists has been complemented by the inputs from not only the institutions and companies mentioned, but from all stakeholders who attended the WSRC IX 2013 and those who have opened their doors to the PRF and South Africa.

Gerhard JH Scholtemeijer


INTA

3.3 THE FISHMEAL INDUSTRY

– through the looking glass

ABOUT THE PRF

The fishing industry and more specifically, the Fishmeal Producers Association (FMPA), played a very important role as a supplier of protein for animal consumption, especially in the previous century up to 1990. The highest production recorded was 476 000 tons of fishmeal in 1967. Sizeable quantities of fishmeal were exported up to 1974 and varied between 80 000 to 300 000 tons whereas imports from 1981 to 1996 varied between 70 000 to 200 000 tons.

From the Protein Research Foundation (PRF) point of view, it is important to note the fact that the first funds dedicated for soybean research came from the FMPA – irrespective of why this was done. More details are available in chapter 4.

It is also a fact that the 39 fishmeal projects funded by the PRF and its predecessors were of the most expensive and included a building for the fishing industry (1989 - 1990) and several million rands for facilities and the refurbishment of the deep sea research vessel, SAS Algoa.

Many gizzerosine projects were also funded, including one by Dr GE Trout of the Fishing Industry Research Institute (FIRI). (See addendum for fishmeal projects funded.)

Valuable contributions were made by their representatives at both the PAC (Messrs DJ Cloete and SJ Malherbe) and the PRF, notably so Mr Malherbe, who was one of the founder members of the PRF.

By the 1970s, fishmeal was regarded as a 'strategic product' which implied that local requirements had to be met before export permits were issued.

Following the 'broiler revolution' in the 1970s, there was generally animosity between the Animal Feed Manufacturers Association (AFMA) and FMPA concerning the amount of fishmeal required and how many tons were warranted. Senior citizens may still recall 'the broilers with the fishy taste'.

In the 1960s and 1980s, a dramatic increase in soybean production in Brazil and Argentina eased the international situation regarding the demand for fishmeal somewhat. After 1973, the international fishmeal situation as far as price and quality were concerned, slowly changed. Production remained constant, demand increased and prices escalated.

In 2005, the PRF decided to abandon research on fishmeal since it was no longer a growing industry. Like sunflower and other proteinaceous products, fishmeal still plays an important role within the animal feed industry, but with decreasing world volumes and hugely inflated prices, the PRF decided that fishmeal no longer has the potential to assist in closing the gap between local demand and local production of protein for animal nutrition.

Gerhard JH Scholtemeijer

4.1 AWAKENING A SLEEPING GIANT

SOYBEANS

The role of the PRF in the establishment of the local soybean industry

The Protein Research Foundation (PRF) played a significant role in the establishment and development of the local soybean industry. Until 1993 its production grew slowly, but after the first protein study group was formed, it improved in leaps and bounds.

THE FIRST SOYBEAN STEPS

The roots of soybean production can be traced down a winding road deep into ancient history with some sources suggesting it began as far back as 5 000 years ago. It would appear that the earliest signs of farming with soybeans are found in China where it was grown as a crop as early as 1100 BC. Wild soybean plants were bred and developed into plants that form seed kernels that are almost ten times the size of the original seeds.

The number of seeds per plant increased by almost eight times the original number. Naturally, yields increased dramatically too. Significantly, soybean seeds on average contain about 40% protein and 20% oil. This composition was probably the most important driving force in establishing the crop in most parts of Asia and later in many parts of the world.

Soybeans were grown in South Africa for the first time in 1903. The first plantings were at Cedara in KwaZulu-Natal and the Springbok Flats in Limpopo Province. After those initial crops, it becomes difficult to trace the development, but the footprint becomes clearer from 1925 as a large-scale effort was made at the Potchefstroom Agricultural College where they planted and evaluated 400 soybean 'cultivars', but these efforts were not as successful as had originally been hoped. By 1943 reports stated that, 'there is no soybean cultivar suited for growing under local conditions'. It seems that this viewpoint was so convincing that production after the Second World War amounted to a mere 6 000 tons, with an average yield of a quarter t/ha.

The development of soybean production was slow:

GROWING SEASON	TOTAL TONS PRODUCED
1973 - 1974	20 000
1987 - 1988	65 000
1997 - 1998	215 000

Production was concentrated mainly on the Eastern Highveld of Mpumalanga and in areas of KwaZulu-Natal with single production islands in the Brits/Koedoeskop area.

Soybeans were clearly outgrowing the toddler production phase, but the tempo was slow. Total production was just too low to generate interest among large companies and investment funds for processing plants.

SOYBEAN PRODUCTION UNDER THE MAGNIFYING GLASS

Over the years various institutions tried to promote soybean production in South Africa. The role of the Department of Agriculture, the Oilseeds Board and later the Agricultural Research Council cannot be underestimated. The problem

was that soybean production had never been considered a strategically important crop that could be managed alongside maize and wheat.

In 1973, a meeting was convened between the Department of Agricultural Economics and Marketing, the Department of Trade and Industry, representatives of the animal feed industry and representatives of the fishmeal industry. It was decided:

1) To impose several levies.
2) To set aside R500 000 of a fishmeal levy for a separate research fund, namely the Protein Research Fund. These funds were to be used to promote the production of protein material for animal feed with particular emphasis on the increased production of soybeans and soya cake.
3) To form a protein study group which was to become the Protein Advisory Committee (PAC) in 1976.

It would require a totally new frame of mind to promote soybeans so that it was no longer 'just another crop' but rather one of the most significant crops in the grain industry. The mind shift occurred in the late seventies.

At the end of 1978, the PAC reported that a harvest estimate of 40 000 tons soybeans was acceptable and that it was believed to be practically possible to increase production to 100 000 tons in the near future. (This only materialised momentarily in 1989 and 1990. After that it came to fruition from 1997, after the establishment of the Soybean Working Group by the PRF).

As a result of the mind shift, the notion grew that soybeans should enjoy more prominence in South African agriculture, the Protein Advisory Committee (PAC), a forerunner of the PRF, established a committee to investigate the situation. The PAC tasked this committee in 1987/1988 to investigate the potential of the expansion of soybean production in South Africa. The committee published a report edited by JGC du Preez, MJ Lourens, KW Pakendorf and JK Siertsema which provided certain perspectives on soybean production. The report indicated that about 1 300 000 dry land hectares and 180 000 hectares under irrigation were available for soybean production in South Africa. The estimated yield potential was indicated as 1,5 t/ha on dry land and 2,5 t/ha under irrigation. The target was not far-fetched, but nonetheless average yields in the country for the 1970/1971 season did not even realise half a ton.

In 1990, the government decided to disband the PAC and to replace it with the Protein Research Advisory Committee (PRAC). Finally a totally independent Protein Research Trust was established in 1994.

The PRF and its predecessors, the Protein Study Group, PAC and later the Protein Research Advisory Committee, used various means such as Think Tanks, Task Teams and Technology Committee Discussions to find ways of increasing soybean production by eliminating problems. It would be essential to maximise the soybean grain yields to make the crop economically attractive to producers as the crop had to compete on economic levels with more popular crops such as maize.

A detailed analysis of soybean production obviously showed certain farm level bottlenecks. There was an urgent investigation into the average soybean yield of only 1,55 t/ha over a period of a quarter century and the factors that had influenced these yields.

TEETHING PROBLEMS

Irrespective of the dramatic expansion of the surface planted under soybeans from just about 60 000 hectares (1987/1988) to almost 700 000 hectares in 2014/2015, soybeans continue to be a secondary crop for many producers. This can be attributed to a variety of factors in particular some sub-optimal growing practices such as:

- Cultivar choice – often incorrect. Not enough attention is paid to seed selection.
- Tilling – practices are often a problem.

- Late planting dates – can lead to yield loss.
- Planters – are often not well adapted for soybean planting. This is particularly true in cases of conservation farming. The wrong planters often lead to the loss of an even planting depth.
- Seed quality – often a problem, especially if retained grain of questionable origin is used.
- Inoculation of seed – often a problem because bacteria are killed or are applied unevenly.
- Lack of fertilisation – soybeans are often left to grow without fertilisation, even where soil analysis shows clear deficits.
- Weed control – is often either late or inadequate.
- Lack of sufficient harvesting capacity – often leads to loss. The problem is aggravated if only one cultivar is grown on a large surface area, because all the grains mature at the same time.

Apart from growing problems, various diseases and pests attack the crop, thereby reducing soybean production. A few of the diseases are mentioned below:

- Stem rot *(Sclerotinia sclerotiorum)* – may lead to huge losses in some production years.
- Asian soybean rust *(Phakopsora pachyrhizi)* – a widely distributed disease.
- Charcoal rot *(Macrophomina phaseolina)* – may cause significant yield loss, especially for irrigation producers.

Although insects can cause a multitude of problems they usually only cause them sporadically. Control measures are generally readily available and may be obtained easily. Nematodes have been identified as a high priority problem in particular, rootknot nematodes, which are the cause of increased production problems. Two species may be mentioned as particular pests namely, *Meloidogyne javanica* and *M incognita*. They are widely distributed throughout South Africa and they cause particular problems for the western expansion areas of soybean production, the sandy soils of the Western Free State and the North West Province.

The list of all possible problems investigated under the magnifying glass, has limited value without a search for solutions to achieve the objectives of a larger surface area planted under soybeans and increased yields.

THE PRF SET OUT TO FIND SOLUTIONS

The easier exercise of identifying problems had to be followed up with actions to alleviate those problems which were restricting production – or at the very least, it is important to find ways of minimising those problems. The PRF has been particularly realistic in its approach since it has known that not all problems or challenges could be eliminated at the same time and it also knew that certain problems could at most merely be limited. It has also always had to consider the reality of limited available expertise. These practical problems could be turned into research briefs towards finding workable solutions within a reasonable period and affordable limits but some issues however, require long-term research and offer limited success. These issues and research projects were placed on the backburner.

From a production point of view it was, just as in 1925, essential to evaluate cultivars as best as possible and to convey the information obtained to producers. In this regard the PRF, through its partial funding of the National Cultivar Trials, has made a huge contribution. In 2015 funding was provided at 50% of the total project costs.

In general terms, it was still the accepted norm that increased soybean production would finally prove to be the solution to the protein shortage in South Africa. In order to give momentum to this, the PRT promoted a Soybean Think Tank

Did you know?

The number of seeds per soybean plant has increased by at least eight times compared to the early yields.

Soybean seeds contain about 40% protein and 20% oil.

during August 1995, which was arranged and presented by the ARC-Grain Crops Institute (ARC-GCI) (This was the first meeting of its kind since a soybean seminar held by AFMA in 1984).

At this time, South Africa saw the arrival of General Agreement on Tariffs and Trade (GATT) and soybeans were re-positioned in the free-market system which brought new requirements and challenges to the PRT. The Soybean Think Tank led to the formation of a Soybean Working Group in 1996. After this event, things really started to happen in the soybean industry.

As can be seen from the annexure of 84 soybean research projects, which were funded from 1976 - 2015, the projects and in particular the soybean projects, up to 1990, were few and far between and were obviously not co-ordinated.

TO MEASURE IS TO KNOW

Measuring success required setting measurable objectives. The working group had to set targets that were approved by the PRF. The two most important objectives were:

1) Striving to achieve a surface area of 100 000 hectares under soybeans in the 1998 planting season.
2) To achieve a yield of 2 t/ha.

As early as 1996, some seed companies that were members of the working group, indicated that they expected a surface area of 120 000 hectares under soybeans in the 1997 planting season. This milestone exceeded the target set for 1998.

One of the most important reasons for the success, apart from the deregulation of, inter alia, the maize industry, was the fact that a member of the working group, Nedan Oil Mills, owner of an oil crushing plant, confirmed a price of R1 200 per ton even before the 1996 planting time. They indicated that the price would be guaranteed irrespective of the quantity. That offered producers both a secure market and a fair price. The result was that soybeans could be grown as a viable alternative to maize.

The PRF realised that more promotion had to be done to bring soybeans to the attention of producers. For several years the PRF participated in the NAMPO Harvest Day in co-operation with the ARC, but in 1998, the PRF arranged its own exhibit in order to become more involved in technology transfer. In this vein, a brochure entitled, *Grow soybeans with confidence* was published, emphasising the most important basic guidelines for the production of soybeans.

The PRF experienced that a big problem in the soybean industry was an inadequate transfer of technology accompanied by ignorance amongst new producers about several important aspects of the cultivation of soybeans. In an attempt to address these problems, the working group requested the PRF for assistance with a comprehensive publication that could provide a detailed 'A - Z' of the soybean industry. This publication, to which co-workers from all sectors of the industry contributed, was finalised under the editorship of the ARC-GCI.

RESEARCH THROUGH THE YEARS

The PRF kept its finger on the pulse of research throughout the 1990s:

- 1992 – PRF started funding the National Soybean Cultivar Trials. This is still an annual event.
- 1994 – PRF decided to co-fund the Super Soya Competition in KwaZulu-Natal, which continued until 2013. In 2014 it was replaced by a Soybean Yield Competition.

- 1997 – Two specialist contractors were appointed to be involved in technology transfer activities in KwaZulu-Natal and in Mpumalanga.
- 1997 – Soybean rust was identified in Zimbabwe. The PRF became pro-actively involved in diverse activities which sought to pre-empt and prepare for an outbreak in South Africa (see chapter 4.2).
- 1998 – The PRT provided the funding for Dr Mark Peoples of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) of Australia to visit South Africa particularly because of his role in the development of the 'Uride' method of measuring nitrogen binding in soybeans as well as his experience in the field of soybean cultivation.

The principle applied by the PRF has always stated that as and when required, researchers from different institutions who are occupied with research on a specific crop, disease or discipline, and wherever the possibility of overlapping or better co-operation exists, it should be brought to a round-table to discuss co-ordination. One of the first of these was a discussion of bio-technological research for drought-resistance in soybeans. Not much success however was achieved.

The Soybean Working Group realised that the targets set for 1998 had already been exceeded in 1997. Accordingly, the working group considered new targets, with projections which were done taking into account a large number of variable factors and predictions from models available to the PRT.

The new goals were as follows:

GROWING SEASON	HECTARES UNDER SOYBEANS	TOTAL TONS PRODUCED
2000	180 000	270 000
2010	300 000	450 000
2020	500 000	750 000

A critical turning point in the local soybean industry came when, at the request of the Department of Agriculture of KwaZulu-Natal, the PRT agreed to import a planter from South America to enable the department to execute trials with minimum tillage and narrow rows. This investment was successful, since the results achieved under the guidance of Messrs Berry, Birch and Killian, irreversibly pointed the soybean industry in KwaZulu-Natal in a new direction.

In 1997, rust was identified in Zimbabwe. The PRF got involved in various ways in preparation for an outbreak in South Africa. This is discussed in more detail in chapter 4.2.

The enormous effort of the PRF and various other role-players contributed to the huge growth in soybean production since 1997 (see Table 1). However, of all institutions involved in the expansion of soybean production, the PRF has probably financially invested the most over the past 25 years.

NEW TILLAGE PRACTICES AND RR® CULTIVARS HELP GET THE GIANT ONTO ITS FEET

While there was already a momentum to local soybean production, a new wave sweeping across the globe arrived on South African soils in the form of conservation farming characterised by no tillage practices. This practice had been dormant for many years, but exploded with the arrival of functional planters that could plant through stubble and when cultivars that were Roundup Ready® (glyphosate resistant) were introduced in the market. In the case of soybeans, in 2001 there had only been two cultivars that were glyphosate resistant whilst today there are almost none without this resistance. A sudden renaissance in crop rotation systems developed and soybeans was the most important rotation crop for maize growers. In this regard the PRF contributed materially by making available comprehensive literature about conservation tilling and even invited a specialist from INTA (Argentina) to visit South Africa to promote conservation farming.

TABLE 1: THE GROWTH OF SOYBEAN PRODUCTION IN SOUTH AFRICA OVER THE PAST 25 YEARS

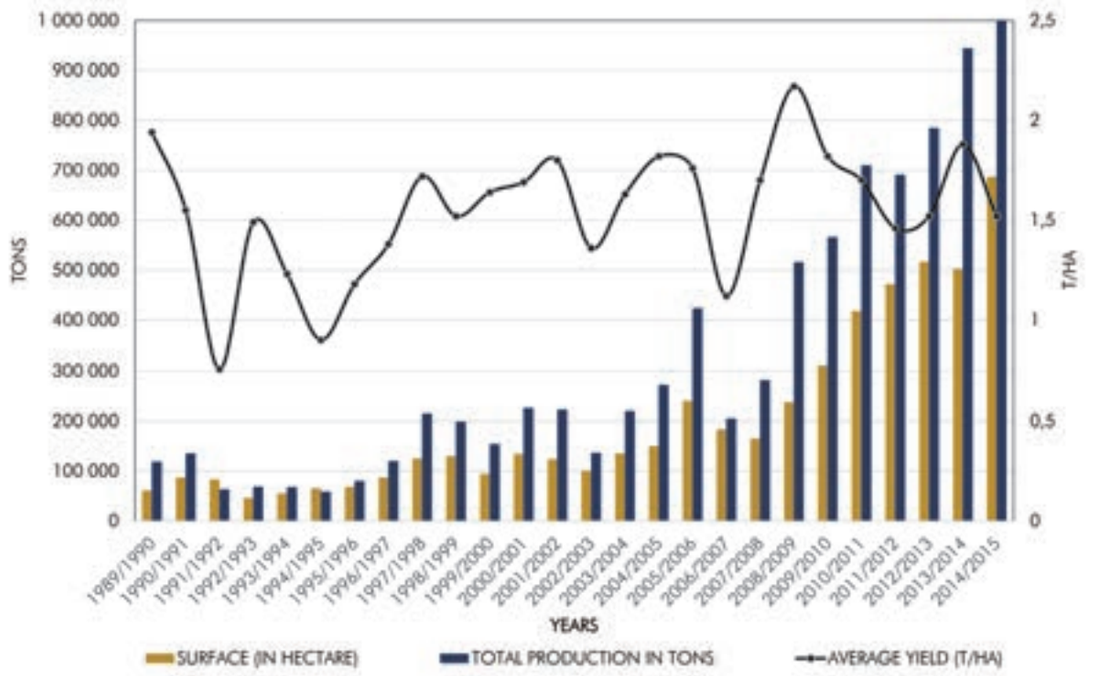
YEAR	AREA (IN HECTARE)	TOTAL PRODUCTION IN TONS	AVERAGE YIELD (T/HA)
1989/1990	61 000	118 200	1,94
1990/1991	87 000	135 200	1,55
1991/1992	83 000	62 900	0,76
1992/1993	46 000	68 600	1,49
1993/1994	55 000	67 700	1,23
1994/1995	65 000	58 500	0,90
1995/1996	68 000	80 000	1,18
1996/1997	87 000	120 000	1,38
1997/1998	125 000	215 000	1,72
1998/1999	130 000	199 000	1,52
1999/2000	93 790	153 925	1,64
2000/2001	134 042	226 210	1,69
2001/2002	124 060	223 000	1,80
2002/2003	100 130	136 500	1,36
2003/2004	135 000	220 000	1,63
2004/2005	150 000	272 500	1,82
2005/2006	240 570	424 000	1,76
2006/2007	183 000	205 000	1,12
2007/2008	165 400	282 000	1,70
2008/2009	237 750	516 000	2,17
2009/2010	311 450	566 000	1,82
2010/2011	418 000	710 000	1,70
2011/2012	472 000	691 050	1,46
2012/2013	516 500	784 500	1,52
2013/2014	502 900	944 340	1,88
2014/2015	687 300	1 041 600	1,52
			AVERAGE 1,55

During 1999, it became clear that the objective for the 2000 planting season of 180 000 hectares would come under pressure. This was directly related to the international price of soybeans which had come under severe pressure. In 1999 the American Soybean Association reported that the price had reached its lowest level in 23 years. On 24 November 1999, the first official figures indicated that only 106 000 hectares of soybeans had been planted, which was naturally a great disappointment to the working group and the PRF.

Cultivation practices were increasingly the topic of discussion. In an attempt to obtain valuable information concerning cultivation practices of soybeans in narrower rows and cultivars, the PRT funded the visit of an USA specialist, Prof Cooper. For the same reason the PRT also initiated and funded the Super Soya Competition in Mpumalanga, supported by a farmers day in Ermelo, which was well attended. This served to confirm the interest in that province. Also, in 1999, the Soybean Working Group requested that considerable more attention be given to gross margins, since the price of soybeans was determined internationally.

The PRF noted with disappointment, that agricultural co-ops and agricultural companies had to a large extent scaled down and even cancelled aspects relating to technology transfer or extension. In view of this the PRF found it necessary to appoint another contractor and based him in the Eastern Free State.

GRAPH 1: THE GROWTH OF SOYBEAN PRODUCTION IN SOUTH AFRICA OVER THE PAST 25 YEARS



The importance of technology transfer was addressed in many ways. A special occasion in 2000 was the exhibition by Dr Jos de Kock and his team, at the NAMPO Harvest Day where the plantings of three soybean cultivars on two hectares of the NAMPO Experimental Farm drew particular attention.

More contractors were employed, with one contractor being established in George, in the Southern Cape, while Mr Wessel van Wyk was contracted in an effort to make a definite difference in the production of soybeans in Mpumalanga and the Northern Province. In 2000/2001 an area of 134 042 hectares was planted. This was the largest area ever planted in South Africa and the total production of 226 210 tons was also a record!

By 2001 the dreaded soybean rust arrived in South Africa. This is discussed in chapter 4.2.

WALKING THE WALK: SLOW BUT STEADY DEVELOPMENTAL STEPS

The first commercial planting of Genetically Modified Organisms (GMO) soybean seed took place in 2001. The so-called Roundup Ready® soybean seed was planted with great anticipation and the history of Roundup Ready® and the benefits thereof is well-known in the soybean industry.

In 2001, the PRF negotiated with John Deere to build a precision-planter at the request of Mr T Machett, a producer of KwaZulu-Natal. Outstanding results were achieved with this planter by the end of the first season.

The South African futures trading exchange, Safex, saw the dawn of a new era when the first soybeans were traded in 2002. In the same year, the PRF in co-operation with Chicory SA, decided to research the benefits of soybeans as rotation crop for chicory. The first trial was planted near Bathurst. Unfortunately the trial did not show truly positive results. However, it was encouraging to note that the highest yield in the Super Soya Competition in KwaZulu-Natal was achieved at 5,68 t/ha under irrigation.

A very successful soybean expert forum was offered in co-operation with the Oil and Protein Seeds Development Trust/Oilseeds Advisory Committee (OPDT/OAC). Various guest speakers were invited and the forum provided an overview of all known research projects that were being

conducted in South Africa at the time. The papers were of very high quality and were received well by the large audience. In addition to the Soybean Working Group a Rust Task Team and a Sclerotinia Task Team were established to address the particular problems.

By 2003 the increasing interest and need for information led to the creation of the PRF website. It was developed to play a significant role in transfer of technology (see chapter 9.1). During 2003 the PRF received royalties for the first time since its establishment. The soybean cultivars, Egret and Stork, which had been developed by ARC-GCI in partnership with the PRF, had flourished and met all expectations. Unfortunately these cultivars did not stay in the market-place for long, mainly because they were not glyphosate resistant (RR). Also in 2003, international soybean production had reached more than 200 million tons, but South Africa only produced 136 520 tons on 100 130 hectares.

Since the largest portion of the locally produced soybean harvest was used for full-fat soy, the PRF planned a Full-fat Soy Day. A related research project was well advanced so the PRF waited for the results from this before presenting the day.

Initially the growth of the soybean industry was earmarked by a series of stops and starts. By 2004, the target of 150 000 hectares which had been set for 2005 had been surpassed and in 2005/2006 the area already comprised more than 240 000 hectares. The area under soybeans then stagnated until 2008/2009 when only 237 750 hectares were planted, but following on this period there was again a strong upward trend. In 2014/2015, 687 300 hectares soybeans were planted and production was well under way towards reaching the PRF target of more than a million hectares by 2020. In 2014 the total international area planted under soybeans was about 120 million hectares.

Various reports about the potential production areas have been published since 1988 (see references to the report in other sections). In 1988 it was indicated that 1 300 000 dry land hectares were considered as potential soybean areas with 180 000 hectares soybeans under irrigation. In 2010 the PRF requested a study by the University of Pretoria. This study used modern techniques to determine the areas suitable for growing soybeans. The extensive report by Blignaut and Taute estimated the total available area for soybean production at 2 610 346 hectares. If one were to add the potential area, dry land and irrigation, a total of about three million hectares are suitable for soybean production.

TALKING THE TALK: THE TRANSFER OF TECHNOLOGY GETS ATTENTION

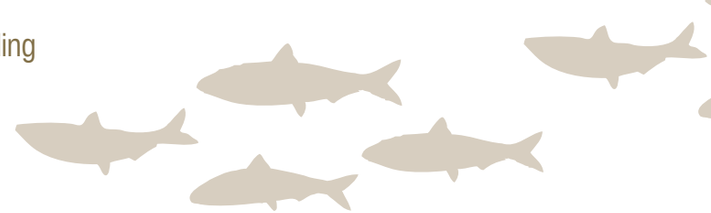
In 2005, the PRF realised that the potential of soybeans in Mpumalanga would not be developed by the Department of Agriculture Mpumalanga since there were many discussions, but no actions.

Bearing in mind the original appointment of Mr Van Wyk to promote soybean production in Mpumalanga, the PRF negotiated with the University of Pretoria for land to be made available on their research farm in Hatfield, where soybean trials could be planted (see chapter 7).

Did you know?

It is believed that soybeans were first farmed by the Chinese as early as 1100 BC.

A partnership between PRF and ARC-GCI led to the breeding of two very successful soybean cultivars known as Egret and Stork. They are only not used anymore because they are not glyphosate resistant (RR), though.



The PRF also decided that it was justified in making more use of the radio for its technology transfer programme, in addition to articles and pamphlets. The policy decision to make use of an agricultural programme on the radio was successfully executed under the guidance of Dr De Kock, in co-operation with a large number of scientists. This weekly programme was broadcast for several months. In an effort to determine the existing problems in the soybean industry and the needs of the leading soybean farms in South Africa, the Board decided to arrange a Think Tank. Technology transfer on an ongoing basis was only one aspect that was highlighted and the PRF paid immediate attention to these requirements.

One consideration for technology transfer was to initiate a soybean magazine. However after negotiations with Grain SA, it was agreed that they would publish information and articles, etcetera free-of-charge in their magazine if from their side, the PRF would appoint a contractor to ensure that the necessary information was put to paper for publication by Grain SA. The PRF also realised the necessity of having more experienced, well-informed soybean producer members to serve on the Soybean Working Group. Members from the leading production areas were co-opted onto the working group by the PRF. The most experienced producer member at that time was probably the late Mr Frans Potgieter, who had many years of experience. He was appointed to the Board in 2007.

The PRF also found it necessary to produce reliable income and cost budgets for the various regions to enable producers to compare the production costs of soybeans to that of maize, wheat, sunflower, etc. Previous figures were outdated and no longer reliable. The Deputy Chairman of the Board, Mr Joubert, took it upon himself to develop this new programme. The required information was sourced from agri-businesses, as well as the two departments of agriculture.

In Mpumalanga, six magisterial districts were covered, with four in the North West Province, four in the Free State and three in KwaZulu-Natal. Various other factors contributed to confirm a wave of interest in soybeans. For example, South Africa experienced a surplus of maize in 2005 and this automatically gave rise to more interest in soybeans. At the same time, the price of soybeans rose sharply internationally, because of the biodiesel projects in America and producers also started to realise the benefits of crop rotation. A very important project, the *Economic study of soybeans as a rotational crop* (2000 - 2002), done by Prof MF Viljoen from the University of the Free State, yielded excellent results in that the study proved that if soybeans were included in a crop rotation system with maize, the results of the continued crop rotation in the medium to long term exceeded the financial results of any other crop rotation system. Monoculture maize systems delivered the poorest results. These projects and the results thereof contributed vastly to the benefit of soybeans at this critical stage.

The PRF-drive to provide as much information as possible to soybean producers was further supported by price calculations from Dr Munro Griessel. Initially, he supplied relevant prices that should be payable on any specific day, based on international information, to the various meetings only. This item became so popular that the price information, as developed by him, is still available on the PRF website on a daily basis.

HOLDING BACK: RETAINED SEED

During the years of growth in the soybean industry, seed companies often complained that producers retained grain to use as seed and that up to 85% of soybeans planted, consisted of 'retained seed'. In 2006, several leading seed companies

issued a press statement, stating that no new soybean cultivars would be released in South Africa, unless the practice of 'farmer-saved seed' was abandoned. The PRF arranged several group discussions and also deliberated the issue at the soybean working group. At the same time however, the PRF decided to embark on an international campaign to identify co-operation from South American companies to assist the South African soybean industry, should such an embargo be implemented (see chapter 3.2).

The ever increasing technology transfer by a sizeable number of contractors, Board and staff members, as well as the members of the soybean working group on the one hand, dwindling research funding from government and decreasing research contributions from research institutions, provinces and universities in general on the other hand, were addressed by a Research Think Tank held in 2008. Since fewer researchers implied less international exposure the PRF decided accordingly on an international liaison programme for co-workers, contractors, staff and Board members. Brazil and Argentina were targeted since both countries had recently made huge strides ahead in the soybean industry. This policy decision became even more urgent, when the ARC-GCI decided in 2008, to discontinue their soybean breeding programme due to the resignation of their only soybean breeder. In order to give additional local support, the PRF co-opted Dr Jan Dreyer, a well-known and nationally acclaimed agronomist, onto the Technology Committee, in 2008.

VIRTUAL REALITY

From the Think Tank, it was also clear to the PRF that international information needed to be gleaned by conducting a detailed study of the soybean world, since, with very small exceptions, no information was forthcoming from the ARC. Accordingly, the PRF contracted Mr Jan du Preez, a previous PRF Board member, to conduct annual web studies of soybeans, with specific reference to the large international seed companies, chemical companies, universities, as well as the American Soybean Association (ASA) and the United Soybean Board (USB). The quality of the work prepared by Mr Du Preez is excellent and the PRF distributes it to the entire South African soybean industry. The importance of this study is that the PRF is timeously informed about the very latest international developments in the large soybean producing countries. It is then up to the PRF to ensure that such new technology be brought to South Africa, soonest. This also heralded in a new approach for the PRF to stimulate the South African soybean industry.

The PRF decided to appoint a dedicated Soybean Task Team to avail itself to the most urgent requirements and the implications thereof. The task team is a small group of soybean specialists who are in virtual contact with the soybean world on a daily basis. In 2015 it became the Soybean Planning Committee.

Most policy decisions are referred to the PRF Board and are first analysed in detail, before recommendations are made and a final decision is taken. The PRF's Pro-active Soybean Information Day at the Hatfield Experimental Farm took place in 2008 for the first time. This information day and the impact thereof, not only on Mpumalanga, are dealt with in chapter 7.

Technology transfer reached new heights every year and in the annual report of 2012, it was reported that 80 articles on soybeans were published that year. These articles are all available on the PRF website *(www.proteinresearch.net)*.

ALL THE WORLD'S A STAGE (WSRC IX 2013)

The PRF spread its wings internationally in many respects and in the chapter on the PRF, it is well documented that the PRF finally accepted responsibility for the World Soybean Research Conference (WSRC IX 2013) which was held in Durban from 17 to 22 February 2013. In the same vein the Board also accepted an invitation for the PRF to become the first non-American member of the World Soybean Foundation (WSF). WSRC IX 2013, directly and indirectly brought huge benefits to the South African soybean industry. Many new international seed companies, entered the South African market and the soybean crushing capacity which was reported in 2013 to be 600 000 tons, increased to 1,2 million tons in 2015. In summary, WSRC IX 2013, opened many doors to South Africa and the PRF and it is important that this opportunity continues to be utilised to its full extent. An opportunity like this only comes around once.

Total hectares planted are not always the decisive factor. Every grower knows that yield plays a very important part and for that reason, the PRF in 2014 decided to change the Super Soy Competition to a Soybean Yield Competition. The 2020 goal of 2,5 million tons of soybeans is accordingly based on an average yield of 2,5 t/ha planted on one million hectares.

All these star-studded fields of technology will not develop to their full potential if producers, advisors and researchers fail to change the mind-set about ways to secure soybean production. This essential mind shift was the basis for the launch of the Soybean Yield Competition. The idea was to stimulate new practices and challenge interested parties to create new ways of looking at soybean production.

It will be equally important for South Africa to obtain the latest technology, packaged as new cultivars. The availability of Roundup Ready® 2 or similar technology is a prerequisite for an increase in yield. Characteristics such as drought

Mss Ana Couto (Brazil), Yvette Papadimitropoulos, Susann Brits and Maria du Preez

Ing. Miguel Calvo, Dr Daniel Ploper, Mr Gerhard Scholtemeijer, Mr Oscar Solis and Mr J Cassissa

Did you know?

The PRF was the first non-American member of the WSF.

Our Super Soy Competition was changed to the Soybean Yield Competition in 2014.

Drs Daniel Ploper, Jos de Kock, Messrs Loganathan Naidoo and Gerhard Scholtemeijer

Prof Dominique Bureau, Drs Shadrack Moephuli, Jos de Kock, Messrs Peter Berweger, Kip Cullers and Gerhard Scholtemeijer

Mr Gerhard Scholtemeijer, Minister Derek Hanekom, Dr John Soper and Mr Thomas Mielke

Dr Munro Griessel, Messrs Deon Joubert, Gerhard Scholtemeijer, Dr Norman Neumaier and Mr Kobus Schonken

tolerance, better water utilisation efficacies and resistance to pests and diseases, including environmental adaptability, are built into new cultivars. These will be essential and vital for soybean growing. However, new technology is available at a price. Breeding institutions will bring the new technology to South Africa only if they will profit from their enterprises. Efforts by Grain SA to facilitate this are valued, because they offer an opportunity for soybean production to grow.

The PRF has no doubt that the next five years will be very stimulating and hopefully they will be very successful. We certainly look forward to achieving our goal of 2,5 million tons of soybeans on more than one million hectares in 2020.

Dr Jan Dreyer
Gerhard JH Scholtemeijer

4.2 FOREWARNED IS FOREARMED

SOYBEANS

The role of the PRF in the control of soybean rust in South Africa

In 1997, rust showed its ugly face in Zimbabwe, although it had already been present in other African countries earlier. The PRF offered to sponsor researchers from the ARC to study soybean rust (SBR) in Uganda, but this offer was rejected.

In 2001 SBR, also known as Asian soybean rust, not surprisingly appeared in South Africa. It is caused by the fungus *Phakopsora pachyrhizi* and has been a major concern to the soybean-cropping sector. It is one of the most feared diseases in soybean growing areas worldwide as it is spread rapidly by wind over long distances, can be explosive if environmental conditions are favourable, and it will become an epidemic in a very short time. Currently (2015), soybean rust is considered to be the biggest problem that the soybean industry in Brazil has ever had to contend with.

SOYBEAN PRODUCTION VERSUS SOYBEAN RUST: THE GIANT VERSUS UREDINIOSPORES

At the instigation of the PRF, a SBR workshop was convened at Potchefstroom soon after the disease was reported in Zimbabwe in 1997. Due to the strong possibility that SBR would enter South Africa, a SBR Working Group was established which represented a wide spectrum of interest groups all working towards gathering information and gaining experience in identifying the disease. This national SBR team of forward-thinking, pro-active researchers, academic institutions, chemical and seed companies, agricultural co-operatives, the previous Department of Agriculture and also the Agricultural Research Council (ARC) brought expertise and advice to the forum which could be developed into a lifeline for the South Africa soybean industry.

Over the following three years the PRF funded many visits of local researchers to Zimbabwe where they were expected to familiarise themselves with the disease and work towards developing an effective control strategy. Because of this pre-emptive planning, chemicals and protocols used in Zimbabwe were able to be implemented as soon as the pathogen arrived in South Africa.

With the serious onslaught of rust in Zimbabwe, a workshop was held in 1998. In an attempt to promote the cross fertilisation of knowledge between the ARC-Oil and Protein Seed Centre (ARC-OPSC) and Agricultural Research Trust (ART) farms in Zimbabwe, the PRF sponsored Dr M Smit (ARC) to attend a rust symposium in Zimbabwe which was addressed by several international experts. In 1999 Messrs Killian, Maree and Middel (all PRF) were also sent to Zimbabwe together with Dr Smit to investigate the latest developments in the control of SBR. Although rust on soybean had not yet occurred in South Africa, by that stage it had already caused much damage in Zimbabwe.

A world authority Dr S Shanmugasundaram, the Director of International Programmes at the Asian Vegetable and Research Development Centre (AVRDC) in Taiwan, as well as Dr Clive Levy from Zimbabwe, were invited by the PRF, together with all interested parties and local expertise, to work out a strategy to control SBR in South Africa. The PRF

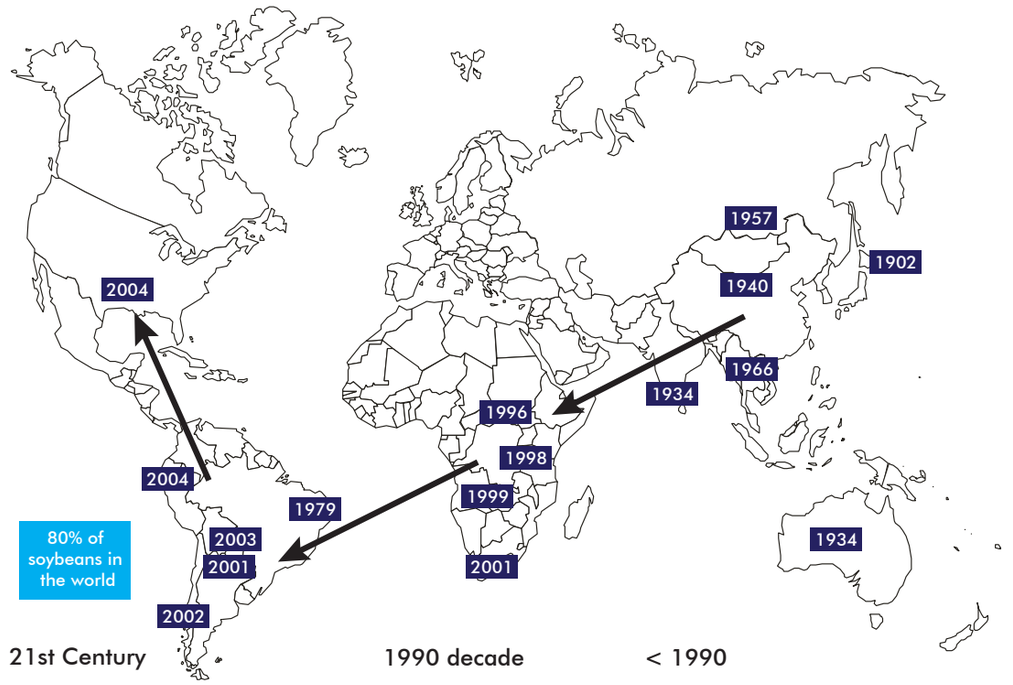
also published a SBR pamphlet which was regularly updated and distributed as widely as possible. It was also placed on various websites in order to make up-to-date information available to producers. Furthermore, the PRF was instrumental in organising farmers days, issuing TV and radio broadcasts, publishing articles in the *SA Grain* and other magazines and holding producer workshops.

The first report of the appearance of SBR in South Africa came in February 2001 from the Vryheid district. Later in that same cropping season, the appearance of SBR was also reported from several areas in KwaZulu-Natal (KZN). After this appearance of SBR in South Africa, the PRF again sent a mission, comprising of Drs De Kock, Mc Laren and Mr Killian, to Zimbabwe to obtain fresh, first-hand information. Shortly after their return to South Africa, a workshop was held in Potchefstroom. At this workshop a SBR task team comprised of researchers from Zimbabwe, ARC-Grain Crops Institute (ARC-GCI), Universities and private companies were put together with the main function to plan a research programme. The development and evaluation of cultivars which showed resistance to SBR, also had to be surveyed.

Dr De Kock attended this inaugural meeting on behalf of the PRF on 25 May 2001. In anticipation of this particular meeting, Dr De Kock had discussions with representatives from Syngenta Seed Co, staff of the ARC-GCI, as well as Mr Rex Tattersfield, from Seed Co Zimbabwe. Seed Co undertook to do the necessary cultivar testing of local cultivars as well as cultivars from the United States of America (USA). The ARC-GCI also undertook to conduct trials investigating the potential of breeding resistant cultivars with material which they intended to obtain from Zimbabwe and the USA. The PRF made a request for closer co-operation between the ARC and the Department of Agriculture KwaZulu-Natal, who finally did the bulk of the SBR research in South Africa under the capable leadership of Dr Pat Caldwell.

It was also decided that rust research had to be carefully controlled and monitored. It was reported that SBR was identified in South Africa in 1934 and was never seen again until 2001. It was also accepted that SBR would not necessarily break out in the other provinces and accordingly, artificial contamination for research purposes was forbidden until rust naturally appeared in specific areas. Accordingly the rust trials and research were concentrated on in KZN.

MAP 1: WHERE DOES SOYBEAN RUST OCCUR GLOBALLY?



Later at the request of Mr J du Plessis of the PRF, Dr Levy from Zimbabwe was invited as the keynote speaker to address producers to share experiences about SBR during the Super Soy Information Days which took place at Cedara on the 28th and at Dundee on the 29th of August 2001.

At this critical time the PRF also funded several research projects investigating SBR:

- Dr NW McLaren – *Soybean rust: Risk analysis, loss assessment and quantification of the epidemiological value of intervention technologies* (2001 - 2005).
- Dr P Caldwell (UKZN) – *Studies on soybean rust* (Phakopsora pachyrhisi) – *Epidemiology* (2002).
- Surely the most significant project for producers was executed initially by Dr M Craven (ARC) and later continued by Mr GP de Beer (PRF) – *Establishing an early warning system for soybean rust* (2006 - 2014).

WHERE THE ILL WINDS BLOW: MORE ABOUT SOYBEAN RUST AND ITS GEOGRAPHICAL DISTRIBUTION

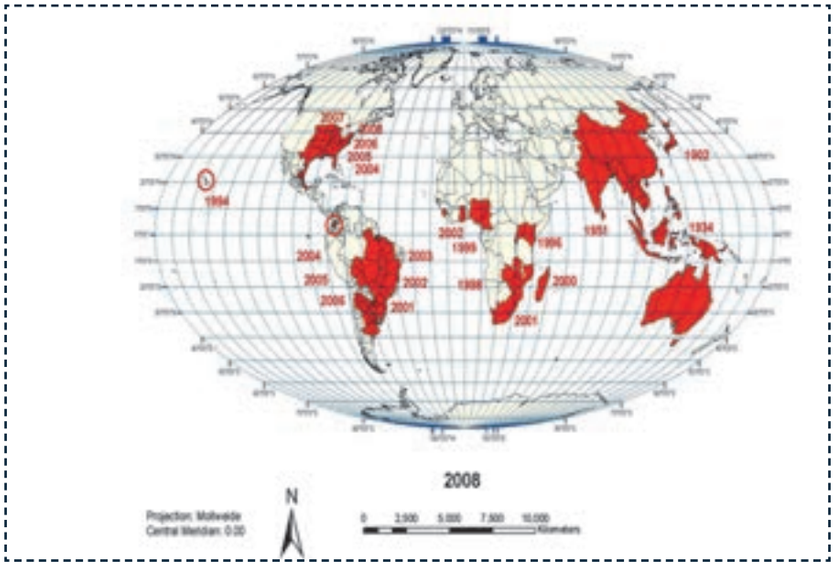
Soybean rust was first observed in Japan as early as 1902 (see Map 1). The pathogen was then reported in other Asian countries, eventually reaching epidemic proportions in South-East Asia. By 1934, the pathogen was identified in some Asian countries and then it appeared in Australia and India in 1951. SBR was reported in Hawaii in 1994.

It is believed that urediniospores were carried by the winds from Asia to Africa, with the result that the pathogen was reported in Kenya, Rwanda and Uganda in 1996 (see Map 2). It marched steadily across the rest of the African continent rearing its head in Zambia and Zimbabwe in 1998 and South Africa in 2001. In 2001 the pathogen was carried further on the winds across to South America, with reports in Paraguay initially and limited areas of Brazil. By 2002 it had been found in Argentina, then Bolivia in 2003 and Uruguay in 2004 (Figure 1). The first reports of SBR in the USA were from Louisiana in 2004, and by 2006 it was reported in 15 states in the USA. In 2007, SBR was detected in Canada and Mexico reported its presence in 2013.

DISTRIBUTION AND SPREAD OF SBR IN SOUTH AFRICA

From 2001 to 2008 members of the SBR Task Team reported outbreaks of SBR which had been positively identified annually (see Table 1 on page 56). Towards the end of this time, more

FIGURE 1: WORLDWIDE DISTRIBUTION OF SOYBEAN RUST



MAP 2: DISTRIBUTION OF SOYBEAN RUST IN AFRICA

frequent reports were made but this was probably also due to the fact that more scientists sent in reports rather than only because there were more outbreaks of the disease. The high rainfall areas of the Drakensberg reported the highest incidence of SBR. Late in the 2006 growing season SBR outbreaks were detected to the far west of its normal distribution area but this did not have an impact on yield as the pods had already developed.

Although there has been no formal research on the distribution of SBR, it appears from the records that local epidemics do not only rely on urediniospores being blown in from the tropics on global trade winds. There are theories instead, that epidemics start from green bridges in frost-free areas from which urediniospores are blown into soybean production areas and, if environmental conditions are conducive then an outbreak of SBR will result, starting in the east and progressing westwards during the production season.

THE ECONOMIC SIGNIFICANCE OF SBR IN SOUTH AFRICA

In South Africa, losses due to SBR vary greatly between seasons and genotypes leading to difficulties in accurate assessments of yield losses caused by the fungus. No functional resistance to SBR of any economic value has been shown to exist in any of the South African commercial genotypes tested. Research has shown that:

- The shorter maturity genotypes show lower yield losses than longer maturity ones.
- Row spacing affects yield losses where symptoms are more severe in narrower spacing (45 cm) than broader ones (90 cm) – but this could also be due to poor fungicide penetration where the canopy is more dense in the narrower row spacing.

In South Africa, yield losses of between 10% and 80% have been reported, with losses of up to 100% where mono-cropping with no rotations is practiced. Complete crop losses can result, if early infection and favourable environmental conditions occur.

ALTERNATIVE HOSTS

Research has shown that SBR does not overwinter on soybean stubble. The likelihood is that the urediniospores survive the winter months, especially in production areas where frost frequently occurs, on one of its many alternative hosts. The kudzu vine has been shown to provide this green bridge in South Africa for the survival of the pathogen over winter in frost-free areas. Other theories suggest that in the KZN Midlands, wind-borne urediniospores form foci within a field from which the epidemic develops.

In 2005, the ARC requested that the PRF take over the management and control of the Soybean Rust Task Team. The task team carried on with its work for several more years, but since chemical controls have been proven to solve the problem to a large extent and with the backing of the so-called early warning system which has been very efficient, the task team was disbanded, in the knowledge that the PRF, as always, is keeping a watchful eye on any future developments which may give cause for concern.

Dr Pat Caldwell
Gerhard JH Scholtemeijer

TABLE 1: RECORD OF OUTBREAKS OF SBR FROM 2002 - 2014

2002/2003 SEASON

- Cedara (30 December).
- In the Karkloof area (26 January).
- Winterton, Dundee, Vryheid and Piet Retief.
- Rust was not sighted in Ermelo and the Highveld, which means that it did not move up the escarpment.

2003/2004 SEASON

- An outbreak in Ermelo was reported by Mr Jacob Middel, and confirmed by Prof McLaren.
- The outbreak in Amersfoort was not confirmed.

2006/2007 SEASON

- On kudzu vine at Cedara (8 January).
- At Piet Retief (26 January).
- Greytown as well as Piet Retief sites (26 January).
- On the indicator crop trials at Greytown and on the soybean indicator crop trials at Vryheid (1 February).
- At Vryheid (1 February).
- Morgenzon (2 February).
- On the indicator crop trial in the Morgenzon region (12 February).
- At Merrivale (12 February).
- Normandien (22 February).
- On the indicator crop trials in the Normandien area (22 February).
- In Besters near Ladysmith and at Bergville early in March.
- Kestell, Winterton, Kinross and Potchefstroom remained free from rust this season.
- The occurrence of rust as well as that of Sclerotinia was most probably hampered by the drought conditions experienced during the past season.
- Rust was not reported in Mpumalanga.

2007/2008 SEASON

- At University of KwaZulu-Natal Disease Garden (20 February) – Dr Pat Caldwell.
- At Greytown (20 February) on both varieties planted as indicator crops i.e. PAN 538R at R2 (full bloom) and PAN 1454R at R6 (full seed).
- At Cedara (25 January) – Mr Neil van Rij.
- At Baynesfield, Richmond, KZN trial sites (about 20 km from Pietermaritzburg) (20 February).
- Soybean rust confirmed at Normandien (6 March) – Dr Maryke Craven.
- Dr Craven reported that rust came in later, the one further on moved inland, and that rust occurred in those areas where it normally presented, but that rust infection was not as severe as the infection experienced during the 2005/2006 season.
- At Groblersdal on late maturing, unsprayed varieties (14 April). It was not possible to establish whether the earlier maturing varieties had escaped rust or not. The rust was not particularly severe.
- At Winterton (14 April) on a sprayed crop, too close to maturity to have an impact on yield.
- No rust was reported at Standerton, Wonderfontein, Delmas or Skandinavia Drift.

» Advanced development of soybean rust

TABLE 1: RECORD OF OUTBREAKS OF SBR FROM 2002 - 2014 (CONTINUED)

2008/2009 SEASON

- At Cedara on kudzu plants (9 January).
- On the soybean rust indicator crop at Greytown (23 January).
- At Merrivale (26 January).
- On a commercial planting at Greytown (5 February).
- During February and March on the Winterton, Piet Retief, Vryheid, Normandien, Kinross and Potchefstroom indicator crop and at Lenjane in the Vryheid district.
- At the Pannar research station outside Delmas (2 April).
- In Mpumalanga – but it did not have any negative effects on yield.
- Fully developed rust was observed in Delmas at quite a late stage – there would possibly have been significant damage, had the rust occurred one week earlier.

2009/2010 SEASON

- In the Vryheid area (27 February).
- In the Morgenzon area (27 February) – Dr Maryke Craven.
- At Lenjane, Vryheid (25 February) on R5 growth stage – Johan Fourie and Carl Havenga.
- Near Piet Retief (3 February) – Dr Maryke Craven.
- On the Winterton Trap Crop (18 February) at the R6 stage at a low incidence (<1%) – Mr Neil van Rij.
- Soybean rust in the Greytown district (5 February).
- On a commercial planting of LS 6164R, planted 21 November, in the Greytown district. Although infection levels were low, symptoms were distinct. The plants were at the R2 stage (full bloom) with no pods. The early onset could have been attributed to the prevailing weather conditions – Mr Rikus Kloppers.
- On an early planted (PAN 1454R) crop in Merrivale. The crop was at R6 and disease severity was up to 75% on the initial focal area – Mr Neil van Rij.
- At Merrivale (23 January).
- At Greytown (23 January).
- Confirmed on the soybean indicator crop in Greytown (Redgates Research Farm) (23 January) which was planted on 21 October. Infection was still very low – only scattered sporulating pustules had been identified on PAN 1454R which was at the R5 stage. No symptoms were present on PAN 538R which was at the R3 stage – Ms Stephanie Tweer.
- Soybean rust at Cedara on kudzu. Pustules appeared to be about a week old (9 January).

2010/2011 SEASON

- At Greylingstad (16 February) – Dr Maryke Craven.
- At Normandien (8 February) – Mr G de Beer (PRF).
- At Morgenzon (8 February).
- On the soybean indicator crop in Greytown (Redgates Research Farm) (28 January), which was planted on 23 October. Infection was still very low – scattered sporulating pustules had been identified on both PAN 1454R and A5409 RG, which were at the R3 stage (beginning pod) and R5 stage (beginning seed), respectively – Ms Stephanie Tweer.
- At Dirkiesdorp and Vryheid (18 January).
- At Cedara on kudzu from samples collected. Pustules were estimated to be one week old (Archana Nunchumar) (18 January).
- In the Piet Retief area (11 January) – Mr Schalk Stapelberg.

2011/2012 SEASON

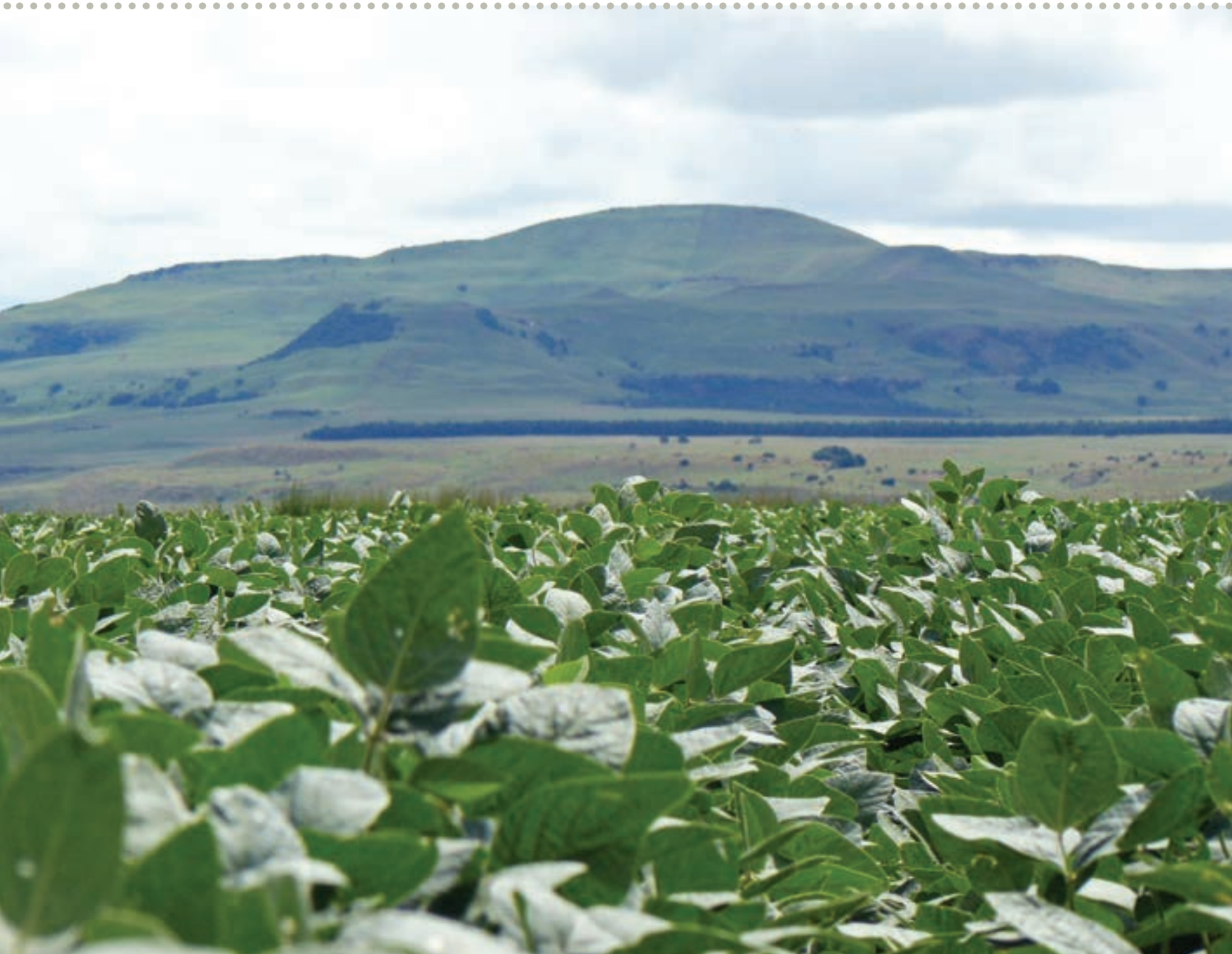
- At Vryheid (7 March) – Mr G de Beer (PRF).
- At Greytown (16 February) on both varieties planted as indicator crops in Greytown. PAN 737R was at R6 (full seed) and PAN 1454R was fully mature. Symptoms were more pronounced on PAN 737R – Mr Antony Jarvie.
- In a vegetable soybean trial planted on the 3 November which was in the R1 growth stage – Mr Neil van Rij.

2012/2013 SEASON

- On kudzu plants at Cedara (5 January) on sporulating lesions.
- At Greytown on PAN 1454R planted as an indicator crop (25 January). PAN 1454R was at R6 (full seed). There were no symptoms on PAN 737R which was at the R3 (beginning of pod stage). Both varieties were planted 24 October.
- At Vryheid (7 February) – Dr Maryke Craven.
- At Dirkiesdorp and Normandien (13 February).
- At Morgenzon (5 March) – Dr Maryke Craven.
- At Kinross (13 March) – Dr Maryke Craven.
- At Kestell (22 March) – Dr Maryke Craven.

2013/2014 SEASON

- Very sparse sporulating rust lesions had been detected in the soybean indicator crop in Greytown (26 February).
- Outbreak at Dirkiesdorp on A5409R. Plants were at the R3 stage (4 March).
- At Vryheid on PAN 737R at R3 stage (17 March) – Mr G de Beer (PRF).



4.3 FOCUS ON SCLEROTINIA

SOYBEANS

Research on Sclerotinia funded by the PRF from 2002 to 2013

Sclerotinia stem rot (SSR) of soybeans and sunflower, caused by the fungus *Sclerotinia sclerotiorum* is an important disease of soybeans and sunflowers as well as numerous other plant species. It causes substantial losses in crop production throughout the world resulting in a reduction in quality and quantity of grain yields. However, it was only in the 1900s that SSR was considered a major pathogen of soybeans.

An increase in SSR incidence may be due to numerous factors, e.g. the cultivation of soybeans following Sclerotinia-susceptible crops, the expansion of soybean production into areas with favourable environmental conditions for disease development and the introduction of cultural practices such as irrigation and narrower row spacing. Crop losses due to SSR range from 0% - 100% and are dependent on susceptible varieties and environmental conditions conducive for pathogen development. Disease severity is positively correlated with the number of sclerotia and ascospores within infested soil and prolonged periods of foliar wetness, during and after crop flowering.

The pathogen was first reported on soybeans in 1924 in Hungary, but now occurs in all cool and moist areas of the world where soybeans are grown. It was first reported on soybean as causing SSR in South Africa, in 1979. SSR was first reported in South Africa in the Badfontein area of Lydenburg. Sporadic outbreaks were then reported in the Winterton/Underberg areas and more commonly in the Piet Retief areas of KwaZulu-Natal (KZN), particularly in wet years. Sporadic outbreaks were also observed on the Highveld in the Ermelo area.

Sclerotinia is usually a major problem in plants that have canopied well, with the result that it is the good soybean producers who are more at risk of their crops being infected. This is also possibly the main pathogen that has the potential of causing a collapse of soybean production in the Highveld. Outbreaks of SSR are becoming increasingly common and severe, rapidly spreading through fields and in some instances totally destroying the crop. In 2003, SSR was so severe on the Swaziland border of KZN that producers harvested their crops early in the season for use as silage, as it was predicted that there would be no grain yield.

The Sclerotinia strain in South Africa is not different from that found in the rest of the soybean world. No final solution

for the control of Sclerotinia has been found as yet and so research on this 'difficult-to-control' pathogen must continue using new and important treatments and methods.

With these facts in mind, together with the increased number of enquiries about Sclerotinia since the increase in soybean production in 2002, it was urgently recommended that the Protein Research Foundation (PRF), the Oil and Protein Seeds Development Trust (OPDT), the Agricultural Research Council-Grain Crops Institute (ARC-GCI), universities and chemical companies (e.g. Monsanto, Syngenta and Philagro) should work in a partnership and act as co-ordinators and financiers for finding solutions to the Sclerotinia problem. Funding for this research was made possible by the PRF, with projects usually lasting for three to four years.

The PRF founded a Sclerotinia Working Group (SSWG) in 2002 with Dr Jos de Kock appointed as the co-ordinator to achieve these goals. The members of the SSWG are all experts in their respective fields and have met together annually or bi-annually in 15 meetings from 2002 to 2013 in order to exchange knowledge and find solutions for the control of Sclerotinia. At the SSWG meetings, important information relating to the control of Sclerotinia, protocols for trial designs, national and international news and general information on Sclerotinia, was shared amongst committee members for the purpose of getting to know more about the pathogen, its epidemiology and control. The minutes of the meetings are published on the PRF website and are available to the public.

MANAGEMENT OF THE PATHOGEN

No single disease management practice effectively prevents infection of soybeans by *S. sclerotiorum*. However, the integration of various measures may reduce the severity of the disease and minimise yield loss. Management practices may be implemented at every stage in the pathogen's life cycle, ranging from prevention of *sclerotial* development to preventing apothecial formation and *ascospore* germination.

At the SSWG meetings, up-to-date knowledge on control methods is discussed and shared among members.

SEED TREATMENTS

The point of seed treatments is to keep the seed free of Sclerotinia. The presence of sclerotia in seed must be as low as 0,5%. If it is higher, then seed must be treated with chemicals.

Seed bought from seed companies invariably comes from clean fields, but it is a well-known fact that seed used by producers often consist of retained grain. This retention of grain for replanting poses a potential threat and has been identified as a source of dissemination of the disease since 'on-farm' quality standards may not be adequate. There is also a possibility of Sclerotinia infection within the seed coat itself especially with regard to grain retained as seed. Some mycelia could get into the seed, but it is unlikely that this could be a major source of inoculum and factor in the spread of the disease and so is not considered to be a problem. A clear distinction should be made between seed-borne Sclerotinia and sclerotia present in the seed.

The current options are mainly:

- **Sumisclex**
  The cost of Sumisclex is very high but it is currently the only chemical registered for the control of Sclerotinia on

Did you know?

No single disease management practice effectively prevents infection of soybeans by *S. sclerotiorum*.

The ARC-National Institute of Plant Protection (ARC-NIPP) has produced a prediction model for Sclerotinia which is available at the PRF offices.

soybeans, provided it is sprayed at the flowering stage. Although Sumisclex has been registered as a preventative fungicide against Sclerotinia, it remains uneconomical for use at the current soybean price. However, it does have other advantages besides Sclerotinia control for producers.

- **Benomyl**
  This is a very effective fungicide for the control of Sclerotinia but all registrations have been stopped in the US. There are no fungicides registered for control of Sclerotinia in the US for both preventative or corrective control.

- **Biozone 125 from Xenococ Bioworx**
  This is available to producers for the control of Sclerotinia. Good results for control were achieved especially when it was applied directly into the soil and when used in conjunction with other control methods. A lower control of the pathogen was achieved when it was applied above ground level in rainy and cold conditions.

TOLERANCE/RESISTANCE/ GENETIC ENGINEERING

The SSWG of the PRF has advised producers that a combination of agricultural practices and the use of soybean cultivars with higher levels of resistance need to be implemented in order to avoid serious yield losses. However, although resistant cultivars may provide sufficient means of control, little is known about the inheritance of resistance of soybeans to SSR. However, various sources of resistance that may aid in increasing the levels of resistance in existing germplasm have been identified. Research into the use of biocontrol agents against *S. sclerotiorum* is gaining in popularity as an alternative to possible chemical control options due to the lack of resistant varieties and concern over fungicide residues in the environment. Registration of biological control products must undergo the same procedures as those used to register chemical products. Good progress is being made with biological control but, as yet, it is not commercialised. The use of a combination of biological and chemical control has been found to be the most effective.

In 2005 the SSWG was encouraged to include biological control methods in their trials and researchers at the University of KwaZulu-Natal were including these in their glasshouse trials.

MODELLING

The ARC-National Institute of Plant Protection (ARC-NIPP) has produced a prediction model for Sclerotinia which is available at the PRF offices.

SUMMARY OF OUTBREAKS OF SCLEROTINIA

Report backs on soybean outbreaks were consistently given at the PRF/SSWG meetings.

- **2005/2006 season**
  During this season there was a fairly high incidence of Sclerotinia in sunflower and soybeans. Attempts were made

TABLE 1: SCLEROTINIA RESEARCH PROJECTS FUNDED BY THE PRF (2000 - 2012)

REF. NO.	INSTITUTE	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
535	ARC-Grain Crops Institute	Dr NW McLaren	2000	Evaluation of fungicides for the control of Sclerotinia stalk rot on soybeans.
659	ARC-Grain Crops Institute	Dr NW McLaren	2003	Evaluation of fungicides for the control of Sclerotinia stalk rot on soybeans.
708	ARC-Grain Crops Institute	Dr NW McLaren	2005	Evaluation of fungicides for the control of Sclerotinia stalk rot on soybeans.
735	University of KwaZulu-Natal	Dr PM Caldwell and Ms D Visser	2006	Studies on *Sclerotinia sclerotiorum* on soybeans.

to quantify the presence of Sclerotinia in the North West Province (NWP). Using information from silos in the drier areas e.g. Delareyville, no Sclerotinia on sunflower was reported. In the central areas of Coligny and Lichtenburg, there were reports of infection and in the middle regions of the NWP Sclerotinia infection levels were at 13,55%. Infection in the Magaliesberg Grain Co-operative (MGK) area was lower than 2%, but in Piet Retief it was as high as 30%. In KwaZulu-Natal infection was low but it did appear in lands that had previously been uninfected.

- **2006/2007 season**

  There was a marked decrease in the incidence of Sclerotinia in this season as environmental conditions were not conducive for infection. No infection occurred in the NWP. In Greytown, infection occurred very late in the season and about 25% to 30% of the artificially inoculated trials were infected. No Sclerotinia was found on any of the Pannar trials undertaken during this season. In Delmas, where there had been 100% infection in the previous season, there was no infection at all this season. In the Brits and Koedoeskop areas, soybeans under irrigation were infected and infection was reported in the Piet Retief area.

  About 45% of one of the centre pivot trials in the Winterton/ Bergville area was reported infected, and there was also infection in the commercial plantings. Infection occurred in about 15% to 16% in one of the dry land trials. Sclerotinia was present in the University of the Free State trials which were planted on land which had not had any soybeans planted on it for the past 20 years. Unexpectedly the soybean crops planted in the dry areas of Mpumalanga and Gauteng were infected. This could probably be attributed to the microclimate which had been created under the canopy of leaves which provided ideal conditions for infection to occur.

- **2007/2008 season**

  From this season onwards, at the request of the PRF, the Crop Estimates Committee (CEC) of the Department of Agriculture, Forestry and Fisheries (DAFF) sent out an annual questionnaire to producers to collect reports of any Sclerotinia outbreaks found in their soybean and sunflower crops. Information about the severity of the infection was not required. Grain SA encouraged the producers to respond to the questionnaire so that relatively accurate results could be obtained which could benefit producers as well. The survey was conducted amongst a random selection of producers of which 41% were sunflower producers and 31% were soybean producers. In this season there was a slight increase in Sclerotinia infection on sunflower but also a fairly high, increased incidence on soybeans. A 3,4% of the area planted to sunflower, i.e. 19 000 hectares, was infected by Sclerotinia, while 15,5% of the area planted to soybeans, i.e. 27 000 hectares suffered with Sclerotinia infection.

  Although there was a relatively low incidence of Sclerotinia in the NWP, a few severe cases had occurred with > 90% infection observed in certain fields of sunflower. The infection of Sclerotinia on soybeans in the NWP was negligible. Some plantings of sunflower in Lichtenburg were also infected. For the first time Sclerotinia also invaded the area to the west of Koster. Charcoal rot *(Macrophomina phaseolina)*, a world-wide disease, had also been observed here and this must not be confused with SSR.

Soybeans

A high incidence of Sclerotinia stem and pod rot was a distinguishing feature in soybeans. A total of 72 questionnaires were returned in which 24 producers confirmed that Sclerotinia infection had occurred on 4 907 hectares of the 17 740 hectares planted. In the 2005/2006 soybean season, infection occurred on 14% of the total area planted, 3% in the 2006/2007 season and 15,45% in the 2007/2008 season which represents 27,7% of the total hectares planted to soybeans. No infection was found on the demonstration strip trials at Piet Retief, but a 70% infection was estimated on the demonstration strip trials at Kinross. Infection broke out in new areas especially in the Middelburg region.

Other plants like khaki bush *(Alternanthera repens)*, cosmos *(Bipinnatus cav. Cosmos)*, common thorn apple ('stinkolie', *Datura stramonium*) and others had also been heavily infected by Sclerotinia. Sclerotinia infection was certainly a feature of the second half of the soy and dry bean production season in areas such as Winterton, Piet Retief, Delmas and Koedoeskop and it was even reported on dry beans in the Springbok Flats.

The occurrence of Sclerotinia infection on soybeans seemed to fluctuate, as 27,66% and 11,49% of the soybean crops included in the survey were infected during the 2008/2009 and 2009/2010 production seasons, respectively.

- **2009/2010 season**
  The incidence of Sclerotinia on soybeans was much lower during this season, but at the same time it was noticeably higher on dry beans, specifically in the areas around Potgietersrus and Roedtan. The Sclerotinia appeared at least two weeks earlier than had been the case in previous seasons, probably because of the favourable weather conditions. Producers on the Eastern Highveld had used Abacus as a foliar spray and had achieved a remarkable increase in yield. It was noted that Abacus, when used for the control of rust, also had a suppressive effect on Sclerotinia. The incidence of Sclerotinia in the areas of Bergville and Winterton was also higher than the previous season.

- **2010/2011 season**
  Severe Sclerotinia infection occurred in areas in the NWP on sunflower.

- **2011/2012 season**
  Only 112 people responded to the questionnaire of 2011/2012. A total of 26 respondents (23,21%) had Sclerotinia problems in the 2011/2012 season compared to the 23,33% reported in the 2010/2011 season. The total area of the respondents infected was 5 534 hectares of their total area of 52 443 hectares. In the 2011/2012 season 472 000 hectares was planted to soybeans of which only 2,4% was infected with Sclerotinia which is about the same as the previous season. Previously 77% of the respondents' land had been planted to maize, 9% had been planted to wheat with 6% to soybean and 2% utilised for cattle/stock.

- **2012/2013 season**
  Although it had been stated that problems with Sclerotinia were on the increase, this was not reflected in the results of surveys conducted over the past three years. This could however possibly be due to poor participation by lower numbers of producers. Grain SA volunteered to assist the CEC in their communication with producers about the Sclerotinia survey.

TRIALS CARRIED OUT AND FUNDED BY VARIOUS CHEMICAL COMPANIES

Philagro and BASF

Philagro and BASF carried out joint trials for the registration of Sumisclex under the leadership of Mr Henk van der Westhuizen. However, as Sclerotinia is a sporadic disease,

trials often did not provide results as no SSR infection occurred. Philagro has also been active in testing other products for the control of SSR. Results from trials using Sumisclex showed that the treatments increased the plants' general health against other unidentified diseases resulting in higher yields as the dose rate increased. Philagro was successful in being granted the registration for Sumisclex for both preventative and corrective applications.

BASF and Syngenta

In the 2003/2004 season, trials were planted in the Kamberg and Winterton areas and the protocol used was drawn up in collaboration with both BASF and Syngenta. Six replicates were used to ensure that there would be enough degrees of freedom in order to analyse the results statistically. A new experimental drug from BASF and Syngenta's Amistar were also included in the trials to see if it controlled Sclerotinia when sprayed for the control of rust. Statistical differences were seen in the trial results. The incidence of disease was at about 60% in the first trial but it was lower in the second trial.

The use of Sumisclex as a corrective treatment (at 1 - 2 litres/ha) gave good results and is justifiable. However, with the current registration of Sumisclex, it is probably not the most effective way to control Sclerotinia, because, although it is effective, it is too expensive. These trials also showed that the use of Amistar and the BASF experimental product to control rust do contribute to the control of Sclerotinia. Amistar proved to be an excellent preventative control fungicide but, if prices and rates are taken into account, it may not be suitable to control Sclerotinia. The BASF product, similarly, may not be economical due to its high cost although it could possibly be used in conjunction with other products such as Sumisclex. In 2010, the Registrar approved the registration of Sumisclex on soybeans with an application dosage of 1 litre/ha and the addition of the wetting agent Break ThruS240.

Philagro also carried out trials on the biological product Eco-77®. Results showed that this product seems to be very effective in the control of the disease, but its efficacy, together with the additive, still needs to be researched further.

Furthermore in 2010, Philagro also obtained the distribution rights for the biofungicide, Contans, a formulation of the mycoparasite, *Coniothyrium minitans*, that had been commercialised in America and Northern Europe, and was used on sunflower and canola. The biofungicide was worked into the soil, and it attacked and destroyed the sclerotia. It has to be applied annually, with the best results being obtained if it is applied post-harvest as the biofungicide is then given sufficient time to destroy the sclerotia. It is hoped that a seed company will soon co-operate in evaluating the product on soybeans and sunflower over a period of three years.

DISCUSSIONS WITH RESEARCHERS OF THE USDA, AGRICULTURAL RESEARCH SERVICE, NATIONAL SCLEROTINIA INITIATIVE AT FARGO, NORTH DAKOTA ON 22 JULY 2011

In a meeting of Mr GTDT Keun (PRF) with Dr Bill Kemp, the Centre Director of the USDA, Fargo, the vision and mission of the Northern Crop Science Laboratory was discussed with

Did you know?

Crop losses due to Sclerotinia stem rot range from 0% to 100%.

Sclerotinia stem rot now occurs in all cool and moist areas of the world where soybeans are grown.

Sclerotinia is usually a major problem in plants that have canopied well.

reference to three sections e.g. cereals, sugar beet, potatoes and sunflower. The funds allocated for research, are listed on the website *www.ars.usda.gov/research/docs*. Dr Kemp emphasised that his organisation concentrates on long term projects and results are made available publicly. He stressed the fact that budget cuts negatively affect their work and, therefore, they constantly look for private partnerships like the PRF and Oil and Protein Seeds Development Trust/ Oilseeds Advisory Committee (OPDT/OAC).

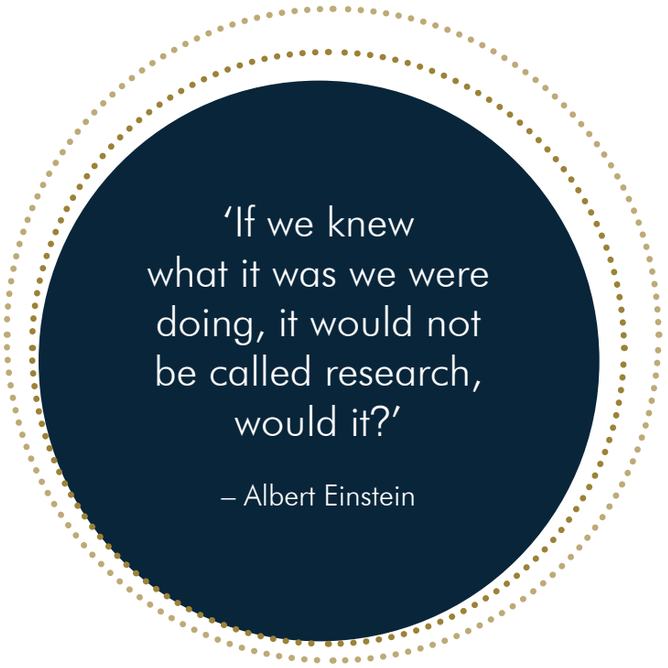
The PRF visiting committee met with several scientists on the National Sclerotinia Initiative where Dr TJ Gulya, a plant pathologist, is responsible for studies on the biology and control of all important diseases of sunflower, concentrating on Sclerotinia head rot and stalk rot, downy mildew and rust. He concentrates on germplasm evaluation and the improvement of these germplasms. The American Sunflower Association gives bursaries for PhD studies related to these topics. This work is done in collaboration with their geneticists.

A number of interesting perceptions were shared by Dr Gulya. He believes:

- It will be difficult to breed totally immune or tolerant cultivars but that there are nonetheless hybrid cultivars available which have high tolerance to the infection.
- Fungicide applications will always be necessary depending on the infection.
- That crop rotation and tillage practices are equally important.
- That yield and oil content remain the most important aspect of soybean production, followed by the other traits.

Other issues that are studied are:

- The disease resistance of cultivated breeding lines and wild sunflower to determine the inheritance of resistance.
- Developing greenhouse inoculation methods to accelerate the breeding progress.
- Monitoring disease distribution by way of annual surveys, identifying races of rust and downy mildew.



About 75 lines are evaluated every year in three trials for stalk rot and two trials for head rot. With this information they are able to rank the cultivars.

Other issues discussed at the meeting were that their stalk rot trials are infected by way of an inoculum; for the head rot trials the correct environment by way of irrigation (mist) had to be met; from time to time it is necessary to plough to bury the sclerotia using an inversion plough.

The PRF tries its utmost to stay in continuous contact with the National Sclerotinia Initiative and other researchers, private companies through web studies and direct liaison in order to stay abreast of the latest developments in the world relating to this problem. The last follow-up visit to Fargo, Dr Kemp and several of his colleagues by Messrs Scholtemeijer and Theron of the PRF took place in June/July 2015.

Dr Pat Caldwell
Dr Jos de Kock

» Advanced stage of Sclerotinia

5.1 UNDER THE LOUPE

CANOLA

The PRF and canola production in South Africa

Canola is the second largest oil seed crop in the world with a total production of 70 million tons per annum (2015). Countries with the largest production are located in Europe, notably France, England and Germany, and others are China, Canada and Australia.

CANOLA IN SOUTH AFRICA

Canola is a relatively new crop in South Africa. Shrinking profit margins from cereal crops as a result of low prices and rapidly increasing input costs during the late 1980s, gave rise to the need for alternative cash crops that could be cultivated in the Swartland and Southern Cape. This led to the seeds of four crops being imported for evaluation purposes, namely canola, linseed, sunflower and safflower. These crops were tested in various locations in the Swartland and Southern Cape over three years from 1990 to 1992, before it was decided that canola showed the most potential and that the emphasis would fall on this crop. Although European and Canadian cultivars were also tested initially, the highest yields were obtained with cultivars from Australia.

During 1992, 30 producers started growing canola on a commercial scale and a total of approximately 400 tons of canola was produced on 400 hectares. From these humble beginnings the canola industry has grown rapidly, particularly in the Southern Cape, and based on the seed orders in 1996, it was evident that approximately 15 000 hectares had been planted under canola in this region. The cultivation of canola in the Southern Cape was promoted further through the founding of the company Southern Oil Ltd (SOILL) in 1996, and the establishment of an oil crushing plant at Swellendam. Although production did not increase rapidly in the Swartland, the construction of an oil mill at Moorreesburg during 1998/1999 also promoted the production of canola in this region.

In 1994 the Protein Research Foundation (PRF) made the first canola research funding available to a project of Dr DB Arckoll from Elsenburg Agricultural Development Institute, which was entitled *The introduction of canola as an alternative crop for the Western Cape*. This was followed by a second project from Dr Arckoll in 1996 with the emphasis on the rotational benefits to other crops in the Western Cape.

This formed the basis for a monumental research project by Dr MB Hardy, also from the Elsenburg Agricultural Development Institute, entitled *An investigation into the production dynamics of eight crop rotation systems, including wheat, canola, lupins and pasture species in the Swartland, Western Cape* (1996 - 2012). The PRF has continuously funded canola research projects from 1996 to the present day, and the production of canola, particularly in the Southern Cape, grew rapidly.

CHALLENGES FACING THE CANOLA INDUSTRY

Regrettably the new canola industry experienced problems with marketing and quality which hampered the momentum of canola production. Discussions were held with the most important role-players in the Western Cape and it was concluded that canola was a useful source of protein that could contribute towards the replacement of imported oilcake. It was accepted that expertise from Elsenburg Agricultural

Development Institute was needed to guide the producers. Both producers and consumers of canola were optimistic about the canola project and a special canola promotion campaign was envisaged for 1997.

After extensive negotiations with the most important role-players, a PRF Canola Working Group was established on 2 September 1997 and it tackled its task with great enthusiasm (see Extract 1 on page 76).

The initial marketing and quality problems experienced, were largely overcome and the working group agreed that a potential market existed for more than 100 000 tons of canola grain per year. It was felt that canola could be a solution to the surplus wheat production in the Western Cape. In addition, it was ideal for cultivation in rotation with wheat, because it was effective in the control of ripgut brome *(predikantsluis)*.

The greatest problems faced by the canola industry at that stage were storage space and successful storage. At the request of the working group, a special meeting was convened between the executive committee of the PRF and the so-called Group 14 Co-operatives. This meeting was held in January 1998 and the storage problems were discussed. Although canola was still largely an unknown crop in South Africa, it was the most important oilcake source of protein for animal nutrition world-wide after soybeans, so it was agreed that in many instances it would not be necessary to reinvent the wheel.

At the request of the PRF, together with its financial backing and as a first step towards technology transfer, Elsenburg arranged for the publication of a brochure on the cultivation of canola before the 1998 planting season. Several information days were also held where advice was given to producers and it was also agreed to immediately commence with national cultivar trials which were all funded by the PRF.

Since canola was unknown in the market, the PRF also funded a range of nutrition experiments undertaken by Prof RM Gous from the University of KwaZulu-Natal, with a view to utilising canola in full-fat form in broiler feeding. The success of these experiments immediately opened doors for the emerging canola industry. All parties agreed that the oilcake produced from canola together with sweet lupin production, could replace a considerable portion of the imported protein that was consumed in the Western Cape.

In 1998, canola was added to the duties of the PRF contractor, Mr H Agenbag, who was initially contracted to promote lupin production.

As early as its second meeting, in 1998, the Canola Working Group made urgent representations to the PRF requesting that immediate attention be given to the handling and storage problems experienced in the canola industry at that time. Mr GJH Scholtemeijer led a three-man delegation from the PRF to Australia, together with one representative each from the Southern and Western Cape co-operatives, where similar problems had been experienced. This mission turned out to be very successful. It found that aeration equipment and sufficient air-flow for the storage of canola was the main solution with the result that the most serious constraints could be addressed in the near future. This first contact made with the canola industry of Australia, proved to be fruitful for the young South African industry, since by 1998 Australia was already producing more than one million tons of canola per annum.

As with other commodities, the formation of a working group proved to be the appropriate way to set about growing the industry. The members were very active and various new projects were launched immediately.

The national cultivar trials under the guidance of Mr Dirk Hanekom from the Department of Agriculture, Western Cape at Elsenburg, together with a number of collaborators, were undertaken at short notice and planted in the various regions. They were completed successfully, as were many

more trials which followed up to 2014. Trials planted by Prof GA Agenbag from the University of Stellenbosch, presented the producers with very interesting information. Under the guidance of Dr Arckoll of Elsenburg and a supporting committee, the working group also published a pamphlet entitled *Canola cultivation*, before the planting season. This pamphlet was well received amongst producers and potential producers of canola.

One of the most important achievements of the working group during 1998 was the industry wide acceptance of grading regulations. Since these actions were voluntary, it proved that the working group, which comprised a cross-section of stakeholders, have always made a valuable contribution to the successes of the canola industry. The working group also requested the PRF to fund a newsletter, *Canola Focus*, which was first published at the end of 1998, under the supervision of Mr Agenbag, and is still published at regular intervals. The PRF is indebted to the editorial committee for their excellent work (see Extract 2 on page 77).

A significant factor contributing to the successful cultivation of canola at that time was the good market for the commodity. Pre-planting contracts were readily available and the demand considerably exceeded the supply. During 1999, the world production of canola totalled 43 million tons, whereas South Africa's contribution was a mere 23 000 tons.

In accordance with PRF policies, the Canola Working Group also set certain targets to measure progress with canola production. The projection for 1999, was 40 000 hectares and 60 000 hectares for the year 2000. It was also generally accepted that the potential existed to establish 100 000 hectares of canola within normal crop rotation systems alongside other crops such as wheat and lupins.

Unfortunately, canola was adversely affected by unfavourable conditions for several years and the projected targets were not met. A period of relative stagnation set in until 2010. Nonetheless, activities supporting the canola industry continued regardless. In 1999, two local scientists were sponsored to attend the international canola congress in Canberra, Australia. The resolved storage problems now gave rise to the expansion of the correct method of storage which resulted in the development of correct canola storage practices by, amongst others, SOILL and Moorreesburg Koringboere Beperk (MKB), who constructed fully-equipped silos with sufficient aeration and a refrigeration unit. This plant was indeed a model for more to follow.

The project by Dr MB Hardy, entitled *An investigation into the production dynamics of 8 crop rotation systems, including wheat, canola, lupins and a pasture species in the Swartland, Western Cape* (1996 - 2012), was undoubtedly one of the primary factors contributing to the successful establishment of canola in the Western Cape. In 1999, he created considerable interest with a publication entitled *Canola's contribution to wheat yield and quality*. The most important advantages of canola in a rotational cropping system were pointed out to producers:

- Firstly, canola's deep taproot system functions as a biological plough, which helps to remove compaction layers developed by tillage.
- Secondly, canola breaks the disease cycle of wheat.
- In the third instance, canola is very effective in controlling 'predikantsluis' in wheat. The alternative would have been to use costly chemical control methods.

The project by Dr Hardy gave rise to various possibilities concerning crop-rotation. Wheat monoculture production became increasingly more difficult from 1996 due to decreasing profit margins. Mr WH Hoffmann under the leadership of Prof Laubscher did his M Agric Admin (Agricultural Economics) on the advantages that crop-rotation had above monoculture wheat, such as higher yield for wheat in the system and reduced input costs mainly due to cuts in fertiliser, herbicides and pesticides.

Due to a lack of reliable information with regards to canola in a crop-rotation system, a multidisciplinary panel of experts were used to obtain information concerning certain aspects of crop rotation. The anticipated profitability could thus be determined. The results of the study showed that crop-rotation systems with canola and lupins showed good results, while systems consisting of wheat and pastures also seemed to be more profitable than wheat monoculture. In 2011 Dr Hoffmann wrote a report to the PRF concerning the economic contribution of canola in crop rotation in typical farming units in both the Swartland and Southern Cape. This pioneering research certainly paved the way for a better understanding of the financial benefits of canola to the farming community as a whole.

PESTS ON CANOLA

Photo 1 (above): Black stem lesions on a canola leaf
Photo 2 (left): Slugs were a serious problem before 2004
Photo 3 (below): Bollworm on a canola pod

In November 2000, the PRF and the Department of Agriculture, Western Cape, hosted a Canola Expertise Forum at which researchers had the opportunity to give brief accounts of their projects, so that the stakeholders in the canola industry could gain a better understanding of the issues that were being addressed by researchers.

In view of the successes over ten years of staging the Super Soy Competition in KwaZulu-Natal, the PRF and the Department of Agriculture, Western Cape agreed to host a similar competition to promote the production of canola in the winter rainfall region. This joint project was officially launched in November 2000.

The Super Canola Competition, popularly known as the 'Canola Farmer of the Year' competition was launched in March 2001. It was a great success and made deep inroads into the expansion of canola production in the ensuing years. In keeping with the policy of the PRF, to have producer members present at working group meetings, the Canola Bedryfskomitee (CBK) were approached to nominate two members, one each from the Swartland and the Southern Cape to attend PRF Canola Working Group meetings. At the same time, the CBK joined Grain SA where they were accommodated as an integral part of the Grain SA Oilseed Working Group. The benefit of the new dispensation meant that Grain SA nominated producer members to attend the PRF Canola Working Group meetings and this served as a stimulus to improve co-operation between the PRF and Grain SA.

In order to improve co-operation between the parties involved in the Swartland, Western Cape, the PRF decided to join forces with the Department of Agriculture, Western Cape as well as Moorreesburg Koringboere Beperk (MKB) and Porterville Landboukoöperasie (PLK) in 2000, to partner in the Swartland Kleingraan Ontwikkelingsgroep (SKOG) initiative. This involvement implied that the PRF could ensure that the necessary trials and promotion of both canola and lupins could take place at the two official SKOG information days each year.

In 2001 a Board meeting was held at Port Alfred followed by discussions with directors and senior staff of Chicory SA, as well as representatives of the pineapple industry, with the intention of establishing a crop rotation experiment with soy, canola and their commodities. Both industries had experienced immense problems with nematodes and the possibility of the suppression of nematodes by canola was interesting to them. Obviously it also served to expand the canola production area.

Although canola production did not meet the targets of the working group, the PRF was still pleased with the growth from just more than 1 000 hectares in 1993 to just over 44 000 hectares in 2003 (see Table 1 and Graph 1 on page 73).

Several other problems also raised their ugly heads such as the disease known internationally as Blackleg. Once identified, it was agreed that the limited research that was being done at that stage should be increased considerably.

The Board also agreed to a recommendation by the working group to form a specialist working group on snails which had become a serious problem. The name of this working group later changed to that of 'The Working Group for the Better Establishment of Canola', in order to serve an even wider purpose than just snails. Two literature studies, one on snails and the other regarding insects with particular reference to isopods, were also published in 2004.

Did you know?

During 1992, 30 producers started growing canola on a commercial scale and a total of approximately 400 tons of canola was produced on 400 hectares.

The Super Canola Competition, popularly known as the 'Canola Farmer of the Year' competition, was launched in March 2001.

TABLE 1: CANOLA PRODUCTION IN THE WESTERN AND SOUTHERN CAPE FROM 1992 - 2010
AREA PLANTED – AMOUNT PRODUCED – YIELD PER HECTARE

YEAR	HECTARES	TONS	YIELD T/HA
1992/1993	400	400	1
1993/1994	1 170	1 000	1,17
1994/1995	5 230	4 500	1,16
1995/1996	14 320	16 000	0,90
1996/1997	10 880	12 600	0,86
1997/1998	15 720	14 800	1,06
1998/1999	17 000	21 000	1,24
1999/2000	25 000	23 000	0,92
2000/2001	21 145	26 549	1,26
2001/2002	27 000	25 750	0,95
2002/2003	33 000	37 975	1,15
2003/2004	44 200	40 770	0,92
2004/2005	44 250	32 000	0,72
2005/2006	40 200	44 200	1,10
2006/2007	32 000	36 500	1,14
2007/2008	33 200	38 150	1,15
2008/2009	34 000	30 800	0,91
2009/2010	38 060	45 660	1,20
2010/2011	34 820	36 900	1,06
2011/2012	43 510	58 800	1,35
2012/2013	44 100	79 650	1,81
2013/2014	72 165	112 000	1,55
2014/2015	95 000	123 500	1,30

GRAPH 1: CANOLA PRODUCTION IN THE WESTERN AND SOUTHERN CAPE FROM 1992 - 2010
AREA PLANTED – AMOUNT PRODUCED – YIELD PER HECTARE

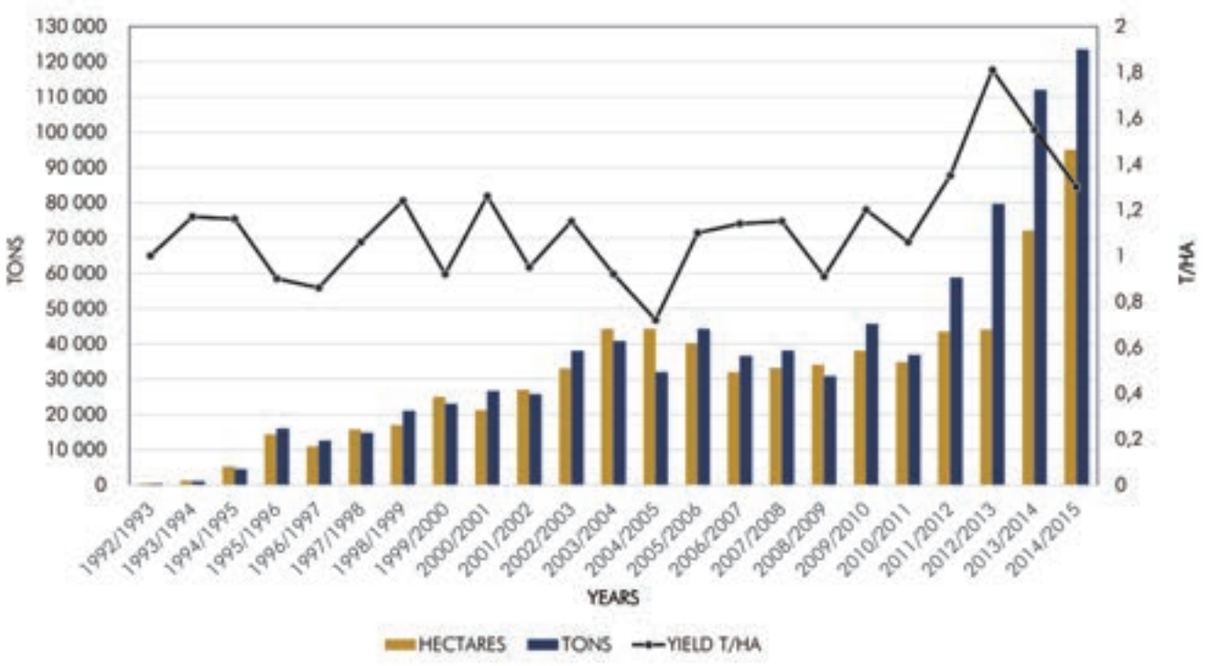


Photo 1: Blackleg crown rot

During this year, a problem already identified around the globe, occurred in the Western Cape when crops began to demonstrate resistance to chemicals. The first indications were that ryegrass could become an even bigger problem to the Western Cape producers. Canola became very attractive to wheat producers, who were experiencing ryegrass problems. A working group examining this aspect did not yield any positive results. Unfortunately only haphazard attention has been given to this problem in past years. It remains a serious topic that will have to be addressed earnestly in the near future since it is a much wider problem than one which only affects the wheat industry.

Prof Agenbag undertook to draw up a manual called *The Canola Production Manual*, which was launched successfully. This research also qualified for Thripp funding and R500 000 was paid over to the University of Stellenbosch in its activities to promote canola. It is of significance that this funding was awarded to the university in view of the fact that they had an industrial partner in the PRF.

Although the canola industry had only been going for 13 years it was not expanding at the rate the PRF had expected. Accordingly the Board negotiated with Dr De Kock to launch a radio programme on canola. Dr De Kock and his colleagues developed a hugely successful programme, comprised of 30 individual weekly topics. This project can certainly be described as one of the very best activities in technology transfer that the PRF had embarked upon up to that point in time.

In 2008, official grading, packaging and marketing regulations, targeted for sales in South Africa for canola, were accepted by the Department of Agriculture, according to the law on Agriculture Production Standards – Act 119 of 1990.

Every year discussions would arise around the quality of canola cultivars especially in view of the persistently low yields. There had been a limited availability of seed of the best cultivars which was regarded as the prime cause of the stagnation of the canola industry. This prompted the PRF to pay a visit to leading seed companies in Australia. As a result of this,

Photo 2: Black lesion on seedpod

a Memorandum of Understanding (MOU) was signed with Pacific Seeds. A good relationship was also established with the Australian Oilseeds Federation (AOF) and the PRF extended an invitation to the Chairman of the AOF, Mr T Potter, to visit South Africa during 2011.

Although canola production flourished for several years, it stagnated from 2003/2004 until 2012/2013. When lupin research funding was cancelled due to the lack of growth, the PRF decided to reconsider the canola position and, taking into account the success of the soybean generic marketing programme, it was decided to implement a five year programme aimed at regenerating the canola industry. This seemed justified, taking into account the fact that international growth patterns and global production levels had already reached the 60 million ton mark. An additional incentive at the time was the low and uneconomical wheat price, which placed the industry under considerable pressure.

The PRF also decided to conduct a survey in the canola industry using a questionnaire which was aimed at determining the reasons why producers were not entering the industry. Various research institutions which had been approached to do this indicated a time delay that was not acceptable to the PRF so the research was conducted internally under the guidance of the Vice-chairman, Mr Joubert, assisted by Prof Agenbag and others.

In order to provide additional support to the canola effort, the PRF negotiated an agreement with the University of Stellenbosch, to make Prof Agenbag, a nationally acclaimed agronomist and expert in winter cereal crops, available to the PRF so he could be more widely involved in canola promotion activities, especially in the Western Cape. The PRF also decided to appoint Mr AP Theron, a well-known leader in agricultural circles and a canola producer, to the PRF Board. In addition, Mr K Schonken, a well-known and successful producer in the Western Cape, was appointed to the Canola Planning Committee.

A marketing drive, based on income and cost budgets, entitled 'The Extra Quarter Ton', was also launched to make the canola producers more conscious of the financial benefits of canola farming. Up to this stage, canola had mainly been planted as a means to combat ryegrass problems in wheat, whereas it was actually already a cash-crop in its own right.

Based on the success and the impact of the study to determine the potential of soybean production in South Africa, the PRF also requested a similar study for canola. In 2012 an agreement was reached with Dr Hardy, to conduct a research project on the *Determination of the area of arable land suited to canola production in the Western Cape*. This study indicated that virtually 750 000 hectares were suitable for the production of canola in the Western Cape Province (see Extract 3 on page 78 - 81).

The results of the generic marketing programme and all the additional effort, which had begun in 2010, also produced immediate results. The production of canola on 34 820 hectares in 2010/2011 has increased annually to 95 000 hectares in 2014/2015, with a total production of 123 500 tons.

The PRF is very positive that the trend of increased canola production in the Western Cape will be maintained for several years to come and that the goal to produce 250 000 tons on 150 000 hectares in 2020, will be reached.

Gerhard JH Scholtemeijer

EXTRACT 1

BYLAE D

N O T U L E

VAN DIE STIGTINGSVERGADERING VAN 'N CANOLAWERKSGROEP VIR DIE WES-KAAP SOOS GEHOU OP 2 SEPTEMBER 1997 OM 11:00 TE ELSENBURG.

1. **OPENING EN VERWELKOMING**

Mnr G J H Scholtemeijer van die Proteïennavorsingstrust rig 'n woord van verwelkoming tot almal wat die vergadering bywoon.

2. **PRESENSIE**

NAAM	INSTANSIE	FAKS NR
Willem Stander	Meadow	021 872 7551
J A Joubert	MKB Moorreesburg	0264 3 2956
D W Bester	CBK	0264 3 2427
D B Swart	CB	0291 3621
Johan Pietersen	SSK	0291 4 1169
Johan Swart	SSK	0291 4 1169
Piet van Wyk	Pioneer Voere	0224 2 3752
Ludwig Zietsman	Pioneer Voere	0224 2 3752
Frik Potgieter	WPK	0224 2 1953
Tienie du Plessis	WPK	0224 2 1953
Francois Potgieter	Sensako	02841 ~~4 2644~~ 5969
Johan Lusse	CRK	0281 2 1521
Sandra Lamprecht	LNR-NIPB	021 883 33285
Nick Kotzé	Agricol	021 981 1120
Loubser Wille	Agricol	021 981 1120
Johan de Lange	PLK	02623 ~~2134~~ 2603
Herman Agenbag	PNT	021 808 ~~5271~~ 5120
David Arkcoll	Elsenburg	021 808 ~~5275~~ 5120

3. **VASSTELLING VAN SAKELYS**

Mnr Scholtemeijer verduidelik kortliks die sakelys.

4. **AGTERGROND**

Mnr Scholtemeijer skets die agtergrond wat tot die bymekaar roep van belanghebbendes in die canolabedryf gelei het. Hy wys daarop dat die PNT canola as een van die potensiële produkte beskou wat kan meehelp om die proteïen tekort in Suid-Afrika te verminder. Na 'n volledige uiteensetting word kortliks bespreking gevoer oor die PNT en sy aktiwiteite.

5. **EVALUASIE VAN BESTAANDE INFRASTRUKTUUR**

Die voorsitter reël dat verteenwoordigers van verskillende belange groepe, elkeen die geleentheid sal kry om hulle waarneming van die stand van die bedryf te skets.

2/...

Minutes of the inaugural meeting of a Canola Working Group held on 2 September 1997 at 11:00 in Elsenburg

EXTRACT 2

CANOLAFOKUS

Mondstuk van die canolawerkgroep

Januarie 2015 No. 63

Sclerotinia stamvrot (*Sclerotinia sclerotiorum*)

Piet Lombard (Wes-Kaapse Dep. Van Landbou) & Jannie Bruwer (Bayer)

Die voorkoms van Sclerotinia het in Australië en Kanada toegeneem met 'n toename in oppervlak onder canola verbouing. In die Wes-Kaap het die opppervlakte onder canola gedurende die afgelope drie seisoene verdubbel en omdat die klimaat in die Overberg en Swartland baie geskik is vir die ontwikkeling van die siekte het die siekte baie algemeen in veral die Overberg voorgekom oor die afgelope vier seisoene (2011 tot 2014). *Sclerotinia* is 'n siekte wat canola maar ook baie ander breëblaar gewasse infekteer. Lupiene is baie vatbaar en in die Swartland kom dit op lupiene voor tot in die Eendekuil gebied. Onkruid soos duwweltjie en ramenas is ook gashere van die siekte, maar erte en fababone is egter minder vatbaar. *Sclerotinia* stamvrot (figuur 1) kom slegs sporadies voor wanneer die klimaatsomstandighede gunstig is vir die ontwikkeling van die siekte en gevolglik wissel dit tussen jare, produksiestreke en selfs van land tot land.

Risiko faktore

1. **Vog**

   Vog is baie belangrik vir die ontwikkeling van die *Sclerotinia*. Hoë grondvoginhoude met ligte reën wat voorkom in die periode twee weke voor die aanvang van blom en gedurende die blomstadium sal die risiko vir *Sclerotinia* infeksie baie verhoog, terwyl droë klimaatstoestande die ontwik-kel ing van die siekte sal beperk.

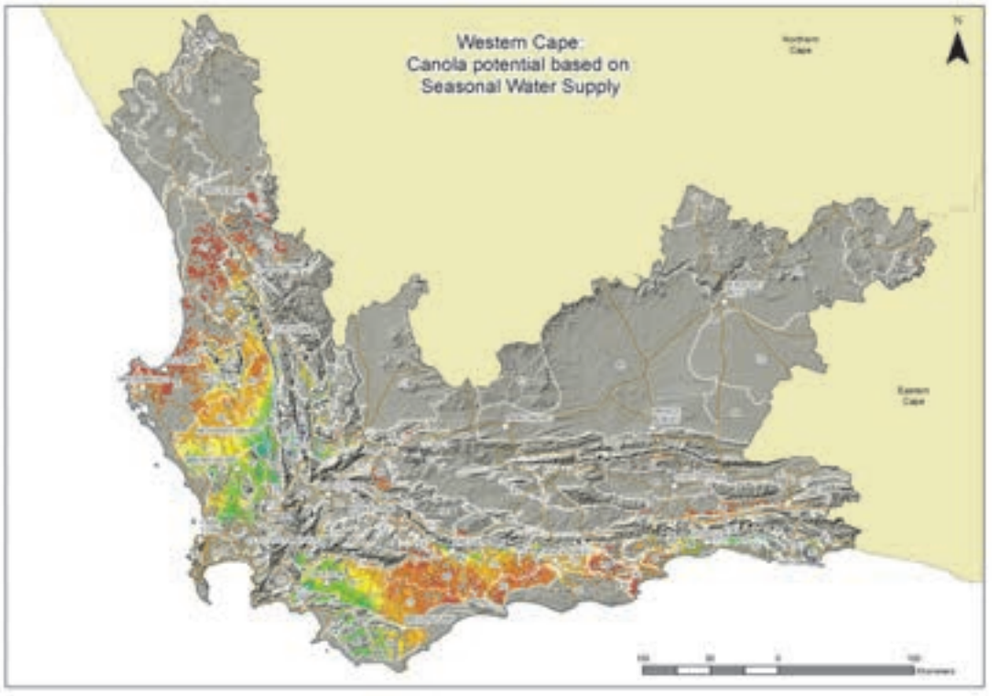
Figuur 1: *Sclerosiums* in stam van canolaplante

Canola Focus, January 2015, no 63

EXTRACT 3

Determining the area of arable land suited to canola production in the Western Cape

Volume 1: TEXT



FINAL REPORT

Determining the area of arable land suited to canola production in the Western Cape

VOLUME 1 - TEXT

Dr MB Hardy, Agri Services, 22 van Riebeeck Street, Montagu 6720
(Independent Agricultural Research Consultant)

Mr MG Wallace, Institute for Resources Utilization,
Department of Agriculture: Western Cape, P/Bag X1, Elsenburg 7607

Western Cape Government
Agriculture

June 2013

Determining the area of arable land suited to canola production in the Western Cape

EXTRACT 3

Executive summary

Final Report: Determining the area of arable land suited to canola production in the Western Cape

Dr MB Hardy, Agri Services, 22 van Riebeeck Street, Montagu 6720
and
Mr MG Wallace, Department of Agriculture: Western Cape, P/Bag X1, Elsenburg 7607

Introduction

The objective of this study was to determine the total area of rainfed arable land suited to canola production, and to develop tables and maps showing canola production regions in the Western Cape Province. Data sets from the DAWC and PICES provided baseline data on the areas of land allocated to rainfed crop and crop pasture production systems, averaged over the past ten years, for all Relatively Homogeneous Farming Areas (RHFA) in the Province. Evaluation of these data resulted in an estimate that approximately 800 000ha of arable land in the Western Cape would be suited to rainfed winter cereal crop production systems (see Table 2 on page 81).

Data and simple relational models were identified from international and local literature that predicted the effects of thermal time (growing degree days – GDD), photothermal units (PTU) and seasonal water supply (SWS) on the growth and development of canola. The potential effects of these environmental variables on the growth and development of canola were quantified using a GIS modelling framework for each RHFA in the Western Cape.

Growing degree days

With few exceptions there were sufficient accumulated growing degree days (GDD) for medium maturity type conventional canola cultivars to achieve 50% flowering within 90 days from planting in all rainfed cultivated areas suited to winter cereal crop production systems in the Western Cape. This result is based on a planting date of 1 May in Region 1 and 15 April in Region 2 (see Table 2 on page 81).

Photothermal units

Accumulated photothermal units (PTU) for each of three growth phases identified for canola i.e. Phase 1 – planting to 50% flowering; Phase 2 – flowering; Phase 3 – post flowering to physiological maturity, were quantified for medium maturity type conventional canola cultivars in each RHFA. The results indicated that almost all of the cultivated lands used for rainfed winter cereal crop production systems received sufficient PTU for Phases 1 and 2 but that insufficient PTU were available for canola plants to complete their physiological development to achieve optimum production during Phase 3 – a 30-day period in our model. However, under ideal temperature and soil water availability conditions during Phases 1 & 2, the end of flowering stage is likely to be completed in a shorter time frame than the 45 days allocated to flowering in our modelling of the physiological development of the canola plant. Under such conditions there should be sufficient PTU to allow canola to achieve normal (non-stressed) physiological maturity during Phase 3 in most RHFAs.

Determining the area of arable land suited to canola production in the Western Cape (continued)

EXTRACT 3

These observations on accumulated PTU are based on average long-term temperature data. However, most grain producing regions of the Western Cape experience extended periods of dry, hot weather during the growing season. Often these extended dry, hot periods occur during Phase 1 (in May) and/or in August/September (late Phase 2 and early Phase 3). Therefore, whilst there are sufficient PTU available, the potential physiological development of canola could be often be limited by excessive temperatures and/or by available soil water which, in turn, tend to extend the number of days required for each growth phase. In addition, the physiological development of the canola plant is often limited towards the end of Phase 3 through temperature- and/or water- stress induced physiological maturity thus limiting the potential of the plant to utilize available PTU.

In general, however, our modelled results indicate that, on their own, accumulated GGD and PTU are not limiting factors to the growth and development of canola in the rainfed crop a pasture production areas of most RHFAs in the Western Cape

Seasonal water supply

Seasonal water supply (SWS) is recognised as the main environmental factor influencing canola production. Predicted canola production, based on a SWS x WUE model, in the present study did not provide, in comparison with known long-term potential yields, realistic estimates of canola yield potential across all RHFAs. However, the range in predicted yields from "low", through "intermediate" to "high" production potential provided a useful guideline towards allocating the RHFAs into "low", "intermediate" and "high" canola production potential categories. The total area that was estimated to be suited to canola production based on SWS-yield predictions was about 875 000ha which is greater than the area of cultivated land suited to cereal grain production systems suggested from the DAWC and PICES data sets.

The one major environmental variable that has a major influence on the production potential of all crops that was not taken into account in our model was the soil. This was due to the fact that sufficiently detailed regional soil classification data were not available for the purposes of this study. We therefore relied on the inputs of experienced field-crop advisors from the grain producing regions to assist in verifying, and adjusting where necessary, the area of each RHFA suited to canola production that resulted from the SWS-based yield predictions.

Identified areas suited to canola production in the Western Cape

Integration of local experience with the modelled effects of environmental factors on canola growth and development yielded the final outcomes of our efforts towards identifying areas suited to canola production in the Western Cape.

The total area of cultivated land suited to rainfed canola production in the traditional winter cereal production sub-Regions of the Swartland and the Southern Cape is estimated at 743 500ha. We estimate that thirty seven per cent of this area (273 000ha) has high production potential, 56% (42 000ha) has intermediate production potential, and 7% (50 300ha) has low production potential. Division of the RHFAs into the low, intermediate and high production potential categories is debateable. This is particularly so for the RHFAs located in Region 2 due to the gross underestimation of actual long-term yields by the SWS-yield prediction of our modelling efforts. The Hoffmann expert consensus data provided some guidance but more area-based, field-scale yield data would be required to improve allocation of RHFAs (or portions of RHFAs) into the production categories (see Extract Table 2 on page 81).

Determining the area of arable land suited to canola production in the Western Cape (continued)

EXTRACT 3

"New" production areas with intermediate to high production potential totalling approximately 19 00ha have been identified whilst "marginal" production areas that include areas of low, intermediate and high production potential total approximately 24 000ha.

Areas allocated to the miscellaneous production areas total about 12 000ha and are included in this category due to the small size of lands, poor soils and high risk associated with canola production.

We recommend that canola production should be promoted on the estimated 743 500ha of traditional crop and crop/pasture production areas. We further recommend that additional detailed investigation of the occurrence, timing and duration of frost during the growing season, and/or the physical and chemical suitability of soils in the many RHFAs listed in the "new" and marginal areas as well as in the "miscellaneous" areas is required before canola production could be promoted in these RHFAs.

Determining the area of arable land suited to canola production in the Western Cape (continued)

TABLE 2: EXTRACT FROM: DETERMINATION OF THE AREA OF ARABLE LAND SUITED TO CANOLA PRODUCTION IN THE WESTERN CAPE

	PRODUCTION POTENTIAL		
A. TRADITIONAL GRAIN AREAS	**HIGH**	**INTERMEDIATE**	**LOW**
Region 1 (ha)	161 877	141 683	50 301
Region 2 (ha)	111 175	278 470	
Total (ha)	273 052	420 153	50 301
B. 'NEW' AND MARGINAL AREAS	**HIGH**	**INTERMEDIATE**	**LOW**
Region 1 (ha)	12 598		2 000
Region 2 (ha)	8 148	9 037	11 005
Total (ha)	20 746	9 037	13 005
C. MISCELLANEOUS AREAS	**HIGH**	**INTERMEDIATE**	**LOW**
Region 1 (ha)	932	2 028	3 455
Region 2 (ha)	2 334	3 037	586
Total (ha)	3 266	5 065	4 041

Region 1: Swartland and Caledon-Rûens

Region 2: Southern Cape

	GRAND TOTALS (HA)
A. Traditional grain areas	743 506
B. 'New' and marginal areas	42 788
C. Miscellaneous areas	12 372

High, intermediate and low production categories for:

A. Traditional grain production areas

B. 'New' and marginal production areas

C. Miscellaneous production areas

5.2 PROMOTING CANOLA

CANOLA

The Canola Competition in the Swartland and Overberg

Canola has been grown by commercial producers in the Swartland and Overberg since 1992. Until 2003 the area under canola production grew rapidly but then it stagnated influenced by low yields and low prices, in other words, low profitability.

The Protein Research Foundation (PRF) approached the Department of Agriculture, Western Cape in 2001 to assist them in promoting canola production by providing research information. They decided to launch a competition that was similar to the soybean competition in KwaZulu-Natal as part of the PRF strategy to promote canola production through technology transfer. This required more research by certain role-players, crop rotation demonstrations, farmer/information days and then, the Canola Competition.

The Canola Competition may essentially be considered a study group of canola producers who wished to learn more about producing canola. It could address most of the production techniques that could lead to higher yields. The economy and profitability of canola was also analysed and addressed in the process. When the competition was launched in 2001, producers were invited to participate. The group of participants would form the core members of the study group and essentially they pioneered local canola production by discovering and implementing best farming practices and in doing so, became role models.

Each year the competition started with a visit to all participants individually. During the visit the participant decided which field he would enter, soil samples were taken at the planting site and plants were counted. Later in the growing season, a follow-up visit was paid to the selected site. During this visit, weed and insect control measures which had been implemented by the participant were evaluated and the general vitality of the plants was also determined. At each visit general canola growing aspects were discussed with the participant and the visits were also opportunities to complete the competition data documents.

> 'Competition is the incentive to progress.'
>
> – Herbert Hoover

During August and September field days were arranged when participants were taken on to the fields entered by other participants. Guest experts were also invited to these field days (photo 1), particularly to answer any questions that the participants had. These field days also served as evaluation days during which production practices at the fields visited were discussed or analysed.

At harvesting time, or shortly after harvesting, the participants were visited again to discuss the harvest and harvesting techniques. The data forms were also completed during the harvest visit. Samples of canola seed were also taken for analysis of the protein and oil content.

After all the visits the information obtained according to the data forms were processed as follows:

- **Sowing densities** – the average weighted yields of all participants that sowed between 4,1 kg and 5 kg were compared to the weighted average yields of participants that sowed between 5,1 kg and 6 kg.

- **Nitrogen fertiliser levels** – the average weighted yields of all participants that applied between 61 kg and 80 kg nitrogen were compared to the weighted average yields of participants that applied between 81 kg and 100 kg.

- **Other production factors** – sowing time, plant density, cultivars, planting methods, etc.

Since profitability is critical for the participant, this was determined by calculating the best margin above variable costs, and taking into account the income and costs for each participant.

All the information was summarised and analysed each year. The report considered correlations as far as possible to determine certain assumptions. These could not be considered scientifically correct, based on the small number of participants

‘Knowledge about sowing density improved over time.’

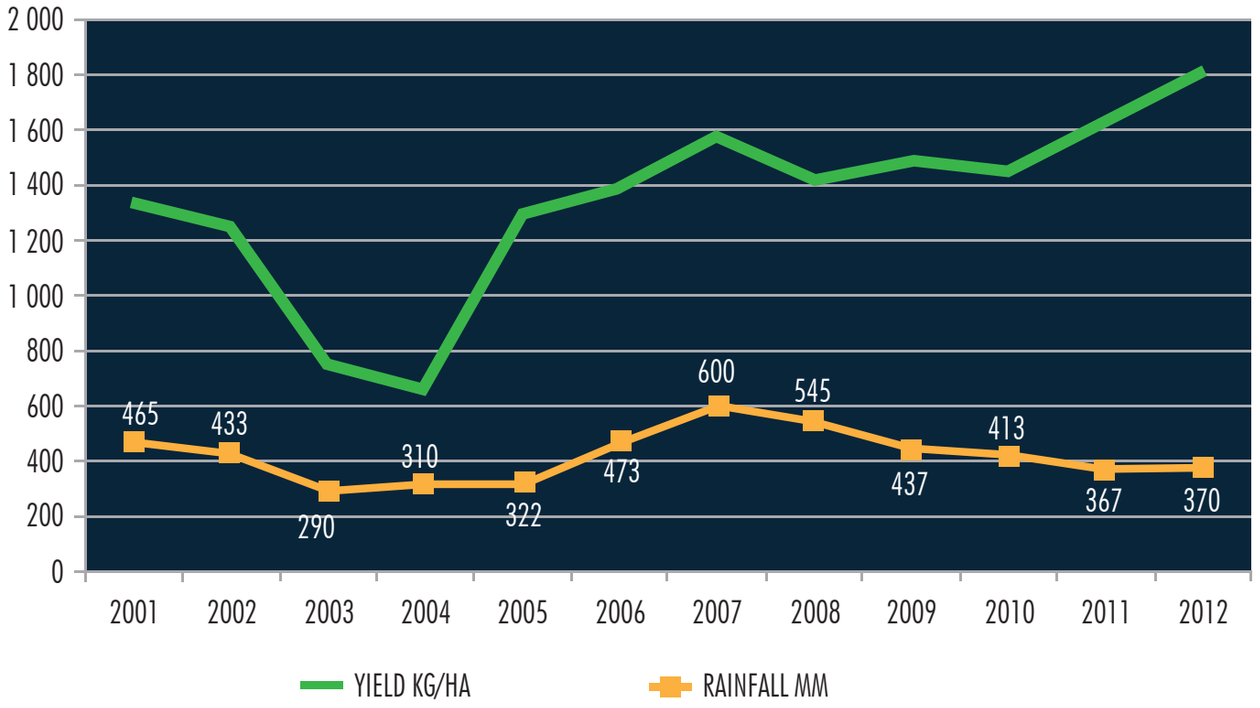
and the interrelated effects of the factors, but certain trends could be identified over the years. Some of these include:

- earlier sowing renders better yields
- 80 kg/ha nitrogen (or more) renders good yields
- good weed control has a positive effect on yields
- a plant density of 4 kg/ha is required for good yields, etc

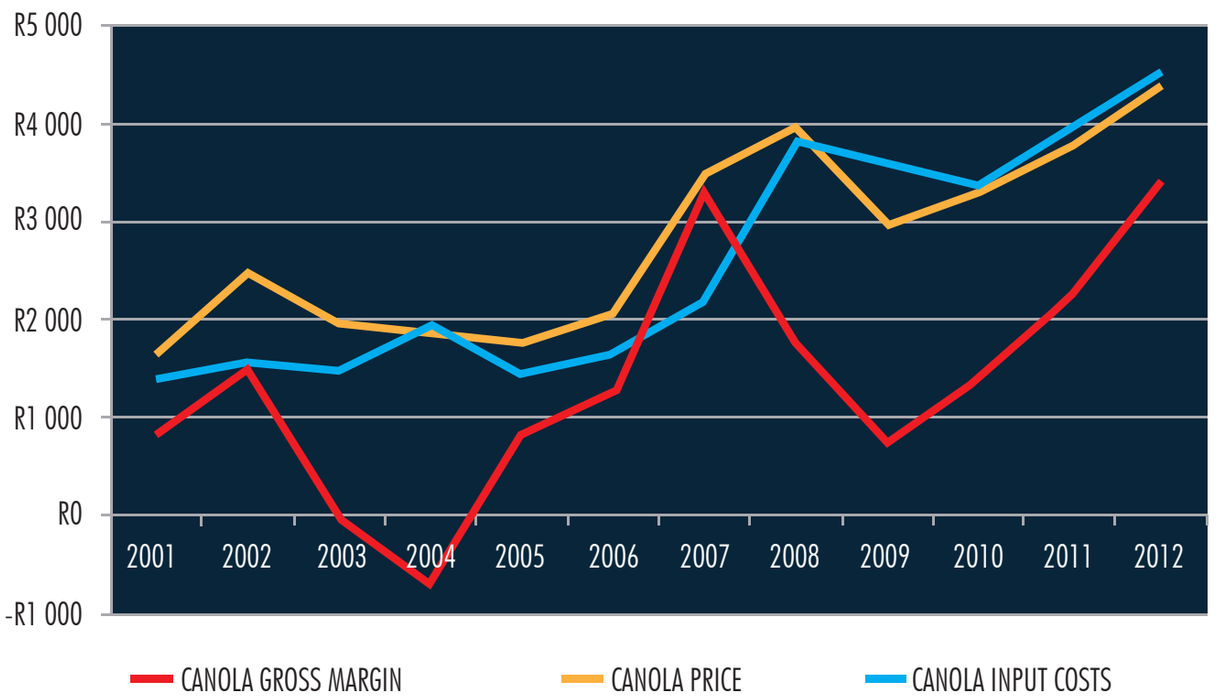
With improved knowledge among participants, it was also apparent that input was not in vain. An example of this is that the application of nitrogen initially varied between about 20 kg N to about 120 kg N per hectare. After a few years, it only varied between 70 kg N to 100 kg N, implying a more prudent application of nitrogen. The same applies to sowing densities that did not vary as much as they did at the beginning. Knowledge about sowing density improved over time.

Photo 1: Canola information day

GRAPH 2: RAINFALL VERSUS YIELD IN CANOLA PRODUCTION 2001 - 2012



GRAPH 3: CANOLA PROFITABILITY IN THE WESTERN CAPE 2001 - 2012



‘Co-operation begins where competition leaves off.’

– Franklin D Roosevelt

Various other problems were also identified during the course of the competition. These included snails and low soil sulphur levels. The snail control practices and sulphur additives were evaluated to compare yields amongst the participants that followed recommended practices (snail control and sulphur application) to those that did not follow the recommended practices. The winners of the competition were identified as outstanding, leading producers.

During 2009 the PRF also conducted a survey involving canola producers and non-producers of canola. Various reasons were listed why certain producers did not want to grow canola and problems were recorded of those that did grow canola. The non-producers of canola mentioned that they prefer farming cattle on medics and that canola yields were considered too variable.

Canola producers, on the other hand, experienced problems such as harvest losses and insufficient harvesting equipment. In trying to alleviate negative perceptions, these problems were primarily discussed with non-producers of canola either in person or during farmer/information days and through using mass media channels of communication like radio, popular magazines etc.

The Canola Competition was one of the main activities in the Swartland and Overberg to promote canola production and the graphs on page 84 illustrate the effect of technology transfer, especially where those relate to canola yields and profitability.

Sakkie Slabbert

6 THE CONTRIBUTIONS OF THE PRE TO LUPIN PRODUCTION

LUPINS

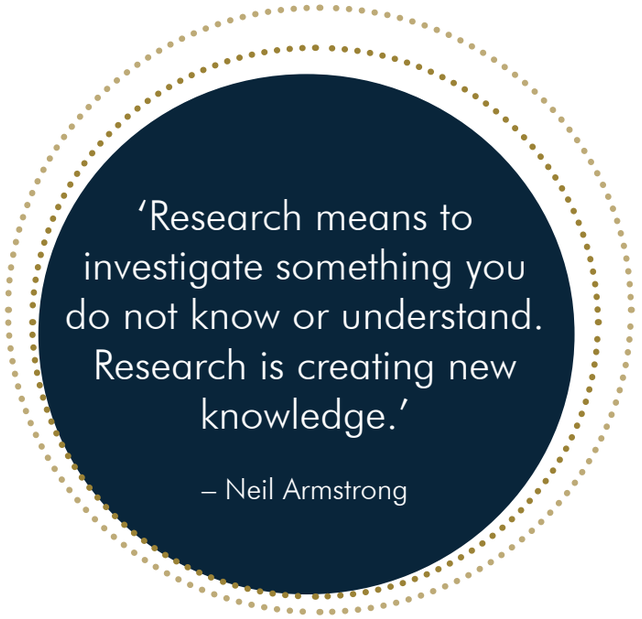
One of the earliest references to lupin production in South Africa is found in Volume XI in the *Agricultural Journal of the Cape of Good Hope*, 1897. Here Mr JP de Waal compares blue, white and yellow flowering types. He also recommends that lupin seeds should be sown densely and inoculated before planting commences.

Since the start of the twentieth century numerous lupin trials have been conducted, yet progress with lupin cultivation has been slow. Producers were afraid that lupins could be toxic to sheep and that it might lead to a weed infestation in wheat fields.

Lupin production only started taking off during the 1940s when Mr CP Wagener, a teacher/producer in the Malmesbury district selected plants without a hard scale and successfully used them as animal feed and as a rotation crop. By 1949 producers generally accepted the value of lupins and since then lupins have played an important role in farming systems, particularly in the Swartland area. Areas such as Rûens initially derived little benefit from cultivating lupins, because there were better and more adaptable feed and rotation crops available at that time.

SPECIES

The most important commercially grown lupin species are *Lupinus angustifolius* (narrow leaf), *L. luteus* (yellow lupin) and *L. albus* (broad leaf or white lupin). All lupin species are annuals and grow upright.



***Lupinus angustifolius* (narrow leaf lupins)**

A defining characteristic of this species is the small, narrow leaves making up the composite leaf. The plants are leafy with light to dark green leaves. Bitter lupin flowers are normally blue, pink or pale pink, while sweet lupins normally have white flowers. Flowers are borne spirally on the axle and are self-pollinating. Sweet cultivars contain a crude protein content of about 30% to 32% and 28% to 30% for bitter cultivars. Narrow leaf lupins do well in sandy to sandy loam soil.

***Lupinus albus* (broad leaf lupins)**

Broad leaf lupins have a strong tap root system and under favourable growing conditions, the plants form strong side branches. Usually the main stem is reasonably thick and slightly woody. Leaves are hand-shaped, composite, fairly large and slightly hairy consisting of five to eight smaller leaves. The broad leaves are characteristic of the species.

The inflorescence is a bunch of flowers forming a spiral around the stem. Flower colours vary between white to white-blue,

depending on the cultivar. Self-pollination is the main form of pollination, but cross pollination also takes place from time to time.

The pods are much larger than the narrow-leaf lupin pods. Ripe pods do not open easily. Broad leaf lupin cultivars are sweet and have a crude protein content of about 35% to 37%. Broad leaf lupins grow well in sandy loam to clay loam soils.

***Lupinus luteus* (yellow lupins)**

The most defining characteristic of yellow lupins is the yellow flower colour and the pleasant scent of the flowers borne in a circle or crown on the stem. Insects, particularly bees, are attracted by the bright yellow colour and sweet scent of the flowers. Cross pollination takes place. Self-pollination also occurs.

The leaves are wider and more hairy than those of the narrow leaf lupins. Like broad and narrow leaf lupins, yellow lupins have composite leaves. The stems and branches also appear to be hairy and are less woody than the other species.

Yellow lupin seeds are smaller than those of broad and narrow leaf species. The protein content varies between 38% to 40%. Only the sweet cultivars are grown commercially. Yellow lupins prefer acidic, sandy soil and handle wet conditions better than other lupin types.

LUPIN CULTIVATION DURING 1956 TO 1990

From 1956 to 1962 lupin cultivation, mainly bitter, narrow leaf varieties, increased from 113 000 to 198 000 hectares. Production then decreased to 127 000 hectares in 1970 because of:

- the increased practice of wheat monoculture
- the sustained increase in wheat prices
- fluctuations in wool prices

In 1971 the popularity of lupins waned due to the sharp decrease in the wool price from 63c to 46c per kg and the epidemic of powdery mildew (white mildew) in 1973 which almost brought lupin production to a standstill. Between 1974 and 1983 the area under production declined to below 20 000 hectares. However since 1985, sweet lupin production, particularly the broad leaf cultivars, has gradually increased. The first locally produced sweet, narrow leaf cultivars were launched during 1988, leading to a substantial increase in sweet lupin production.

LUPIN CULTIVATION DURING 1990 TO 1997

With the deregulation of the maize industry, the Protein Research Foundation (PRF) has sought to determine the

potential of several protein-rich products and lupins was identified as a strong contender amongst other crops. Research has shown lupins is particularly well suited to the winter rainfall area and the cooler parts of the summer rainfall area. The PRF have funded lupin projects in the Western Cape since the first initiative on *Genetics and breeding of lupins*, in 1990 by Dr JA Louw. Since 1993 the Agricultural Research Council (ARC) has conducted important research at Potchefstroom under the guidance of Dr JAM van der Mey on the establishment of lupins in the colder parts of the summer rainfall area.

The PRF decided to take the same action in the lupin industry as the model used in the soybean industry. A Lupin Think Tank was held on 20 November 1996 at the Elsenburg Agricultural Development Centre near Stellenbosch to which role-players in the winter rainfall areas were invited. Following this a Lupin Working Group for the winter rainfall region was established on 2 April 1997 (see Extract 1 on page 94 - 97).

In truth sweet lupins had already been well known in the Western Cape for years but the concept of producing sweet lupins for commercial use was a new approach. Its cultivation had stagnated for various reasons but the interest in regenerating and extending the industry was very encouraging. It was essential to have this action co-ordinated by an expert, and in 1997 the PRF obtained the services of Mr Herman Agenbag, an expert in lupin cultivation in the Western Cape previously from Elsenburg. His main duties were to visit individual producers, study groups, cultivar experiments and strip trials, as well as network with co-operatives and interested parties in the industry including processors, researchers and other experts. Additional to the telephonic information service he provided from Elsenburg, he arranged many information days.

Many other aspects like grading, alkaloid levels, registration of weed killers, means to control pests and diseases, cultivar experiments, etc needed consideration. At meetings held in November 1997, a list of research priorities was compiled with the assistance of experts and members of the Lupin Working Group.

In 1997 about 30 000 hectares of sweet lupins was planted, but unfortunately anthracnose and bollworm caused a major setback to the harvest. By 1999 less than 15 000 hectares were under lupin production because the local sweet cultivars, particularly broad leaf cultivars, were highly susceptible to this disease, and large crop losses were reported.

Anthracnose under the microscope

As early as 1996, anthracnose was diagnosed in the Western Cape and in the Malmesbury area where both anthracnose and bollworm caused serious damage to the harvest. With the spread of anthracnose, sweet lupin production declined dramatically from approximately 30 000 hectares in 1997 to below 15 000 hectares in 1999 because the local sweet cultivars, particularly the broad leaf cultivars, were so susceptible to it.

When anthracnose was diagnosed again, the PRF immediately convened a meeting of experts which decided to send Mr Agenbag and Dr S Koch to Australia where anthracnose had been managed successfully. In particular this was a major setback for the cultivation of *L. albus* in the Western Cape but fortunately none appeared in *L. angustifolius*.

The PRF sought to ensure that the lupin industry did not suffer permanent damage so various research projects were undertaken. Additional to the efforts to combat anthracnose they were actively involved in:

- cultivar experiments
- registration of certain chemicals
- the transfer of technology

The PRF identified anthracnose as the most significant setback faced by the lupin industry. An Anthracnose Working Group was officially formed on 5 October 1999 and continued functioning until lupin research was terminated by the PRF in 2009 (see Extract 2 on page 98 - 99). In the quest to find anthracnose resistant cultivars, Dr Van der Mey and Mr Agenbag attended the 9th International Lupin Conference during June 1999. Valuable networking took place with good contacts made with countries like Germany, Poland, Chile and Belarus, from which cultivars were sourced, in the hopes of overcoming the persisting anthracnose problem.

In the same year the PRF decided to fund a project by Dr Van der Mey, entitled *Selection and breeding for anthracnose* (Collectotrichum gloeosporioides) *resistance in germ plasm of* lupinus albus in an all-out effort to curb anthracnose.

During the study tour to Australia in 1997, several sweet, narrow leaf cultivars with high anthracnose resistance were identified as suitable for local production. These cultivars have been available locally since 2000 and sweet lupin production once again increased to about 27 000 hectares. Severe drought conditions from 2002 to 2004, coupled with concerns about possible anthracnose infection, caused a decline in production to a meagre 7 000 hectares.

The PRF took a policy decision to liaise more closely with researchers in Australia, especially in an effort to combat anthracnose.

Special mention must be made of the work done by Dr JA de Ronde in her project *The determination of the role of proline biosynthesis in reaction to drought stress in soybeans by the use of antisense and sense technology*. The technique she developed in this particular study was used immediately in other studies and especially on anthracnose. The PRF in co-operation with the ARC decided to patent this technique that Dr De Ronde had developed. This was the first patent ever to be registered from PRF funds. The project also generated another patent by Dr D Oeloefse (ARC). Despite this, the South African researchers and scientists from the ARC-PPRI and ARC-GCI, as well as the Council for Scientific and Industrial Research (CSIR) and PRF could not solve the problem or combat anthracnose. Each passing year saw more concentrated efforts to promote lupins. Dr D Berger of the ARC was sent to Australia to liaise with researchers on bio-technical work to combat anthracnose. The division of Food Science and Technology of the CSIR and the ARC Roodeplaat, registered a joint project with the PRF entitled *Genetic engineering of lupins* (lupines sp.) *for resistance to anthracnose*. The PRF has great appreciation for a complete report and a large number of recommendations proposed by Dr Berger.

In view of the imminent retirement of Dr Van der Mey and the importance of the anthracnose breeding programme, the PRF engaged in discussions with the ARC concerning the future of research on both lupins and soybeans. Eventually the lack of progress led to a decision by the PRF to review the lupin situation by the end of 2001 and decide whether the lupin effort should be continued. The negotiations with the ARC did not bear positive results and the PRF contracted Dr Van der Mey for a year to determine the progress with his project.

Lupins beyond the Western Cape: The summer rainfall region

In 1997 approximately 1 500 hectares of *L. albus* comprised the sum total of the summer planting as it was a relatively unknown product in the summer rainfall region. The transfer of technology and expertise was therefore of utmost importance to the PRF. The success story of lupins in Australia, where considerably more than a million tons were being produced continued to be an encouragement to extend and establish the local industry in a similar manner.

The intention was to promote lupins in the cooler areas of Mpumalanga, the Free State and KwaZulu-Natal. As mentioned earlier, Dr Van der Mey had had extensive experience with lupins and the PRF knew that Mr Brian Birch was already actively involved with lupins in KwaZulu-Natal by then (see Extract 3 on page 100 - 101).

Although lupins was still a new commodity to the summer rainfall area, the PRF was optimistic that, with essential technology transfer strategies in place, 50 000 tons on 25 000 hectares was achievable within three years. To support this effort a Lupin Working Group for this area was founded on 29 October 1998 in Bethlehem which was central enough to the Eastern Free State, KwaZulu-Natal and Mpumalanga (see Extract 4 on page 102). The PRF appointed a contractor in each region to not only promote lupin production to individual producers, but also arrange information days wherever lupin production was viable. Pamphlets were compiled and distributed at these events and the PRF funded two newsletters for the summer rainfall area, *Luptec* by Dr Van der Mey and *Lupino*, an information bulletin by Mr Agenbag which was first published in March 2000 (see Extract 5 on page 103).

The summer rainfall areas were especially suited to *L. albus*, the broad-leafed lupin, with a protein content of 36% and a higher energy value than the narrow-leafed lupins or *L. angustifolius* with 30% protein content. Anthracnose reached epidemic proportions in Mpumalanga as early as 1998, mainly due to the conducive climatic conditions. The disease manifested slightly in the Eastern Free State while KwaZulu-Natal was totally free of anthracnose.

A cultivar that yielded five tons per hectare was developed by the Department of Agriculture, KwaZulu-Natal, and was so successful that the collaborators resolved to create a five-ton club in 1999. The best results in this region were achieved in winter under irrigation (see Extract 6 on page 104).

A last effort

The previously flourishing lupin industry had to be totally rebuilt in the Western Cape. Some important aspects which required attention, time and effort were grading, alkaloid levels, registration of herbicides and pesticides. The national cultivar trials which was launched in co-operation with the Department of Agriculture, Western Cape and more specifically employees of Elsenburg, was one of the most important milestones at that time.

During 1998, approximately 22 000 hectares of sweet lupins were planted for commercial purposes, which was less than the previous season. This was a result of the anthracnose losses of the previous season which resulted in less seed being available. Fortunately, seed could be imported from Australia and several cultivars showed more resistance to anthracnose than the ones locally used.

The PRF opened its purse in pursuit of knowledge

A variety of research projects were financed in an effort to find solutions for the serious threat that this disease posed for the industry. Projects included the breeding of resistant cultivars and genetic manipulation as well as the testing of various seed remedies in an effort to overcome this disease. Some of the studies were:

- All commercial seed, both local and imported was tested by Dr Koch for inclusion in a scale of resistance, which could serve as a guideline to all producers and seed companies.
- Prof J Hayes from the University of Stellenbosch focused on nutrition and studied the different levels of lupin inclusions in poultry rations.
- Feeding trials done by Prof Gous of the University of Natal and Dr T Brand from Elsenburg provided important information to the feed industry. They determined the relative values of various lupin cultivars in comparison to soya oilcake, thereby providing all parties with an indication of the values of each particular cultivar.

Did you know?

Sweet lupins had already been well known in the Western Cape for years, but the concept of producing them for commercial use was a new approach in the seventies.

- Prof GA Agenbag of the University of Stellenbosch conducted studies on various methods of planting and sowing.
- With the increasing onslaught of anthracnose, Mr Agenbag was sent on a research mission to Western and Southern Australia in October 1997. The Australians had already achieved success and Mr Agenbag felt that as much as 100 000 hectares of sweet lupins could be produced in South Africa by the year 2000.

Marketing lupins

The lack of a stable market and fair price for sweet lupins seemed to be the biggest concern in the local lupin industry at that time, and this resulted in bitter lupins being the preferred variety. Furthermore, input costs for bitter lupins were lower than for sweet lupins, whereas the benefits of crop rotation were the same for both varieties. These benefits included:

- disease prevention
- increased wheat production after lupin cultivation
- a saving in nitrogen fertilisation in the follow-up crop

According to estimates, the area under bitter lupin cultivation was between 10 000 hectares to 12 000 hectares in 2007.

Lupin breeding in South Africa was limited to the ARC-OPSC which developed broad-leaf cultivars and the co-operative Sensako developed narrow-leaf cultivars for the Western Cape. Sensako was taken over by Monsanto in 1999 who decided it would have no further involvement in the lupin industry.

The tenth international lupin congress was held in Iceland in 2002 with indications that anthracnose was a priority topic under discussion. Elsenburg and the PRF decided to jointly send Dr A van Jaarsveld to this congress, but unfortunately no wonder remedies were discovered.

During 2002 the PRF decided to combine the separate working group meetings of lupin and canola in the Western Cape for practical reasons. This decision was generally welcomed.

Further funding of research on lupins in the summer rainfall area became a serious discussion point in 2002 and it was decided that the final decision on future research would be taken in 2003. Of the 40 research projects funded by the PRF

in 2002, 14 dealt with lupins. Towards the end of 2002, the PRF confirmed that research and promotion of the lupins in the Western Cape will still be a priority.

During 2003 the decision was finally taken to stop all research in the summer rainfall area and also to discontinue production of the newsletter *Luptec* as of December 2003.

During 2003, anthracnose research received another blow when Dr Van Jaarsveld of Elsenburg passed away. The PRF and Elsenburg however decided to spend three more years on the completion of his research concerning cultivars with possible resistance to anthracnose. Eventually, nothing came from this particular project.

In the meantime, hectares under lupins in the Western Cape hovered steadily around the 10 000 mark. In 2005 only 14 100 hectares lupins were planted and the PRF was seriously concerned about the industry. In 2006, the number of hectares under lupins grew to 16 000 but with a yield of only 14 400 tons.

The final blow came when Mr Agenbag who had been contracted by the PRF and the authority on lupins retired and severed his ties with the lupin industry. The PRF Board decided not to fund new lupin projects after 31 December 2008 particularly since in the 2008 season lupin production once again failed to meet expectations and a mere 13 300 tons were produced on 14 000 hectares.

CONCLUSION

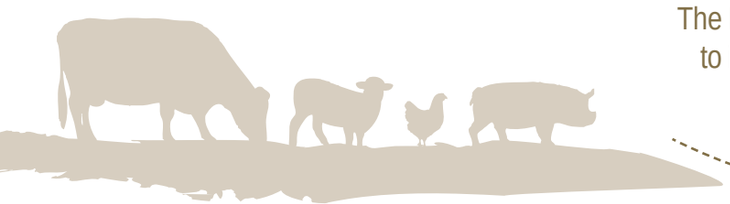
Periodically, as has been the case for the past 50 years or more, lupin production has spiked for a few years only to once again drop back to between 10 000 hectares and 15 000 hectares per annum. Little progress has been made with higher yielding cultivars in the past 20 years and the typical diseases of lupins have not yet been overcome.

The PRF's main aim is always focussed on finding ways to increase the production of locally produced protein in order to replace imported protein. After many years of research support and millions of rands spent, it was concluded that lupin production does not have the potential to grow or contribute significantly to the aims of the PRF. As with many precursors to lupins, like groundnut, sunflower, lucerne (Alfalfa) and others which had reached a stagnation point in time, the PRF was forced to end research funding of lupins. It must be accepted that unless there is evidence to the contrary, the lupin industry will not be revisited again by the PRF.

Herman Agenbag
Gerhard JH Scholtemeijer

Did you know?

The PRF's main aim is always focussed on finding ways to increase the production of locally produced protein in order to replace imported protein.



EXTRACT 1

VERSLAG VAN LUPIENE WERKSGROEP

Die Lupiene Werkgroep het in opvolging van die vergadering laat in November 1996 in die Kaap 'n aanvang gemaak met werksaamhede in die Wes-Kaap op 1 Februarie met behulp van mnr Agenbag, soos aan u bekend. Aangeheg vind u die eerste maandverslag van mnr Agenbag wat van selfsprekend is.

Die aktiwiteite van die Lupiene Werkgroep sal in twee maar moontlik selfs in drie dele verdeel moet word, te wete Wes-Kaap, KwaZulu- Natal en die res van die somerreënvalstreek.

Mnr Agenbag is al jare lank werksaam met lupiene in die Wes-Kaap, Dr Jan van der Mey soortgelyk in die Transvaal en Vrystaat gebiede, en ons is bewus dat mnr Brian Birch betrokke is by Lupiene in Natal. Van laasgenoemde se aktiwiteite en aksies weet ons min behalwe dat hy ons meegedeel het dat hy hierdie jaar nie saad van dr van der Mey benodig aangesien hulle self besig is met saad vermeerdering. Die feitlike situasie sal eersdaags bepaal word wanneer ons 'n persoonlike besoek aan mnr Birch kan bring. Wat die hoëveld betref is dr van der Mey aktief. Daar is saad beskikbaar, maar die kennis en belangstelling van die boere is nog nie gemobiliseer nie. Ons werk daaraan om hierdie jaar vordering te probeer maak en meer belangstelling te kweek. Die eerste sogenaamde soet wit lupien promosie oggend word op 19 Maart te Dafel aangebied. Ons hoop om eersdaags 'n Belange Werksgroep saamgestel te kry vir lupiene en om teen die volgende raadsvergadering vir u hieromtrent in te lig.

Die Westelike Provinsie belangstelling oortref alle verwagtinge. Die verslag van mnr Agenbag spreek van self. Die belangstelling is sodanig dat ons die ongeveer 250 ton saad wat beskikbaar sal wees vir die Westelike Provinsie sou kon verdubbel het, en waarskynlik nog steeds nog nie genoeg saad gehad het nie. Die saad probleem naamlik suiwerheid en die graad van soetheid is van kardinale belang. Wanneer 'n Werksgroep daar gestel word sal so iets soos graderingsregulasies en metodes om bepalings te doen hoog op die sakelys wees. Die invoer van aanvullende saad is hoegenaamd nie moontlik nie vanweë die voorkoms van antraknose in alle lupien produserende lande behalwe Suid Afrika.

2/...

Report of the Lupin Working Group

EXTRACT 1

Die eerste betrokkenheid van die PNT hierdie jaar sal bestaan uit 'n besoek Elsenburg deur dr Bigalke en mnr Scholtemeijer om die toekoms van lupiene en die samewerking met Elsenburg te bespreek. Dr Griessel en mnr Scholtemeijer sal by die Boeredag in Oos-Transvaal optree. Mnr Joubert en mnr Scholtemeijer sal gedurende April 'n besoek aan mnr Birch in Natal bring.

Die mikpunte wat waarskynlik deur die lupiene groep daar gestel sal word, sal soos volg saamgestel word :

1. Wes-Kaap 50 000 hektaar kommersiële lupiene binne drie jaar.

2. 50 000 ton of te wel 25 000 hektaar lupiene in die sommerreënvalgebied binne drie jaar.

Tydens hulle besoek aan Elsenburg sal dr Bigalke en mnr Scholtemeijer ook met Elsenburg onderhandel oor die canolaprojek wat potensiaal het om veral in die Wes-Kaap, die proteïen tekort kan help verlig.

In teenstelling tot die sojabedryf wat reeds oor jare gevestig is, en 'n infrastruktuur het, bestaan daar geen basis vir hetsy lupiene of canola nie. Potensiaal is ongetwyfeld daar, maar baie baanbrekerswerk sal benodig word in 'n baie kort tyd van hierdie bedryf (lupiene) binne drie jaar die sukses te maak wat ons dink behaal te kan word.

DR R D BIGALKE M GRIESSEL G J H SCHOLTEMEIJER

Lupvers6/3/97

Report of the Lupin Working Group (continued)

EXTRACT 1

PROTEïENNAVORSINGSTRUST

NOTULE VAN DIE STIGTINGSVERGADERING VAN 'N LUPIENWERKGROEP VIR DIE WES-KAAP GEHOU TE ELSENBURG OP 2 APRIL 1997

1. VERWELKOMING

Die Voorsitter mnr GJH Scholtemeijer, rig 'n woord van verwelkoming tot almal. Hy bevestig dat die PNT sover moontlik, gepoog het om alle rolspelers in die soetlupien bedryf in die Wes-Kaap na hierdie vergadering te nooi.

Hy wys daarop dat die doel van die vergadering is om 'n lupienwerkgroep vir die Wes-Kaap daar te stel, gebaseer op die suksesformule wat die PNT met soortgelyke werkgroepe in die sojabedryf ondervind het. Dit behels dat alle rolspelers in die lupienbedryf sover moontlik versoek word om so 'n vergadering by te woon en saam te werk om die lupienbedryf weer in die Wes-Kaap op sy bene te kry. Soetlupiene kan 'n belangrike rol speel om ingevoerde proteïen te vervang maar om die bedryf suksesvol te vestig is die samewerking van alle rolspelers noodsaaklik. Die PNT beplan om 'n klein werkgroep daar te stel onder voorsitterskap van die PNT met verteenwoordigers uit alle fasette om as lede van hierdie komitee te dien. Hierdie klein werkgroep sal jaarliks aan 'n algemene vergadering van belanghebbendes in die lupienbedryf vordering rapporteer.

2. PRESENSIELYS

W Stander	Meadow	Posbus 262, Paarl, 7620
H Kotzé	Pioneer Voere	Posbus 700, Malmesbury, 7299
K van der Linde	Sensako	Posbus 188, Malmesbury, 7299
AJG Lesch	Sensako	Posbus 133, Napier, 7270
J Lusse	CRK	Posbus 50, Caledon, 7230
J Pietersen	SSK	Posbus 12, Swellendam, 6740
PJ Laubscher	BNK	Posbus 58, Bredasdorp, 7280
L Willie	Agricol	Posbus 300, Brackenfell, 7560
HJG Agenbag	PNT	Privaatsak X1, Elsenburg, 7607
L Robertson	MKB	Posbus 30, Moorreesburg, 7310
F Potgieter	WPK	Posbus 22, Malmesbury, 7299
AJ van der Merwe	PLK	Posbus 18, Piketberg, 7310
J de Lange	PLK	Posbus 13, Porterville, 6810
Dr DJ Crafford	Dept. Landbou, W-Kaap	Privaatsak X1, Elsenburg, 7607
Dr R Bigalke	PNT	Posbus 8783, Pretoria, 0001
GJH Scholtemeijer	PNT	Posbus 671, Parklands, 2121

Verskonings

N Basson	Riversdal-Koöp
Christo Kotze	Suidwestelike Koöp, Mosselbaai
J Allison	Epol, Worchester

Minutes of the inaugural meeting of a Lupin Working Group for the Western Cape held on 2 April 1997 at Elsenburg

EXTRACT 1

3. DOELSTELLINGS VAN PNT MET SPESIALE VERWYSING NA LUPIENBEDRYF

Die Voorsitter van die PNT, dr RD Bigalke, bring die doelstellings van die PNT in verband met sy besondere belangstelling in die lupienbedryf.

Hy verwys na die verkenningsvergadering wat aan die einde van 1996 te Elsenburg gehou is, waar onderneem is om 'n lupienwerkgroep in 1997 te stig, wat nou gestalte kry. Om die stigting te motiveer skets hy kortliks die agtergrond en doelstellings van die PNT, soos bepaal by verskeie bosberade. Die hoogste prioriteit van die PNT se missie is om die plaaslike produksie van proteïen vir dierevoeding te bevorder. Dit is noodsaaklik in die lig van die feit dat tans meer as R900 miljoen se proteïen jaarliks ingevoer word.

Hierdie bevordering deur die PNT word hoofsaaklik bewerkstellig deur die fondse wat tot sy beskikking is vir die stimulering van navorsing en ontwikkeling te gebruik. Aangesien heelwat tegnologie reeds ontwikkel is, word tans meer aandag aan ontwikkeling as in die verlede gewy. Hy sien die fasilitering van die totstandkoming van werkgroepe en die bevordering van hulle aktiwiteite as ontwikkelingsaksies.

Weens die groot aanvraag op PNT fondse word vier proteïenryke gewasse uitgesonder waarvan die produksie gepromoveer word, naamlik soja, lupiene, canola en katoen. Die werkgroepstelsel is aanvanklik slegs op die sojabedryf toegepas. Die produksiemikpunte wat as deel van die strategie om die bedryf te stimuleer vir die jaar 2000 gestel is, is reeds in sig en sal waarskynlik in 1998 ver oortref word.

Dit is nou soetlupiene se beurt. Die Wes-Kaap is ideale lupiene wêreld en 'n spesialis kundige in die vorm van mnr H Agenbag was gelukkig beskikbaar om te benut vir die doel om lupiene in hierdie geweste te bevorder. 'n Mikpunt vir hierdie bedryf kan wees om 50 000 na teen die jaar 2000 onder lupiene gevestig te hê. Die hoofdoel van die vergadering, soos reeds deur mnr Scholtemeijer uitgewys is , is die stigting van 'n lupienwerkgroep en om die samestelling daarvan te bepaal.

4. VOORGESTELDE SAMESTELLING VAN DIE KOMITEE

Die Voorsitter deel die vergadering mee dat die PNT hierdie komitee wil saamstel uit genooide individue wat verskillende fasette van die bedryf verteenwoordig. Dit behoort in te sluit produsente en vervaardigers van veevoer (met ander woorde verbruikers van lupiene, navorsing, voorligting, saadtelers, saad handelaars en finansierders.

Koöperasies sal beide die Suid-Kaap en die Swartland verteenwoordig aangesien hulle die funksies van finansiering, hantering, opberging en verspreiding verteenwoordig. Ander rolspelers, indien enige, sal algaande geidentifiseer word en na vergaderings genooi word.

Minutes of the inaugural meeting of a Lupin Working Group for the Western Cape held on 2 April 1997 at Elsenburg (continued)

EXTRACT 2

PROTEïENNAVORSINGSTRUST

NOTULE VAN 'N VERGADERING VAN KUNDIGES IN VERBAND MET ANTRAKNOSE GEHOU OP 28 MAART 2000 OM 10:00 TE AFMA, RIVONIA

1. VERWELKOMING

Die Voorsitter heet almal hartlik welkom by die vergadering en veral vir dr Staphorst wat die vergadering vir die eerste keer bywoon.

Die Voorsitter beklemtoon die PNT se doelstellings tewete om ingevoerde proteiene wat vir dierevoeding aangewend word te verminder deur plaaslik geproduseerde proteiene te bevorder.

Die PNT is bewus van die finansiële probleme wat die LNR ondervind. Die luuksheid van duplisering en oorvleueling met navorsers moet hok geslaan word. Leemtes wat egter in navorsing ontstaan moet identifiseer word.

2. PRESENSIE

Mnr GJH Scholtemeijer	PNT(Voorsitter)
Dr M Griessel	PNT
Dr D Berger	LNR-Roodeplaat
Me B Campbell	WNNR
Me K de Ronde	LNR-Roodeplaat
Dr S Koch	LNR-NIPB
Mnr R Laurie	LNR-Roodeplaat
Dr JL Staphorst	LNR-NIPB
Dr JAM van der Mey	LNR-IGG
Dr T Watson	WNNR
Me L Terblanche	Sekretaresse

Verskoning

Mnr D Oelofse	LNR-Roodeplaat

3. VASSTELLING VAN SAKELYS

Die sakelys word aanvaar nadat item 7.1 toegevoeg is.

4. NOTULE VAN VERGADERING VAN 5 OKTOBER 1999

Die notule word aanvaar nadat die volgende wysigings aangebring is:

- Bladsy 1,1 eerste paragraaf, eerste reël - vervang "velle" met "felle"
- Bladsy 2,5,1, tweede reël - vervang "vel" met "fel"

Minutes of a meeting of experts with regard to anthracnose held on 28 March 2000 at 10:00 at AFMA, Rivonia

EXTRACT 2

- Bladsy 4, 6.3, derde paragraaf - vervang die laste sin met "A specific DNA sequence (gene) from the fungus/organism is amplified to more that 10 000 copies and is then detected."
- Bladsy 4, 6.3, vierde paragraaf, tweede reël - vervang "spasies"met "basispare"
- Bladsy 5, 6.3.3 - vervang "sal ook" met "versoek dat", "doen" met "gedoen word" en "Dr Berger" in die aandag kolom met "Dr van der Mey"
- Bladsy 8, 6.1.2.6, eerste paragraaf, tweede reël - eindig die eerste sin na "versamel" en begin die tweede sin met "Slegs"
- Bladsy 9, 8.1.1 - vervang die besluit met "Die saad wat die WNNR ontvang moet ook vir alkaloïedvlakke getoets word." Vervang die name in die aandag kolom met "Dr van der Mey" en "Dr Brand"

5. OORSIG VAN LUPIENPRODUKSIE EN –BEMARKING IN DIE RSA

5.1 Wes-Kaap

Verlede jaar was daar 2 gebiede in die Wes-Kaap waar CED6150 geplant is, 1 te Eendekuil wat geen antraknose gekry het nie en 1 te Moorreesburg wat wel beperkte antraknose gekry het.

Die PNT was vanjaar behulpsaam om 105ton CED6150 na die Wes-Kaap te stuur in 'n poging om skoon saad daar beskikbaar te stel en sodoende antraknose te beperk.

In KZN word lupiene hoofsaaklik in die winter onder besproeiing geplant. Sover is KZN nog vry van antraknose.

Dit word ook beplan om lupiene in die winter onder besproeiing in Mpumalanga te plant.

Aanplantings in die Vrystaat vertoon goed en geen antraknose is nog gevind nie.

Produsente te Swartruggens het ±100 ha lupiene geplant wat 3 ton/ha gelewer het. 'n Mark vir die opbrengs moet egter nog gevind word. MGK het te Brits 3 toetsaanplantings gehad met 1 breëblaar en 2 smalblaar (Merrit en Wonga) lupiene. Die *albus* het 3 ton/ha en die *angustifolius* net onder 3 ton/ha gelewer. Geen antraknose is in gemelde aanplantings gevind nie asook nie te Potchefstroom nie.

In 1999 is daar 15 000 ha lupiene in die Wes-Kaap geplant en vir 2000 18 000 – 20 000 ha. Indien 'n cultivar bekom kan word wat meer antraknose bestand is, sal hierdie oppervlakte uitbrei. Lupiene word in die Wes-Kaap hoofsaaklik gebruik vir melkbeeste, varke en skape.

Produsente hou saad terug en sal weldrae sien hoe die produksie beïnvloed. Dr Staphorst noem dat produsente CED6150 as 'n goeie cultivar beskou en dit nie as skoon saad sien nie. Dit is kommerwekkend dat produsente nie die probleem met die terughou van saad sien nie. Hierdie boodskap moet aan die Lupienewerkgroep van die Wes-Kaap oorgedra word. Verder moet mnr Agenbag versoek word om in samewerking met koöperasies 'n opname te maak van saad wat teruggehou word. Dr Griessel is van mening dat produsente wel die voordele van skoon saad sal begin insien met die beter opbrengste wat CED6150 gaan lewer in die Wes-Kaap te stuur.

Op 'n vraag van die Voorsitter of daar latente antraknose teenwoordig kan wees in skoon saad wat geoes is, noem dr Staphorst dat omgewingstoestande en beheer maatreëls 'n rol speel en dat sulke saad nie noodwendig skoon is nie.

- 2 -

Minutes of a meeting of experts with regard to anthracnose held on 28 March 2000 at 10:00 at AFMA, Rivonia (continued)

EXTRACT 3

PROTEIN RESEARCH TRUST

&

KZN DEPT OF AGRICULTURE

LUPIN

BOEREDAG / FARMERSDAY

DATE: **8 October 1998**

TIME: **09:30**

VENUE: Andrew Sclanders Farm-
Winterton

Protein Research Trust and KZN Department of Agriculture Lupin farmers day

EXTRACT 3

PROGRAMME

09:30	Registration and Tea	
10:00	Opening and Welcoming	*Bill Berry*
10:10	The potential of lupins in KZN	*Brian Birch*
10:20	Lupin production guidelines	*Leon Killian*
10:40	Lupins as livestock feed	*Trevor Dugmore*
11:05	The potential of lupins as a no-till crop and in crop rotations	*Bill Berry*
11:20	Weed control and undersowing Of lupins with ryegrass	*Leon Killian*
11:40	Sprouted lupins as feed	*Foddercon*
12:00	Economics of Lupin Production	*Brian Birch*
12:20	Visit to Lupin Demonstration Block	
13:00	Lunch	

IMPORTANT

A registration fee of R20 would be required. For catering purposes it is necessary that all participants advise the organisers of their intention to attend. Please telephone 0331 3559194 or write Secretary, Private Bag X9059 Pietermaritzburg 3200 before 28th September 1998.

Protein Research Trust and KZN Department of Agriculture Lupin farmers day (continued)

EXTRACT 4

NOTULE

VAN DIE LUPIENWERKGROEP (SOMERREëNVALSTREEK) GEHOU OP 29 OKTOBER 1998 TE BETHLEHEM

1. **TEENWOORDIG**

Dr M Griessel
Dr J van der Mey
Mnr Herman Agenbag
Mnr E Maree
Mnr L Kilian
Mnr J Middel
Mnr J Everitt
Mnr G Scholtemeijer

2. **OPENING EN VERWELKOMING**

Mnr Scholtemeijer heet almal baie hartlik welkom namens die PNT by hierdie vergadering wat die eerste van sy soort in die somerreënvalstreek is.

3. **DOEL VAN DIE VERGADERING**

Die doel van die PNT word kortliks verduidelik aan die hand van sy doelstellings en die tekort aan proteïen wat plaaslik geproduseer word. Die belangrikheid van lupiene word kortliks aangehaal en die spesifieke rol wat dit kan speel in die somerreënvalstreek word uitgewys. Die doel van die vergadering is om die belangrikste rolspelers in die somerreënvalstreek te identifiseer in die streke wat geidentifiseer sal word en om gedagtes uit te ruil t.o.v. die werkswyses wat in die somerreënvalstreek gevolg kan word. Die rol van die PNT sowel as die LNR word kortliks aangeroer en die wedersydse ondersteuning word beklemtoon.

4. **DOELWITTE**

Die daarstelling van doelwitte t.o.v. verskillende streke is in die werksopdragte van die verskillende verteenwoordigers per streek vasgestel. Die vergadering besluit dat daar doelwitte vir die volgende drie jaar opgestel moet word sodat vordering gemeet kan word. Die volgende doelwitte word aangestip :

1

Minutes of the Lupin Working Group (summer rainfall region) held on 29 October 1998 in Bethlehem

EXTRACT 5

LUPINO
Nuusbrief van die lupinewerkgroep: Wes-Kaap

Januarie 2009 No. 36

Lupien kultivarevaluasie: Wes- en Suid-Kaap 2008

PJA Lombard, L Smorenburg en Dr J Strauss
Departement Landbou:Wes-Kaap, Privaatsak X1, Elsenburg, 7607

Algemene oorsig

Klimaatstoestande in die Swartland was die afgelope seisoen soos in 2007 baie gunstig vir gewasverbouing. Dit was droog gedurende April en Mei en min produsente kon vooropkoms onkruidbeheer toepas, met die gevolg dat gewasse later as in 2007 gesaai is. Dit was 'n baie lang seisoen met bogemiddelde reënval vanaf Junie tot September. Sekere areas in die middel en Noord-Swartland het baie swaar reën in Junie gehad en wortelvrot het op groot skaal in sekere aanplantings voorgekom. Ongelukkig het antraknose vroeg in verskeie aanplantings uitgebreek en moes produsente die aanplantings vernietig. Laat in die seisoen het die antraknose besmetting steeds voorgekom en is selfs die peule aangetas. Indien produsente van hierdie aanplantings se saad sou terug hou kan groot probleme in die komende seisoen verwag word, aangesien die siekte saadgedraag is. Probleme met bolwurm het ook voorgekom en produsente moes bespuitings doen.

Die toestande in die Suid-Kaap was ongelukkig minder gunstig vir gewasproduksie. In die Oostelike dele kon produsente wel vroeg lupiene plant. In dele van die Caledon, Riviersonderend en Swellendam areas was dit vroeg in die seisoen baie droog en sommige aanplantings het eers in Junie ontkiem. Bolwurm probleme het ook sporadies in sekere areas voorgekom.

Bitterlupiene se gewildheid neem steeds toe en maak 'n groot oppervlak van die totale lupiene aanplantings in die Wes- en Suid-Kaap uit. Meer produsente plant bitterlupiene as in die onlangse verlede. Produsente soek alternatiewe maniere om onkruiddoder weerstand te bestuur.

Klimaat oorsig

Klimaatstoestande tydens die 2008 seisoen was gekenmerk deur goeie reënval in die Swartland (Tabel 1 en Figuur 1). Periodes van swaar reën het veral in die Noorde voorgekom en jong gesaaides het plek-plek versuip. Die reënval was bogemiddeld vir die hele Swartland. 'n Baie laat en koel lente het vanjaar voorgekom en het die laat canola aanplantings baie bevoordeel. Die maksimum en minimum temperature vir September was onder die langtermyn gemiddeld en was selfs laer as in Augustus (Figuur 2 en 3). Die laer temperature is ideaal vir die produksie van gewasse.

Lupino, January 2009, no 36

EXTRACT 6

BUDGETS OF IRRIGATED LUPINS AND WHEAT FOR 1999

ALLOCATED PRODUCTION COSTS (R/HA)

ITEM	LUPINS	WHEAT
Seed (120, 100kg)	250	420
Fertilizer (20P, 30P + 109N, kg)	226	675
Molyflo	25	-
Inoculant	22	-
Herbicide (Simazin, Buctril)	90	68
Pesticides	20	20
Irrigation (400 mm)	495	495
ısurance (half target yield)	150	165
Harvesting	230	230
Miscellaneous (transport, drying, etc.)	70	140
Non Directly Allocatable (Mech, fuel,rep.)	126	193
Total Allocatable Costs	1704	2406

IRRIGATED WHEAT GROSS MARGIN (R/HA)

Producer Price Realization (%)	90	100	110
Wheat Producer Price (R/T)	765.00	850.00	935.00
4.5T/Ha Yield x Price	3442.50	3825.00	4207.50
Total Allocatable Costs (R/Ha)	2406.00	2406.00	2406.00
Gross Margin (R/Ha)	1036.50	1419.00	1801.50

IRRIGATED LUPIN GROSS MARGIN (R/HA)

Producer Price Realization (%)	90	100	110
Lupin Producer Price	1170.00	1300.00	1430.00
3.0 T/Ha Yield x Price	3510.00	3900.00	4290.00
Total Allocatable Cost R/HA	1704.00	1704.00	1704.00
Gross Margin (R/Ha)	1806.00	2196.00	2586.00

EBBirch 22/Lupwheat.Trs

Budgets of irrigated lupins and wheat for 1999

7.1 PRF CO-OPERATION WITH DAWC

PARTNERSHIPS AND POTENTIAL

A closer look at interaction *inter alia* with Elsenburg

The first interaction between the Protein Research Foundation (PRF) and the current Department of Agriculture, Western Cape (DAWC), more specifically Elsenburg, was in 1994 when the funding application of Dr DB Arckoll of the Elsenburg Agriculture Development Institute was approved. The amount of R82 650 was approved for the project entitled *The introduction of canola as an alternative crop for the Western Cape*. In 1996 the project title was changed to *The introduction of canola and other protein oil crops in the rotation system of the Western Cape*.

Based on that first Elsenburg application for funding from the Protein Research Trust (PRT), the PRT held a Board meeting at the Elsenburg Agricultural Development Institute on 31 August 1995 where research leaders and researchers were given the opportunity to present their opinions about canola.

In the meanwhile an appeal was made by the National Oil and Protein Seed Producers' Organisation (NOPO), requesting better co-operation with DAWC. Mr M Prinsloo, a PRT trustee and NOPO member, presented a strong case for growing canola in the summer rainfall region.

During a founding meeting for a National Canola Liaison Committee held on 23 January 1996, it was reported that the production potential of canola in the Western Cape was 50 000 tons and that two co-operatives had commissioned canola oil presses.

Although the Western Cape Province was the second largest provincial consumer of protein for animal nutrition by 1996, all the protein utilised had to be imported. At the time, the PRF resolved to strive towards stimulating production of more protein for animal feeding in the Western Cape.

TROUBLED WATERS AND TENSIONS

This was not an easy process. Mr Herman Agenbag expressed open criticism with his opinion that the PRF should have recognised lupins as a viable protein source for the Western Cape much earlier. Initial feelers extended to Elsenburg directly had not been warmly received, while the Canola Specialist Committee (CSC) exhibited open aggression toward the PRF. It later came to light that the CSC had just experienced an altercation with the NOPO Chairman and Secretary. According to the committee, NOPO was not keen on canola, because they feared that it would cause damage to the sunflower industry.

THE PRF PLOUGHED ON

Dr Arckoll's research continued, despite a slight amendment to the title of the research in 1996. Mr TS Brand from the Elsenburg Agricultural Development Institute submitted another application in 1996 with the research title *The evaluation of various locally produced protein sources in the feeding of growing pigs*.

WINDS OF CHANGE

The most significant change happened in 1997 when Mr Herman Agenbag took early retirement, causing a slight stir at Elsenburg. Various discussions followed and an agreement was concluded between the PRF and Elsenburg. According to

this, Mr Agenbag would continue his work at Elsenburg and in the Western Cape if the PRF were to contract his services and if Elsenburg were to provide him with the required infrastructure such as an office etc.

Relationships improved immediately and Elsenburg literally opened various research taps. Elsenburg forthwith submitted applications for the funding of a few new projects. The two projects of 1996 grew to three by 1997 and to five by 1998. During 1998 the first cultivar trials conducted under the guidance of Mr Dirk Hanekom were witnessed. By 1999, six projects were funded among which Mr M Wallace did a study to determine the potential of both canola and lupins. Ultimately the PRF funded a total of 28 projects submitted by the Western Cape Department of Agriculture between 1994 and 2015.

A MEETING OF THE MINDS

Based on the PRF principle of bringing people within the industry together to discuss matters of mutual interest and learning from each other as well as determining research demands, a Lupin Work Group was founded on 2 April 1997, followed by a Canola Work Group on 2 September 1997.

Dr DB Arckoll's project, aimed specifically at rotation crop systems, formed a solid basis for the huge contribution provided by Dr MB Hardy from 1996. His project, *An investigation into the production dynamics of eight crop rotation systems, including wheat, canola, lupins and pasture species in the Swartland/Western Cape*, (funded between 1996 and 2012), testifies to the enormous contribution made to the Western Cape Agriculture by Elsenburg. Various other projects that followed included weed control and disease control. Dr TS Brand, a regular recipient of funding for various feeding projects, contributed significantly to the body of knowledge about the utilisation of canola and lupins in the diets of chickens and pigs.

A very successful Super Soy Competition in KZN was taken over by the PRF. This PRF strategy for facilitating technology transfer had been particularly successful in the soybean industry. Based on the KwaZulu-Natal success, the PRF, in co-operation with the DAWC, launched Super Canola Competitions in the Western Cape in 2000, with one competition held in the Southern Cape and another in the Swartland.

Co-operation with the DAWC was positive and good relationships grew annually. In this process it was established that the equipment available to the DAWC to conduct National Cultivar Trials was outdated. Replacement was very costly, so in an attempt to accelerate the replacement process, the PRF Board decided to provide bridging financing to allow the DAWC to protect and preserve the valued research conducted by them.

It is difficult to fully appreciate the contribution to agriculture of the continuous projects undertaken by the DAWC and funded by the PRF. The co-operation between the two partners involved in lupins continued until the termination of lupin research (see chapter 6), but the canola cultivar trials remain an annual project conducted with the co-operation of the partners. The Super Canola Competitions in the Southern Cape and the Swartland also continued until the end of 2014, but was replaced by a yield competition in 2015.

ACCOLADE AWARDED TO DAWC
Mr Mogale Sebopetsa, Ms Joyene Isaacs, Minister Gerrit van Rensburg, Dr Ilse Trautmann and Mr Floris Huysamer

Initial work relating to rotation crops conducted from 1996 and taken over by Dr Hardy, was funded until 2012 when the PRF felt that the project had served its purpose. Additional work in this regard is continued by the DAWC and this still receives PRF support (see list of projects in the addendum).

Dr Hardy's work in the Swartland was supplemented by similar work that he and Dr Strauss had done in the Southern Cape. The PRF supported the project in the Southern Cape from 2002 to 2012.

When it became clear that lupins would not make the desired impact, the PRF initiated, with the assistance of Mr Agenbag, research into faba beans. Faba beans seemed to hold great promise but after Mr Agenbag's resignation, DAWC did not have the required manpower to continue with the project so it was terminated.

A final remark about canola is essential. We have to mention that research about the canola industry in South Africa has primarily been conducted by the DAWC, with the support of the Stellenbosch University and the Agricultural Research Council. The PRF provided canola research funding and has been the only private funder to contribute towards the development of the canola industry to where it is today. Prospects for the canola industry remain positive but it would not have had the same successes without the partnership between the PRF and DAWC. For this reason, the PRF felt it prudent to honour the DAWC with the highest possible accolade that may be awarded to any institution. The accolade was awarded to the department on 11 April 2013 (see photo on page 107).

Eight honorary accolades had previously been awarded to a number of the DAWC researchers. The first recipient was Dr Brand (1998) and he was awarded this for the best publication in a scientific journal. The other recipients were:

The PRF trusts that the good co-operation between the PRF and the DAWC will continue for many years, to the benefit of all involved in the canola industry.

Gerhard JH Scholtemeijer

HONORARY ACCOLADES AWARDED TO DAWC RESEARCHERS

YEAR	NAME	TITLE OF AWARD
1998	Dr TS Brand	Best publication in a scientific journal.
1999	Dr TS Brand	Best article in a scientific journal.
2001	Ms Z Brand	Best Masters Degree thesis.
2001	Dr TS Brand	Best article in a scientific journal.
2002	Mr TT de Villiers	Individual who contributed exceptionally in promoting the PRF's objectives.
2003	Dr MB Hardy	Individual who contributed exceptionally in promoting the PRF's objectives.
2004	Dr TS Brand	Best article in a scientific journal.
2006	Mr PJA Lombard	Individual who contributed exceptionally in promoting the PRF's objectives.

14TH INTERNATIONAL RAPESEED CONGRESS, SASKATOON 2014
Mr Andries Theron, Prof Andre Agenbag, Messrs Garth Hodges, Chris Cumming and Gerhard Scholtemeijer

7.2 WORKING HAND IN GLOVE WITH THE UNIVERSITY OF PRETORIA

PARTNERSHIPS AND POTENTIAL

Utilising the experimental farm at Hatfield to stage soybean information days

During 2005, the Board of Trustees of the Protein Research Foundation (PRF) decided that definite provision had to be made for the training or contracting of soybean and canola specialists, following the precedent set in 1997 when the PRF acquired the services of Mr Herman Agenbag as a lupin specialist in the Western Cape. Subsequently several more contractors were employed to assist with the promotion of various commodities in the different provinces. In 2001, Mr Wessel van Wyk, a well-qualified and experienced agronomist, was contracted to promote soybeans in Mpumalanga and Limpopo.

In 2005 the PRF Board decided to liaise with Mr Van Wyk in order to appoint him as a soybean scientist and support him with training and exposure both locally and internationally.

During the same time, the PRF Board also decided to actively seek co-operation with universities in order to become less dependent on the Agricultural Research Council (ARC).

After discussions with the Dean of the Faculty of Agriculture at the University of Pretoria, the University of Pretoria (UP) and the PRF concluded an agreement whereby UP would make land available for soybean research on their research farm in Hatfield, whilst the scientist and researcher on soybean would be supplied by the PRF. In light of the appointment of Mr Van Wyk to promote soybean production in Mpumalanga, the co-operation with the University of Pretoria fitted beautifully into the picture. The lion's share of the agreement between the two institutions was centred around a research project conducted by Mr Van Wyk, concentrating on different aspects of soybean production. The project's title was *Increasing soybean production on the Highveld of South Africa*.

During the 2006 season, Mpumalanga produced soybeans on 146 000 hectares – the biggest single soybean producing province in the country. However, historical data indicated that the average yield was a meagre 1,5 t/ha, which was obviously a problem. Certain producers produced 2,5 t/ha to 3 t/ha, but in general the feeling was that training and technology transfer at Hatfield could contribute to expansion of the area, as well as increase the average yield. Three problem areas were identified as follows:

- plant nutrition
- planting technology
- weed control

This project finally proved to be one of the best examples of technology transfer that the PRF engaged in.

In October 2007, the first trials were planted at Hatfield and consisted of three individual trials:

- row width x cultivar x plant density
- fertiliser trial
- weed control trial

The PRF trials drew the necessary attention and during the season the trials were visited by staff of UP, staff of the chemical companies and individual producers. A total of 52 students from UP and 24 from Tshwane University of Technology (TUT), also visited the trials.

» Proceedings at Hatfield Soybean Information Day

On 26 February 2008, a farmers day was held which was attended by some 55 visitors. This was a red-letter day for both UP and the PRF. The Dean of the Faculty of Agriculture, Prof A Ströh, highlighted the importance of the university's co-operation with the PRF, in an effort to advance soybean production. As far as can be established, this was the first information day held by the Department of Agronomy of the Agricultural Faculty of the University of Pretoria in 26 years. Other speakers were Prof Johann Kirsten, Head of the Department of Agricultural Economics, who pointed out the importance of soybeans and also the necessity of increasing yield, in order to compete with maize. Dr Munro Griessel and Mr Van Wyk, both from the PRF, presented very stimulating papers. The success of the information day prompted the decision to make it an annual event to be held each February.

The next information day held on 24 February 2009, showed a slight increase in attendance with 65 guests. Recognition of the importance of this event grew steadily accompanied by corresponding increasing attendance. In 2010 attendance reached 100 and by 2012 more than 250 guests registered for the day.

During the five years of these trials, more than 300 students visited the trials together with several lecturers from the UP and TUT. Two students also did their field work for their Masters degrees, on information gleaned from the trials.

In 2010, the PRF started with the so-called Elite Soybean Trials, which included cultivars from Brazil, Argentina and China. These Elite Trials are still planted annually. In 2012, Dr David Hume, who manages the Canadian 100 Bushel Club, was the keynote speaker of the day and Dr Pedro Barbagelata from Instituto Nacional de Tecnología Agropecuária (INTA), Argentina also presented an informative paper on conservation agriculture. On this occasion, the PRF honoured Mr Van Wyk, with an award presented to an individual who has made an exceptional contribution in promoting the PRF's objectives.

The World Soybean Research Conference (WSRC) takes place every four years. In 2009 it was held in China, where it was decided that the WSRC IX would be held in South Africa in 2013. In view of the fact that the Hatfield Information Day was usually held in February, it was decided that the programme would be too cluttered if the WSRC IX was hosted in the first half of February followed immediately by the February PRF Hatfield Day.

The Hatfield meeting was cancelled but fortunately, the PRF was invited by John Deere to participate in joint information days, held at the Delmas Show grounds on 27 and 28 August 2013. High attendance figures again proved the popularity of these information days.

Similarly, in February 2014, the Hatfield Day was cancelled once again as the Soy Crop Rotation Dynamics Information Days were held from 3 to 7 February 2014, at Brits, Delmas, Ermelo, Bergville and Bethlehem, in conjunction with DuPont/ Pioneer, BASF, John Deere and the Noble Group. These information days were attended by more than 2 000 visitors.

The PRF is proud of the contribution that the Hatfield Information Days have made to the success of the soybean industry through their partnership with UP. The intention certainly is to continue pursuing similar collaborative actions with UP in the future.

Dr Jos de Kock
Gerhard JH Scholtemeijer
Wessel van Wyk

Did you know?

The first Hatfield farmers day was held on 26 February 2008 and was attended by 55 visitors.

The World Soybean Research Conference (WSRC IX) was held in South Africa in 2013.


22

7.3 OTHER ORGANISATIONS

PARTNERSHIPS AND POTENTIAL

The role the PRF has played in support of protein research

Over the past 25 years the Protein Research Foundation (PRF) has co-operated with various organisations in striving to achieve its objectives. This co-operation started very early and the list of funded research projects in the addendum (page 136) bears testimony of the support. It includes organisations such as the Department of Agriculture and Fisheries, Fishing Industry Research Institute, Fishmeal Marketing Company, Fishmeal Manufacturer's Association, Department of Agriculture and Water Affairs, Abattoir Corporation, Senwes Limited, Department of Environmental Affairs and SA Coastal Fisheries.

Since 1990 the co-operation has included working closely with the organisations listed below. The PRF did not only support these organisations as the co-operation has also meant that some targets could be reached and certain successes could be secured.

Agricultural Research Council (ARC)

Co-operation started as early as 1976, with the then Department of Agriculture. The co-operation was primarily based on research. With the establishment of the Agricultural Research Council (ARC), the co-operation continued and various research projects were funded.

Most of this co-operation was with the Grain Crops Institute, but research projects were also conducted by the Animal Production Institute (ARC-API), Vegetable and Ornamental Plant Institute (ARC-VOPI), Plant Protection Research Institute (ARC-PPRI), Institute for Soil, Climate and Water (ARC-ISCW), Institute for Industrial Crops (ARC-IIC) and Institute for Agricultural Engineering (ARC-IAE).

Funding was not only limited to research projects since some overseas study tours which were undertaken by ARC researchers were also funded by the PRF.

A particular soybean project resulted in co-operation between the PRF, ARC, Council for Scientific and Industrial Research (CSIR), the University of Johannesburg and the Innovation Fund (NRF).

Over the past ten years the ARC-PPRI in particular contributed valuable work with regards to both soybeans and canola. These contributions came especially from the plant pathology section.

University of KwaZulu-Natal (UKZN)

Co-operation with the former University of Natal started in 1978, when the first research project was funded.

'Coming together is a beginning; keeping together is progress; working together is success.'

– Henry Ford

This relationship delivered valuable research results which were of significant benefit as they helped to boost the South African poultry and pig industry.

The biggest contribution came from Prof Rob Gous who, 25 years later, has undoubtedly been the most productive researcher from a PRF point of view.

Other valuable work done at the University of KwaZulu-Natal (UKZN) included the design of protein forecasting models which were developed by Prof WL Niewoudt as well as research into soybean rust notably under the leadership of Dr Pat Caldwell. The research into soybean rust *(Phakopsora pachyrhizi)* started in 2000 and was followed by work done on Sclerotinia.

University of Stellenbosch (US)

Funding of research projects dates back to 1979 and relates to a wide spectrum of subjects including animal feeds, lupins, fishmeal, groundnut oilcake, triticale, sunflower oilcake, abattoir by-products, carcass meal, poultry by-products, soybean oilcake and cotton seed. In later years the focus changed to concentrate more on the oil and protein seed crops grown in the Western and Southern Cape, particularly canola.

Valuable economic ground breaking work was done by Mr WH Hoffmann and Prof J Laubscher regarding the value of canola in crop-rotation systems. Another unique aspect which was researched by the US pertains to snails which did great damage mostly in canola. Prof GA Agenbag, who is presently the champion of canola in the Western Cape, must be mentioned, not only for technology transfer but also for the various research projects which he undertook.

Council for Scientific and Industrial Research (CSIR)

The CSIR is another PRF research partner. Co-operation started in 1983 and was focussed on ruminants, sunflower oilcake, single cell protein, fishmeal, sugar cane bagasse and anthracnose in lupins. Due to structural changes at the CSIR, co-operation has stopped.

University of Pretoria (UP)

Initially co-operation with UP was focussed mainly on animal feeds and related funding was already approved in 1986. However, funding for an economics study, *Economic aspects of optimising the supply of and demand for animal feed protein in South Africa* by Prof J van Zyl, was approved in 1992. In the same year research related to soybeans was begun and this was followed by other projects relating to various crops.

In reality the co-operation with the UP reached much further than merely the normal research projects. In 1996, Mr Wessel van Wyk, a PRF contractor, started soybean research in co-operation with the university's experimental farm (see chapter 7.2). The trials planted were also used for technology transfer e.g. the Hatfield Information Day. Students benefited by being able to study and learn from the trials which were planted as well as the expertise brought to the table by the PRF contractor.

During 2010 the PRF, University of Pretoria and DAFF joined forces to conduct a study, *The development of a map showing the soybean production regions and surface areas of the RSA*. That study was of critical importance to determine the potential for soybean growing. It provided essential information for the PRF to determine its soybean production targets and focus on promotion actions.

The Bureau for Food and Agricultural Policy (BFAP) (UP)

Apart from the co-operation between the PRF and UP, close ties have also been established with BFAP which has strived to develop scenarios to understand the potential future in terms of the next ten years of protein for animal feed. This co-operation resulted in the publication of *The Protein for Animal Feed Game* in 2009.

North-West University

In 1992, the PRF received the first application for the funding of a research project by Prof Gert Krüger entitled *The physiological and biochemical basis for drought resistance and*

efficiency of water usage in soybeans, from this university. It was the beginning of a relationship between the two bodies and resulted in valuable research results over the years. All the results from this research were in support of soybean growing in South Africa. Prof Krüger was a regular recipient of research funding since 1992 and in 2015 received an achievement award for an individual who has made an exceptional contribution in promoting the PRF vision and mission.

Photo 1: Prof Gert Krüger, second from left, received a PRF achievement award for best article in a scientific journal in 2014. Gerhard Scholtemeijer, left, handed over this award to him at one of the PRF's 25 year anniversary celebratory functions in 2015. With them are Andries Theron and Gerhard Keun

Department of Agriculture, Western Cape (DAWC)

This PRF partner's name appears for the first time in the list of research projects conducted in 1996. The initial co-operation was expanded over time and various research projects relating to canola, lupins and animal feeds were funded (see chapter 7.1).

The importance of the DAWC as research partner in the Western and Southern Cape was emphasised by the Achievement Award given to them in 2012. The award was for the category, 'Highest Honorary Award of the PRF'.

Fishing Industry Research Institute (FIRI)

Co-operation with this institution centred on marine biology, fish and fishmeal research, including the consumption of those products. Funding of the related research dates back to as early as 1982. A considerable amount of research funded was done with regards to *Gizzerosine* in broiler feeding as well as factors responsible for the development of *Gizzerosine* in fishmeal.

University of the Free State

The first co-operation with this university dates back to 1999 when funding for an investigation into the size, importance and potential of the lucerne industry was approved. The co-operation expanded in the next years to include research projects relating to soybeans as rotation crop, soybean rust, yield increases based on the application of growth stimulants, *Sclerotinia* and the forecast estimates of animal protein demand in South Africa.

Swartland Kleingraan Ontwikkelingsgroep (SKOG)

On 28 March 2002, the PRF, Western Cape Department of Agriculture, Moorreesburg Koringboere Beperk (MKB), Porterville Landboukoöperasie (PLK) and Kaap Agri concluded an agreement to support the Swartland Kleingraan Ontwikkelingsgroep (SKOG).

The parties agreed to co-operate in terms of practice-oriented research and appropriate information actions by means of agricultural crop demonstrations in the Swartland, to acknowledge and protect the parties' interests. SKOG is used as medium to achieve the objective.

SKOG consists of a group that attempts to expand and develop the small grain industry by means of demonstration trials and making available practice-oriented production information to producers. SKOG also involves other co-operating parties, input suppliers and role-players (referred to as 'SKOG co-operators'). These SKOG co-operators serve the small grain industry in the Swartland voluntarily in order to achieve the objectives of the project. All SKOG co-operators are members of a committee which has a project manager who is a compulsory member. This committee still functions and the partnership generates a valuable body of knowledge.

Animal Feed Manufacturers Association (AFMA)

Co-operation between AFMA and the PRF has been a longstanding process. The co-operation arises naturally as a result of the objectives of both parties and is critical for securing the production of animal feeds in South Africa.

Grain SA

Over the 25 years of the PRF's existence, millions of rands have been earmarked to focus on the production of protein

crops. Since the results of such research are important for producers, it was natural that it would result in a long period of co-operation between Grain SA, a producer organisation, and the PRF.

Up until 2013 the PRF had a presence at NAMPO Harvest Day, with the specific intention of conducting technology transfer.

In 2006 and 2007 co-operation between Grain SA and the PRF also gave rise to a radio programme being broadcast on RSG and aimed at technology transfer.

Oil and Protein Seeds Development Trust (OPDT) and Oilseeds Advisory Committee (OAC)

Co-operation between the PRF and OPDT/OAC is unique. It started when the administrative functions of the bodies were placed under the management of one administration, despite the continued separate functions of the two independent bodies. The move also helped to stretch the available rands for research as it meant that research projects could be funded jointly.

Administrative co-operation started as early as 2002, when OPDT/OAC staff became involved in the PRF Anthracnose Working Group. In subsequent years the activities of the PRF and OPDT/OAC expanded to such a degree that full-time administration was essential. After the retirement of a seconded ARC member of staff in 2003 the joint administration was instituted.

Co-operation between the PRF and OPDT/OAC in terms of research funding started in the 2002/2003 financial year and related to soybean research. It resulted in the availability of more research funding. The co-operation was expanded to include canola in the 2014/2015 financial year.

Agri Mega

The promotion of canola production and technology transfer relating to canola was addressed through a co-operation with Agri Mega. In 2010 a large-scale action was launched during the Agri Mega week to introduce canola to producers. In later years the PRF action there, has been limited to a PRF exhibition stall.

National Agricultural Marketing Council (NAMC)

In March 2011, a study, *The South African Soybean Value Chain* was launched by NAMC. The PRF's involvement in the study involved providing the researchers with critical information and the scope also stretched to include the identification of role-players in the soybean industry. The promotion of soybean production has naturally also required that co-operative partnerships were established with other industry role-players. Those include, particularly the Northern Cape Department of Agriculture, GWK, VKB and Obaro.

Although co-operation may have been limited, the funding of some other research projects also warrants mentioning. This includes research projects conducted by the following organisations: The University of Cape Town, Stimuplant, Department of Agriculture, KwaZulu-Natal, University of the North, University of the Witwatersrand, University of Zululand, Carnia Seed, Senwes Limited, Suiderland Development Corporation and the Mpumalanga Department of Agriculture.

Gerhard Keun

8 PROTEIN RESEARCH

PROTEIN RESEARCH

Improving the efficiency of utilisation of protein for animal feed

Not only does the Protein Research Foundation (PRF) strive to increase the amount of protein that is produced in South Africa for animal nutrition, but it has also encouraged research on the better utilisation of this protein and some innovative and useful research has been conducted as a means of achieving this aim.

Projects as diverse as those on single-cell protein and on goats, ostriches, fish and dairy cows have been funded over the past 25 years. These projects have been extremely diverse but have concentrated primarily on evaluating alternative protein sources and methods of improving the nutritive value of these raw materials using poultry, pigs, dairy cows and even sheep and goats. In addition, many of the projects have measured the responses of poultry and pigs to dietary amino acids with a view to determining the optimum economic intake of these nutrients in commercial operations. Other projects have addressed critical issues that have arisen from the feeding of certain protein sources, such as the gizzard erosion problem when fishmeal was used extensively in poultry feeds. These projects are described in more detail below.

EVALUATION OF PROTEIN SOURCES FOR ANIMAL AND POULTRY FEEDING

Prior to the late 1990s the major protein sources for poultry and pig production in South Africa were sunflower oilcake meal and fishmeal. As stocks of the latter raw material diminished and became almost prohibitively expensive, soybean meal became the protein of choice, with virtually all our requirements being sourced overseas.

There was consequently considerable interest in identifying alternative sources of protein that could be sourced locally:

- Dr TG Watson from the Council for Scientific and Industrial Research (CSIR) believed that single cell protein could provide much of the required protein for animal feed and was granted significant funds by the PRF to develop this protein source, but the project was a failure.
- Prof WH van Zyl from the University of Stellenbosch received funding for a project in which functional yeast protein was used as a supplement in feed for monogastrics, also without success.
- Over a three-year period Dr L Erasmus from the Animal and Dairy Science Research Institute at Irene evaluated a wide range of raw materials as a source of protein in complete feeds for high producing dairy cows. These included carcass meal, blood meal, poultry by-product meal, marine by-products, whole- and cracked canola and cottonseed oilcake.
- Prof JP Hayes from the University of Stellenbosch measured the availability of amino acids in abattoir by-products, carcass meal, poultry by-product meal and soya- and cottonseed oilcake for poultry feeding.
- Prof RM Gous from the University of KwaZulu-Natal (UKZN) evaluated the extent to which lupins, canola, faba beans and distillers dried grains and solubles (DDGS) could replace soybean oilcake in the feeding of pigs and poultry.
- Dr T Brand from the Department of Agriculture, Western Cape, Elsenburg, quantified the energy values and composition of potential alternative protein sources including sweet lupin, full-fat canola- and canola oilcake meal-containing diets for poultry and pigs, as well as evaluating the application of feed enzymes to these protein sources.

- Mr MD Olver, Agricultural Research Council (ARC), also evaluated lupins as a protein source for poultry.

A number of researchers were interested in the effects of the processing of raw materials such as soybeans, sunflower seed, canola and lupins on the energy and amino acid availability for young chickens. These included Dr L Eckermans from the University of Stellenbosch and Prof PA Boyazoglu of Medunsa as well as:

- Dr PJ Pretorius from the North-West University who attempted over a three year period to improve feather meal as a feed source using microorganisms.
- Dr D Palic from the ARC evaluated and standardised an analytical method for determining the degree of soya processing, an important consideration as both under- and overheating of soybeans during processing prevent the nutrients in soybeans from being fully utilised by monogastrics.
- Dr Brand from Elsenburg wanted to circumvent the processing of soybeans so he evaluated the use of raw soybeans in the feeding of growing ostriches.

RAPID METHODS FOR MEASURING THE NUTRIENT CONTENT OF PROTEIN SOURCES

The accuracy with which nutrient contents could be measured in feedstuffs using near infrared spectroscopy (NIRS) improved considerably in the 1990s and the value of being able to obtain accurate measurements of the protein, metabolisable energy (ME) and even digestible amino acid contents of feed ingredients as they are delivered to the feed mill was immediately recognised. More accurate feed formulations would result from a more accurate knowledge of the nutrient content of the raw materials being used in the mill, rather than using average or book values for these ingredients.

The improvement in the efficiency of utilisation of dietary protein was obvious, and so the PRF agreed to fund a number of projects in which the use of NIRS was evaluated:

- Dr Brand from the Western Cape Department of Agriculture at Elsenburg conducted a project on the use of NIRS to determine the chemical composition and energy contents of a range of raw materials including different protein sources, and another in which lupin alkaloids were evaluated by means of NIRS. These alkaloids reduce the digestibility of protein in lupins, so those with high alkaloid levels can be detected and then avoided in feeds for poultry and pigs.
- Dr M Ciacciariello from the University of KZN successfully submitted a project which aimed to calibrate the NIRS for total and digestible amino acid analysis of animal feed. This is being accomplished successfully in France but this project was terminated before the technique could be perfected here.

GIZZARD EROSION IN POULTRY

Following the gizzard erosion problems experienced in the early 1990s in broilers and laying hens, associated with the feeding of high levels of fishmeal, the Fishing Industry Research Institute (FIRI) submitted many research projects to the PRF dealing with this problem, for which significant funding was made available. The projects, under the direction of Dr JPH Wessels, were designed initially to discover what factors in fishmeal contributed to the variation seen in performance of chickens, and when it was discovered that gizzerosine was the cause of gizzard erosion, projects were initiated on finding methods for measuring the content of gizzerosine in fishmeal. Local and imported fishmeal for the poultry industry were evaluated; the nutritional value of fishmeal with variable gizzerosine scores was measured for weaner pigs and broilers; new methods for measuring the content of gizzerosine in fishmeal were developed including an immunoassay technique; and fishmeal was even tested for its suitability for ruminants. Before the turn of the century, fishmeal had become a scarce and expensive commodity and gizzerosine is therefore no longer of any concern to the feed industry.

DAIRY COW (AND RUMINANT) NUTRITION

A wide range of topics dealing with ruminant nutrition has been tackled over the past 25 years by ruminant nutritionists and physiologists at the ARC-Animal Nutrition and Animal Production Institute, formerly known as the ARC-Animal and Dairy Science Research Institute (ADSRI) and later the ARC-Animal Production Institute. The most prolific researcher at this institute involved with projects for the PRF was Dr L Erasmus who conducted:

1) A four-year project entitled *In sacco digestibility and amino acid profile of rumen undegradable protein in the lower digestive tract.*
2) He then worked on *The effect of processing on the bio-availability of amino acids from various protein sources in the lower digestive tract of dairy cows.*
3) Later he submitted a project on *The effect of processing of protein sources on the partitioning of nutrients such as amino acids to the mammary gland for milk synthesis.*
4) Before he left the Institute Dr Erasmus conducted a further study, over two years, on *The effect of cottonseed and whole- and cracked canola on productivity of first-lactation Holstein heifers.*

Other researchers who worked on projects at this Institute were:

- Ms M Smuts-Ayers addressed digesta kinetics and its effect on ruminant production.
- Dr CW Cruywagen worked on rumen degradability of carbohydrates in feed sources for microbial protein synthesis in ruminants and on the evaluation of soybeans, lupins, groundnuts, sunflower and cottonseed in starter feeds for calves.
- Dr P Henning received funding for two projects:
  1) *Combining dietary energy sources for increased rumen microbial protein yield.*
  2) *The relationship between carbohydrate structure, rate of rumen fermentation and microbial protein production.*
- Ms MJ Linington received funding for a project in which she compared the physiological adaptation of different cattle breeds to low quality roughage.

The only non-ADSRI nutritionist to work on ruminant nutrition was Prof GA Smith from the University of Pretoria who conducted research for one year on the nutritional value of protein-enriched by-products for ruminants. Prof Smith was a non-specialist who also worked with:

- Turkeys – exploring the influence of lysine and methionine contents at given ME contents on the efficiency of utilisation of dietary protein by growing turkeys.

- African sharp-tooth catfish – studying the quantification of the feeding value of protein and energy components of feeds for *Clarias gariepinus*.

POULTRY RESEARCH

In the category of research to improve the utilisation of dietary protein for animal production the largest number of projects, and the greatest share of PRF funding, was allocated to research in poultry. The majority of these projects were conducted by Prof Gous of the University of KZN (formerly University of Natal) who undisputedly is the researcher who received the most regular research funding over the past 25 years. The main thrust of his research was to characterise the responses of broilers, laying hens and broiler breeders to amino acids with a view to determining the optimum economic intake of these amino acids. Because it is necessary to be able to predict food intake in order to convert the optimum intake of a nutrient to a dietary concentration for formulation purposes, a considerable effort was made to predict food intake in these strains, and this led to the development of simulation models that have proved to be highly successful world-wide in optimising the way in which broilers, pigs, laying hens and broiler breeders should be fed.

These simulation models identified important gaps in our knowledge of various processes related to protein nutrition, and the PRF has funded many projects in an attempt to fill these gaps. These included a project to determine the potential protein growth rate of broilers, and another that investigated whether animals should be fed to their genetic potential if this is unachievable because of environmental or physiological stress.

In a series of trials with Cobb and Ross broiler strains used in South Africa, it was discovered that these strains responded quite differently to dietary protein and consequently each needed to be fed in a different way to optimise the use of this protein. A follow-up project investigated the effect of day-length on the efficiency with which these two broiler strains utilised dietary protein.

In a series of trials by Prof Gous in which an attempt was made to reduce the age at sexual maturity of broiler breeder pullets, the discovery was made that these birds do not respond to light in the same way as do laying hens, demonstrating that the lighting programmes recommended by breeding companies were detrimental to productivity. The considerable increases in numbers of eggs produced per hen are the result of this research, thereby improving the efficiency in the utilisation of protein and increased profitability. This and other projects with broiler breeders, have led to the development of a simulation model that optimises the feeding of broiler breeder hens during lay.

The notion of 'improving the utilisation of protein in animal feeding' can mean different things; whether it is to more accurately measure the digestible amino acid content of protein sources used in the feed industry, to determine whether alternative protein sources contain anti-nutritional factors that might reduce performance when fed to poultry and pigs or to find ways of processing such protein sources to eradicate these deleterious chemicals. But the issue of greatest importance to the PRF is taking account of the marginal cost of supplying protein to the animals and the marginal returns obtained, i.e. determining the optimum economic intake of protein for different classes of poultry and pigs under different environmental conditions, when the product is sold in different ways (live, dressed, further processed). To achieve this, it is necessary to be able to predict voluntary food intake, from which the optimum economic amounts of the amino acids for a given dietary energy level can be calculated. Consequently, the simulation models developed by Prof Gous with the generous funding obtained from the PRF are possibly the most valuable outputs emanating from the funding of research in this field.

Gerhard Keun

9.1 THE ORIGINS AND DEVELOPMENT OF THE PRF WEBSITE

WEBSITE, BURSARY SCHEME AND ACHIEVEMENT AWARDS

The PRF is keeping up with the times

A Protein Research Foundation (PRF) Board resolution to promote technology transfer and provide more ready access to research results, related to a recommendation contained in the Chairman's report at the 2001 Annual General Meeting, and resulted in a decision to investigate the possibility of establishing a website for the PRF during 2002. The matter was investigated and the PRF Board resolved to establish a website as soon as possible.

2003

At the January 2003 PRF Board meeting, Mr Deon Joubert, as Chairman of the Marketing Committee, reported that websites already developed by Mr Thomas of *Tigme.com* had been checked and traced. The Marketing Committee was satisfied with the sites and resolved to request that Mr Thomas continue with the first phase of the layout and design for a PRF website.

This was the foundation of a website developed to serve as a tool for technology transfer and has grown into the flagship of the PRF. A website is never stagnant and the initial design was continuously updated to satisfy the growing needs of the PRF. This is a time-consuming process. In the case of the PRF, the development grew as follows:

After the design and layout of the site, the first step in 2003 was to register the web address, *www.proteinresearch.net*, reserve the web space and develop the programming. Some of the topics of information that needed to be published were:

- Annual reports
- Minutes of working group meetings
- Articles published by bursary students (including brief summaries)
- Final theses
- Information about research projects funded by the PRF
- Administrative aspects of funding applications

Other matters published included:

- Short- and medium-term demand for protein.
- Information relating to achievement awards.
- The Board also wished to publish brief descriptions of models financed by the PRF and links to institutions that were involved directly or indirectly in the research funded by the PRF.

At each Marketing Committee and PRF Board meeting more aspects to be included on the PRF website were identified including:

- Detail about all information days
- Overviews of international protein pricing

The design of the website required attention to details such as:

- The PRF logo
- Letterheads
- Complimentary slips
- Business cards

Email addresses were also made available for publication when the website was registered and launched. They were all linked to the *@proteinresearch.net* home site.

2004

By 2004 the website was established and quickly proved to be a particularly useful tool in the PRF's technology transfer programme. Another Board resolution required the inclusion of existing information available in the PRF archives. This was a huge task and has not yet been fully finalised. It will take more time, but will definitely become a valuable source of information for the respective industries.

At the request of the members of the respective PRF Working Groups, the PRF Board resolved in 2004 that information concerning prices of soybeans, lupins and canola provided by Dr Munro Griessel, Chairman of the Technology Committee, be included on the website as a regular feature. This information provided an overview of soybean price movements in international protein markets and price reviews indicating what current fair producer prices in South Africa should be.

2005

In 2005 the site developed rapidly under the guidance of Mr Joubert, PRF Vice-chairman, and with the support of *Tigme.com*, Dr L du Plessis (contractor) and Ms M du Preez of the PRF. Some of the matters that were addressed included:

- Completion of a manual relating to the website, developed by *Tigme.com*.
- Regular publication of website statistics.
- Broader marketing of the website to encourage utilisation thereof.

In terms of marketing the website, the Marketing Committee recommended that outside interested parties should be informed about the site. Accordingly it was decided that the broad marketing of the site was to be considered as soon as more substance had been added in the form of price information and the database.

The committee recommended an awareness campaign in the second half of 2005 to make producers aware of the information available on the site which included the wording,

Visit our website on all newsletters, pamphlets and other publications of the respective PRF Working Groups.

In addition:

- Preparations were initiated to include daily price information on the website.
- An evergreen contract was concluded with *Tigme.com* in terms of updating and maintaining the website.
- Links to South African Grain Information System (SAGIS), Grain SA and Agri SA were implemented.
- The data base prepared by Drs De Kock and Griessel was included on the site. According to a resolution, current research information to be published on the website also had to be included as part of the database. Indexing of research data available for the period 1973 to 2005 continued. This meant that the available web space was insufficient and required expansion.

2006

The 2006 Annual Report named the website as one of the most powerful and effective means of communication that the PRF had used. The PRF thus strove to promote extensive awareness of the site and make it more user-friendly. To this end the entire website was revised in 2006 making it even more appealing and the information on the home page was amended to make it more user-friendly.

Other new additions included an archive and the design of a new framework for a database to include research subjects, the name of the researcher(s), the name of the institution and management summaries.

Other new features adding value were:

- A photo album
- Projections of protein consumption
- Income and cost estimates of commodities
- Findings and observations of international study tours
- A Canola Development Plan

The news about the PRF website was spread in as many ways as possible:

- By spreading the news at meetings and farmers days.
- On letterheads and business cards.
- By placing links on related industry websites – this was one of the most effective ways of introducing the PRF website.

The increase in the number of unique visitors supports the belief that the website is one of the PRF's most powerful and effective means of communication:

- January - December 2004 – 1 691 unique visitors
- January - December 2005 – 3 282 unique visitors
- January - December 2006 – 4 552 unique visitors

2007

The continued development of a website is of utmost importance. During 2007, the following innovations were introduced:

- The home page included an indication of new information recently uploaded.
- The site included important news flashes.
- The price index for imported soya oilcake was updated daily.
- A list of important dates to remind visitors of future events was included to facilitate planning and attendance of those events.
- Important deadlines were shown in flash format on the home page.
- Another important 2007 introduction was a new heading, namely Biofuels.

As mentioned earlier, a framework for a research database was included on the site in 2006, which provided a platform

Did you know?

An income and cost budget 'DIY' form, which allowed producers to prepare their own budgets for certain crops, was designed in 2010.

for the publication of research results. By 2007, the uploading of information available in document form at the PRF offices was initiated.

Links to other websites remain an important way to promote utilisation of a website and in 2007 links to 16 other important websites were published.

The monitoring of visits to the website indicated that a high percentage of hits were from international visitors and in a particular month, they comprised 31% of the total number of visitors.

The steady increase in the number of visitors continued and by 2007, 5 404 unique visitors were recorded.

2008

Peer review

In 2008 the website was subjected to a peer review to determine the need for large-scale change. The conclusion was that the layout was neat, professional and the programming was good. A few cosmetic changes were recommended and implemented.

Database

The database was established and new research information was included as it was received. The uploading of historical research information as part of the database was also initiated.

News flashes

News flashes are popular on the site but required better management by removing outdated information regularly and adding new news items received from the respective PRF Working Groups.

Website links

Links to other websites still enjoyed high priority in 2008 and resulted in a link to an Australian website. After this several links were established with other international websites.

The popularity of the PRF website was measured annually based on the number of unique visitors. By 2008 the number of unique visitors for the year was 11 104.

2009

Sharing links to other websites remained a priority during 2009 since they promote the PRF website. Two new links in 2009 included two very important institutions:

- 'National Variety Trials', an Australian site
- The 'Iowa State University'

The database which had been uploaded in 2007 continued to enjoy high priority and a large quantity of historical data that had previously only been available in document format only was included as part of the database.

Between 2004 and 2008, the number of unique visitors increased exponentially, but the number declined to only 8 484 in 2009. This prompted actions to market the website more aggressively, particularly the soybean and canola campaigns that the PRF launched.

2010

The campaign to market the PRF website more aggressively was launched in 2010. All efforts were aimed at introducing the PRF website to potential users. The web address was shown on all documents issued by the PRF and was promoted at all information days and other events. Links to other institutions that could increase awareness of the PRF website and promote better utilisation were investigated. During 2010, links to other sites had increased to 22 external links.

During the course of 2010, PRF Board members and staff contributed significantly towards redesigning the website into a more user-friendly end product. Efforts resulted in the identification of a need to place information on the site sooner and more quickly. In an effort to find a solution to this problem two members of staff, Mrs M du Preez and Y Papadimitropolous attended an HTML course. Ms Du Preez also attended a *Search Engine Optimisation* course.

An important control system aimed at controlling the uploading of information was developed in 2010. The Marketing Committee assumed responsibility for this and more timeous and regular updating of information on the site resulted.

Another 2010 highlight was the design of an income and cost budget 'DIY' form, which allowed producers to prepare their own budgets for certain crops. A programme that could enable producers to download the forms and information and help them prepare the information on their own computers was investigated. This was an extension of the seasonal income and cost analysis which the PRF makes available to soybean and canola producers.

In spite of efforts to market the PRF website, the number of unique visitors declined to 7 313 in 2010. The presumption was that the visits were of higher quality and that more positive time was spent per visit since the number of pages viewed per visit also increased.

2011

This year the importance of links to other sites was confirmed by the fact that 27% of PRF website visits were ascribed to those external links. As such, the following aspects enjoyed particular attention in 2011:

- Programming work relating to the 'DIY' income and cost estimates was completed and users could download the software to prepare their own budgets.
- Programming in terms of the online income and cost estimates form that allowed users to prepare a budget on the PRF website started.
- The backlog relating to uploading historical information as part of the database was reduced considerably.
- The website layout changed slightly allowing regular inclusion of interesting information about soybeans and canola. The snippets included were loaded as brief bursts of information on the home page.

By the end of 2011 the number of visitors had increased by 7% (7 830) compared to 2010, more pages were viewed and the time spent on the site had increased.

2012

The important role of the PRF website in communicating matters of interest to role-players was reconfirmed in 2012. A photo gallery of visual images with information described in text format was also added.

The income and cost estimates online function was finalised and was a complete and effective tool to producers. The backlog of management summaries of projects, theses and articles was wiped out and included in the website.

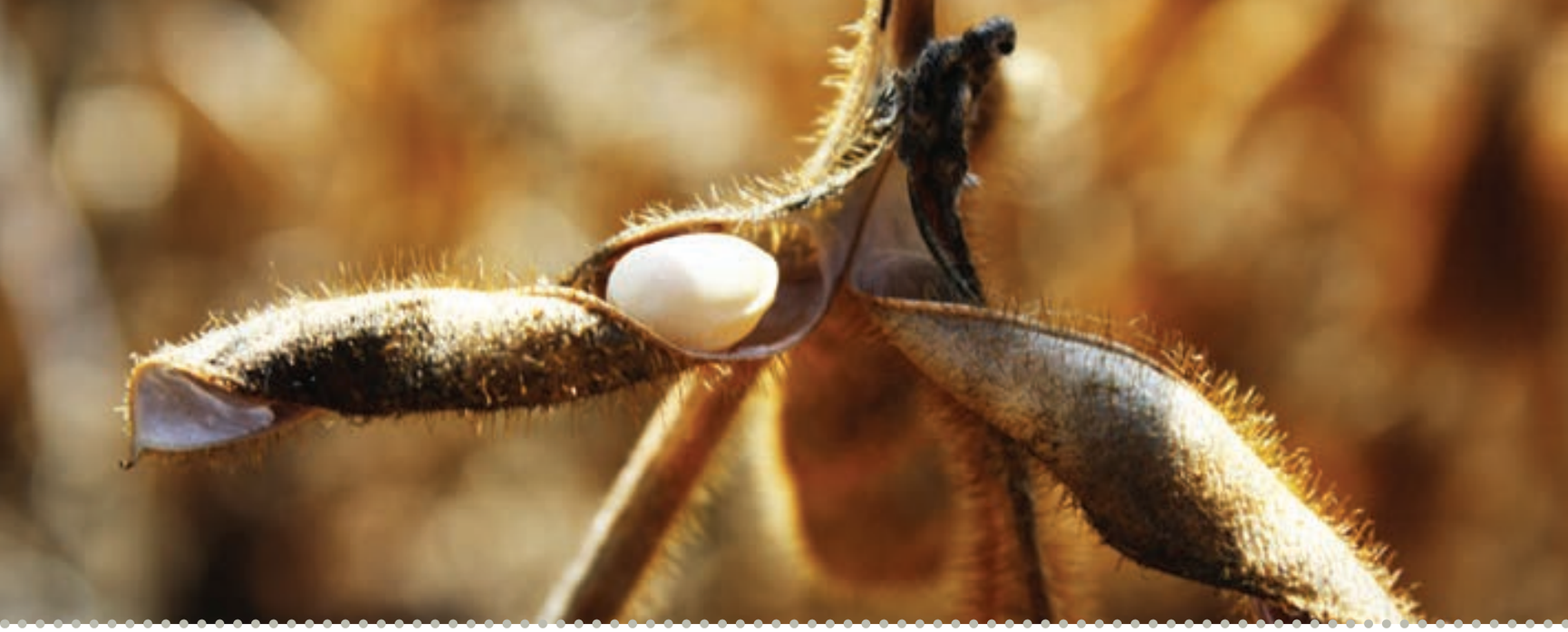
The number of visitors in 2012 surpassed the 2011 number of visitors by 18,2% to reach 9 252 hits. It was encouraging to see that the total number of pages visited and the number of pages per visitor had also increased.

The PRF operates in a volatile and dynamic environment. Therefore as the PRF activities are adapted to change, the PRF website needs continuous management to keep the information updated and relevant so as to maintain the site as a facilitating tool.

2013

During 2013, the following matters received attention:

- Soybean growing guidelines were made available in video format on the website.
- Up-to-the-minute soya oilcake price information was published in a new format and included price movements of oil and husks.
- A redesign of the online application form for research funding applications was begun.
- Links were placed on the home page so consumers could indicate whether they wished to receive the income and cost estimates, including newsletters by email.



- A link to the World Soybean Research Conference (WSRC IX) was established for those wishing to receive information about WSRC IX 2013.
- New links were introduced which offered users the opportunity to share information on the website with others through social media platforms like *Facebook*, *Twitter* etc.

The number of unique visitors in 2013 reached 8 767.

2014

Constant attention had been paid to the renewal of the website, with the following results:

- A new welcome message on the PRF website.
- The soybean growing guidelines that were introduced on the website in 2013 were made accessible on *YouTube* as platform in 2014.
- The PRF Board resolved that the website should be made more interesting by adding, *inter alia*, audio-visual material.

At a PRF Board meeting it was reported that a large percentage of the visitors were visiting the PRF website directly, indicating that sustained marketing efforts had been effective. They were also informed of a 218% increase in visitors to the income and cost estimates pages!

During the course of 2014, the following matters received attention:

- Expanding links with other websites.
- Updating the database and associated work to make more information available on the website.
- Formatting of links to websites to introduce an attractive and user-friendly packaging of website information including improved utilisation of PRF website links.
- Introducing a new search engine facility.
- Progress was made with the uploading of articles.
- Publishing the informative document about the *Combuds* concept on the site, prepared by Mr JSG Joubert.
- Requesting for a legal opinion about the indemnity measures to ensure complete PRF indemnity.

During that year a website developer was approached to evaluate the PRF website. Once again the feedback was positive and only cosmetic changes were proposed.

It was also noted that an objective-oriented site map of the PRF website was linked to both *Bing* and *Google* search engines and that the PRF web page has a *Google* Page Rank of five, which is rewarding since a rank of eight is considered the highest possible. With that as our challenge, a little more activity saw the website ranking improved to a six within two months.

The number of unique visitors in 2014 was 8 581.

With the onset of 2015, every contributor was working hard to implement more improvements to the PRF website. All that is required now is for YOU to visit the site at *www.proteinresearch.net*!

Gerhard Keun

9.2 BUILDING THE FUTURE

WEBSITE, BURSARY SCHEME AND ACHIEVEMENT AWARDS

The PRF bursary scheme

The Protein Research Foundation (PRF) contributes to and realises its vision through the pro-active stimulation and funding of appropriate objective-oriented research. This includes the promotion and implementation of such research results through technology transfer, in its efforts to provide for the increasing demand for protein for animal nutrition and ensure the optimal utilisation of such protein in South Africa.

Apart from the funding of research and the technology transfer of research results, the PRF realised that other contributions to support research and expanding the research capacity in South Africa were essential. At a meeting held on 5 February 1993, Dr RM Finlayson proposed a bursary scheme. The PRF investigated the possibility of offering bursaries and on 22 October 1993, the scheme was launched. Bursaries were initially awarded by the Bursary Committee under the auspices of the Chairman, Mr Danie Joubert, but later the scheme became a function of the Marketing Committee under the chairmanship of Mr Joubert.

Bursary funds are made available annually to support deserving applicants who are conducting research in the course of obtaining a Masters or Doctorate degree. Clear guidelines and requirements are entrenched about the utilisation of bursaries and distinct qualifying criteria must be met. All the relevant information is available on the PRF website at *www.proteinresearch.net*.

In the case of a Masters degree, the aim is to create capacity for deserving candidates that will enable them to contribute through scientific research of a high quality, to the body of knowledge particularly in the field of protein research and/or protein consumption as these apply to animal feeds. The main objective of the bursary scheme is to train researchers and facilitate the process of reading for a Masters degree. The Board resolved that funding for Doctorate studies would only be considered if the subject matter was of particular interest to the PRF.

The PRF is proud to report that 72 candidates have obtained bursaries since 1995 and that the financial value of those bursaries amounts to R3 637 000.

It is important to remember that the total value of a bursary depends on the particular field and scope of each study. The guidelines are two years for a Masters degree and three years for a Doctorate.

In 1995 the value of a bursary was R12 000 per year, but that had to be revisited regularly in order to keep up with the rising costs. This trend saw an upward movement in the allocation of bursary funds per student over the years:

YEAR	RANDS/YEAR
1996	14 000
2001	17 000
2003	20 000
2006	28 000
2008	30 000
2009	35 000
2013 - 2015	40 000

The PRF currently makes available eight bursaries per year. However, in 2013 and 2015 respectively nine bursaries were awarded because of the high standard of the applications submitted.

The scope of the bursary scheme is not only defined by the pursuit of a Masters or Doctoral degree, but more particularly to the purpose and role the degree might play in expanding research capacity as well as the contribution made in supporting research.

This prompted the PRF to conduct a survey aimed at determining whether past bursary recipients are working in the industry and to maintain these relationships. To date only four former bursary recipients have not yet been traced while 13 are still in the process of finalising their studies.

The success of the PRF bursary scheme is significant and the survey showed that most of the former bursary recipients are indeed working in the industry – both locally and internationally. Their involvement and contribution covers a wide spectrum of disciplines and includes the fields of academia, research, technical management, managing directorships as well as entrepreneurial activities such as the ownership of companies in the animal feed chain.

Gerhard Keun

9.3 ACHIEVEMENT AWARDS

WEBSITE, BURSARY SCHEME AND ACHIEVEMENT AWARDS

Rewarding performance aimed at achieving the PRF's objectives

The Protein Research Foundation (PRF) announced its first achievement award in 1995. These awards are yet another innovative way of achieving the PRF's objectives. The first award was aimed at promoting and publishing the acclaimed research achievements within the pre-determined field of the Protein Research Trust's (PRT) vision and mission. Publishing research results does not only generate new knowledge, but also adds impetus to the process of making new technology available.

In the early years, the awards were allocated in three categories, namely the Best Doctoral thesis, the Best Masters treatise and the best article published in a scientific journal. A process of peer evaluation was used to identify suitable winners with the fundamental criteria being the PRT's mission statement.

When it was reported that the number of entries submitted for possible awards in 1996 did not meet with expectations, it was decided to launch a special marketing campaign to inspire institutions and individuals to avail themselves of the opportunities presented by these achievement awards to acknowledge merit. In the same year, the PRT Board of Trustees also resolved to include a fourth category which is for a person/persons who has made an exceptional contribution in promoting the PRF vision and mission. This new category was introduced in the 1997 calendar year.

In 1998 the following categories were included in the achievement award determination process:

- Best Masters treatise
- Best Doctoral thesis
- Best article published in a scientific journal
- An individual who has made an exceptional contribution in promoting the PRF's vision and mission

The aim of the first two categories was to encourage post-graduate students to focus their attention on subjects that promote the PRF's objectives. The third category is aimed at encouraging scientists to publish their research achievements. The aim of the fourth additional category hardly requires explanation, but the emphasis is on persons who have been involved, *inter alia*, in technology transfer.

Despite various efforts to market the achievement awards, the level of interest and the number of entries that could qualify, still remained below expectations.

In 1999 however, it became clear that interest in the achievement awards was growing. Although only one award was approved in 1997 and 1998 respectively, the PRF was particularly satisfied with the announcement of three awards in 1999.

During 2006/2007 the PRF Board made the decision to add a fifth category. This category is aimed at the acknowledgement of a PRF Board member who played a significant long-term role in the PRF activities.

By 2012/2013 the PRF Board resolved to add a sixth category aimed at acknowledging a local or international organisation which has contributed beyond the mere call of duty towards assisting the PRF in achieving its objectives. With the introduction of its awards the PRF provided, apart from its financial contributions toward research, technology transfer

Photo 1 (above): Highest Honorary Award awarded to Mr SJ Malherbe
Photo 2 (below): Farewell function for Mr H Agenbag held at In Die Bos, Stellenbosch

and grants, an opportunity for persons and/or organisations to be acknowledged within six achievement award categories:

- Best Masters treatise
- Best Doctoral thesis
- Best article in a scientific journal
- An individual who has made an exceptional contribution in promoting the PRF's vision and mission
- A PRF Board member who has played an outstanding role in the PRF activities
- An organisation, local or international, that has contributed beyond the mere call of duty to assist the PRF in achieving its objectives

It is significant that from 1995 to 2014 the PRF has presented 60 achievement awards in the different categories. In so doing, the PRF has reinforced the leading role it plays within the protein industry. The process of highlighting and publishing remarkable achievements and honouring individuals and organisations which have made valuable contributions in the pursuit of PRF objectives has been of value in promoting the image of the PRF and the industry it champions.

Gerhard Keun

10 FUTURE VISION

FEED THE FUTURE

As a future-focussed organisation, the PRF is constantly monitoring future growth in demand and supply of protein for animal nutrition. Current information suggests that the latest statistics project the demand for oilcake in 2020 to be about 2 335 727 tons and 2 632 604 tons by 2025.

Throughout this volume, reference has been made to the various models the PRF have used to determine the measure of success achieved in terms of the targets it has set for itself in striving to reach its objectives, namely:

- The promotion of appropriate research in favour of locally produced protein to replace imported protein.
- The better utilisation of such protein.
- Ensuring the effective implementation of these results through technology transfer.
- Measuring the gap between locally produced protein and imported protein for animal nutrition.

THE BIG PICTURE

While contributions to this publication have primarily referred to soybean and canola projections, an aspect that has not been discussed in detail is the contribution that other sources, such as sunflower oilcake, make towards satisfying the total demand for protein.

Whereas total local contribution of protein 25 years ago was only slightly more that 30%, the PRF is obviously very grateful that in 2015 for the first time ever, South Africa produced more protein for animal nutrition than what was imported:

	LOCALLY PRODUCED	IMPORTED
2013/2014	913 356	976 624
2014/2015	1 197 606	711 224

If calculations are based on the assumption that sunflower oilcake and fishmeal, etcetera continue to be produced at current levels and if the projected production of soybeans and canola are added to this, South Africa will certainly be in a position to produce sufficient protein for animal nutrition by 2020, which should make South Africa self-sufficient. However, the projections also indicate that there will be an additional increased demand of 300 000 tons by 2025.

IS ENOUGH EVER ENOUGH?

So while the PRF is continuously striving to ensure that there is a steadily increasing local production of protein for animal nutrition, we recognise that simply meeting current demands cannot be considered adequate nor does it imply that we may rest on our laurels. Instead, it is essential that we pursue every opportunity in an effort to ensure there is a reasonable surplus of oilseeds and/or protein resources available for each calendar year.

We are realistic enough to understand that there may be many more challenges for the PRF on the road ahead. It is significant

> ‘I find my greatest pleasure, and so my reward, in the work that precedes what the world calls success.’
>
> – Thomas Edison

that ‘sufficient’ does not necessarily imply either that a product is produced at maximum profit or at the lowest cost. These factors will need careful consideration and new approaches to create security both for the suppliers and the consumers of protein for animal nutrition.

DUAL-PURPOSE: PROTEIN IN THE FEEDLOT AND THE SUPERMARKET

The PRF also maintains that a very important aspect of the future is the increased processing of soybeans as a valuable source of protein for human consumption. By implication there will be a new demand for protein which is additional to the demand for soybeans in animal nutrition – and thus increase the demand for this crop even further.

THE PRF KEEPS ITS FINGER ON THE GLOBAL PULSE

Looking to the future, another aspect which must be addressed by the PRF is the release of new cultivars onto the local market. This is necessary to ensure that commodity cultivars with new characteristics such as resistance to weed herbicides, as well as resistance to nematodes, disease and insects are available as soon as possible – even though our market is presently not usually considered large enough to be entered early on in the life cycle of a new product.

YESTERDAY, TODAY, TOMORROW: THE PRF IS A PARTNER FOR THE FUTURE

In conclusion, the PRF has proven that each year its innovative approach was able to keep up to date with all the latest developments. It is also true that within the next five to ten years there may be many fresh, new perspectives in terms of oil and protein seeds in the market as well as other protein sources, for example single cell protein, algae and other innovations, which may require the PRF to set new objectives. With the track record we have built thus far, I trust and believe that the PRF will continue to play a leading role in the promotion of protein production and so continue to be as significant, relevant and successful as it has been during the past 25 years.

Gerhard JH Scholtemeijer
Chairman

SOYBEAN RESEARCH PROJECTS

(1976 - 2015)

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
4	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1976	The visit of an American soybean expert to South Africa.
12	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Dr WJ Snyman	1980	Visit to Zimbabwe in connection with soybean research.
16	Department of Agriculture and Water Affairs	N/A	1981	Threshing machine for soybeans.
20	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Mr MA Smit	1982	Overseas travel: Soybean research in the USA.
28	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Dr J Dreyer	1983	Overseas travel: Research techniques in respect of yield physiology of groundnuts and soybeans.
34	AFMA		1984	Soybean Seminar.
65	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Mr TEM Odendaal	1987	Overseas travel: Collection of germ plasm and study of crossbreeding technology in soybeans.
70	University of Pretoria	Prof GA Smith	1987	Processing and evaluation of full-fat soya.
81	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Dr MA Smit	1988	Overseas travel: Attendance at 4th International Soybean Conference in Argentina.
86	University of KwaZulu-Natal	Prof J van Staden	1989	Procedures whereby genetic material may be added to the soybean genome using certain strains of *Agrobacterium tumefaciens*.
96	University of KwaZulu-Natal	Prof J van Staden, Ms MA McKenzie & Dr WA Cress	1990	Transformation of soybeans. Genotypes with *Agrobacterium* tumor inducing (Ti) plasmids.
98	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	N/A	1990	Microplots for nematode research.
102	University of Pretoria	Prof H Huismans	1990 - 1992	A molecular study of a South African isolate of soybean Mosaic Virus as a model in the poty virus group.
103	ARC-Grain Crops Institute	Messrs MA Prinsloo, JL Erasmus, GP de Beer, Ms AS de Beer & Dr MA Smit	1992 - 2015	National Soybean Cultivar Trials (M101/60).
105	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Ms MA McKenzie	1992 - 1995	The role of proline in the response of soybeans to environmental stress.
111	University of Pretoria	Prof HA van de Venter	1992	Germination capacity and seed vigour of South African soybean cultivars.
112	ARC-Grain Crops Institute	N/A	1993	*Ad hoc* award for soybean projects.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
115	ARC-Grain Crops Institute	Dr MA Smit	1993 - 1997	Modelling soybean seed and protein.
119	ARC-Grain Crops Institute	Ms CMS Mienie	1993	Biotechnology and nematode resistance in soybeans.
120	ARC-Grain Crops Institute	Messrs TEM Odendaal, AJ de Lange & Dr MA Smit	1993 - 2007	The development of soybean cultivars with a better adaptation and seed quality.
121	ARC-Grain Crops Institute	Drs JL Staphorst & ADP Botha	1993 - 1996	Biological nitrogen fixation in soybeans – N15 isotope studies.
125	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Mr BP O'Regan & Dr JT Burger	1993 - 1995	Genetic manipulations and tranfer of the *phosphinothricin acetyltransferase* (PAT) gene into soybeans.
126	University of Stellenbosch	Prof JP Hayes	1993 - 1995	Availability of amino acid in abattoir by-products, carcass meal, poultry by-product meal and soya- and cottonseed oilcake.
128	ARC-Grain Crops Institute	Dr MPW Farina	1993 - 1996	Factors affecting the response of soybeans to molybdenum application.
131	University of Cape Town	Dr FD Dakora	1994	Identify transcriptional regulators of bacterial nodulation genes from genetically diverse soybean lines.
133	ARC-Grain Crops Institute	Dr MA Smit	1994 - 1996	Biological nitrogen fixation in soybeans: Field trials.
136	ARC-Plant Protection Research Institute	Dr G Pietersen	1994 - 1996	Identification and assessment of the importance of viruses of soybeans and groundnuts in South Africa.
140	Cedara Agricultural Research Institute		1994	Soybean promotion campaign.
145	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Mss JA de Ronde & A van der Mescht	1995 - 1998	The role of proline in soybean responding to drought stress.
146	ARC-Institute for Soil, Climate and Water	Dr ADP Botha	1995	Quantification of symbiotic nitrogen fixation by inoculated soybean cultivars, under different soil and nutrient conditions through the use of the the isotope 15N.
150	ARC-Grain Crops Institute	Ms MCS Mienie	1995	Identification of molecular markers linked to nematode resistance in soybeans.
162	University of KwaZulu-Natal	Prof J van Staden & Mr WA Cress	1996 - 2000	Isolation and characterisation of the gene complex regulating the response of soybeans (*Glycine max* [L.] Merr.) to water deprivation, salinity stress and temperature extremes.
166	ARC-Grain Crops Institute	Ms R Keeve	1996 - 1997	The potential for oil and protein crops in the North-western Free State.
167	ARC-Plant Protection Research Institute	Dr G Pietersen	1997	Identification and importance of viruses of soybeans and peanuts in South Africa.
169	ARC-Grain Crops Institute	Dr MA Smit & Mr MA Prinsloo	1997 - 2003	Yield Gap Analysis: Identifying and quantifying yield limiting factors for soybean production in South Africa.
171	ARC-Plant Protection Research Institute	Dr IJ Law	1997	Determination of the competitive abilities of *Bradyrhizobium japonicum*.
172	Carnia Seed	Mr JM Lindeque	1997 - 1999	The improvement of the protein content and yield of soybean cultivars through breeding and selection.
173	Cedara Agricultural Research Station	Mr WAJ Berry	1997	Evaluation of seeding equipment for crop rotations with soybean, wheat and maize.
174	Department of Agriculture, KwaZulu-Natal	Messrs C Havenga & CJ du Plessis	1995 - 2014	Super Soya Competition KwaZulu-Natal.
175	ARC-Grain Crops Institute	Dr MA Smit & Mr APJ de Beer	1997 - 2002	Super Soya production practices.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
177	ARC-Plant Protection Research Institute	Dr G Pietersen	1998 - 1999	Increasing soybean yields through control of soybean mosaic virus by identification of resistance sources.
179	ARC-Plant Protection Research Institute	Mss JF Bloem, B Bouwman, Dr JL Staphorst & A Booysen	1998 - 2000	Biological nitrogen fixation in soybeans: Innoculation problems.
182	North-West University	Prof GHJ Krüger	1998 - 1999	Response of soybeans to temperature stress and its interaction with light intensity evaluated by photosystem II function, photosynthetic gas exchange and xanthophyll cycle activity.
183	ARC-Institute for Soil, Climate and Water	Mr D Beukes	1998 - 1999	Evaluation of the interaction between the soil and symbiotic nitrogen fixation in soybeans.
184	ARC-Institute for Agricultural Engineers	Mr JG van Gass	1998	Development of a soybean harvesting table.
193	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Dr JA de Ronde	1999 - 2004	The effect of enhanced proline synthesis in soybeans with special reference to drought stress, comparing antisense and sense technology.
200	ARC-Animal Nutrition and Animal Products Institute	Dr D Palic	1999 - 2005	Evaluation and standardisation of analytical methods for determining the degree of soya processing.
207	ARC-Grain Crops Institute	Dr CMS Mienie	2000 - 2004	Development and application of genetic markers linked to nematode resistance in soybeans.
208	ARC-Grain Crops Institute	Dr CMS Mienie	2000	Increasing generation progress in soybean breeding.
211	ARC-Grain Crops Institute	Mr GP de Beer	2000	Soybean demonstration trials.
212	University of the Free State	Prof MF Viljoen	2000	Economic study of soybeans as a rotational crop.
220	ARC-Plant Protection Research Institute	Dr IJ Law	2001 - 2002	Effect of soil rhizobia on the success of soybean inoculant strain WB74.
225	ARC-Grain Crops Institute	Dr NW McLaren	2001 - 2005	Soybean Rust: Risk analysis, loss assessment and quantification of the epidemiological value of intervention technologies.
229	North-West University	Prof GHJ Krüger, Mss MM Viljoen, KR du Plessis & MF de Villiers	2002	a) The influence of dark chilling on the endogenous rhythms of photosynthesis and sucrose synthesis in *Glycine max. (L.) Merrill.* b) The impact of dark chilling followed by exposure to high light intensities on ultrastructure and selected biochemical reactions of photosynthesis in *Glycine max. (L.) Merrill.* c) The effect of dark chilling and its interaction with drought stress on the photochemical, physiological and enzymatic processes of photosynthesis in *Glycine max. (L.) Merrill.*
230	University of KwaZulu-Natal	Dr PM Caldwell	2002 - 2005	Studies on soybean rust *(Phakopsora pachyrhizi)* – epidemiology.
231	Department of Agriculture, KwaZulu-Natal	Dr PM Caldwell, Mr N van Rij & Ms E du Preez	2002 - 2005	Chemical control of soybean rust *(Phakopsora pachyrhizi)*.
232	ARC-Grain Crops Institute	Dr NW McLaren & Ms M Craven	2002 - 2006	Evaluation of fungicides for the control of Sclerotinia stalk rot of soybeans.
243	University of the Free State	Prof ZA Pretorius	2004 - 2006	Physiology of growth stage related susceptibility in soybeans to rust.
244	ARC-Grain Crops Institute	Ms H Fourie	2005 - 2006	Chemical control options for plant-parasitic nematodes associated with soybeans in South Africa.
250	University of KwaZulu-Natal	Dr PM Caldwell & Ms D Visser	2005 - 2006	*Sclerotinia sclerotiorum* on soybeans.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
253	University of the Free State	Prof JC Pretorius	2006 - 2007	Improving the yield of soybeans with the use of growth stimulants.
254	Protein Research Foundation	Mr GP de Beer & Ms M Craven	2006 - 2014	Establishment of an early warning system for soybean rust.
255	University of the Free State	Prof NW McLaren	2006 - 2010	Study of inoculation and disease evaluation techniques for *Sclerotinia* stalk rot of soybeans.
256	University of the Free State	Prof NW McLaren	2006 - 2010	Determining the epidemiological value of resistance to rust caused by *Phakopsora pachyrhizi* in soybean lines.
259	University of KwaZulu-Natal	Dr PM Caldwell	2007 - 2009	The use of silicon for the control of soybean rust.
260	University of KwaZulu-Natal	Dr PM Caldwell	2007 - 2009	Generating management-orientated maps of long-term soybean rust susceptibility trends for South Africa.
261	University of KwaZulu-Natal	Dr M Ciacciariello	2007 - 2010	Amino acid and protein utilisation of broiler breeder hens fed maize-soya diets.
265	University of Pretoria	Prof K Kunert	2007	Phenotypic markers for nodulation capacity of soybean cultivars.
266	North-West University	Dr R van Heerden	2007 - 2009	Quantification of air pollution impacts on South African soybean genotypes.
267	Department of Agriculture, Western Cape	Dr TS Brand	2007 - 2009	Evaluation of raw soybeans in the feeding of growing ostriches.
268	Protein Research Foundation	Mr WF van Wyk	2007 - 2014	Increasing the production of soybeans in the Highveld.
275	ARC-Grain Crops Institute	Mr EN Ndou	2009	Evaluation of advanced soybean breeding lines (M191/60).
277	University of the Free State	Messrs D Strydom & J Henning	2010 - 2012	Crop rotation systems incorporating soybeans: An economic and financial interpretation.
279	Department of Agriculture, Forestry and Fisheries, University of Pretoria	Prof C Blignaut & Ms M Taute	2010	The development of a map showing the soybean production regions and surface areas of the RSA.
283	ARC-Plant Protection Research Institute	Dr YT Tewoldemedhin	2011 - 2012	Investigating the etiology and incidence of soilborne diseases of soybeans in South Africa.
284	Protein Research Foundation	Messrs GP de Beer & WF van Wyk	2012 - 2015	Evaluation of PRF-Soybean Elite Lines under South African conditions.
289	North-West University	Prof D Fourie	2012 - 2013	Investigating catalase enzyme activity as a new tool to facilitate rapid identification of root-knot nematode resistance in soybean genotypes.
293	ARC-Grain Crops Institute	Ms JM Truter	2013	Insect biodiversity and abundance in soybeans *(Glycine max)*.
294	ARC-Grain Crops Institute	Ms AS de Beer	2013	Enhancing the production potential of soybeans in South Africa by evaluating imported high yielding cultivars.
297	University of KwaZulu-Natal	Dr KS Yobo	2014 - 2015	Studies on *lecanicillium lecanii* as a potential mycoparasite of the soybean rust fungus, *Phakopsora Pachyrhizi* and its use as a biological control agent against soybean rust.
298	University of Pretoria	Dr J van der Waals	2014 - 2015	Integrated management of charcoal rot *(Macrophomina phaseoline)* of agronomic crops in South Africa, with the emphasis on sunflower and soybeans.
299	ARC-Plant Protection Research Institute	Dr YT Tewoldemedhin	2014 - 2015	Management strategies for soilborne diseases of soybeans in South Africa.
300	University of KwaZulu-Natal	Prof RM Gous	2014 - 2015	Classification of climatic zones for soybean cultivation.
301	Kroonstad High School	Blouskool	2014	Seeding Project – Kroonstad High School.

CANOLA RESEARCH PROJECTS

(1976 - 2015)

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
139	Elsenburg Agricultural Development Institute	Dr DB Arkcoll	1994	The introduction of canola as an alternative crop for the Western Cape.
152	Elsenburg Agricultural Development Institute	Dr DB Arkcoll	1996	The introduction of canola and other protein and oil crops into the rotational systems of the Western Cape.
165	Elsenburg Agricultural Development Institute	Mr TS Brand	1996 - 1999	The evaluation of various locally produced protein sources in the feeding of growing pigs.
166	ARC-Grain Crops Institute	Ms R Keeve	1996 - 1997	The potential for oil- and protein crops in the North-western Free State.
181	Department of Agriculture, Western Cape	Dr TS Brand	1998	Quantification of energy values and composition of potential alternative protein sources.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
185	University of Stellenbosch	Prof GA Agenbag	1998 - 2001	Optimal planting methods for oil- and protein seed crops in the Western and Southern Cape.
186	ARC-Plant Protection Research Institute	Dr SC Lamprecht	1998	Evaluation of root rot resistance in lupin and canola cultivars.
188	Department of Agriculture, Western Cape	Mr GJ de Jager	1998	Survey and occurence of diseases of existing and new canola cultivars in the Western Cape.
189	ARC-Animal Nutrition and Animal Production Institute	Dr L Erasmus	1998	The effect of whole canola, cottonseed and cracked canola on productivity of first-lactation Holstein heifers.
190	University of KwaZulu-Natal	Prof RM Gous	1998 - 2002	Evaluation of canola and lupins for pig and poultry feeding.
191	Department of Agriculture, Western Cape	Messrs PJA Lombard & D Hanekom	1998 - 2010	Cultivar evaluation of lupin and canola seeds in the winter rainfall region.
195	ARC-Plant Protection Research Institute	Dr SC Lamprecht	1999 - 2003	The extent and role of canola and lupin soilborne diseases on yield depression: A prerequisite for developing an effective and sustainable control strategy.
196	Department of Agriculture, Western Cape	Mr MG Wallace	1999	Deterministic model of lupin and canola production potential in the Western Cape.
197	Department of Agriculture, Western Cape	Dr MB Hardy	1999 - 2011	An investigation into the production dynamics of eight crop rotation systems, including wheat, canola, lupins and pasture species in the Swartland, Western Cape.
198	Department of Agriculture, Western Cape	Dr TS Brand	1999 - 2001	Application of feed enzymes to improve the utilisation of sweet lupin, full-fat canola and canola oilcake meal containing diets for poultry and pigs.
210	University of Stellenbosch	Dr PJ Pieterse	2000 - 2002	Economic short rotation crops for wheat.
213	ARC-Plant Protection Research Institute	Drs DJ Crafford, A van Jaarsveld & Ms EE Auret	2000 - 2004	Epidemiology and management of Blackleg on canola in the winter rainfall region of South Africa.
214	University of Stellenbosch	Prof GA Agenbag	2001 - 2005	Optimal row width and seed density in canola production.
215	University of Stellenbosch	Dr LG Ekermans & Mr M de Beer	2001 - 2002	The influence of processing of soybeans, sunflower seed, canola and lupins on the energy and amino acid availability for young chickens.
223	Department of Agriculture, Western Cape	Messrs CL van Rooyen, IF Slabbert & JG Loubser	2001 - 2015	Enhancement of canola as a rotation crop within a conservation system in the dry-land areas of the Southern Cape using a competition between producers: Super Canola Competition.
224	ARC-Grain Crops Institute	Mr AA Nel	2001 - 2004	An agronomic evaluation of canola under irrigation in the summer rainfall region.
228	Department of Agriculture, Western Cape	Dr MB Hardy	2002 - 2011	Economic sustainability of short- and long rotation crop/pasture production systems in the Southern Cape.
235	Department of Agriculture, Western Cape	Mr DJ Hanekom	2002 - 2004	The efficacy of dessication as opposed to swathing in harvesting canola.
239	ARC-Grain Crops Institute	Dr AA Nel	2003 - 2007	An evaluation of crop rotation with canola under irrigation.
240	University of Stellenbosch	Proff GA Agenbag & SC Lamprecht	2003 - 2005	Chemical control of seedling diseases and insect damage in canola and lupins.
241	ARC-Grain Crops Institute	Dr AA Nel	2004 - 2006	The nitrogen requirements of canola under irrigation.
242	ARC-Plant Protection Research Institute	Prof SC Lamprecht	2004 - 2009	Characterisation of Rhizoctonia on canola and lupin in cropping systems in the Western Cape.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
245	University of Stellenbosch	Prof GA Agenbag	2005 - 2011	N-fertilisation of canola based on N-mineralisation and leaching.
246	ARC-Plant Protection Research Institute	Dr GF Tribe	2005 - 2012	Insects and other pests of canola.
247	ARC-Grain Crops Institute	Dr AA Nel	2005 - 2007	Evaluation of canola cultivars under irrigation.
252	University of Stellenbosch	Prof GA Agenbag	2006 - 2007	Salt tolerance in canola.
257	ARC-Plant Protection Research Institute	Dr SC Lamprecht	2006	Field trials to improve the establishment of canola.
258	Grain SA	Ms A McDonald	2006 - 2007	Radio programme – RSG.
269	University of Stellenbosch	Dr PJ Pieterse	2008 - 2011	Management of herbicides resistance in the Western Cape.
270	University of Stellenbosch	Prof GA Agenbag	2008 - 2010	Optimal soil tillage methods for crop production in the Swartland wheat producing areas of the Western Cape.
271	Department of Agriculture, Western Cape	Drs J Labuschagne & MB Hardy	2008 - 2011	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.
272	Department of Agriculture, Western Cape	Dr J Strauss	2008 - 2010	Assessing canola seed losses during seed ripening and harvesting in the Western Cape.
273	University of Stellenbosch	Prof GA Agenbag	2009 - 2011	Sulphur (S)-fertiliser requirements of canola produced in the production areas of the Western Cape.
276	University of Stellenbosch	Mr WH Hoffmann	2010	The economic contribution of canola as a rotation crop, in different agricultural systems in a typical farming unit in the Swartland and Southern Cape.
280	Department of Agriculture, Western Cape	Mr PJA Lombard	2011 - 2015	Cultivar evaluation of canola seeds in the winter rainfall region.
281	Department of Agriculture, Western Cape	Mr PJA Lombard	2010 - 2011	Cultivar evaluation of oil and protein seeds in the winter rainfall region: Elite.
285	University of Stellenbosch	Prof GA Agenbag	2012 - 2014	Boron requirements of canola.
286	University of Stellenbosch	Prof GA Agenbag	2012 - 2014	Sulphur (S) and Nitrogen (N) requirements of canola.
287	University of Stellenbosch	Dr PJ Pieterse	2012 - 2013	Plant density of canola: Impact on the suppression of weed and yield of canola in the Swartland.
288	Department of Agriculture, Western Cape	Mr JA Strauss	2012 - 2015	Evaluation of shortened canola production periods and the use of alternative crops on the sustainability of winter grain production under conservation agricultural practices in the Riversdale Flats.
290	University of Stellenbosch	Dr PJ Pieterse	2012 - 2013	Chemical options for weed control in GM canola cultivars.
291	University of Stellenbosch	Dr AP Malan	2012 - 2015	Developing a biological control agent for molluscs (slugs and snails) in South Africa.
295	Department of Agriculture, Western Cape	Dr MB Hardy & Mr MG Wallace	2013	Determining the area of arable land suited to canola production in the Western Cape.
302	University of Stellenbosch	Prof GA Agenbag	2015	Chemical manipulation of vegetative growth, reproductive development and grain yield in canola.
303	University of Stellenbosch	Prof GA Agenbag	2015	Nitrogen topdressings in canola: Time of application and rates.

LUPIN RESEARCH PROJECTS

(1976 - 2015)

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
32	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Mr HL Loubser	1984	Overseas travel to Australia: To study sunflower and lupin production.
36	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	N/A	1984	Overseas travel: Lupin Conference in France.
85	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Dr J Viljoen	1989	The use of *Lupinus albus* and *lupinus angustifolius* in poultry feeding.
100	University of Stellenbosch	Dr JH Louw	1990 - 1992	Genetics and breeding of lupins.
134	ARC-Grain Crops Institute	Dr JAM van der Mey	1993 - 2002	Development of production technology for sweet lupins in the summer rainfall region.
138	ARC-Animal Production Institute	Mr MD Olver	1994	Lupins as a protein source for poultry.
156	ARC-Grain Crops Institute	Ms L Herselman	1996 - 1998	Regeneration of *Lupinus albus L.*
157	ARC-Grain Crops Institute	Ms R Keeve	1996 - 1997	The influence of temperature and photoperiod on plant structure and development of sweet white lupin *(Lupinus albus).*
170	ARC-Plant Protection Research Institute	Ms SH Koch	1997 - 1998	Idenfication, pathogenicity and control of lupin anthracnose in South Africa.
178	ARC-Plant Protection Research Institute	Dr G Pietersen	1997 - 2001	Control of viruses of lupins *(Lupinus spp.)* in South Africa.
180	Council for Scientific and Industrial Research	Dr TG Watson	1998 - 2002	Genetic engineering of lupins *(Lupinus spp.)* for resistance to anthracnose.
181	Department of Agriculture, Western Cape	Dr TS Brand	1998 - 2000	Quantification of energy values and composition of potential alternative protein sources.
185	University of Stellenbosch	Prof GA Agenbag	1998 - 2001	Optimal planting methods for oil- and protein seed crops in the Western and Southern Cape.
186	ARC-Plant Protection Research Institute	Dr SC Lamprecht	1998	Evaluation of root rot resistance in lupin and canola cultivars.
187	Department of Agriculture, Western Cape	Ms L van Deventer	1998 - 1999	Monitoring of root diseases in lupins in the Western Cape.
190	University of KwaZulu-Natal	Prof RM Gous	1998 - 2002	Evaluation of canola and lupins for pig and poultry feeding.
191	Department of Agriculture, Western Cape	Messrs PJA Lombard & D Hanekom	1998 - 2012	Cultivar evaluation of lupin and canola seeds in the winter rainfall region.
192	ARC-Grain Crops Institute	Dr JAM van der Mey, Ms D Fourie & JC Smit	1999 - 2004	Breeding for anthracnose resistance in lupins.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
195	ARC-Plant Protection Research Institute	Dr SC Lamprecht	1999 - 2000	The extent and role of canola and lupin soilborne diseases on yield depression: A prerequisite for developing an effective and sustainable control strategy.
196	Department of Agriculture, Western Cape	Mr MG Wallace	1999	Deterministic model of lupin and canola production potential in the Western Cape.
197	Department of Agriculture, Western Cape	Dr MB Hardy	1999 - 2011	An investigation into the production dynamics of eight crop rotation systems, including wheat, canola, lupins and pasture species in the Swartland, Western Cape.
198	Department of Agriculture, Western Cape	Dr TS Brand	1999 - 2001	Application of feed enzymes to improve the utilisation of sweet lupin, full-fat canola and canola oilcake meal containing diets for poultry and pigs.
201	Council for Scientific and Industrial Research	Dr TG Watson	1999	*In vitro* regeneration of *Lupinus albus cv Cedara 6150* and *Lupinus angustifolius cv tanjil*.
202	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Dr JA de Ronde	1999 - 2001	Vacuum infiltration of lupin seed for genetic engineering for resistance to anthracnose.
203	ARC-Plant Protection Research Institute	Dr SH Koch	1999 - 2003	Pathological characterisation and selection of lupin anthracnose causing strain(s) to be used in resistance screening.
209	ARC-Plant Protection Research Institute	Dr IJ Law	2000 - 2001	Inoculation of lupins in South Africa.
210	University of Stellenbosch	Dr PJ Pieterse	2000 - 2002	Economic short rotation crops for wheat.
215	University of Stellenbosch	Dr LG Ekermans & Mr M de Beer	2001 - 2002	The influence of processing of soybeans, sunflower seed, canola and lupins on the energy and amino acid availability for young chickens.
216	Department of Agriculture, Western Cape	Dr AB van Jaarsveld	2001 - 2003	Chemical control of anthracnose in lupins.
217	Department of Agriculture, Western Cape	Dr AB van Jaarsveld & Mr J van Zyl	2001 - 2003	Development of better adapted lupin cultivars for the Western Cape.
221	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Mr D Oelofse	2001 - 2004	Constructs for removal of bar gene after transformation and isolation of promoter from *Lupinus albus*.
222	ARC-Grain Crops Institute	Dr AEJ Saayman du Toit	2001	Weed control in sweet white lupins planted in narrow rows.
226	ARC-Grain Crops Institute	Dr AEJ Saayman du Toit	2001 - 2002	Registration of simazine on lupins.
227	ARC-Plant Protection Research Institute	Dr IJ Law	2002 - 2004	Promoting survival of rhizobia.
228	Department of Agriculture, Western Cape	Dr MB Hardy	2002 - 2011	Economic sustainability of short- and long rotation crop/pasture production systems in the Southern Cape.
234	ARC-Grain Crops Institute	Mr JC Smit	2003	Production of sweet lupin seed for breeding purposes.
236	Department of Agriculture, Western Cape	Dr TS Brand	2003	Determination of lupin alkaloids by means of near infrared spectroscopy.
238	University of Pretoria	Prof D Berger	2003 - 2004	Gene isolation of a virulence factor from the lupin anthracnose fungus.
240	University of Stellenbosch	Proff GA Agenbag & SC Lamprecht	2003 - 2005	Chemical control of seedling diseases and insect damage in canola and lupins.
242	ARC-Plant Protection Research Institute	Prof SC Lamprecht	2004 - 2009	Characterisation of Rhizoctonia on canola and lupin in cropping systems in the Western Cape Province.
249	ARC-Grain Crops Institute	Messrs HL Loubser & JW Lodewyckx	2005 - 2007	Lupin seed production.
271	Department of Agriculture, Western Cape	Drs J Labuschagne & MB Hardy	2008 - 2011	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.

FISHMEAL RESEARCH PROJECTS

(1976 - 2015)

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
14	University of Stellenbosch	Mr JJ du Preez	1981	Overseas travel: Amino acid requirements of chickens and attendance at International Association of Fishmeal Manufacturers (IAFMM).
21	Fishing Industry Research Institute	Dr JPH Wessels	1982	Metabolisable energy content of fishmeal.
22	University of Stellenbosch	Prof PJ de Wet	1982	Utilisation of fish protein instead of skim milk powder for lambs and calves.
23	University of Stellenbosch	Prof JP Hayes	1983	Additivity of amino acid digestibility values in fishmeal and ground nut oilcake meal.
29	SA Fishmeal Marketing Company	Messrs SJ Malherbe & R Ball	1983	Development of lantern fish sources.
35	Fishing Industry Research Institute	Dr JPH Wessels & Mr BJ Post	1984 - 1992	Occurrence and causes of gizzard erosion in broilers.
43	Fishmeal Manufacturer's Association	Messrs SJ Malherbe & R Ball	1984	Exploitation of alternative fish sources.
50	SA Fishmeal Marketing Company	Mr SJ Malherbe	1985	Partial recovery of research expenditure on the occurrence of mesopelagic and midwater fish species.
61	Fishing Industry Research Institute	Dr JPH Wessels	1986 - 1987	Incidence of gizzerosine in broiler feeding.
78	Department of Environmental Affairs	Dr CJ Augustyn	1988	Research concerning the occurrence of mesopelagic fish sources.
79	Fishing Industry Research Institute	Dr JPH Wessels & Mr BJ Post	1988	Preparation of spray-dried fish powder.
80	Fishing Industry Research Institute	Dr JPH Wessels & Mr BJ Post	1988	Reactivity of fishmeal obtained from *Lampanyctodes hectoris* (Hector's lanternfish).
82	Fishing Industry Research Institute	N/A	1988	Building complex.
87	Council for Scientific and Industrial Research	Messrs GN Davis, JJL Cilliers, P Swartz & PJ van Niekerk	1989 - 1990	The determination of the gizzerosine content of fishmeal.
92	Fishing Industry Research Institute	N/A	1989	Fishing Industry Building.
93	Fishing Industry Research Institute	Dr JPH Wessels	1989	Factors responsible for the development of gizzerosine in fishmeal.
95	SA Coastal Fisheries		1989	Experimental mid-water trawling for red-eye fish species.
101	Fishing Industry Research Institute	Dr JPH Wessels	1990 - 1991	Factors in fishmeal contributing to variation in performance of chickens.
104	Fishing Industry Research Institute	Dr JPH Wessels & Mr BJ Post	1992	A new method for measuring the content of gizzerosine in fishmeal.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
110	Department of Environmental Affairs	Dr LV Shannon	1992	Equipment and facilities for a deep sea research vessel, SAS Algoa.
113	Fishing Industry Research Institute	Dr GE Trout	1993 - 1994	The determination of the gizzerosine content of fishmeal: Methodology.
117	ARC-Animal Production Institute	Mr FJ Nell	1993	Nutritional value of fishmeal with variable gizzerosine scores for weaner pigs and broilers.
168	Council for Scientific and Industrial Research	Dr RM Horak	1997	Development of an immunoassay for the detection of gizzerosine in fishmeal.
199	Suiderland Development Corporation	Mr R Ball	1999	Exploitation of mesopelagic fish sources.
296	University of Stellenbosch	Dr N Goosen	2014 - 2015	Increasing South African protein production through the development of value added products from fish processing waste.

WESTERN CAPE DEPARTMENT OF AGRICULTURE RESEARCH PROJECTS

(1976 - 2015)

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
139	Elsenburg Agricultural Training Institute	Dr DB Arkcoll	1994	The introduction of canola as an alternative crop for the Western Cape.
152	Elsenburg Agricultural Training Institute	Dr DB Arkcoll	1996	The introduction of canola and other protein and oil crops into the rotational systems of the Western Cape.
165	Elsenburg Agricultural Training Institute	Mr TS Brand	1997	The evaluation of various locally produced protein sources in the feeding of growing pigs.
181	Department of Agriculture, Western Cape	Dr TS Brand	1998	Quantification of energy values and composition of potential alternative protein sources.
187	Department of Agriculture, Western Cape	Ms L van Deventer	1998	Monitoring of root diseases in lupins in the Western Cape.
188	Department of Agriculture, Western Cape	Mr GJ de Jager	1998	Survey and occurence of diseases of existing and new canola cultivars in the Western Cape.
191	Department of Agriculture, Western Cape	Messrs PJA Lombard & D Hanekom	1998 - 2010	Cultivar evaluation of lupin and canola seeds in the winter rainfall region.
196	Department of Agriculture, Western Cape	Mr MG Wallace	1999	Deterministic model of lupin and canola production potential in the Western Cape.
197	Department of Agriculture, Western Cape	Dr MB Hardy	1996 - 2011	An investigation into the production dynamics of eight crop rotation systems, including wheat, canola, lupins and pasture species in the Swartland, Western Cape.
198	Department of Agriculture, Western Cape	Dr TS Brand	1999 - 2001	Application of feed enzymes to improve the utilisation of sweet lupin, full-fat canola and canola oilcake meal containing diets for poultry and pigs.
216	Department of Agriculture, Western Cape	Dr AB van Jaarsveld	2001 - 2003	Chemical control of anthracnose in lupins.
217	Department of Agriculture, Western Cape	Dr AB van Jaarsveld & Mr J van Zyl	2001 - 2003	Development of better adapted lupin cultivars for the Western Cape.
223	Department of Agriculture, Western Cape	Messrs CL van Rooyen, IF Slabbert & JG Loubser	2001 - 2015	Enhancement of canola as a rotation crop within a conservation system in the dry-land areas of the Southern Cape using a competition between producers: Super Canola Competition.
228	Department of Agriculture, Western Cape	Dr MB Hardy	2002 - 2011	Economic sustainability of short- and long rotation crop/pasture production systems in the Southern Cape.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
235	Department of Agriculture, Western Cape	Mr DJ Hanekom	2002 - 2004	The efficacy of dessication as opposed to swathing in harvesting canola.
236	Department of Agriculture, Western Cape	Dr TS Brand	2003	Determination of lupin alkaloids by means of near infrared spectroscopy.
267	Department of Agriculture, Western Cape	Dr TS Brand	2007 - 2009	Evaluation of raw soybeans in the feeding of growing ostriches.
271	Department of Agriculture, Western Cape	Drs J Labuschagne & MB Hardy	2008 - 2011	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 and soil quality.
272	Department of Agriculture, Western Cape	Dr JA Strauss	2008 - 2010	Assessing canola seed losses during seed ripening and harvesting in the Western Cape.
280	Department of Agriculture, Western Cape	Mr PJA Lombard	2011 - 2015	Cultivar evaluation of canola seeds in the winter rainfall region.
281	Department of Agriculture, Western Cape	Mr PJA Lombard	2010 - 2011	Cultivar evaluation of canola seeds in the winter rainfall region: Elite Trials.
288	Department of Agriculture, Western Cape	Dr JA Strauss	2012 - 2015	Evaluation of shortened canola production periods and the use of alternative crops on the sustainability of winter grain production under conservation agricultural practices in the Riversdale Flats.
295	Department of Agriculture, Western Cape	Dr MB Hardy & Mr MG Wallace	2013	Determining the area of arable land suited to canola production in the Western Cape.

OTHER RESEARCH PROJECTS

(1976 - 2015)

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
1	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1976	Chemical and physical evaluation of protein sources for animal feeding.
2	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1976	Improved utilisation of lucern meal for ruminants.
3	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1976	The use of poultry manure in animal feeding.
5	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Mr W Vermeulen	1977	Overseas travel: Sunflower Congress in the USA.
6	University of KwaZulu-Natal	Mr JJ du Preez	1978	Analysis of methods to determine the energy value of various feedstuffs for animal nutrition.
7	University of KwaZulu-Natal	N/A	1979	Amino acid analysis of animal feeds.
8	University of Stellenbosch	Prof JP Hayes	1979	Overseas trip: To the US in connection with testing and refining models for protein – and to determine amino acid requirements of laying hens.
9	University of KwaZulu-Natal	Prof RM Gous	1980 - 1985	Improving the utilisation of existing protein sources for poultry nutrition.
10	University of KwaZulu-Natal	Prof RM Gous	1980	Determination of tryptophan in poultry feeds.
11	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1980	Overseas travel: Research in Europe on the utilisation of protein by farm animals.
13	University of Stellenbosch	Mr JJ du Preez	1981	Tryptophan, lysine and methionine requirements of growing chickens.
14	University of Stellenbosch	Mr JJ du Preez	1981	Overseas travel: Amino acid requirements of chickens and attendance at IAFMM.
15	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Mr PB Cronje	1981	Amino acid laboratory.
17	Department of Agriculture and Fisheries	N/A	1981	Kjeldahl.
18	University of KwaZulu-Natal	Prof RM Gous	1982	Overseas travel: Poultry Research Centre, Edinburgh: Co-ordinate research on quantitative nutrition of broilers.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
19	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr J Gooden	1982	Protein turnover in the bodies of animals.
23	University of Stellenbosch	Prof JP Hayes	1983	Additivity of amino acid digestibility values in fishmeal and ground nut oilcake meal.
24	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Mr PB Cronje	1983	Overseas travel (UK): Techniques for protein research in ruminants; France: International conference on protein metabolism and feeding.
25	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Mr PB Cronje	1983	Utilisation of urea as a protein supplement in feeds with 16% crude protein.
26	Council for Scientific and Industrial Research	Mr GN Davis	1983	Research on the protein metabolism of ruminants.
27	Council for Scientific and Industrial Research	N/A	1983	Kjeldahl.
28	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Dr J Dreyer	1983	Overseas travel: Research techniques in respect of yield physiology of groundnuts and soybeans.
30	Protein Advisory Committee		1983	Overseas travel: Visited various countries to keep abreast of developments in protein research.
31	University of KwaZulu-Natal	Dr C Dennison	1984	Analysis for available amino acids including tryptophan in feed ingredients.
32	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Mr HL Loubser	1984	Overseas travel (Australia): To study sunflower and lupin production.
33	Department of Agriculture and Water Affairs	N/A	1984 - 1987	Maintenance of amino acid laboratory.
37	Department of Agriculture and Water Affairs	N/A	1984	Automatic 15 N Analyser, to determine ammonia transport in rumen bacteria.
38	Department of Agriculture and Water Affairs	N/A	1984	NIR technology for accurate determination of crude protein, fibre and digestible organic matter in feeds.
39	Department of Agriculture and Water Affairs	N/A	1984	Bomb Calorimeter.
40	Department of Agriculture and Water Affairs	N/A	1984	The protein sparing effect of urea as a nitrogen supplement in high producing dairy cows.
41	University of Stellenbosch	Prof JP Hayes	1984	Amino acid analyser.
42	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	N/A	1984	Centre for Oil and Protein Seeds Equipment.
44	Council for Scientific and Industrial Research	Dr TG Watson	1985 - 1990	Single cell protein production and application of biomass supplied particles.
45	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1985 - 1986	Amino acid laboratory.
46	SA Abattoir Corporation		1985	Overseas travel: Germany.
47	Council for Scientific and Industrial Research	Dr LM du Plessis	1985	Fractionation of sunflower oilcake.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
48	Department of Agriculture and Water Affairs	N/A	1985	Root length meter.
49	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	N/A	1985	Portable photosynthesis meter.
51	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1986	Dairy nutrition.
52	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1986	Dairy Industry – protein databank.
53	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1986	Overseas travel (Europe): Protein metabolism and nutrition.
54	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr JG Cloete	1986	Amino acid analyser.
55	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	N/A	1986	Image analyser.
56	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	N/A	1986	Autoclave.
57	University of Pretoria	Prof NFG Rethman	1986	Nutritional potential of high quality cultivated pastures.
58	University of Pretoria	Prof NFG Rethman	1986	Influence of supplementation of various protein sources.
59	University of Pretoria	Prof NFG Rethman	1986	Overseas travel to Europe: Protein metabolism and feeding.
60	University of Stellenbosch	Mr JJ du Preez	1986	Comparison of two methods of measuring the metabolisable energy content of feedstuffs for poultry.
62	University of Stellenbosch	Dr GF Marais	1986 - 1993	Triticale breeding programme: Increasing the protein content.
63	Sentraal-Wes Koöperasie	N/A	1986	Trial run in connection with research on the fractionation of sunflower oilcake.
64	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	N/A	1987	Scanning densiometer and page system.
66	University of KwaZulu-Natal	Prof RM Gous	1987 - 1992	The strategic utilisation of amino acids in laying hen nutrition.
67	University of Stellenbosch	Prof JP Hayes & Dr JH Louw	1987 - 1990	Evaluation of the amino acid availability in feedstuffs for poultry.
68	University of Pretoria	Prof GA Smith	1987 - 1988	The influence of protein, both quantitative and qualitative, at various feeding levels and metabolisable energy concentrations on growth and feed efficiency of young oxen.
69	University of Pretoria	Prof NFG Rethman	1987	Hydrolised feather meal as a potential protein source for ruminants.
71	University of Pretoria	Prof GA Smith	1987	Processing of bloodmeal, carcass meal and poultry manure using microwaves.
72	Council for Scientific and Industrial Research	Dr LM du Plessis	1987	Fractionation of sunflower seeds.
73	University of KwaZulu-Natal	Dr J van Ryssen	1987 - 1989	Presence of heavy metals in poultry manure.
74	University of Pretoria	Prof GA Smith	1988	Attendance at the XVII World's Poultry Congress.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
75	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr L Erasmus	1988	Strategic protein feeding of high producing dairy cows.
76	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Drs J Viljoen & L Erasmus	1988 - 1993	Dairy cow nutrition: *In sacco* digestibility and amino acid profile of UDP in the lower digestive tract.
77	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr J Viljoen	1988	Apparatus: Contribution to amino acid laboratory.
83	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Dr J Viljoen	1989 - 1994	The amino acid digestibility of various protein sources for the early weaned pig.
84	Department of Agriculture and Water Affairs: Animal and Dairy Science Research Institute	Drs J Viljoen & LJ Erasmus	1989 - 1990	Ideal protein requirement of growing pigs.
88	University of Stellenbosch	Dr GF Marais	1989	A comparison between triticale and maize meal in dairy meals.
89	University of Stellenbosch	Prof JP Hayes	1989	Amino acid requirements of broilers.
90	University of Stellenbosch	Prof JP Hayes	1989	Use of sunflower oilcake in poultry feeds.
91	University of Stellenbosch	Prof JP Hayes	1989	Overseas travel (Poultry Research Centre, Edinburgh): Methods for evaluating the metabolisable energy content of feeds.
94	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	Dr HO Gevers	1989	Overseas travel: Attendance at West German Congress on high lysine maize.
97	Department of Agriculture and Water Affairs: Centre for Oil and Protein Seeds	N/A	1990 - 1991	Steam steriliser.
99	ARC-Grain Crops Institute	N/A	1990	Commercial glasshouse.
106	University of KwaZulu-Natal	Prof RM Gous	1992 - 1995	Factors influencing the voluntary food intake of chickens and pigs.
107	University of KwaZulu-Natal	Prof RM Gous	1992 - 1995	The strategic utilisation of amino acids in the nutrition of poultry and pigs.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
108	University of Pretoria	Prof J van Zyl	1992 - 1994	Economic aspects of optimising the supply of and demand for animal feed protein in South Africa.
109	ARC-Grain Crops Institute	Dr MA Smit & Mr HL Loubser	1992	N/A: Equipment for various projects.
114	University of Pretoria	Prof GA Smith	1993	The nutritional value of protein-enriched by-products for ruminants.
116	ARC-Range and Forage Institute, Roodeplaat	Prof HH Meissner	1993 - 1997	Establishment of a low bloat-risk cultivar of lucerne.
118	University of KwaZulu-Natal	Prof RM Gous	1993 - 1997	The use of simulation modelling for improving the utilisation of dietary protein.
122	ARC-Plant Protection Research Institute	Dr IJ Law	1993	Role of lectins in the peanut nodule.
123	ARC-Animal Production Institute	Dr L Erasmus	1993	The effect of processing on the bio-availability of amino acids from various protein sources in the lower digestive tract of dairy cows.
124	ARC-Animal Production Institute	Dr L Erasmus	1993 - 1996	Biological and economic evaluation of carcass meal, bloodmeal and poultry by-product meal in complete feeds for high producing dairy cows.
126	University of Stellenbosch	Prof JP Hayes	1993 - 1995	Availability of amino acid in abattoir by-products, carcass meal, poultry by-product meal and soya- and cottonseed oilcake.
127	University of Pretoria	Prof NFG Rethman	1993 - 1994	The evaluation of fodder trees and shrubs with reference to their utilisation as protein supplements for low grade roughage.
129	ARC-Grain Crops Institute	Dr PJA van der Merwe	1993 - 1996	Development of groundnut cultivars for protein production.
130	ARC-Range and Forage Institute, Roodeplaat	Mr AJ Kruger	1993 - 1996	The collection, introduction, maintenance, multiplication and description of *Cajanus*, *Vigna* en *Voandziea* germplasm.
132	Council for Scientific and Industrial Research	Drs IAG Weinert & LM du Plessis	1994 - 1996	The effect of seed quality on dehulling characteristics of commercial sunflower seed.
135	University of Cape Town	Dr FD Dakora	1994 - 1995	Field assessment of symbiotic potential and nitrogen fixation in selected pasture legumes from the winter rainfall region of the Southern Cape.
136	ARC-Plant Protection Research Institute	Dr G Pietersen	1994 - 1996	Identification and assessment of the importance of viruses of soybeans and groundnuts in South Africa.
137	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Dr A Smith & Mr AJ Kruger	1994	Evaluation of gene sources of *Vigna* and *Cajanus* for agricultural potential and selection of profitable lines.
141	ARC-Plant Protection Research Institute	Dr IJ Law	1995 - 1997	*In situ* localisation of nodule lectin mRNA and analysis of lectin genes of peanuts.
142	ARC-Animal Nutrition and Animal Products Institute	Mr GE Schroeder & Dr L Erasmus	1995 - 1998	The effect of processing of protein sources on the partitioning of nutrients such as amino acids to the mammary gland for milk synthesis.
143	ARC-Animal Production Institute	Dr PH Henning	1995 - 1997	The relationship between carbohydrate structure, rate of rumen fermentation and microbial protein production.
144	ARC-Animal Nutrition and Animal Products Institute	Mr G Schroeder & Dr CW Cruywagen	1995 - 1997	Rumen degradability of carbohydrates in feed sources for microbial protein synthesis in ruminants.
147	University of Pretoria	Dr JG van der Walt	1995 - 1998	Interaction between water balance and protein metabolism of ruminants.
148	North-West University	Dr PJ Pretorius	1995 - 1996	Improvement of feather meal as a feed source using micro-organisms.
149	University of Stellenbosch	Proff WH van Zyl & HJJ van Vuuren	1995 - 1998	Functional yeast protein supplement to monogastric animal feed.
151	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Ms A van der Mescht	1995 - 1998	Development of a screening method for variation in drought tolerance in *Cajanus cajan* and *Vigna unguiculata*.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
153	ARC-Animal Nutrition and Animal Products Institute	Mr PW Plumstead	1996	The effect of dietary protein content on the growth and chemical composition of the edible parts in commercial broilers.
154	University of KwaZulu-Natal	Prof WL Nieuwoudt	1996	Protein forecasting model for 2000, 2010 and 2020.
155	ARC-Range and Forage Institute, Roodeplaat	Dr A Smith	1996	Selection, evaluation, breeding and commercial development cultivar release of *Cajanus cajan*, *Vigna unguiculata* and *Voandzeia subterranea* for food and fodder.
158	ARC-Animal Nutrition and Animal Products Institute	Dr L Erasmus	1996 - 1997	Dairy cow nutrition: Evaluation of the Cornell Net Carbohydrate and Protein Systems.
159	ARC-Animal Nutrition and Animal Products Institute	Ms MJ Linington	1996	A comparative study of the physiological adaptation of different cattle breeds fed on a low quality roughage.
160	University of KwaZulu-Natal	Prof RM Gous	1996 - 1997	The efficient use of dietary protein in the feeding of broiler breeder hens.
161	University of KwaZulu-Natal	Prof RM Gous	1996 - 1997	The response of broilers and laying hens to dietary tryptophan.
163	University of Stellenbosch	Dr J Coetzee	1996	The evaluation of a slow release urea product.

NO.	INSTITUTION	RESEARCHER	YEAR	TITLE OF RESEARCH PROJECT
164	University of Stellenbosch	Prof GF Marais & Mr JM Swart	1996 - 1997	Evaluation of the genetic variation in *Medicago polymorpha*.
165	Elsenburg Agricultural Training Institute	Mr TS Brand	1996 - 1997	The evaluation of various locally produced protein sources in the feeding of growing pigs.
176	University of KwaZulu-Natal	Prof RM Gous	1998 - 1999	The response of growing pigs to dietary amino acids.
181	Department of Agriculture, Western Cape	Dr TS Brand	1998	Quantification of energy values and composition of potential alternative protein sources.
189	ARC-Animal Nutrition and Animal Production Institute	Dr L Erasmus	1998	The effect of whole canola, cottonseed and cracked canola on productivity of first-lactation Holstein heifers.
194	University of KwaZulu-Natal	Prof RM Gous	1999 - 2004	Should animals be fed to their genetic potential if this potential is reduced by stress?
204	University of KwaZulu-Natal	Mr E Briedenhann	1999	A model to predict the usage of agricultural products for the feeding of livestock in South Africa (APR model).
205	University of the Free State	Prof HD van Schalkwyk	1999	The size, importance and potential of the lucerne industry in South Africa.
206	University of KwaZulu-Natal	Prof WL Nieuwoudt	1999	International demand and supply situation with regard to protein for animal consumption.
218	University of KwaZulu-Natal	Prof RM Gous	2001	Determination of genetic parameters of some common pig breeds in South Africa.
219	University of KwaZulu-Natal	Prof RM Gous	2001 - 2002	Measurement of the response of broilers to dietary amino acids, as measured in cages and floor pens.
233	ARC-Grain Crops Institute	Dr HD Fourie	2002 - 2005	Evaluation of fungicides for the control of *Sclerotinia* stem and head rot of sunflower.
237	University of KwaZulu-Natal	Prof RM Gous	2003 - 2004	Reducing the age at sexual maturity of broiler breeder pullets.
248	University of KwaZulu-Natal	Prof RM Gous	2005	Evaluation of faba beans as an alternative protein source for broilers, laying hens and growing pigs.
251	University of KwaZulu-Natal	Prof RM Gous	2006 - 2007	A comparison of the response to dietary protein by the Cobb and Ross broiler strains used in South Africa.
262	University of KwaZulu-Natal	Dr M Ciacciariello	2007	Calibration of near infrared spectrometer for amino acid analysis in animal feed.
263	University of KwaZulu-Natal	Prof RM Gous	2007	The evaluation of Distillers Dried Grains and Solubles (DDGS) as a protein source for poultry and pigs.
264	University of KwaZulu-Natal	Prof RM Gous	2007 - 2011	The effect of lighting on the efficiency of utilisation of dietary protein by Cobb and Ross broiler strains used in South Africa.
274	University of KwaZulu-Natal	Prof RM Gous	2009 - 2011	Development of a simulation model to optimise the feeding of broiler breeder hens during lay.
278	University of the Free State	Messrs DJ Strydom & J Henning	2010 - 2013	Forecast estimates of animal protein demand in South Africa.
282	University of KwaZulu-Natal	Dr NC Tyler	2011 - 2012	The effects of dietary crude protein on the fertility of broiler breeder males.
292	University of Pretoria	Dr E Raffrenato	2013 - 2014	Quality of roughage as determinant of efficiency of nitrogen use in dairy cows.
304	University of the Free State	Dr DB Strydom	2015	Forecast estimates of protein in South Africa.

BURSARY AWARDS
(1995 - 2015)

STUDENT	QUALIFICATIONS	INSTITUTION	TITLE OF THESIS	DEGREE
1995				
Ms E Upton	BSc Agric, BSc Agric Hons	University of Stellenbosch	Development and evaluation of polymer coated urea as a potential slow-release urea supplement for ruminants.	MSc
Mr GE Schroeder	BSc Agric, BSc Agric Hons, MSc Agric	University of Pretoria	Availability and partitioning of amino acids from various heat processed protein sources to the mammary gland of lactating dairy cows.	PhD
1996				
Mr HM Böhme	BSc Agric, BSc Agric Hons	University of Stellenbosch	*Evaluering van die insluiting van 'n kommersiële stadig-vrystellende ureum-melasseproduk (Ureïed) in lekke vir skape op laergraadse ruvoer.*	MSc
Ms MB Young	BSc Agric	University of KwaZulu-Natal	An evaluation of effective energy in the formulation of diets for laying hens.	MSc
Mr AV Ferreira	BSc Agric, BSc Agric Hons, MSc Agric	University of the Free State	The essential amino acid requirements of South African Mutton Merino lambs.	PhD
Mr CA Loëst	BSc Agric, BSc Agric Hons, MSc Agric	University of the Free State	Amino acid profile of lamb carcass and *duodenal digesta* content.	PhD
1997				
Ms L McLoughlin	BSc Agric	University of KwaZulu-Natal	An investigation of factors influencing rate of lay, egg weight and embryonic growth in broiler breeder hens.	MSc
Mr PDR van Heerden	BSc, BSc Hons, MSc	PU for CHE	Physiological and biochemical basis of dark chilling and superimposed drought stress in *Glycine max* (L.) Merrill.	PhD
1998				
Ms A Booysen	BSc, BSc Hons	PU for CHE	Factors affecting biological nitrogen fixation as assessed by the ureide technique in *Glycine Max* (L.) Merrill and its implication on soybean production in South Africa.	MSc
Ms GJM Coetzee	BSc Agric	University of Stellenbosch	Effects of feeding omega-3 fatty acids and vitamin E on the chemical composition and microbial population of broiler meat.	MSc
Mr CM Coetzer	BSc Agric, BSc Agric Hons, MSc Agric	Kansas State University	Methionine metabolism in growing cattle.	PhD
1999				
Mr J van E Nolte	BSc Agric	University of Stellenbosch	An evaluation of degradable protein and non-protein nitrogen on intake and digestion by Dohne Merino sheep fed wheat straw.	MSc
Mr PGW Wessels	BSc Agric	University of Stellenbosch	Soil Nitrogen Dynamics and Spring Wheat (*Triticum Aestivum*) production in different cropping systems in the Swartland.	MSc
Mr WD Jonker	BSc	PU for CHE	*Invloed van vog- en ligstremming op die ontwikkeling en Bioproduktiwiteit van* Glycine max (L.) Merrill *genotipes van verskillende volwassenheidsgroeperings.*	MSc

STUDENT	QUALIFICATIONS	INSTITUTION	TITLE OF THESIS	DEGREE
2000				
Mr GDJ Scholtz	BSc Agric, BSc Agric Hons	University of the Free State	Models for lucerne quality grading.	MSc
Mr S Tyiso	BSc, HDE, BSc Hons, MSc	University of KwaZulu-Natal	Lipid Peroxidation and the antioxidant system in soybean seed maturation and germination.	PhD
Mr JR Sara	BSc, BSc Hons, MSc	University of KwaZulu-Natal	An investigation into the Protein Requirement of Marine Prawn *Fenneropenaeus indicus* (H. Milne Edwards).	PhD
Mr JD Thornton	BSc Agric	University of Stellenbosch	The effect of dietary protein degradability on the performance of Saanen Dairy goats.	MSc
2001				
Ms S Nel	BSc, BSc Hons	University of KwaZulu-Natal	Cloning of the xyna gene from *Thermomyces lanuginosus* and expression in *Saccharomyces cerevisiae*.	MSc
Mr SG de Jager	BSc Agric, BSc Agric Hons	University of the Free State	*Groei en ontwikkeling van sojaboonkultivars by verskillende rywydtes.*	MSc
Mr M de Beer	BSc Agric	University of Stellenbosch	The influence of processing of soybeans and sunflower seed on their energy and amino acid availability for poultry.	MSc
Ms L Brundyn	BSc Agric	University of Stellenbosch	The utilisation and supplementation to stubble lands for South African Mutton Merino ewes.	MSc
2002				
Ms H Fourie	BSc, HOD, BSc Hons, MSc	Catholic, University of Leuven, België	*In vivo* evaluation of resistance to *Meloidogyna incognita* race 2 (Nematode: Tylenchida) and identification of genetic markers for this trait in soybeans *(Glycine max)*.	PhD
Ms MM Viljoen	BSc, BSc Hons	PU for CHE	The influence of dark chilling on the endogenous rhythms of photosynthesis and sucrose synthesis in *Glycine max* (L.) Merr.	MSc
2003				
Ms LR Breytenbach	BSc Agric Hons	University of Stellenbosch	The influence of processing of lupins and canola on apparent metabolisable energy and broiler performance.	MSc
Mr SG Payne	BSc Agric Hons	University of Stellenbosch	The Phosphorus availability of feed phosphates in broilers.	MSc
Ms JB Griffiths	BSc Agric Hons	University of Stellenbosch	The effect of extrusion on the degradability parameters of various vegetable protein sources.	MSc
Mr D Backhouse	BSc Agric	University of KwaZulu-Natal	The effect of photoperiod and feeding time on broiler breeder eggshell quality and oviposition time.	MSc
2004				
Ms ER Malleson	BSc Agric (Animal Science)	University of Pretoria	Fishmeal supplementation to high producing Jersey cows grazing ryegrass or kikuyu pasture.	MSc
Ms Z Bester	BSc Agric (Animal Science)	University of Pretoria	Evaluation of a liquid rumen protected methionine source using different techniques.	MSc
Ms N Smith	BSc Agric (Animal Science)	University of Stellenbosch	The effect of dietary inclusion of canola oilcake, full-fat canola and sweet lupins on the production performance and fat composition of broilers and pigs.	MSc
2005				
Mr W Visagie	BSc Agric (Animal Science)	University of Stellenbosch	The digestibilty and degradability of feeds and protein sources in Dohne Merino sheep and boer goats.	MSc
Mr J Fourie	BSc Agric	University of Stellenbosch	The effects of a multiple-enzyme combination in maize-soya diets for broiler chickens.	MSc
Ms M Kritzinger	BSc Agric	University of Stellenbosch	Alternatives to replace antibiotics in broiler diets: Effects on protein utilisation and production performance.	MSc

STUDENT	QUALIFICATIONS	INSTITUTION	TITLE OF THESIS	DEGREE
2006				
Ms MR Modiba	BSc (Microbiology)	University of Limpopo	Evaluation of solid state fermentation in the detoxification of *Jatrpoha curcas* seed press cake.	MSc
Mr SF Magoda	BSc Agric	University of KwaZulu-Natal	Poultry nutrition (alternative protein source for laying hens).	MSc
Mr H Nienaber	BSc Agric, BSc Hons	University of Pretoria	Effect of roughage to concentrate ratio on ruminal fermentation and protein degradability in dairy cows.	MSc
Mr D Mellet	BSc (Zoology & Botany)	North-West University	Studies not completed.	
2007				
Ms M Strydom	BSc Agric	University of Stellenbosch	The effect of different levels of supplementary feed on the production of finisher ostriches *(Struthio camelus)* grazing irrigated lucerne *(Medicago sativa)* pastures.	MSc
Ms BK Theeruth	BSc (Animal & Poultry Science), MSc (Animal Science)	University of KwaZulu-Natal	Selecting suitable mathematical functions to describe the time course of anorexia during pathogen challenge.	MSc
Mr DB Strydom	BCom	University of the Free State	The economic impact of maize-based ethanol production on the South African Animal Feed Industry.	MSc
2008				
Mr TL Khetani	BSc Agric	University of KwaZulu-Natal	The effects of maternal dietary lysine intake on broiler breeder offspring performance.	MSc
Ms PT Mabulwana	BSc (Botany & Microbiology), BSc Hons (Botany)	University of Limpopo	Determination of drought stress tolerance among soybean varieties using morphological and physiological markers.	MSc
2009				
Mr SB Ruck	BSc Hons (Animal Science)	University of KwaZulu-Natal	The response of broiler breeder hens to dietary lysine: Hatchability, embryo growth and subsequent offspring performance.	MSc
Ms J Patel	BSc Hons (Animal & Poultry Science)	University of KwaZulu-Natal	The effect of dietary lysine, crude protein, energy and feed allocation on broiler breeder hen performance.	MSc
Mr TR Olivier	BSc Agric	University of Stellenbosch	Determination of the nutrient requirements of breeding ostriches.	MSc
Mr EJ van der Westhuizen	BSc Agric	University of Stellenbosch	The effect of slaughter age on the lamb characteristics of Merino, South African Mutton Merino and Dorper lambs.	MSc
2010				
Ms MM Minnaar	Hons (Plant Pathology), BSc (Environmental Sciences)	North-West University	Constraints on photosynthesis and antioxidant metabolism in winter and summer crops induced by sulphur dioxide fumigation.	MSc
Ms AM Jooste	BSc Agric	University of Pretoria	The effect of supplementing slow release nitrogen (optigen II) and FME on the degradability of poor quality roughage in sheep.	MSc
Ms S Greaves	BSc Agric	University of Pretoria	Growth and immunity of weaner piglets supplemented with dietary tryptophan, threonine and glutamine.	MSc
Mr WJ Kritzinger	BSc Agric	University of Stellenbosch	Allometric description of ostrich *(Struthio camelus var. Dometricus)* growth and development.	MSc

STUDENT	QUALIFICATIONS	INSTITUTION	TITLE OF THESIS	DEGREE
2011				
Mr PD Carstens	BSc Agric	University of Stellenbosch	Studies to develop a mathematical optimisation model to desribe the effect of nutrition on the growth of ostriches *(Struthio camelus var. Domesticus)*.	MSc
Mr FV Meyer	BSc Agric (Animal Science)	University of Pretoria	The response of weaned piglets to varying dietary levels of synthetic valine and leucine.	MSc
Ms M du Plessis	BSc (Biotechnology), BSc Hons (Plant biotechnology)	University of Pretoria	Cysteine proteases activity and gene expression studies in soybean nodules during development and drought stress.	MSc
Ms SL von Waltsleben	BSc Agric	University of KwaZulu-Natal	The effect of dietary crude protein on fertility of broiler breeder males.	MSc
2012				
Ms MP Genis	BSc Agric (Animal Science with Agronomy)	University of Stellenbosch	The effect of dietary energy content and the provision of a *Beta*-adrenergic agonist in the diet on the production and meat quality of South Africa Mutton Merino feedlot lambs.	MSc
Ms L van Emmenes	BSc Agric (Animal Science as a major)	University of Stellenbosch	Evaluation of phytase enzymes on performance, bone mineralisation, carcass characteristics and small intestinal morphology of broilers fed maize soybean diets.	MSc
Mr R Steyn	BSc Agric (Animal Science and Agricultural Economics), Hons (Agricultural Economics)	University of the Free State	When does a market qualify as a niche market: A canola case study.	MSc
Ms GA Tesselaar	BSc Agric (Animal Science with Conservation Ecology) 2010	University of Stellenbosch	Development of a mathematical optimisation model for breeding ostriches: Identification of possible factors affecting feed intake and production.	MSc

Did you know?

The PRF honours every role-player and each contribution made towards advancing the interests of the PRF and assisting us to make an indelible impact on the sector.

STUDENT	QUALIFICATIONS	INSTITUTION	TITLE OF THESIS	DEGREE
2013				
Mr LL Eksteen	BSc Agric (2012)	University of Stellenbosch	Reducing height and lodging in canola *(Brassica napus L.)* using plant growth regulators.	MSc
Mr H Schuurman	BSc Agric	University of Stellenbosch	Evaluation of bypass protein supplementation in sheep.	MSc
Ms TC Maluleke	BSc (Genetics) (2011), BSc Hons (2012)	University of Pretoria	Plant Cystatins and insect resistance: Inhibition of insect midgut cysteine proteases by plant cystatins and their role in plant insect resistance.	MSc
Ms M du Plessis	BSc (2009), BSc Hons (2010), MSc (2012)	University of Pretoria	Molecular markers for drought tolerance in soybeans.	PhD
Ms GC Buitendach	BSc (Animal Science) (2009), BSc Hons (2011)	University of the Free State	The effect of long term exposure to different dietary fatty acids on production and egg quality of layers.	MSc
2014				
Mr MN Engelbrecht	BSc (Agricultural Economics) (2013)	University of Stellenbosch	The effect of supplements containing different protein and energy sources and essential oils on the performance pasture finished heifers.	MSc
Ms T Khahlu	BSc (Biotechnology) (2010 - 2012)	University of Pretoria	Drought tolerance markers in soybeans.	MSc
Mr HCvdW Leicester	BSc (Animal Science) (2011), BSc Hons (2012)	University of Pretoria	Animal nutrition examining the effect of a quality roughage as a determinant of nitrogen efficiency in dairy cows.	MSc
Ms E Jordaan	BSc Agric (Plant Pathology) (2008), MSc Agric (Plant Pathology) (2014)	University of Pretoria	Epidemiology and population on structure of *Macrophomina phaseolina* (Charcoal rot) on sunflower and soybeans in South Africa (TBC).	PhD
2015				
Mr W de Jager	BSc Agric (Animal Science and Agricultural Economics) (2013)	University of the Free State	An integrated model to project animal protein consumption in South Africa.	MSc
Ms L van Emmenes	BSc Agric (Animal Science) (2011), MSc Agric (Animal Science) (2014)	University of Stellenbosch	The use of fly larvae meal as an alternative protein source in the diets of monogastric animals. Exploring the potential benefits for the animal, farmer, consumer and environment.	PhD
Ms KZ Neethling	BSc Agric (Animal Science) (2013)	University of Stellenbosch	The effect of interaction between different combinations of energy and protein sources on *in vitro* forage NDF digestibility.	MSc
Ms JA Engelbrecht	BSc (Animal Science) (2014)	University of Stellenbosch	The evaluation of alternative protein sources (lupins, canola and canola oilcake in ostrich nutrition).	MSc
Mr A Coetzee	BSc Agric (2011 - 2014)	University of Stellenbosch	Determining the optimal rate and time of nitrogen topdressing applications for canola *(Brassica napus)* in the Swartland and Southern Cape production areas.	MSc

ACHIEVEMENT AWARDS

(1995 - 2014)

NAME	AWARD	TITLE OF AWARD	INSTITUTION	PRESENTED
1995				
Dr BJ Willemse	Best Doctoral thesis	Economic implications of an alternative marketing system for yellow maize on the South African Animal Feed Industry.	University of the Free State	Award presented at the Agricultural Economics Association's AGM held on 26 - 28 September 1995 in Bloemfontein
1996				
Mr ND Paton	Best Masters Degree thesis	The effect of environmental temperature on the performance of broilers.	University of KwaZulu-Natal	Award presented in 1996 at a conference of the Southern African Branch of the World Poultry Association
Ms CE Hancock	Best Article in a Scientific Journal	The evaluation of the growth parameters of six strains of commercial broiler chickens.	University of KwaZulu-Natal	Award presented in 1996 at a conference of the Southern African Branch of the World Poultry Association
1997				
Mr GE Schroeder	Best Article in a Scientific Journal	Chemical and protein quality parameters of heat processed sunflower oilcake for dairy cattle.	ARC-Animal Nutrition and Animal Products Institute	Award presented in 1997
1998				
Ms HM Venter	Best Doctoral thesis	A bloat risk classification method for pasture legumes.	ARC-Range and Forage Institute	Award presented in 1999
Dr TS Brand	Best Article in a Scientific Journal	Full-fat canola as a protein source for weaning and growing-finishing pigs.	Chief Directorate Agriculture, Western Cape	Award presented at a function held at In Die Bos, Stellenbosch
Mr C Havenga	An individual who made an exceptional contribution in promoting the PRF's objectives	For his contribution to the success of the Super Soya Competition.	Department of Agriculture, KZN	Award presented at the Super Soya Competition, KZN 1999
1999				
Ms E Upton	Best Masters thesis	Development and evaluation of polymer coated urea as a potential slow release urea supplement for ruminants.	University of Stellenbosch	Award presented in 2000
Dr TS Brand	Best Article in a Scientific Journal	The true metabolisable energy content of canola oilcake meal and full-fat canola seed for ostriches *(Struthio camelus)*.	Chief Directorate Agriculture, Western Cape	Award presented at a function held at In Die Bos, Stellenbosch
Mr L Killian	An individual who made an exceptional contribution in promoting the PRF's objectives	For pioneering research work with narrower rows and promoting soybean and lupin production in KwaZulu-Natal.	Protein Research Foundation (PRF) contractor, KwaZulu-Natal	Award presented in 2000

NAME	AWARD	TITLE OF AWARD	INSTITUTION	PRESENTED
2000				
Dr CMS Mienie	Best Doctoral thesis	Towards marker assisted selection for nematode resistance in soybeans.	ARC-Grain Crops Institute	Award presented at a function held by the ARC-GCI, Potchefstroom (2001)
Mr AA Nel	Best Article in a Scientific Journal	(a) The effect of plant population on the quality of sunflower seed for processing. (b) The effect of environment and cultivar on sunflower seed I. Yield, hull ability and seed characteristics. (c) The effect of environment and cultivar on sunflower seed II. Composition and processing quality. (d) The yield and processing quality of sunflower seed as affected by the amount and timing of nitrogen fertiliser.	ARC-Grain Crops Institute	Award presented at a function held by the ARC-GCI, Potchefstroom (2001)
Mr HJC Agenbag	An individual who made an exceptional contribution in promoting the PRF's objectives	For pioneering work in narrower rows and the promotion of canola and lupin production in the Western Cape.	Protein Research Foundation (PRF) contractor, Western Cape	Award presented at a function held at In Die Bos, Stellenbosch
2001				
Dr JA de Ronde	Best Doctoral thesis	Proline biosynthesis in transgenic soybean plants.	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Award presented at a 'Soybean Think Tank' held on 6 November 2002 at Caesars, Gauteng
Ms Z Brand	Masters Degree thesis	The effect of energy and protein nutritional levels on production of breeding ostriches.	Department of Agriculture, Western Cape	Award presented at a function held at In Die Bos, Stellenbosch
Dr TS Brand	Best Article in a Scientific Journal	A review on research performed in the Mediterranean rainfall area of South Africa as alternative protein sources in pig diets.	Department of Agriculture, Western Cape	Award presented at a function held at In Die Bos, Stellenbosch
Mr GJH Scholtemeijer	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	Protein Research Foundation (PRF) Chairman	Award presented at a Board members' function held on 1 August 2002
2002				
Mr TT de Villiers	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	Department of Agriculture, Western Cape	Award presented at a function held at In Die Bos, Stellenbosch

NAME	AWARD	TITLE OF AWARD	INSTITUTION	PRESENTED
2003				
Dr M Ciacciarello	Best Doctoral thesis	The productive response of broiler breeder hens to lighting and growth manipulation during rearing.	University of KwaZulu-Natal	Award presented at the PRF's 10 Year function held in the Western Cape on 30 November 2004
Dr PDR van Heerden	Best Article in a Scientific Journal	Dark chilling effects on soybean genotypes during vegetative development: Parallel studies of CO_2 assimilation, chlorophyll a fluorescence kinetics O-J-I-P and nitrogen fixation.	North-West University	Award presented at the PRF's 10 Year function held in Johannesburg on 5 October 2004
Dr MB Hardy	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	Department of Agriculture, Western Cape	Award presented at the PRF's 10 Year function held in the Western Cape on 30 November 2004
2004				
Dr D Oelofse	Best Doctoral thesis	Molecular strategies towards anthracnose resistance in lupin.	ARC-Roodeplaat Vegetable and Ornamental Plant Institute	Award presented at a meeting of The Innovation Fund held on 23 May 2006
Mr D Backhouse	Best Masters Degree thesis	The effect of photoperiod and feeding time on broiler breeder eggshell quality and oviposition time.	University of KwaZulu-Natal	Award presented at a function of the Department of Animal and Wildlife Sciences held at the University of KwaZulu-Natal on 23 June 2006
Dr TS Brand	Best Article in a Scientific Journal	Chemical composition, true metabolisable energy content and amino acid availability of grain legumes for poultry.	Department of Agriculture, Western Cape	Award presented at a meeting of the Canola and Lupin Working Group held on 9 February 2006
Mr GW Bührmann	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	GWB Seed	Award presented at a Board members function held on 17 November 2005
2005				
Dr H Fourie	Best Doctoral thesis	*In vivo* evaluation of resistance to *Meloidegyna incognita race 2 Nematode: Tylenchida* and identification of genetic markers for the trait in soybeans *(Glycine max)*.	ARC-Grain Crops Institute	Award presented in 2006
Ms E du Preez	Best Masters Degree thesis	Chemical control of soybean rust *(Phakopsora pachyrhizi)* on soybeans.	University of KwaZulu-Natal	Award presented during a Congress of Plant Pathology held on 23 January 2007
Prof RM Gous & Dr M Ciacciarello	Best Article in a Scientific Journal	A comparison of the effects of feeding treatments and lighting on age at first egg and subsequent laying performance and carcass composition of broiler breeder hens.	University of KwaZulu-Natal	Award presented in 2006
Mr CJ Lubbe	An individual who made an exceptional contribution in promoting the PRF's objectives	*Patrys Lubbe en die sojaboonbedryf.*	Agriocare	Award presented at a Board members function held on 23 November 2006

NAME	AWARD	TITLE OF AWARD	INSTITUTION	PRESENTED
2006				
Mr R Strauss	Best article in a Scientific Journal	Ranking of dark chilling tolerance in soybean genotypes probed by the chlorophyll a fluorescence transient O-J-I-P.	North-West University	Award presented at a North-West University function held on 14 October 2008
Mr PJA Lombard	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	Department of Agriculture, Western Cape	Award presented at a function held at In Die Bos on 28 November 2007
2007				
Dr MK Nonis	Best Doctoral thesis	Modelling nutrient responses and performance of broiler breeders after sexual maturity.	University of KwaZulu-Natal	Award presented at a function held on 1 December 2009
Ms DD Visser	Best Masters Degree thesis	Studies on *Sclerotinia sclerotiorum* (*sclerotinia* stem rot) on soybeans.	University of KwaZulu-Natal	Award presented at a function held on 17 April 2009
Mr R Strauss	Best Article in a Scientific Journal	The role of low soil temperature in the inhibition of growth and PSII function during dark chilling in soybean genotypes of contrasting tolerance.	North-West University	Award presented at a North-West University function held on 14 October 2008
Mr CJ du Plessis	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	Farmer PRF-contractor	Award presented on 16 September 2008 at the Super Soya Competition held at Dundee
Mr SJ Malherbe	Highest Honorary Award of the PRF	Recognition for his outstanding contribution during an uninterrupted period of 25 years as member of the Protein Advisory Committee from 1982 - 1990 and the Protein Research Foundation from 1990 - 2007.	PRF Trustee	Award presented at a Board members function held on 13 July 2007
2008				
Mr JSG Joubert	Highest Honorary Award of the PRF	Recognition of his outstanding contributions during an uninterrupted period of 18 years as member of the Protein Research Foundation from 1990 - 2008.	PRF Vice-chairperson	Award presented at a Board members function held on 12 July 2008
Dr M Griessel	Highest Honorary Award of the PRF	Recognition of his outstanding contributions during an uninterrupted period of 18 years as member of the Protein Research Foundation from 1990 - 2008.	PRF Trustee	Award presented at a Board members function held on 12 July 2008
Mr F Joubert	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	Farmer Riversdal	Award presented at The Riversdal Information Day held on 3 September 2009
Ms E Heyneke	Best Masters Degree thesis	Interaction between SO_2 fumigation and drought stress on growth, photosynthesis and symbiotic nitrogen fixation in soybeans, studied in an open-top chamber facility.	North-West University	Award presented at a North-West University function held on 25 March 2010
Dr PDR van Heerden	Best Article in a Scientific Journal	Regulation of Respiration and the Oxygen Diffusion Barrier in Soybean Protect Symbiotic Nitrogen Fixation from Chilling-Induced Inhibition and Shoots from Premature Senescence1[W][OA].	Newcastle University	Award presented at a function held on 18 May 2010

NAME	AWARD	TITLE OF AWARD	INSTITUTION	PRESENTED
2009				
Mr GJH Scholtemeijer	Highest Honorary Award of the PRF	Recognition of his outstanding contributions during an uninterrupted period of 19 years as member of the Protein Research Foundation from 1990 - 2009.	PRF Chairman	Award presented at a Board members function held on 10 July 2009
Mr FAS Potgieter	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	PRF Trustee/ Grain SA	Award presented at a function of the Board held at Hartford House on 7 May 2010
Mr DB Strydom	Best Masters Degree thesis	The economic impact of maize-based ethanol production on the South African animal feed industry.	University of the Free State	Award presented 15 September 2010 at the 20th PRF function held at Southern Sun, Bloemfontein
Dr EH Tesfamariam	Best Article in a Scientific Journal	Water stress effects on winter canola growth and yield.	University of Pretoria	Award presented on 29 October 2010 at a function at the University of Pretoria
2010				
Mr WF van Wyk	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional contribution in promoting the PRF's objectives.	PRF Contractor	Award presented at the Hatfield Information Day held at Hatfield Trial Farm on 21 February 2012
Mr GD Sparks	Best Masters Degree thesis	The economic feasibility of non-farm biodiesel production on KwaZulu-Natal, South Africa.	University of KwaZulu-Natal	Award presented at the Annual Agricultural Economics Association of South Africa (AEASA) Gala Dinner held at "Diep in die Berg", Pretoria on 29 September 2011
Ms MK Nonis & Prof RM Gous	Best Article in a Scientific Journal	Modelling egg production and nutrient responses in broiler breeder hens.	University of KwaZulu-Natal	Award presented at a Board members function held on 13 May 2011
2011				
Dr J de Kock	Highest Honorary Award of the PRF	Recognition of his outstanding contributions during an uninterrupted period of 13 years as a member of the Protein Research Foundation from 1998 - 2011.	PRF Trustee	Award presented at a Board members function held on 13 May 2011
Prof GA Agenbag	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	University of Stellenbosch	Award presented at the Swartlandse Kleingraan Information Day held at Langgewens Research Farm, Moorreesburg on 6 September 2012
Mr GD Sparks	Best Article in a Scientific Journal	An economic evaluation of soybean-based biodiesel production on commercial farms in KwaZulu-Natal, South Africa.	University of KwaZulu-Natal	Award presented at the Annual AEASA Gala Dinner held at University of the Free State, Centenary Hall on 2 October 2012

NAME	AWARD	TITLE OF AWARD	INSTITUTION	PRESENTED
Landbouweekblad	Highest Honorary Award of the PRF	Charter to the Landbouweekblad, as a token of appreciation for the contribution the magazine delivered to make South Africa more independent of imported protein.	Landbouweekblad	Award presented at Board members function held on 16 September 2011
Mr FV Meyer	Best Masters Degree thesis	Feed intake, growth and carcass composition of weaned piglets receiving varying levels of valine and leucine in their diets.	University of Pretoria	Award presented at the Department of Animal and Wildlife Sciences: Annual Merit Awards function on 24 May 2013
2012				
Mr GTDT Keun	Highest Honorary Award of the PRF	Recognition of his outstanding contributions during an uninterrupted period of eleven years as member of the Protein Research Foundation from 2001 - 2012.	PRF Trustee	Award presented at a Board members function held on 11 May 2012
Mr GP de Beer	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	PRF Contractor	Award presented at the John Deere Information Day that was held on 27 August 2013
Ms M du Preez	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	General Manager PRF	Award presented at a Board members function held on 9 May 2013
Prof RM Gous & Ms R Danisman	Best Article in a Scientific Journal	Effect of dietary protein on the allometric relationships between some carcass portions and body protein in three broiler strains.	University of KwaZulu-Natal	Award presented at a Board members function held on 8 May 2014
Department of Agriculture, Western Cape	Highest Honorary Award of the PRF	The Protein Research Foundation hereby bestows its highest honorary award upon the Department of Agriculture, Western Cape for pioneering work done towards establishing the canola industry in South Africa, as well as for their ongoing help and support.	Department of Agriculture, Western Cape	Award presented at a function held on 11 April 2013
2013				
Mr JSG Joubert	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	PRF Trustee	Award presented at a Board members function held on 8 May 2014
Mr PD Carstens	Best Masters Degree thesis	Studies to develop a mathematical optimisation model to describe the effect of nutrition on the growth of ostriches *(Struthio camelus var. domesticus)*.	University of Stellenbosch	Award presented at a function held on 25 November 2015
2014				
Dr SC Lamprecht	An individual who made an exceptional contribution in promoting the PRF's objectives	Exceptional Contribution in promoting the PRF's objectives.	ARC-Plant Protection Research Institute	Award presented at a function held on 25 November 2015

PROTEIN RESEARCH FOUNDATION TRUSTEES (1990 - 2015)

YEAR	NAME	**DESCRIPTION/DESIGNATION	TERMINATION
November 1990	Dr RD Bigalke	Department of Agriculture & Development	May 2000
November 1990	Dr GS Bredell	Department of Agriculture & Development	December 1997
November 1990	Mr JCG du Preez	Oilseeds Board	November 1994
November 1990	Dr RM Finlayson	SA Oil Processors Association	March 1996
November 1990	Dr M Griessel	SA Animal Feed Manufacturers Association	May 2014
November 1990	Mr SJ Malherbe	SA Fishing Industry	July 2009
November 1990	Mr GJH Scholtemeijer	South African Agricultural Union (SAAU)	
November 1990	Mr JSG Joubert	Department of Agricultural Economics	September 2015
November 1990	Mr JF van der Merwe	SAAU	November 2005
November 1990	Mr PJ le Roux	Department of Environmental Affairs: Sea Fisheries	November 1991
*November 1991	Dr L Botha	Department of Environmental Affairs: Sea Fisheries	May 1995
November 1994	Mr BR Hundley	SAAU	November 1994
November 1994	Mr MJ Prinsloo	SAAU	March 1996
February 1995	Mr HJ Diekmann	SAAU	
February 1995	Mr SF Streicher	Oilseeds Board	February 1999
*November 1995	Mr G de Villiers	Department of Environmental Affairs: Sea Fisheries	December 1998
March 1996	Mr CJ du Plessis	Specialist: Producer of Oil and Protein Seeds	November 2006
October 1996	Dr AJ Viljoen	SA Oil Processors Association	February 2000
April 1998	Dr J de Kock	Research Management	
*February 1999	Dr A Badenhorst	Department of Environmental Affairs: Sea Fisheries	February 2001
February 2001	Dr AC van der Merwe	Specialist: Oil Crushing Industry	September 2010
May 2006	Prof RM Gous	Consumers of Protein	
January 2007	Mr FAS Potgieter	Specialist: Producer Oil and Protein Seeds (Soybeans)	May 2014
March 2010	Mr AP Theron	Specialist: Producer Oil and Protein Seeds (Canola)	
November 2010	Dr E Briedenhann	Specialist: Oilseeds Processors	
November 2010	Mr GTDT Keun	Chief Executive Officer	
November 2013	Prof FH Meyer	Specialist: Agricultural Economics	

**** Dr A Badenhorst was secundus for Dr Botha and Mr De Villiers until 1998. He was appointed to the Board in February 1999. However, he resigned from the Department of Environmental Affairs: Sea Fisheries in February 1999. His term finally ended in February 2001.***

***** Time of appointment***

LIST OF ABBREVIATIONS

AAOPDT	Amino Acid Optimisation System
AVRDC	Asian Vegetable and Research Development Centre
AFMA	Animal Feed Manufacturers Association
AOF	Australian Oilseeds Federation
APR-model	Animal Products Requirements-model
ARC	Agricultural Research Council
ARC-GCI	Agricultural Research Council-Grain Crops Institute
ARC-PPRI	ARC-Plant Protection Research Institute
ARC-OPSC	ARC-Oil and Protein Seeds Centre
ART	Agricultural Research Trust
ASA	American Soybean Association
AVCASA	Association of Veterinary and Crop Associations of South Africa
BFAP	Bureau for Food and Agricultural Policy
CEC	Crop Estimates Committee
CSIR	Council for Scientific and Industrial Research
DAD	Department of Agricultural Development
DAFF	Department of Agriculture, Forestry and Fisheries
DAWC	Department of Agriculture, Western Cape
DDGS	Distillers Dried Grains and Solubles
EEAOC	Estacion Experimental Agroindustrial Obispo Colombres
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
FIRI	Fishing Industry Research Institute
FMPA	Fishmeal Producers Association
GATT	General Agreement on Tariffs and Trade
GMO	Genetically Modified Organisms
Grain SA	Grain South Africa
ha	Hectares
INTA	Instituto Nacional de Tecnología Agropecuária
KZN	KwaZulu-Natal

MKB	Moorreesburg Koringboere Beperk
MOU	Memorandum of Understanding
MTA	Material Transfer Agreement
m ton	Metric ton
NAMPO	National Agricultural Maize Producers Organisation
NWU	North-West University
OAC	Oilseeds Advisory Committee
OPDT	Oil and Protein Seeds Development Trust
PAC	Protein Advisory Committee
PLK	Porterville Landboukoöperasie
PRAC	Protein Research Advisory Committee
PRF	Protein Research Foundation
PRT	Protein Research Trust
RSA	Republic of South Africa
SAAU	South African Agricultural Union
Safex	South African Futures Exchange
SBR	Soybean Rust
SCPS	Stellenbosch Centre for Photographic Services
SKOG	Swartlandse Kleingraan Ontwikkelingsgroep
SSR	Sclerotinia stem rot
SWG	Soybean Working Group
SSWG	Sclerotinia Working Group
t/ha	Tons per hectare
TSB	Transvaal Suiker Beperk
UFS	University of the Free State
UKZN	University of KwaZulu-Natal
UP	University of Pretoria
USA	United States of America
USB	United Soybean Board
WCDA	Western Cape Department of Agriculture
WSF	World Soybean Foundation
WSRC IX 2013	World Soybean Research Conference IX 2013

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PAGE NO.	DETAILS OF PHOTOGRAPHER/S
Pages 1 & 5	Mr Rudolph Thomas, Tigme.com (wide lens photo)
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Pages 6, 11, 17, 20 & 124	Mr Gerhard Scholtemeijer, PRF Chairman
Pages 8, 10, 62, 111, 113, 133, 141 & 171	Mr Wessel van Wyk, PRF Contractor
Pages 9, 87 & 169	Embrapa Soybean, Londrina, PR Brazil
Pages 18 & 19	Majority of the photos provided by Mr Joe Diekmann, PRF Trustee
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Pages 89, 91, 93, 105, 115, 131, 142, 147, 153, 159, 162, 163 & 167	Mr Piet Lombard, WCDA
Pages 74 & 75	Dr Sandra Lamprecht, ARC-PPRI
Page 83	Mr Sakkie Slabbert, WCDA
Page 117	Prof Andre Agenbag, Stellenbosch University/PRF Contractor
Page 120	Prof TS Brand, WCDA
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