Vol 8 No 4 • December 2022
ISSN 2410-1206

OILSEEDS focus

Protein Research Foundation • Oil & Protein Seeds Development Trust • Oilseeds Advisory Committee

Soya bean cultivar selection

Genetic progress in oilseeds research

Planting date & sunflower yield

Future of groundnuts in the spotlight

THE HIGH-PERFORMANCE SOYBEAN RANGE YOU CAN TRUST

Pannar's soybean range offers you a winning combination of excellent yield potential and exceptional agronomic characteristics. The cultivars demonstrate stability over different yield potentials, production areas and seasons. Pannar offers a full range of maturity classes covering almost all planting dates and densities. With Pannar, your every soybean need is well-covered.

STEADFAST IN OUR COMMITMENT TO YOU, THE FARMER.

PANNAR®

Together we farm for your future™

www.pannar.com

CORTEVA™ agriscience

Oilseeds production in South Africa: Celebrating successes

By Dr Erhard Briedenhann, chairperson, Oilseeds Advisory Committee and vice-chairperson, Protein Research Foundation

Total oilseeds crop production in South Africa increased over the last ten years from 1,32 million tons to 3,3 million tons, while imported oilcake for animal feed production decreased from 900 302 tons ten years ago to an estimated (extrapolated) 220 000 tons in 2022.

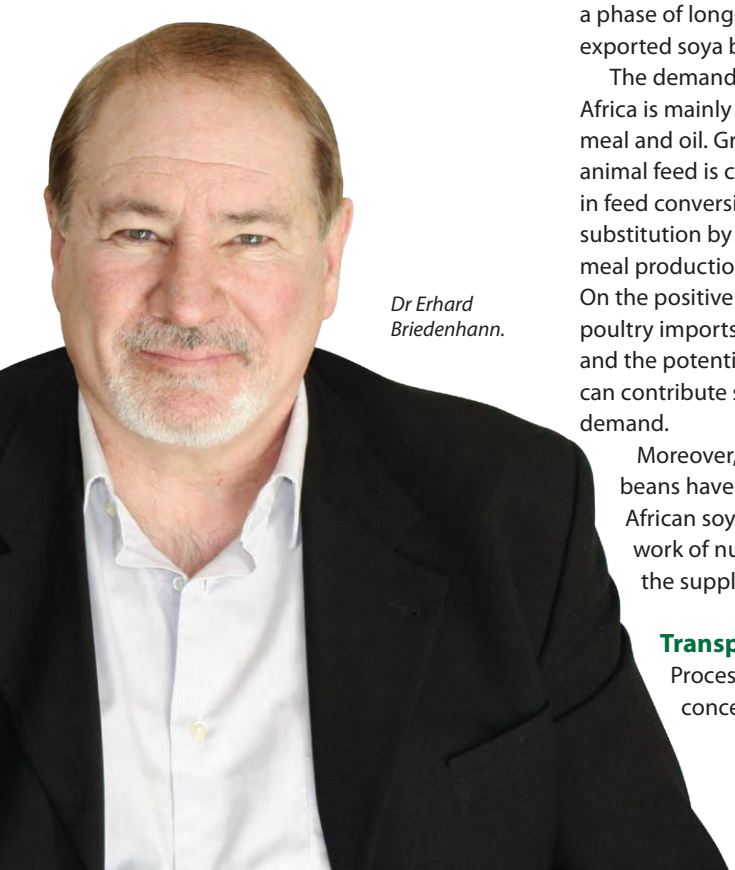
Rising input costs continue to support the shift from maize to soya beans (in most parts of the country the profitability calculations are in favour of soya beans). The current increase of 16% in hectares for the next season is a good signal and possibly a sign of good things to come.

In the Western Cape, the 135% growth in canola production the last ten years, given the recent rise in crush capacity and successful exports, is a sign of a healthy, growing industry.

Growth challenges

The sunflower industry still faces challenges, despite high sunflower seed prices. The concept of sunflower seed as a main crop rather than a crop planted late in the season remains a challenge, but is progressing. The slow rate at which yields are improving relavite to soya and canola, as well as the *Sclerotinia* challenge need to be addressed. In addition, the initiative to increase oil content by way of a price incentive has the potential to rejuvenate the industry.

The groundnut industry's growth has been less successful. A reduction of 20% in hectares planted was seen this season due to price ratios, more lucrative alternative crops under irrigation, as well as groundnuts not doing well under wet conditions. Add to that government's unwillingness to support the industry's fight for duty alignment, especially on downstream imported finished products such as peanut butter.



Dr Erhard Briedenhann.

Soya bean demand and exports

If the current growth in soya bean production continues, production will exceed demand and we will need to enter a phase of long-term sustainability via exported soya beans.

The demand for soya beans in South Africa is mainly to produce soya bean meal and oil. Growth in soya bean meal in animal feed is curtailed by improvements in feed conversion efficiencies and substitution by other growing oilseed meal production such as canola meal. On the positive side, the reduction in poultry imports by preventing dumping and the potential of poultry meat exports can contribute significantly to increased demand.

Moreover, export markets for soya beans have been opened for South African soya beans thanks to the work of numerous organisations in the supply chain.

Transport of soya bean meal

Processing capacity is mainly concentrated around the central soya bean production area, while approximately 30% of demand for soya bean meal is in the Eastern and Western Cape. Transporting soya bean meal to these regions is costly due to the distances involved, lack of return loads and the ever-increasing fuel price.

These markets are essential for the continued expansion of the soya bean industry until we reach 100% self-sufficiency. This logistical disadvantage is currently to a lesser extent supported by the duty on imported soya bean meal.

Initiatives to possibly move soya bean meal via rail over these distances are hampered by the double handling required due to a lack of rail sidings at primary production and end users. The reliability of railway systems, which are essential in the transportation of a more perishable product such as soya bean meal, is also a significant barrier.

Technological improvements

Continued efforts in improving the availability of new seed cultivars and technology suited to our requirements in South Africa has brought major benefits, supported by the South African Cultivar and Technology Agency levy on soya beans. From 2023, we can look forward to continued expansion and commercialisation of new soya bean technology.

It is critical for value chains to work in partnership to support one another and launch initiatives to the advantage of the supply chain. In the oilseeds industry, we can confirm this has certainly been the norm and contributed to its success.

For more information, contact the author at email erhardb@netactive.co.za.

Local oilseeds industry remains resilient throughout ups and downs

As the year draws to a close, we can say with certainty that it has been an eventful one. It seems that each year requires a new perspective.

The difficulties caused by load shedding have been particularly hard on the manufacturing industry. Within the local value chain, oilseed crushers, feed manufacturers, and abattoirs have been negatively affected.

> International best practices, improving agronomic practices, and new seed technology are among the initiatives that have been and need to continue being pursued.

Port strikes delayed the importation and delivery of essential agricultural products and goods. The Russia-Ukraine conflict continues to disrupt grain trade and energy norms, and the situation is not expected to be resolved soon.

Rainfall was above average and was positive for producers, while input costs increased substantially and put pressure on profitability. Fortunately for producers, commodity prices were high but became a heavy burden for the consumer.

Prospects of a high rainfall season for 2022/23 appear to be very likely in the initial stages. We have already seen numerous areas trying to cope with excessive rain and in some cases flooding is causing difficulty for those busy planting.

South Africans remain resilient and despite challenges, we will do our level best and adjust to circumstances. The negative impact on the economy does weigh heavily on everyone's mind regardless.

Expect a rise in oilseed production

The oilseeds industry has stepped up production, making a significant positive contribution towards easing high feed costs for the approximately 1,2 billion broilers slaughtered in 2022, which supplies the lowest-cost animal protein to the people of South Africa.

New technology

New technology remains key to the future success of the industry. International best practices, improving agronomic practices, and new seed technology are among the initiatives that have been and need to continue being pursued. We are very excited that Intacta technology will be entering the commercial space in 2023 and there is great anticipation for the contribution it could make to easier and/or improved farming practices, along with the latest germplasm-increased yields.

We are positive that 2023 will be a great year, with expansion in oilseed production and prosperity for all in the value chain.

Enjoy this issue of *Oilseeds Focus*.

Dr Erhard Briedenhann

Send us your contributions and suggestions to make *Oilseeds Focus* an enjoyable and valuable publication for the oilseeds industry. Contact Dr Briedenhann at erhardb@netactive.co.za for more information.

Editor: Dr Erhard Briedenhann
+27 82 551 1634
erhardb@netactive.co.za

Associate editor: Gerhard Keun
+27 11 803 2579
oliesade@opot.co.za

Published by: Plaas Media (Pty) Ltd
217 Clifton Ave, Lyttelton, Centurion, RSA
Private Bag X2010, Lyttelton, 0140, RSA
Tel: +27 12 664 4793 • *www.agriorbit.com*

Chief editor: Lynette Louw
+27 84 580 5120
lynette@plaasmedia.co.za

Deputy editor: Jayne du Plooy
+27 82 414 0151
jayne@plaasmedia.co.za

Sub-editor: May Nel
+27 67 749 4059 • may@plaasmedia.co.za

News editor: Elmarie Helberg
+27 73 339 2920 · elmarie@plaasmedia.co.za

Design & layout: Inge Gieros
+27 82 959 9607 • inge@plaasmedia.co.za

Advertising:

Karin Changuion-Duffy
+27 82 376 6396 • karin@plaasmedia.co.za

Susan Steyn
+27 82 657 1262 • susan@plaasmedia.co.za

Sales manager: Marné Anderson
+27 72 639 1805
marne@plaasmedia.co.za

Subscriptions: Beauty Mthombeni
+27 64 890 6941
beauty@plaasmedia.co.za

Printed and bound by: Typo
+27 11 402 0571

Published on behalf of:
Protein Research Foundation
PO Box 1564, Rivonia, 2128
Tel: 011 803 2579 • Fax 011 803 2287 / 086 634 8067
Enquiries: gkeun@proteinresearch.net

To subscribe

Oilseeds Focus is a magazine aimed at addressing issues that are relevant to the canola, soya bean, sunflower and groundnut industries. To subscribe, please contact Beauty Mthombeni at 064 890 6941 or email beauty@plaasmedia.co.za. Subscriptions are free.

CONTENTS

NEWS

Farmers must guard against seed theft

Organised agriculture in the Free State has warned producers who have already started preparing for the summer planting season to protect themselves against the theft of inputs. Dr Jane Buys, security risk analyst at Free State Agriculture (FSA), says there seems to be an emerging trend of seed theft in this province. This follows three incidents that were reported in Bothaville, Reitz and Fouriesburg, respectively.

According to Dr Buys, the criminals do not simply loot a few bags at a time but target hundreds of bags amounting to thousands of rand. Millions of rand worth of seed, for instance, were stolen in an incident in Steynsrus last August.

There is a strong suspicion that organised crime syndicates are responsible, with primarily white maize seed being targeted. Jakkals le Roux, chairperson of FSA, says the culprits have spotted an opportunity to sell the stolen seed at a lower price to those who are willing to buy it because of the sharp rise in input costs.

FSA has warned producers to keep a watchful eye on their seed stock and to do regular counts. Le Roux also encourages them to report all incidents of theft, including seed theft, to the police so that a trend or pattern can be identified. – *Christal-Lize Muller, Plaas Media*

Rise in soya bean production to continue

The most recent data released by the Crop Estimates Committee indicates that South African producers intend to plant a total area of 4,35 million hectares of summer grains and oilseeds in the 2022/23 season, up mildly by 0,2% year-on-year (y/y).

A deep dive into the numbers shows a mixed picture. For example, the 2022/23 maize planting intention is 2,59 million hectares, down by 1% y/y (but well above the ten-year average area of 2,53 million hectares). Approximately 1,50 million hectares is white maize (down by 5% y/y), and 1,09 million hectares is yellow maize (up 4% y/y).

The sorghum area could fall by 11% y/y to 33 100ha (well below the ten-year average of 51 102ha). The groundnut area will likely decline by 21% from the 2021/22 production season to 34 500ha (lower than the ten-year average of 43 143ha).

The sunflower seed planting could decline by 13% from the 2021/22 season to 580 500ha (slightly above the ten-year average of 579 955ha). Meanwhile, soya bean area plantings are set to increase by 16% from the 2021/22 production season to 1,08 million hectares, which is a record area. – *Wandile Sihlobo, Agbiz*

Billion-rand scheme to empower South Africa's farmers

The minister of agriculture, land reform and rural development, Thoko Didiza, has launched a R3,2 billion blended finance scheme with Land Bank to assist farmers.

The programme will be implemented over a ten-year period, with the department investing a minimum of R3,2 billion. The funding will be based on a blended finance structure – a combination of a loan and a grant – with the focus on commodities as per the *Agriculture and Agro-processing Master Plan*.

The department and Land Bank will each invest R325 million per annum, which will effectively result in a fund of R650 million a year; this will grow to R1,95 billion by the end of the third year.

"Strategic partnerships like these are critical to ensure growth, food security, development of farmers and transformation of the agricultural sector, and contribute towards job creation," said Didiza. – *Department of Agriculture, Land Reform and Rural Development*

Europe to become leading canola oil consumer

The value of the global canola oil market in 2022 is US$19,3 million and is likely to reach US$27,5 million by 2032, with the market expanding at a compound annual growth rate of 3,6% through 2032.

Europe is expected to occupy a substantial share during the forecast period. Moreover, it is estimated that Europe will offer various opportunities for canola oil, as it has been experiencing increased consumption of canola oil. Various health benefits that are associated with the surge in use of this oil also serve as one of the most common factors boosting the growth avenues. Moreover, consumers from Europe are also gaining more awareness about canola oil and its ability to reduce heart diseases.

Research activities that are taking place in the field of personal care and cosmetics are expected to increase the use of canola oil. The lucrative growth in the market also analyses the future potential of this oil and is likely to add insights to industry expectations with some prior options also. – *Global News Wire*

United States and Argentina sunflower seed harvests to rise

The United States (US) and Argentina are expected to bring in a significantly larger sunflower seed harvest, while poor growing conditions in the European Union (EU-27) limited yields there.

According to information published by the International Grains Council (IGC), around 52,1 million tons of sunflower seed will likely be produced globally in the 2022/23 crop year. This would be 700 000 tons more than forecast in September, but will be 7,9% short of the previous year's volume.

While Russia is seen to produce 6,5% more sunflower seed than in 2021/22, Ukraine's supply will probably shrink by one-third due to the continuing war and decline in sunflower area. Just less than half the Ukrainian area was reportedly harvested by 14 October. However, rain has recently delayed harvest operations and exacerbated concerns about a considerable drop in quality.

Despite an expansion in area, EU production, at 9,5 million tons, is also expected to fall around 8,9% short of the previous year's output as poor growing conditions over the summer months significantly reduced the yield potential.

By contrast, the IGC is optimistic about sunflower seed supply in North and South America. Given an increased sunflower area, US production is seen to reach 1,3 million tons, which would be up 45% on the previous year's level. The same applies to Argentina, with a likely rise of around 8,7% to a record amount of 4,4 million tons. – *Biofuels International*

Kazakhstan profits from sunflower shortage

Production and exports of sunflower oil have skyrocketed in Kazakhstan this year as the world faces supply shortages and rising prices because of Russia's invasion of Ukraine. Ukraine was the world's largest supplier last year, exporting billions of dollars' worth of sunflower oil. But the war has disrupted farming, production and shipping.

With Ukraine's sunflower oil exports forecast to plummet this year, Kazakhstan is one of the countries moving to fill the gap. Exports shot up by 158% in the first seven months of this year, compared to the same period last year, while production rose by 37%.

But compared to Ukraine's pre-war output and exports, the numbers from Kazakhstan are tiny. Before the war, Ukraine was producing around one-third of the sunflower oil consumed by the world and supplying almost half of global exports, according to the United States Department of Agriculture (USDA).

Its share in global production is now projected to fall to 21% and its share of exports to 35% in the 2022/23 marketing year, the USDA says.

In Kazakhstan, production reached 267 700 metric tons in the first seven months of 2022, up from 195 600 tons last year. Exports reached 129 500 metric tons in January/July, up from 50 200 metric tons in the same period last year. – *Eurasianet*

Peanut oil market valued at US$2,40 billion

The world peanut oil market was valued at US$2,40 billion in 2021 and is expected to reach US$3,28 billion by 2029, at a compound annual growth rate of 4% during the forecast period of 2022 to 2029.

The North American market is expected to account for the largest revenue share in the global market over the forecast period due to the increasing adoption of peanut oil in the cosmetic industry and the presence of major operating players in the United States and Canada.

The Asia-Pacific market is expected to grow at an even faster rate. The growing population, rising disposable income, increased presence of manufacturers, and increased awareness among individuals about the health benefits of peanut oil usage are the factors driving the growth of the peanut oil market in the region.

Furthermore, the rising use of peanut oil in the cosmetic sector is another factor driving growth in the Asia-Pacific market. – *Data Bridge Market Research*

Indian palm oil import tariffs increase

India's government has decided to increase palm oil import tariffs by six to 11%. The decision comes as part of the government's effort to help farmers who are reeling from lower oilseed prices.

The government said the crude palm oil import tariff is now raised to US$952 from US$858 per ton, whereas the refined, bleached and deodorised (RBD) palm oil import tariff stood at US$962 from US$905 per ton before. The new palm oil import (others) tariff was raised from US$882 to US$957 per ton.

The new import tariff for crude palm olein stands at US$968, while at US$971 and US$970 for RBD palm olein and palm olein (others), respectively. The list also includes crude soya bean oil, of which the new import tariff now stands at US$1 345 per ton, whereas the brass scrap (all grades) tariff has increased to US$4 518 per ton.

Earlier this year, India abolished the basic import tax on crude palm oil to keep a lid on prices. The government revises base import prices of edible oils, gold and silver every fortnight. The world's biggest vegetable oil importer, India, meets more than 70% of its demand through imports. Palm oil constitutes nearly two-thirds of the country's vegetable oil imports. – *CNBC*

Rhizobia:
The star of the show

By Elmarie Helberg

Rhizobia inoculation is a critical practice for soya bean production in South Africa and around the world, but some concerns are continuously being raised about this practice. These concerns were discussed during the Rhizobia Symposium 2022 held in September at the Council for Scientific and Industrial Research International Convention Centre, by the Oil and Protein Seeds Development Trust and the Oilseeds Advisory Committee (OAC).

Rhizobia is a group of soil bacteria that infects the roots of legumes to form root nodules. It is found in the soil and after infection, produces nodules in the legume where they fix nitrogen gas (N_2) from the atmosphere, turning it into a more readily useful form of nitrogen (N).

Experts from around the world discussed the challenges and opportunities regarding rhizobia practices at the 2022 Rhizobia Symposium presented by the Oil and Protein Seeds Development Trust and the Oilseeds Advisory Committee.

A key component to yield

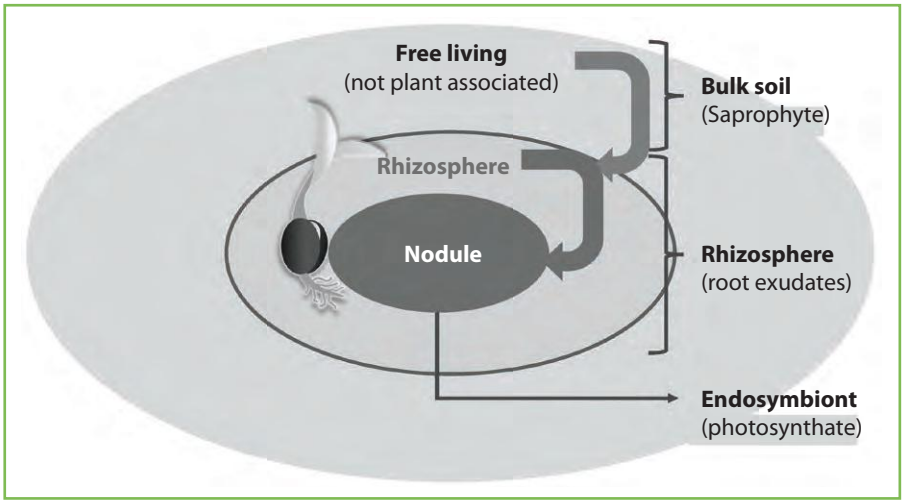
"We try to improve on yields on a continuous basis in the industry, but we have to start exporting our soya beans and must therefore produce at export parity. To be able to maintain that, we need to be highly competitive," said Dr Erhard Briedenhann, chairperson of the OAC. "Rhizobia is one of the key components in terms of saving on N and increasing yields, therefore we received international expertise at the symposium to share information regarding the challenges and opportunities in this regard."

One of the challenges is the tremendous amount of confusion regarding the registration of rhizobia. "There are two different categories under which you can register rhizobia, depending on the wording, so we would love to get some clarity on that. The amount of time it takes to get the product registered is also very challenging. The availability of new technology in South Africa is slowed down by the registration process."

Dr Briedenhann added that the industry is also looking for clarity regarding the documentation and processes needed to be able to get registered.

Thilivhali Nepfumbada, managing director at Retrose Scientific, discussed the red tape surrounding the registration of rhizobia in South Africa as well as other legislation impacting the importation of biological organisms used in agriculture.

Figure 1: The rhizosphere is considered the immediate soil zone around the plant roots, influencing microbial associations, proliferations and activities. (Source: Dr Ronel Hendriks, Mikrobika)



Importance of nitrogen

Jonathan Etherington of Microbial Biological Fertilizers International (MBFI) discussed the importance of N in the plant. "Nitrogen is an essential part of the compounds which regulate plant growth and development. It is also an important part of the plant structure and makes up part of the chlorophyll in plants. It is found in proteins and enzymes in the roots, which help the nutrients and water to be absorbed into the plant."

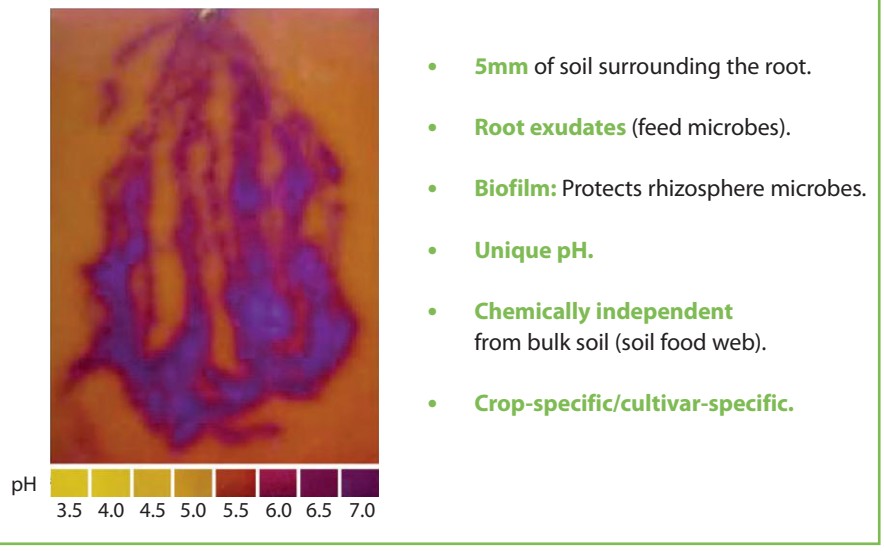
According to Etherington, 70 to 105kg of N is required per ton of soya beans – 94% of yield is directly linked to N assimilation, which is directly linked to soya bean yield increases. He also elaborated on how bacterial inoculants work and the mutualistic symbiosis between the bacteria and the plant.

"Bacterial nodules aid in facilitating the root system with N-based compounds. Plants provide bacterial nodules with organic carbon, and shelter the bacteria from the influences of the external soil environment. This symbiosis is essential for providing the plant with usable N-based compounds without polluting the surrounding soil environment with excess N and subsequent nitrates."

Desiccation is, however, one of the most important factors resulting in poor survival of rhizobia on legume seeds. Therefore, additives to improve the survival of rhizobia exposed to desiccation stress should have high stabilisation and optimum moisture absorption properties.

Dr Ronél Hendriks, chief scientific officer at Microbika, discussed *Rhizobium* and cultivar interaction (*Figures 1* and *2*). Nodulation patterns were tested in different cultivars in Carletonville, North West. According to Dr Hendriks, more insight is needed into how different legumes host cultivars and different *Rhizobium* strains interact to unlock full yield potential.

Figure 2: The plant's rhizosphere is a microbial hotspot and is considered one of the most complex ecosystems on earth. (Source: Dr Ronel Hendriks, Mikrobika)



For enquiries, contact the Oil and Protein Seeds Development Trust at 011 234 3400 or email info@opot.co.za.

SOYBEANS

POWERED BY THE PIONEER® BRAND

Backed by superior agronomics and herbicide tolerant traits, our soybeans are equipped with the strongest DNA in Pioneer history.

pioneer.com/za
info.rsa@pioneer.com

PIONEER®

MADE TO GROW™

CORTEVA™ agriscience

Focus on flowering in the battle against *Sclerotinia*

By Elmarie Helberg

The planting date of crops does not directly affect the prevalence of *Sclerotinia* – rather, it is driven by the weather and, ultimately, the flowering date. This was the key take-home message from a panel of experts during a recent symposium focussed on *Sclerotinia* held by the Oil and Protein Seeds Development Trust (OPDT) at the Council for Scientific and Industrial Research (CSIR).

Sclerotinia stem rot causes severe damage to crops, particularly soya bean and sunflower, and can result in significant yield losses. The *Sclerotinia sclerotiorum* fungus causes the disease. In South Africa, the most important crops affected by this disease are sunflower, soya bean and canola.

According to Dr Nicky Creux of the Forestry and Agricultural Biotechnology Institute (FABI), producers need to understand the environmental factors associated with planting date which impact sunflower development and the progression of *Sclerotinia* head rot.

She says a good way to control *Sclerotinia* is to control the flowering date. She also discussed the factors that influence plant development and flowering at different planting dates. "There does not appear to be a clear planting date that would escape *Sclerotinia* every year, due to the close association with temperature and humidity parameters."

Sclerotinia Research Network

Dr Lisa Rothmann, lecturer in plant pathology at the University of the Free State, discussed the South African Sclerotinia Research Network (SASRN) and the work they do. This network serves as a platform for South African researchers, industry members and producers to connect and build a community to find solutions to diseases caused by *Sclerotinia* spp in economically important crops.

The SASRN, which was founded in 2017, is aimed at finding the most appropriate management practices for local producers to control *Sclerotinia* diseases. In addition, the network aims to interact and communicate directly with producers to convey and distribute relevant information to enable producers to make informed decisions on preventing and managing these diseases.

Producer-focussed research is pivotal for the network and will be supported through collaborations established by the network. These collaborations promote communication between the parties involved, which prevents duplication and allows researchers to directly inform the industry of findings, and vice versa.

The network also serves as a platform where industry and academia can acquaint themselves with the needs of producers to actively resolve issues through applied and directed research questions. The established community of practice will drive the communication between producers and network members.

Ways to combat *Sclerotinia*

During the discussion, panel members also gave tips on how to combat *Sclerotinia* during summer at farm level:

- Prevention is always better than cure; if you know that certain fields had *Sclerotinia* pressure during the past season and you want to plant a susceptible crop, stay committed to a programme to prevent infection.
- Make sure your timing does not coincide with flowering and a cooler, wetter period.
- Test out what your neighbour, who is successful in managing *Sclerotinia*, is doing, but do not convert your entire production system to match your neighbour's system.
- Map out your fields' *Sclerotinia* history and places where you see new infections.

Dr Nicky Creux of the Forestry and Agricultural Biotechnology Institute (FABI) explained the environmental factors associated with planting date which impact sunflower development and the progression of Sclerotinia head rot.

- Know your cultivars and what works in your region with regard to flowering dates.
- Stagger the cultivars used across different crops as well. Stagger the rotation, the time of planting and also the length of growers, so that not all of the crops flower at the same time.
- Do not try to control the disease – rather try to manage it. There is no silver bullet for this one, so do not think that there is a single solution to this problem.

For more information, visit the South African Sclerotinia Research Network website at *www.sclerotinia.co.za*.

Great minds gather to examine the future of groundnuts

By Adri Botha, chairperson, South African Groundnut Forum

Role-players in the local groundnut industry gathered for the Groundnut Symposium 2022 hosted by the Oilseeds Advisory Committee (OAC) on 25 August at the South African Groundnut Forum (SAGF) in Potchefstroom. A wide spectrum of topics was discussed by esteemed experts in the field.

This article highlights the critical subject of local cultivar maintenance and future cultivar development outlooks.

Cultivar DNA fingerprinting

During 2021, the groundnut industry, through the SAGF, the OAC and the Agricultural Research Council-Grain Crops Institute (ARC-GCI), collaborated to ensure the responsible maintenance of our most prominent groundnuts. One outcome of many discussions was the OAC funding a project that had originally been initiated by Dr Wikus Snijman of the ARC-GCI and Dr Renée Prins of CenGen.

With the ARC's groundnut team and individual members from the industry, specifically Lourens de Kock (SAGF vice-chairperson), the project aimed to generate DNA fingerprinting from different seed sources of the five major ARC-registered groundnut cultivars (*Table 1*): Akwa, Sellie Plus, Anel, Kwarts and Akwa Plus.

The objective was to identify a suitable set of microsatellite simple-sequence repeat (SSR) markers available in the public domain. The next step would be to optimise these markers using a single representative of each cultivar and to assess the ability of the markets to discriminate between the different cultivars. Finally would be the evaluation of the purity of individually germinated seed from three different sources: the gene bank, mother seed and breeder seed.

According to an earlier report by CenGen: "Leaf samples of four individual gene banks of each of the five cultivars were sent to CenGen by the ARC-GCI, alongside seed of each of the three stated seed sources. The seed sources were germinated at CenGen, and emerging shoots were used as templates for DNA extractions. These individuals were thus destroyed in the process. The gene bank samples submitted as leaves will be harvested by the ARC-GCI team with their respective fingerprints recorded for future use.

"A set of 18 SSR markers were identified and ordered. Standard molecular genetics methodologies were used to extract the DNA. The data was generated on an ABI 3730XL instrument using a LIZ 500TM Size Standard and a 50cm capillary at the DNA Sequencing Unit of the Central Analytical Facilities of Stellenbosch University. The data was scored using GeneMapper v5 and exported to Excel."

Dr Prins shared her findings with the larger industry during the SAGF, further laying the foundation for discussion by industry and the ARC. Her findings can be summarised as follows:

- A total of 120 individuals across the targeted cultivars and sources were screened with the markers found to be informative during the first two stages of the project.
- A final fingerprint was generated with 12 SSRs, of which ten ultimately provided marker scores that could be used reliably.
- Nine heterozygous individuals were identified and removed, with three individuals that did not work well for any markers. Heterozygotes are an important source of variation within cultivars when seed is multiplied from these sources.
- The trimmed dataset was then used based on the specific profile obtained, with ten SSRs to assign a unique profile identification number to each individual.
- From a profiling basis, a major concern is that 22 profiles were identified instead of the expected five profiles for five cultivars, pointing towards impurity.
- Akwa and Akwa Plus are of serious concern due to the large variations recorded. Akwa Plus seed sources containing two specific profiles should be assessed phenotypically since one of them may be representative of the original cultivar released. In the meantime, the ARC, in agreement with the SAGF, will not release Akwa seed to breeders until this matter has been fully addressed.

According to Dr Prins, the way forward must take into consideration adding more individuals for profiling and expanding the marker set. Plans are already under way to immediately use this information in the seed multiplication process. The ARC has already advised that DNA fingerprint validation for seed multiplications of new cultivars will in future be conducted before release. This will ensure that true fingerprint profiles are available for future evaluation to protect the ARC against undue use of material and to indicate possible variations before release.

Dr Prins mentioned available technology and protocols which may be of future use in deciding the predominant genetic SSR, as well as the benefits of marker-assisted selection which may fast-track efficient breeding. Dr Solomon Ntladi presented on behalf of the ARC-GCI, accompanied by other key members of the team and management, including Dr Kingstone Mashingaidze.

Dr Ntladi highlighted seed and cultivar quality control and assurance, including factors such as the protentional sources of genetic impurity, which include mutations, residual heterozygosity and physical mixing. These risks are mitigated through field inspections and 'rogueing' at breeder seed production level and increased, future application of molecular markers in collaboration with the SAGF and CenGen to evaluate the purity of cultivars.

Referring to the findings of the DNA fingerprinting project as discussed by Dr Prins, the following plan has been put in place by the ARC for the maintenance of germplasm, nucleus and breeder seed.

Germplasm

In the short term, seed that was derived from the fingerprinted plants which displayed consistent patterns will be planted for Akwa, Anel, Kwarts and Sellie Plus and harvested in bulk. Due to the inconsistent pattern reported for Akwa Plus, more seeds will be planted. The ARC will also embark on a project to fingerprint the rest of the ARC-registered cultivars not included in the initial project.

Nucleus

The immediate action plan entails planting all existing germplasm and nucleus seed, as well as seeds of fingerprinted plants as reference checks for Akwa, Anel, Kwarts, Tufa and Sellie Plus. The South African National Seed Organisation (Sansor) will be involved with field inspections.

Table 1: The following ARC-registered cultivars are of importance to the local industry.

Cultivar	Date of registration	Current PBR* status	Current production
Kwarts	1991	Expired	Commercialised
Anel	1993	Expired	Commercialised
Akwa	1994	Expired	Commercialised
Tufa	2008	Active	Commercialised
ARC-Opal 1	2013	Active	Not commercialised
ARC-Oleic-2	2013	Active	Not commercialised
Akwa Plus	2015	Active	Not commercialised
Sellie Plus	2015	Active	Commercialised

**PBR: Plant breeders' rights.*

Breeder

The long-term plan is to plant 250 germplasm kernels under irrigation, which is estimated to finally result in 750kg breeder seed per cultivar.

Dr Ntladi concluded by stating that their objective was to sustainably deliver pure breeder seeds to the industry to optimise the seed multiplication programme by collaborating with the groundnut industry.

National breeding project

Of equal importance to maintaining existing cultivars is the introduction of new varieties to stimulate an ever-shrinking local groundnut industry. New technology has not advanced to the same extent as is seen in competing summer crops. There are various reasons for this but considering the unique production environment in South Africa's main groundnut areas, not many international cultivars have shown sufficient adaptability to unseat our most planted cultivars just yet.

Dr Ntladi discussed the various factors considered in breeding a new South African cultivar. Firstly, a distinction must be made between early and medium maturing. Most current groundnut cultivars fall in the medium- to longer-maturing group, which limits producers in planting choices, keeping in mind changing weather and rainfall patterns. Shorter growers are therefore high on the breeding priority list.

It was presented to the symposium that breeding is done for genetic improvement and that in searching for continuous genetic gains, breeding remains a continuous process. This will be achieved by planting at least two generations per year using both the glasshouse (winter) and fields (summer), single-seed descent (two generations in a glasshouse) and the use of molecular markers to increase breeding efficiency.

As far as the national cultivar trials are concerned, it was reported that the 2021 trials were planted in seven localities with 19 accessions (cultivars and breeding lines). Future plans include the evaluation of cultivar performance at different plant populations, the inclusion of ARC and other varieties, plant spacing of 90 x 10, 75 x 10, and 45 x 10, three irrigated and three dryland plantings, the use of confirmed pure seeds, and the planting of trials by the ARC agronomy team.

Dr Ntladi indicated that the national breeding project will be supported by increased collaboration with universities. Through CenGen, it will seek phenotyping of germplasm for various traits and apply results from molecular markers for diseases and align ARC grading protocols with that of the industry, finally strengthening partnerships throughout the local groundnut and agricultural industry.

The three presentations covered in this article address one, if not the most critical, aspect faced by the groundnut industry in South Africa – finding and caring for cultivars that put the industry in a position to sustainably compete with alternative summer crops and reduce the reliance of the local market on imports.

For enquiries, send an email to groundnutforum@opot.co.za.

On-farm evaluation of planting date effect on sunflower yield and quality

By Dr Safiah Ma'ali, ARC-Grain Crops

Sunflower in South Africa is often used as a catch crop and is planted as an alternative when rainfall onset is too late for maize or soya plantings. Therefore, the stable yields under these late planting conditions are well below the crop's yield potential.

Late sunflower plantings are more likely to encounter adverse conditions during their development, including seed/seedling exposure to high December/January temperatures, and pollination or seed development occurring under rapidly decreasing temperatures. To maximise the use of natural resources, optimum planting time of a crop is essential as it ensures good seed germination and optimum root system development which, in turn, enables the plant to absorb essential nutrients from a large volume of soil.

Sunflower grain and oil yields are greatly reduced when normal planting dates are delayed. To promote optimum planting dates, four field trials were conducted at the Grain Crops Potchefstroom research farm and three at Steynsrus to evaluate the effect of different planting dates (early, optimum and late planting date) on selected sunflower parameters (*Table 1*).

The hybrids AGSUN 8251, AGSUN 5106 CLP, AGSUN 5270, P 65 LL 14, P 65 LP 65, PAN 7170, PAN 7180 CLP, PAN 7080 and SY 3970 CL were evaluated in Potchefstroom, and the same hybrids evaluated at Steynsrus (except PAN 7080) in a randomised complete block design with three replications. After maturity, four rows 8m in length were harvested by hand to measure the grain yield per plot (grain yield measured and corrected at 9% moisture content). Sunflower seed samples were taken from each subplot for oil and protein analysis on an 'as is' basis.

Data from each site was subjected to statistical analysis of variance (ANOVA) using the SAS program. To explain the interaction of sunflower hybrids and the planting date in addition to investigate the performance and the stability of tested sunflower hybrids beyond ANOVA, the genotype and genotype environment interaction (GGE) bi-plot method was employed using the Genstat program.

Table 1: Planting dates at Potchefstroom and Steynsrus trial sites.

Sites	Planting date			
Potchefstroom	2 Nov 2021	7 Dec 2021	11 Jan 2022	24 Jan 2022
Steynsrus	1 Dec 2021	5 Jan 2022	26 Jan 2022	—

Table 2: Effect of different planting dates on sunflower yield and quality at the Potchefstroom research farm during the 2021/2022 growing season.

Planting date	Seed yield	Oil content	Protein	Oil yield
	(t/ha)	(%)	Content (%)	(t/ha)
2021/11/02 (D1)	3,54^{a}	38,66^{b}	14,54^{c}	1,37^{a}
2021/12/07 (D2)	3,10^{b}	36,83^{c}	16,82^{b}	1,15^{b}
2022/01/11 (D3)	1,87^{d}	42,39^{a}	13,06^{d}	0,79^{d}
2022/01/24 (D4)	2,38^{c}	36,88^{c}	21,64^{a}	0,88^{c}
Mean	2,72	38,73	16,51	0,97
LSD $_{0,05}$	0,190	0,919	0,642	0,077

The sunflower stand at the Potchefstroom trial site.

Precipitation

Total recorded precipitation at Potchefstroom for the period October 2021 to May 2022 was 850mm, which is higher than the long-term average of 634mm. Most of the precipitation occurred during December 2021, January 2022 and April 2022 with 39 days of rainfall exceeding 5mm. At Senekal (Driepan – the nearest weather station to the Steynsrus site), total precipitation was 1 048mm, with December 2021 and April 2022 receiving the highest amount of rainfall (286 and 154mm), respectively.

Mean effect of planting dates on sunflower yield and quality

Potchefstroom

Planting dates significantly affected seed

yield, oil and protein content, and oil yield, whereas sunflower hybrids significantly affected all studied parameters except seed yield. The first planting date (2 November 2021) yielded the highest volume of seeds (3,54t/ha), followed by the second planting (7 December 2021) at 3,1t/ha.

The lowest seed yield was recorded for the third planting date (11 January 2022), which can be attributed to high precipitation that caused water logging and subsequent poor sunflower growth and development. The late planting (24 January 2022) produced a surprisingly good seed yield (2,38t/ha), which might be due to the good rainfall during April.

The third planting date produced the highest oil content (42,39%) across hybrids, with the second planting yielding the lowest oil content (38,66%). Protein content ranged from 13,06% for the third planting to 21,64% for the last planting. Oil yield is the result of seed yield multiplied by oil content, and ranged from 0,79t/ha for the third planting to 1,37t/ha for the first planting (*Table 2*). Seed yield and oil yield decreased with roughly 33 and 0,36%, respectively, when the planting date was delayed until 24 January 2022.

At the Potchefstroom site no significant interaction between planting date and sunflower hybrids was dedicated for seed and oil yield; however, there is a significant interaction for oil content. SY 3970 CL produced the highest oil content under all planting dates. For the first planting, P 65 LP 65 came second after SY 3970 CL, whereas for the second planting PAN 7170 was second, for the third planting P 65 LL 14 was second, and for the last planting AGSUN 5270 was second after SY 3970 CL.

Steynsrus

Planting date and sunflower hybrids significantly affected all studied parameters. The second planting date (5 January 2022) had the best seed and oil yield (2,82 and 1,15t/ha, respectively). The last planting date (26 January 2022) had the lowest yield and oil yield (1,92 and 0,82t/ha, respectively). A lot of rain fell directly after the December planting (first planting date), which had a negative effect on both seed germination and seedling establishment.

The last planting date produced the highest oil content (42,44%), while no significant differences were observed between the first and the second planting for the same parameter. The highest protein content (17,76%) was recorded for the last planting date, followed by the second planting. The lowest protein content was recorded for the first planting 14,45% (*Table 3*).

Table 3: Effect of different planting dates on sunflower yield and quality at Steynsrus during the 2021/2022 growing season.

Planting date	Seed yield	Oil content	Protein	Oil yield
	(t/ha)	(%)	Content (%)	(t/ha)
2021/12/01 (D1)	2,35[b]	40,14[b]	14,45[c]	0,94[b]
2022/01/05 (D2)	2,82[a]	40,72[b]	16,28[b]	1,15[a]
2022/01/26 (D3)	1,92[c]	42,44[a]	17,76[a]	0,82[c]
Mean	2,36	41,1	16,16	0,97
LSD $_{0,05}$	0,128	1,017	0,878	0,050

Mean performance and stability analysis of sunflower hybrids

Potchefstroom

Mean seed yield across hybrids and different planting dates was 2,72t/ha. PAN 7170 produced the highest yield of 2,91t/ha followed by P 65 LL 14 and PAN 7080. The lowest yield of 2,52t/ha was recorded for SY 3970 CL. Tested hybrids showed significant differences for oil yield, with SY 3970 CL yielding the most oil (1,17t/ha) followed by PAN 7170 (1,15t/ha).

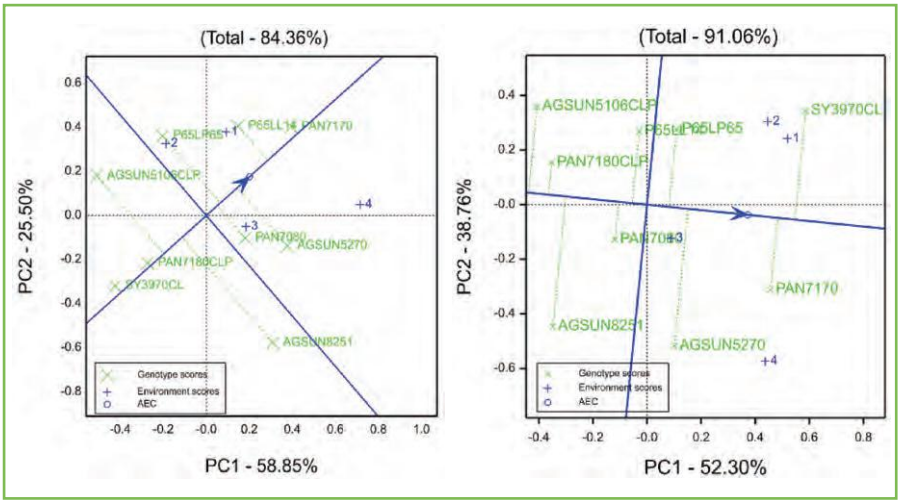
Seed yield and the stability of the tested sunflower hybrids were evaluated using an average environment co-ordination (AEC) method (Yan 2001, 2002). PAN 7170 and P 65 LL 14 performed best in terms of high seed yield (2,91 and 2,81t/ha, respectively) and PAN 7071 was the most stable genotype, with high yield ability.

In terms of seed yield performance, the sunflower genotypes were divided into two groups. The first group performed above average and included PAN 7170, P 65 LL 14, AGSUN 5270, P 65 LP 65 and PAN 7080. The second group consisted of the remaining genotypes, which performed below average in terms of yield and stability (*Figure 1A*). The highest oil content on an 'as is' basis was recorded for SY 3970 CL (46,16%), followed by PAN 7170 (40,11%). AGSUN 5106 CLP (17,97%) followed by AGSUN 8251 (17,42%) had the highest protein content.

Oil yield and the stability of the tested sunflower hybrids are presented in *Figure 1B*. SY 3970 CL performed the best, while PAN 7170 was the most stable genotype, with high yield ability.

In terms of oil yield performance, the sunflower hybrids were divided into two groups. The first group performed above average and included SY 3970 CL, PAN 7170, AGSUN 5270 and P 65 LP 65.

Figure 1: Average environment co-ordination views of the GGE bi-plot based on environment-focussed scaling for the means performance and stability of genotypes (seed yield t/ha [A] and oil yield t/ha [B]).



ELECTROLEE

3 YEAR GUARANTEE

Planter Monitor

- Seed per 100m per row, seed population
- Hectares worked and much more
- Easy to install and maintain
- Fertilizer and turning of axles
- Can be applied to most planters
- Real tough, rust and water resistant

Hit Sensor
Flex Pipe Mount

Process Monitor
for Air Seeders

- Area Speed
- Tacho up to 4 axles
- Alarm on each function
- Easy to install
- Bin / Tank full
- Bin / Tank empty

www.electrolee.co.za
012 345 3193

Proudly made in South Africa

Plant with VISION
Cut losses with PRECISION

The second group consisted of the remaining genotypes, which performed below average in terms of oil yield.

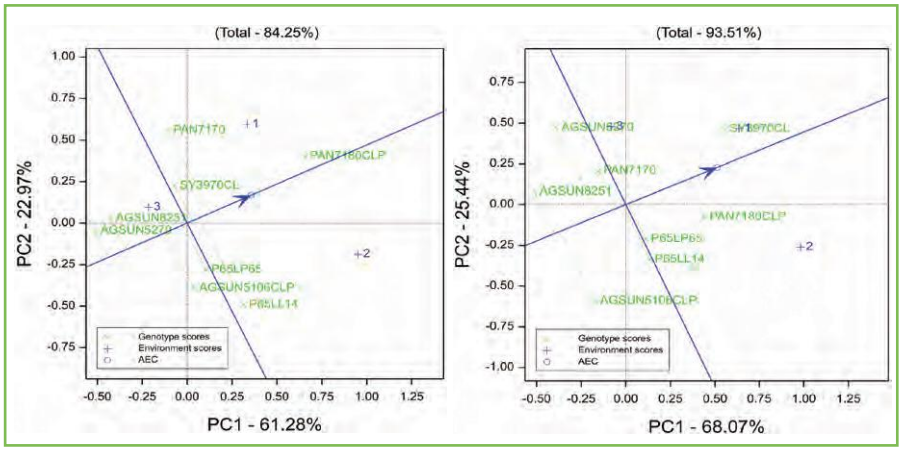
Steynsrus

The sunflower hybrids evaluated differed significantly for all studied parameters. PAN 7180 CLP produced the best mean seed yield (2,64t/ha) across all planting dates. The seed yield mean across hybrids and planting dates was 2,36t/ha, which is 15% less than the 2,72t/ha yield at the Potchefstroom site. The oil yield mean was 0,97t/h, which is 8% less than Potchefstroom mean (1,05t/ha). SY 3970 CL had the highest oil yield (1,11t/ha), followed by PAN 7180 CLP (1,05t/ha).

Seed yield and the stability of the tested sunflower genotypes were evaluated by using an AEC method (Yan 2001, 2002). PAN 7180 CLP was the most stable genotype, with high yield ability (*Figure 2A*). In terms of performance during this study, the sunflower hybrids were divided into two groups. The first group performed above average and included PAN 7180 CLP, PAN 7170, P 65 LL 14 and SY 3970 CL. The second group consisted of the remaining genotypes that performed below average in terms of yield.

The average oil content was 41,1%, which is 6,4% more than the average oil content at the Potchefstroom site (38,73%). SY 3870 CL had the highest oil content (47,63%), followed by AGSUN 5270 (41,67%). The highest protein content was recorded for SY 3970 CL (17,97 %), followed by AGSUN 8251 (16,95%). Oil yield and the stability of the tested sunflower hybrids are shown in *Figure 2B*. SY 3970 CL performed best in terms of high oil yield and stability.

Figure 2: Average environment co-ordination views of the GGE bi-plot based on environment-focussed scaling for the means performance and stability of genotypes (seed yield t/ha [A] and oil yield t/ha [B]).



In terms of oil yield performance, the sunflower hybrids were divided into two groups. The first group performed above average and included SY 3970 CL, PAN 7180 CLP and P 65 LP 65. The second group consisted of the remaining genotypes, which performed below average in terms of yield and stability.

At the Steynsrus site, the sunflower hybrids reacted differently under different planting dates for seed and oil yield. Under the first planting date PAN 7180 CLP had the best seed yield, followed by PAN 7170. Under the second planting dates PAN 7180 CLP had the best seed yield, followed by P 65 LL 14. AGSUN 8251 preformed the best, followed by AGSUN 5270 under the late planting date.

SY 3970 CL had the best oil yield, followed by PAN 7180 CLP for the first planting date, while for the second planting PAN 7180 CLP preformed the best, followed by SY 3970 CL. For the late planting AGSUN 5270 preformed the best, followed by AGSUN 8251. This indicates that there is highly significant interaction between sunflower hybrids and planting dates for seed and oil yield.

Conclusion

The current project commenced with an exceptional first growing season, marked by very high precipitation at both trial sites. Planting date had a significant effect on all studied parameters.

At Potchefstroom, the November and December planting dates on average resulted in higher seed and oil yield, and the late planting date (January) the lowest seed and oil yield. At Steynsrus, planting in the first week of January on average produced the highest seed and oil yield, whereas planting in the last week of January produced the lowest seed and oil yield.

Sunflower hybrids also performed differently at varying planting dates for all parameters, except for seed and oil yield at the Potchefstroom trial site. On average, PAN 7170 and PAN 7180 CLP had the highest seed yield at Potchefstroom and Steynsrus, respectively, while SY 3970 CL had the highest oil content and oil yield at both sites. On average, oil and protein content were more hybrid-related than planting date, while seed and oil yield were more affected by the planting date.

Sunflowers at the Steynsrus trial site.

For enquiries, email Dr Safiah Ma'ali at MaaliS@arc.agric.za.

Soya bean cultivar selection for the best results

By Annelie de Beer and Lizette Bronkhorst, ARC-Grain Crops, Potchefstroom, and Nicolene Cochrane, ARC-Biometry, Pretoria

Following the ground-breaking study by Hall in 1930, indicating that "soya beans can be grown in those parts of Natal (KwaZulu-Natal) having good rainfall", the second largest grain crop was produced during the 2021/22 season (2 201 000 tons on 925 300ha).

A combination of improved yields together with favourable soya bean prices, as well as the benefit of increased soil health in a crop rotation system are the main drivers for the rapid expansion of soya bean production. However, the added input costs also contributed to the expansion of soya beans to the drier and non-traditional soya bean production areas, resulting in the Free State being the largest soya bean production area (415 000ha during the 2021/22 season).

Locality matters

The productivity of soya bean cultivars varies from one locality to the other, owing to locality-specific genotype x environment interactions as soya beans are sensitive to daylight as well as the prevailing temperature, resulting in the division of the soya bean production areas into cool, moderate and warm sections. This is also why the planting date will influence the length of the growing season of a given cultivar.

Cultivar evaluation trials are an indispensable source of information for producers, given the yield benefits that accumulate by virtue of being able to adequately identify cultivars with reasonable adaptability that fits in their localities to ensure optimum yield and profitability.

When cultivars are selected, it is important to establish which locality has similar climatic conditions. The following are other important characteristics to consider during cultivar selection.

Table 1: Average number of days to 50% flowering and harvesting of cultivars during the 2021/22 growing season for warm, moderate and cool production areas.

Cultivar	Days to 50% flowering			Days to harvest		
	Warm[1]	Moderate[2]	Cool[3]	Warm[4]	Moderate[5]	Cool[6]
PAN 1479 R	40	45	60	140	139	154
DM 5953 RSF	39	46	59	140	139	149
NS 5258 R	40	48	59	141	145	149
RA 4918 R	40	48	61	144	139	150
DM 5351 RSF	41	47	58	144	139	152
SSS 5449 (tuc)	50	58	70	143	139	156
Y540	49	60	70	146	143	155
RA 565 R	53	61	74	150	145	159
LS 6851 R	48	60	70	149	149	162
SSS 5052 (tuc)	64	61	76	150	148	161
P57T19 R	60	63	72	150	151	163
PAN 1555 R	59	62	76	149	151	160
PAN 1521 R	59	64	78	150	148	161
DM 5302 RSF	49	60	75	142	142	156
RA5921 R	56	62	76	150	152	167
PAN 1588R	61	64	77	152	151	165
NS 5909 R	61	63	76	150	147	167
RA 660 R	56	63	76	150	147	163
DM 59R03	55	62	79	152	153	168
LS 6164 R	56	63	78	156	153	171
LS 6860 R	66	65	76	153	152	174
P62T16R	57	64	80	153	158	174
Y627	61	64	79	155	154	168
PAN 1692 R	63	67	86	151	153	168
P64T39 R	58	68	82	157	156	175
NS 6448 R	56	65	79	153	153	174
RA6520RS	61	65	84	158	158	178
Y657	63	65	79	152	150	164
DM 68R09	64	66	81	159	155	175
PAN 1644 R	54	65	77	153	153	168
DM 6,8i RR	59	65	78	158	156	174
P71T74 R	64	66	82	159	158	177

1: Average of four localities; 2: average of six localities; 3: average of seven localities; 4: average of five localities; 5: average of five localities; 6: average of seven localities. Days to flowering: Average of 50% of plants with one flower. Days to harvest: Average of pods is mature, brittle and dry.

Table 2: Grouping of localities according to warm, moderate and cool production areas during the 2021/22 growing season.

Warm	Moderate	Cool
• Groblersdal Agri Seed, irrigated, Limpopo • Groblersdal Agricultural Research Council, irrigated, Limpopo • Hoopstad, dryland, Free State • Pyramid, irrigated • Schweizer-Reneke PD1, dryland, North West • Schweizer-Reneke, PD2, dryland, North West	• Barberspan, dryland, North West • Bergville, irrigated, KwaZulu-Natal • Cedara, dryland, KwaZulu-Natal • Greytown, dryland, KwaZulu-Natal • Kroonstad, dryland, Free State • Leeudoringstad, dryland, North West • Potchefstroom Limagrain, irrigated, North West	• Bapsfontein, irrigated, Mpumalanga • Belfast, dryland, Mpumalanga • Bethlehem PD1, irrigated, Free State • Bethlehem PD2, irrigated, Free State • Clarens, dryland, Free State • Delmas, dryland, Mpumalanga • Standerton, dryland, Mpumalanga • Winterton, dryland, KwaZulu-Natal

Table 3: General information on registered soya bean cultivars evaluated in 2021/22.

Cultivar	Maturity grouping	Growth habit[1]	Pod height[2]			Shattering[3]			Supplier
			Cool	Moderate	Warm	Cool	Moderate	Warm	
PAN 1479 R	4,7	I	5	8	8	1,14	1	1	Pannar
DM 5953 RSF	4,8	I	7	10	10	1,05	1	1	GDM Seeds
NS 5258 R	4,9	I	5	9	9	1,24	1	1	Limagrain (K2)
RA 4918 R	4,9	I	7	10	12	1,24	1	1	Agri Seed
DM 5351 RSF	5,1	I	7	11	10	1,10	1	1	GDM Seeds
SSS 5449 (tuc)	5,2	I	10	12	13	1,14	1	1	Syngenta (Sensako)
Y540	5,4	I	9	11	14	1	1	1	Southern Hemisphere Seeds
RA 565 R	5,5	I	11	13	13	1	1	1	Agri Seed
LS 6851 R	5,5	D	9	13	8	1	1	1	Limagrain
SSS 5052 (tuc)	5,5	I	11	14	16	1	1	1	Sensako
P57T19 R	5,7	I	14	16	17	1	1	1	Corteva Agriscience RSA
PAN 1555 R	5,7	I	14	16	21	1	1	1	Pannar
PAN 1521 R	5,7	I	13	15	17	1	1	1	Pannar
DM 5302 RSF	5,7	I	10	12	11	1	1	1	GDM Seeds
RA5921 R	5,9	I	10	10	14	1	1	1	Agri Seed
PAN 1588 R	5,9	I	13	14	16	1	1	1	Pannar
NS 5909 R	5,9	I	13	16	17	1	1	1	Limagrain (K2)
RA 660 R	6	I	11	14	16	1	1	1	Agri Seed
DM 59R03	6	I	14	15	19	1	1	1	GDM Seeds
LS 6164 R	6,1	I	14	14	21	1	1	1	Limagrain
LS 6860 R	6,2	I	14	16	20	1	1	1	Limagrain
P62T16R	6,2	I	13	15	17	1	1	1	Corteva Agriscience RSA
Y627	6,2	I	11	13	19	1	1	1	Southern Hemisphere Seeds
PAN 1692 R	6,3	I	14	14	16	1	1	1	Pannar
P64T39 R	6,4	I	14	15	19	1	1	1	Pioneer
NS 6448 R	6,4	SD	10	14	13	1	1	1	Limagrain (K2)
RA650RS	6,5	I	15	15	19	1	1	1	Agri Seed
Y657	6,5	I	13	15	23	1	1	1	Southern Hemisphere Seeds
DM 68R09	6,6	I	11	14	18	1	1	1	GDM Seeds
PAN 1644 R	6,7	I	11	15	21	1	1	1	Pannar
DM 6,8i RR	6,8	I	11	18	21	1	1	1	GDM Seeds
P71T74 R	7,1	I	14	16	24	1,14	1	1	Pioneer

[1]D – determinate, I – indeterminate, SD – semi-determinate; [2]Pod height (cm); [3]Tendency to shatter is evaluated on a scale from 1 to 5, where 1 equals few and five equals numerous.

Days to 50% flowering and harvest

The number of days from planting to flowering is a critical stage in the development of the soya bean plant. The number of days to harvest maturity is used to determine the length of the growing season of a cultivar; however, it is influenced by climate and planting date (*Table 1*).

Pod and plant height

Pod and plant height has an impact on the ability to harvest the crop (*Table 3*). A relationship exists between pod and plant height and the relative length of the growing season. Cultivars with a shorter growing season tend to have lower plant and pod heights compared to longer growing season cultivars under similar growing conditions. Both characteristics are also influenced by production practices. Narrower inter- and intra-row spacing will increase pod height significantly.

Seed shattering

Tolerance against shattering can play an important role during unfavourable harvesting conditions (*Table 3*). Shattering is one of the most challenging aspects of soya bean production and it is recommended to plant a package of different maturity grouping cultivars to stagger the harvesting process.

Standability

Standability (lodging) is influenced by plant height, which tends to increase when overcast weather and extremely wet and windy conditions occur, which could result in a higher lodging percentage of plants. Some cultivars withstand lodging better than others under the same conditions.

Yield

Yield indicates the genetic adaptation and suitability of a cultivar that is to be planted in a specific area. During the 2021/22 season, 32 cultivars were included in the national soya bean cultivar trials. Data from 21 localities was acceptable for statistical analyses. It is recommended to use the yield results with the yield probability and stability values for a more accurate cultivar choice (*Tables 4, 5* and *6*). Determine which yield potential recommendations must be made for. The next step is to consult the yield probability table at the determining yield potential. From the yield probability table, cultivars with above-average probability values and yield stability should be selected. This will provide the producer with the best chance for a stable, successful yield.

Table 4: Yield probability (%) of cultivars in the 2019/20, 2020/21 and 2021/22 seasons for the cooler dryland production areas at different yield potentials.

Cultivar	Yield potential (t/ha)								Regression line	
	1,5	2	2,5	3	3,5	4	4,5	5	FProb	R2
DM 5953 RSF	91	88	84	79	73	65	57	50	0,0038	0,38
DM 5351 RSF	79	75	70	64	57	51	44	38	0,0027	0,40
SSS 5449 (tuc)	65	58	51	44	36	29	23	19	<0,001	0,64
LS 6851 R	65	60	53	46	39	33	27	23	<0,001	0,67
SSS 5052 (tuc)	25	25	26	26	27	28	30	31	<0,001	0,79
PAN 1555 R	36	36	37	39	40	41	43	44	<0,001	0,79
PAN 1521 R	88	85	81	77	71	64	58	51	<0,001	0,74
DM 5302 RSF	79	74	68	61	53	46	38	31	<0,001	0,58
NS 5909 R	26	31	36	43	49	56	62	68	<0,001	0,89
LS 6164 R	43	42	42	41	40	40	40	40	<0,001	0,83
LS 6860 R	11	15	20	25	32	39	47	56	<0,001	0,88
P64T39 R	49	51	53	55	57	59	60	61	<0,001	0,63
NS 6448 R	19	23	29	35	43	50	58	65	<0,001	0,72
PAN 1644 R	41	45	49	52	57	60	64	67	<0,001	0,84
DM 6,8i RR	37	41	46	51	56	61	66	70	<0,001	0,86
P71T74 R	19	27	37	48	60	71	79	86	<0,001	0,85

Table 5: Yield probability (%) of cultivars in the 2019/20, 2020/21 and 2021/22 seasons for the moderate dryland production areas at different yield potentials.

Cultivar	Yield potential (t/ha)								Regression line	
	1,5	2	2,5	3	3,5	4	4,5	5	FProb	R2
DM 5953 RSF	66	62	58	53	48	44	40	36	<0,001	0,78
DM 5351 RSF	12	22	36	54	71	83	92	96	<0,001	0,92
SSS 5449 (tuc)	40	37	33	29	26	24	22	20	<0,001	0,82
LS 6851 R	40	42	43	46	47	49	51	53	<0,001	0,93
SSS 5052 (tuc)	49	40	32	24	18	13	9	7	<0,001	0,81
PAN 1555 R	32	34	35	38	41	42	46	49	<0,001	0,94
PAN 1521 R	70	65	59	53	46	40	34	29	<0,001	0,90
DM 5302 RSF	36	34	33	33	32	31	32	31	<0,001	0,88
NS 5909 R	50	47	41	36	31	27	25	22	<0,001	0,94
LS 6164 R	57	54	52	50	47	45	43	40	<0,001	0,87
LS 6860 R	39	35	31	28	25	23	22	20	<0,001	0,89
P64T39 R	69	69	69	70	69	68	68	67	<0,001	0,87
NS 6448 R	63	65	66	68	69	68	69	69	<0,001	0,91
PAN 1644 R	62	64	65	67	69	70	71	72	<0,001	0,87
DM 6,8i RR	67	70	73	75	77	78	80	80	<0,001	0,80

Cultivar stability

The stability of a cultivar is determined by how much closer the coefficient of determination value is to one, and the smaller the FProb value (preferably <0,1), the more stable the cultivar will be.

Yield probability

The yield probability of a cultivar is the potential to achieve an above-average yield at a particular yield potential. For instance, if the yield probability of a cultivar at a particular yield potential equals 60%, the chance to get a yield above the mean of all cultivars is 60% with a 40% chance of obtaining a yield below the mean. Since new cultivars are introduced and some are removed annually, a multi-season yield probability is only possible for a limited number of cultivars.

Acknowledgements

Execution of these trials was made possible through the financial support of the Agricultural Research Council, the Oil and Protein Seeds Development Trust, other seed companies, and numerous collaborators who conducted trials. We would like to acknowledge Heila Vermeulen of the ARC-Grain Crops for her technical assistance, and UPL for sponsoring the inoculants.

Table 6: Yield probability (%) of cultivars evaluated in the 2019/20, 2020/21 and 2021/22 seasons for the warm production areas at different yield potentials.

Cultivar	Yield potential (t/ha)							Regression line	
	2	2,5	3	3,5	4	4,5	5	FProb	R2
DM 5953 RSF	46	44	43	42	41	39	39	<0,001	0,69
DM 5351 RSF	38	39	40	41	42	43	44	<0,001	0,84
SSS 5449 (tuc)	30	26	22	18	15	13	11	<0,001	0,78
LS 6851 R	62	60	57	55	52	49	47	<0,001	0,82
SSS 5052 (tuc)	42	43	44	44	45	46	47	<0,001	0,91
PAN 1555 R	48	46	44	41	39	37	35	<0,001	0,83
PAN 1521 R	63	64	64	65	65	65	65	<0,001	0,88
DM 5302 RSF	36	37	40	42	45	48	50	<0,001	0,80
NS 5909 R	53	54	57	58	60	62	63	<0,001	0,78
LS 6164 R	52	47	41	36	31	27	24	<0,001	0,82
LS 6860 R	56	53	51	49	47	44	42	<0,001	0,77
P64T39 R	63	64	65	66	67	67	68	<0,001	0,83
NS 6448 R	53	54	56	56	58	58	59	<0,001	0,90
PAN 1644 R	50	54	59	64	69	72	76	<0,001	0,88
DM 6,8i RR	55	58	61	64	66	68	70	<0,001	0,80
P71T74 R	55	57	59	61	62	64	65	<0,001	0,74

For enquiries, contact Annelie de Beer of the ARC-Grain Crops at debeerannelie@arc.agric.za or Nicolene Cochrane of ARC-Biometry at ThiebautN@arc.agric.za.

CAL LABS

011 474 7450
serology@calsa.co.za
feeds@calsa.co.za
www.calsa.co.za

ISO 17025 ACCREDITED
PROTEIN AND UREASE ANALYSIS

With the adoption of AOCS methodology, and participation in AOCS oilseed industry proficiency schemes, Central Analytical Laboratories (CAL) is the leading laboratory in the region for the crushing industry.

ilac-MRA

sanas Testing Laboratory T0606

Astral

CAL LABS

Soya bean and sunflower microbiomes:
Identifying bacterial microbes for plant health and *Sclerotinia* inhibition

By Neo Hlongwane, Dr Lisa Rothmann and Prof Wijnand Swart, University of the Free State

An array of bacterial and fungal species are harboured by plants in various microbiomes that display the beneficial effects on plant growth and yield. The plant microbiome is the collection of micro-organisms associated with the plant – above and below ground – living out their lives and interacting with plant tissues (Ma Del Carmen Orozco-Mosqueda *et al*., 2018).

This microbial community consists of a vast variety of micro-organisms, such as bacteria, fungi, protozoa and viruses, from the shoots to the roots, and plays a beneficial role in the plant. The most common beneficial micro-organisms associated with the root microbiome, also known as the rhizosphere, are bacteria from the *Pseudomonas* and *Bacillus* genera. Rhizospheric microbes that benefit the plant are known as plant-growth promoting micro-organisms (PGPMs), and in some cases can also act as biological control agents (BCAs).

Micro-organisms and microbiomes

PGPMs improve the growth of crops by enhancing nutrient uptake through various mechanisms. Phosphate solubilisation is one of the important mechanisms, especially in phosphorus-depleted soils, to ensure root formation, flowering and seed setting. PGPMs solubilise insoluble phosphorus to make it easy for the crop to utilise. In some cases, microbiomes can produce ammonium – a form of nitrogen – to promote growth and the process of photosynthesis.

Organic chemical substances known as phytohormones, commonly referred to as plant growth regulators, such as auxins (Fahad *et al*., 2015) are also produced by PGPMs to advance plant health. The most common plant auxin is indole acetic acid (IAA) which specialises in several aspects of plant development – i.e., cell elongation and differentiation. The absorption of IAA to the cell membrane also affects the permeability of the membrane and most importantly, root formation and elongation.

As BCAs, these beneficial micro-organisms can indirectly improve crop yield by reducing or preventing the effects brought about by plant pathogen invasions (Fu *et al*., 2016) by producing antibiotics and cell-wall degrading enzymes to inhibit pathogen activity. Beneficial micro-organisms are an alternative to chemical pesticides and can also play a role as biofertilisers. Biofertilisers are substances that are made up of living micro-organisms which are used to enhance plant growth and protect plants against pathogenic micro-organisms (Mitter *et al*., 2021).

The aim of the study was to isolate and identify microbes associated with soya bean (*Glycine max*) and sunflower (*Helianthus annuus*) that promote plant growth and control *Sclerotinia sclerotiorum* pathogen interactions with the plant. Samples of soya bean and sunflower roots, stems, leaves and pods (soya bean only) from different growth stages – seedling (V1), maturing (V3), flowering (R2) and pod formation (R5; soya bean) – were collected from Delmas, Mpumalanga in February 2021.

Figure 1: Phosphorus solubilisation capability of 16 selected bacterial isolates.

Green bars indicate isolates that gave a P-index which is ≥1 and are considered the best performers of phosphorus solubilisation. P-index = colony diameter + halo diameter/colony diameter.

The isolation of microbes from plant parts was conducted in two ways: isolated as fresh surface sterilised plant material, and crushed plant parts mixed with a phosphate buffer. Samples were isolated on nutrient agar plates and tubes with nutrient broth. Plates were incubated at 25°C for seven days, while those on tubes were incubated on a rotary shaker at 25°C for one day. Approximately 80 microbes were isolated, although only 40 different bacterial isolates were selected for further research.

Ability to inhibit *S. sclerotiorum*

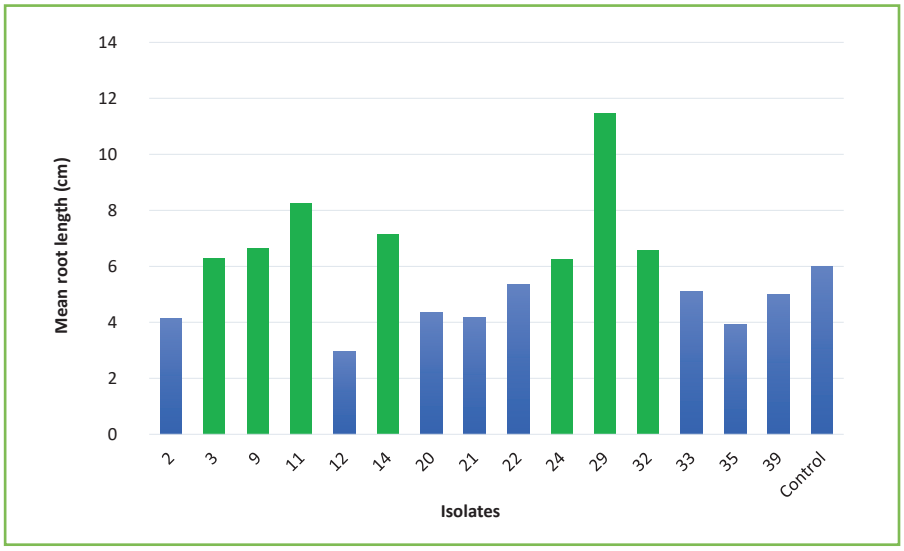
The performance of each isolate for phosphate solubilisation, ammonium production, and IAA production was conducted in triplicate. Subsequently, *in vivo* (on the plant) and *in vitro* tests (on a Petri plate) of each isolate's ability to inhibit *S. sclerotiorum* were determined. Eleven evaluated isolates were selected for molecular identification and sent to Inqaba Biotec for sequencing.

Identification yielded six known species of bacteria and five isolates belonging to undescribed genera. Confirmed bacterial species included *Pseudomonas viridiflava, Pantoea agglomerans, Stenotrophomonas maltophilia* and three *Bacillus veselenzis*. In contrast, of the undescribed isolates, four were classified as *Bacillus* spp. – one unknown isolate belongs to the *Lysinibacillus genus*.

Positive results were observed for the phosphate solubilisation (*Figure 1*), where isolates *Pantoea agglomerans* (29) and *Lysinibacillus* spp. (3) performed best, resulting in the greatest P-index. Additionally, all isolates gave positive results for the ammonium production test, and results ranged from very weak to strong ammonium production. However, none of the isolates gave positive results to produce IAA. These tests were also supported by the results observed during *in vitro* and *in vivo* experiments.

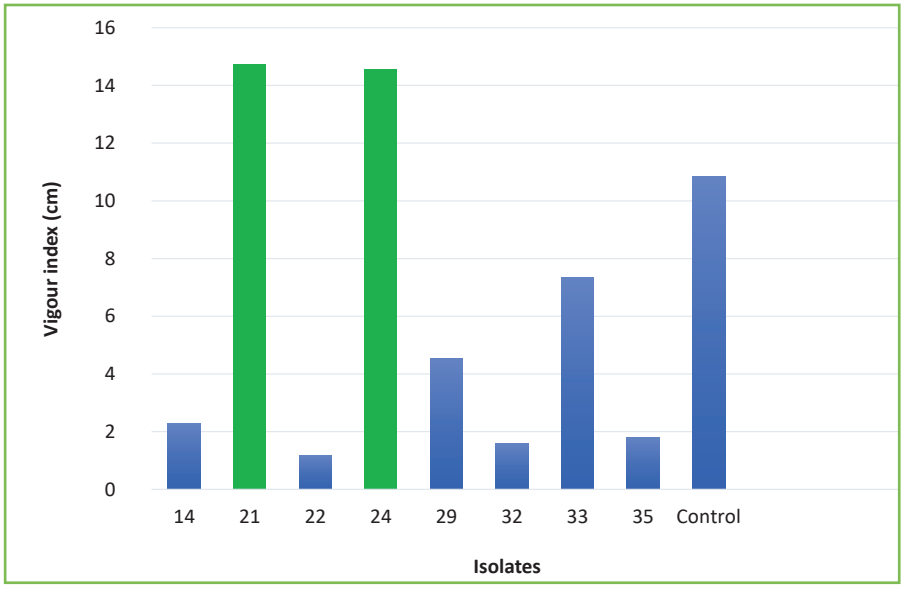
Isolates *Pantoea agglomerans* (29) and unidentified species (11) significantly improved the root length *in vitro* (*Figure 2*), whereas isolates *Bacillus veselenzis* (24) and an unidentified species (21) improved the vigour index during *in vivo* tests (*Figure 3*). A study on the ability of *Bacillus veselenzis* as a PGPM was observed across nine different types of plants (Meng, Jiang and Hao, 2016). Similarly, *Lysinibacillus*

Figure 2: The length of soya bean roots grown in water agar under *in vivo* study conditions.



All isolates were individually applied to seeds to identify root growth-promoting abilities. Only isolates showing root lengths of >2cm are presented. The green bars indicate the isolates which enhanced root length significantly (P<0,05) from the control.

Figure 3: Seedling vigour index of seeds inoculated with individual isolates grown in vermiculite pots and incubated for seven days.



Only the isolates that promoted seed germination were recorded. Seedling vigour index = seedling length × germination %. The green bars indicate isolates which performed significantly from the control (P<0,05).

sphaericus ZA9 was found to promote the growth of cucumber and tomato and inhibit the growth of several pathogenic fungi (Naureen *et al*., 2017).

Varying degrees of aggressiveness

Varying results were observed when the isolates were tested for their ability to be applied as BCAs against four different isolates of *S. sclerotiorum*, with varying degrees of aggressiveness, i.e., the ability to cause greater severity in host plants (*Photos 1* and *2*).

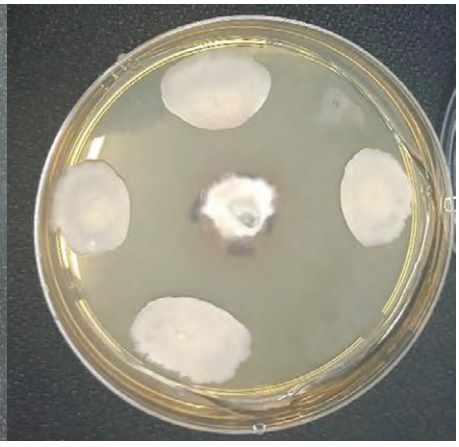
Isolates that could inhibit more than 50% growth of *S. sclerotiorum* were regarded as the best biocontrol agents (*Table 1*). Strains identified as potential PGPMs in our study from the genus *Pseudomonas* have also been identified to control the causal organism of the

Table 1: Inhibition (%) effect of bacterial biocontrol agent isolates on four different *S. sclerotiorum* isolates.

Sclerotinia sclerotiorum isolate[a]	Inhibition range (%)	Bacterial biocontrol agent isolate[b]
SSCC419 **Soya bean, Delmas.** **Colony colour: beige.** **Growth rate: fast.** **Oxalic acid production potential: intermediate.**	50 to 75	*Bacillus veselenzis* (14; 24) and unidentified (35)
SSCC427 **Soya bean, Delmas.** **Colony colour: beige.** **Growth rate: slow.** **Oxalic acid production potential: low.**	67	*Bacillus* sp. (32) and *Bacillus veselenzis* (24)
SSCC033 **Soya bean, Clocolan.** **Colony colour: dark.** **Growth rate: fast.** **Oxalic acid production potential: high.**	51 to 58	*Bacillus veselenzis* (14; 24) and *Bacillus* sp. (32)
SSCC035 **Soya bean, Clocolan.** **Colony colour: dark.** **Growth rate: slow.** **Oxalic acid production potential: high.**	<50	*Bacillus veselenzis* (14; 24)

a: brackets provide details of the specific S. sclerotiorum isolate; b: brackets indicate bacterial isolate numbers.

The control of S. sclerotiorum where no biocontrol agent was applied.



Inhibition of S. sclerotiorum by surrounding biological control agents selected from the study.

Fusarium wilt of bananas (Bubici *et al*., 2019). Additional evidence indicates that rhizospheric bacteria *Azotobacter chroococcum, Pseudomonas fluorescens* (strains 1 and 2) and *Bacillus subtilis* can improve the growth and yield of onion by reducing the effect of phytopathogenic fungi (Colo *et al*., 2014).

Conclusion

Beneficial micro-organisms isolated from the microbiome of crops are naturally sourced, have the potential to be cost-effective, and are safe for the environment and end users (animals and humans). It is important to have multiple disease management options integrated into a cropping system rather than limiting and risking crop protection with one practice.

Our study indicated the potential for bacterial isolates from soya bean and sunflower microbiomes to promote plant growth and inhibit *S. sclerotiorum*. Isolate *Bacillus* sp. (32) and *Bacillus veselenzis* (24) showed promise for both plant growth promotion and pathogen inhibition and will be considered in our future research as seed treatments.

This article forms part of research conducted by Neo Hlongwane during his BSc Agric research module under the supervision of Prof Wijnand Swart at the University of the Free State (UFS). Hlongwane presented his work at the Southern African Society for Plant Pathology (SASPP) Congress in August this year, with his poster titled "Exploring Sunflower and Soya Bean Microbiomes for Beneficial Micro-Organisms". He was awarded runner-up for the best poster at the congress. Hlongwane is currently busy with his MSc Agric at UFS, under the supervision of Dr Lisa Rothmann. His research objectives are to identify the prevalence and yield-limiting seed-borne pathogens of soya bean and to evaluate biopesticide and chemical control treatments of seed-borne *S. sclerotiorum* and *Fusarium* spp.

For enquiries, contact
Dr Dr Lisa Rothmann at 051 401 3666
or lisa.ann.rothmann@gmail.com.

The reviewed and updated South African irrigation design and user manual

By Fanie Vorster and Drs Macdex Mutema and Khumbulani Dhavu, ARC-Natural Resources and Engineering

South Africa is located in a water-constrained region; therefore, it is crucial that efforts are made to utilise water more efficiently. In an initiative by the Water Research Commission (WRC), a report was issued in 2010 titled *Standards and Guidelines for Improved Efficiency of Irrigation Water Use from Dam Wall Release to Root Zone Application*.

The report recommends, among others, that information on improved water-use efficiency (WUE) be shared with everyone involved in the irrigation industry. This includes irrigation equipment suppliers and management services, as well as producers since they play a pivotal role in water management at farm level.

Until recently, the main sources of locally relevant information on the design and management of irrigation systems were the *Irrigation Design Manual* and the *Irrigation Users' Manual* which were originally published by the Agricultural Research Council (ARC) in 1996 and 2002, respectively. The two manuals were updated as recently as 2021 by a team of irrigation experts from the ARC and partners from across South Africa. The following sections present highlights of the updates.

New chapters added

The updated *IDM* comprises 20 chapters of highly technical information, while the *IUM* contains 16 chapters of information relevant to irrigation system users.

New chapters added to the *IDM* include "Greenhouse Irrigation Systems" (Chapter 14), "Documentation and Drawings" (Chapter 18), "Feasibility Studies" (Chapter 19), and "Terminology, Conversion Tables, Design Norms, and an Overview of Design Software" (Chapter 20).

The new chapters added to the *IUM* are "Greenhouse Irrigation Systems" (Chapter 13), and "Terminology, Conversion Tables, Design Norms, and Overview of Scheduling Software" (Chapter 16).

The chapter/s on greenhouse irrigation systems is a valuable addition to the manuals. A greenhouse irrigation system design is based on the same principles as micro- and drip irrigation, with a few adaptations to facilitate more frequent and intensive irrigation strategies. However, the management requirements for these systems require more sophisticated equipment and application techniques.

Homing in on system efficiency

A significant addition to the chapter/s on system planning (Chapter 6) is the elaboration on irrigation system efficiency under the section on irrigation requirements. The assumption is that the maximum theoretical efficiency of any irrigation system should be 100%. Assumptions are then made for acceptable losses that can occur in any system, and the total losses are deducted from 100% to obtain the maximum recommended efficiency. The minimum acceptable value is based on the previous norms.

In the chapter/s about pipe hydraulics (Chapter 8), a section on the components of an irrigation system was added. This is important in the design of the irrigation system after the planning phase. In addition, two sections were added to this chapter where the on-farm and in-field parts of an irrigation system are discussed.

The purpose of the on-farm water supply system is to convey the water from the source to the in-field part in the most economical and energy-efficient way. This includes rising main pipelines, gravity pipelines and economic pipe sizing.

The purpose of the in-field part is to distribute water uniformly across the field to satisfy the demand of the crop. The focus of this section is on the selection of emitters and their pressure-discharge relationships, the design of steady-uneven systems and the hydraulic gradient thereof, pressure variation in systems, as well as pipe sizing using the Jensen and Fratini factor. A table with the allowable pressure variation in different irrigation systems is also included.

A key improvement

One of the key improvements to the manuals includes a complete section on variable speed drives. A variable speed drive is a device that facilitates variation of the speed of a normal fixed-speed motor, ultimately enabling accurate control of the motor speed over a broad range.

The two manuals are valuable and comprehensive reference tools for the irrigation system designer as well as the irrigation system user. The manuals were reviewed and updated by a team of irrigation experts from the ARC as well as private companies, under guidance of the WRC.

For technical enquiries, send an email to Fanie Vorster at vorsters@arc.agric.za, or to purchase the manuals, email Elmarie Stoltz at stoltze@arc.agric.za.

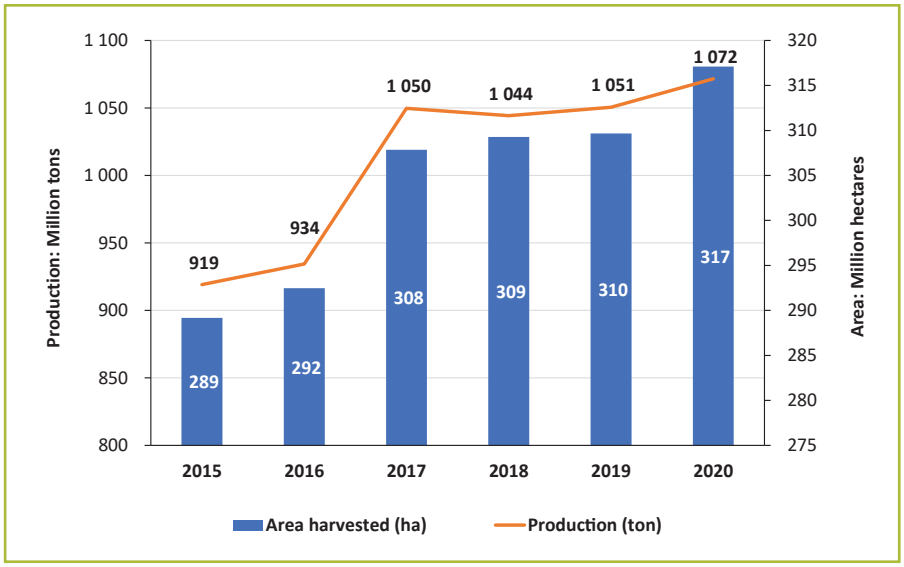
Genetic progress in South African oilseeds research

By Andrew Bennett, CEO, South African Cultivar and Technology Agency

Global production of the main oilseed crops is steadily rising, largely due to the increased demand as a result of population growth and the use of vegetable oils in biofuel production. Plant oils are also used as surfactants, soaps, detergents, lubricants, solvents, paints, and cosmetics.

These oils or fatty acids generally fall into six main classes, namely palmitic, stearic, oleic, linoleic and linolenic acids, which comprise 16 to 18 carbon chains and 12 carbon lauric acids. Edible and industrial oils may be extracted from seeds, fruits (mesocarp) and nuts of about 40 species of perennial and annual plants.

Figure 1: Planted area and production of oilseed crops. (Source: FAO, 2022)



A new-world approach

Globally, both planted area and production have increased steadily over the past five to seven years (*Figure 1*). Various global organisations such as the Food and Agriculture Organization of the United Nations (FAO) have identified the need to improve the production systems of most agricultural crops, to deal with the big challenges of human population growth, climate change and land degradation.

Biotechnology and genome editing will make a valuable contribution in improving the production systems of oilseed crops. New genome editing technologies, or site directed nuclease (SDN) technologies are classified according to whether they require additional regulation or not.

SDN versus GMO

SDN-1 and SDN-2 do not use recombinant DNA and do not lead to the insertion of foreign DNA. As such, they do not produce new plant varieties that fall under the scope of most GMO legislation frameworks. In the case of SDN-3, the newly developed plant should fall under GMO legislation only if foreign DNA exceeding 20 base pairs (bp) are inserted. For most countries' regulatory bodies, SDN-1 and SDN-2 technologies are widely considered not to require additional regulation, while SDN-3 edits do require regulation.

Soya bean

Soya bean provides the best vegetable oil and protein for use in human food products. Genetic transformation of soya bean to resist glyphosate herbicide was the first major commercial GMO introduced in 1995. Since the advent of new genome editing approaches, considerable research has been done in the areas of enriching food/feed quality, plant growth and yield, industrial utilisation, abiotic and biotic stress tolerance, and herbicide resistance.

Food and feed quality improvements in soya beans include developing lipoxygenase-free soya beans, high-oleic, low-linoleic acid soya beans, reduced saturated fatty acids in soya beans for improved nutrition and reduced cardiovascular diseases, reduced phytic acid content, and improved seed protein content.

Traits relating to increased plant yield and growth include increasing the number of seeds per pod, controlling flowering times and increasing the number of nodes on the main stem. Research on reducing pod shattering, increasing nodulation, enhancing photosynthesis and the development of dwarf soya bean types is also receiving attention.

Other research being undertaken relates to the generation of male-sterile lines to reduce seed production costs, drought and salt tolerance, and resistance to the fungal disease *Phytophthora sojae*.

It is interesting to note that much of the research originates from China, and that the genome-editing technologies being used are either SDN-1 or SDN-2 technologies.

Sunflower

Although much research using more conventional methods has been successfully deployed to improve oil quality and resistance to various fungal diseases, and combat abiotic stresses, very little work appears have been done using modern biotechnology.

Both *Agrobacterium* and micro-projectile mediated transformations have been found to be difficult to apply in sunflower. Sunflower breeding should be greatly facilitated by the application of SDN technologies.

Clustered regularly interspaced palindromic repeats (CRISPR)/Cas9 should be valuable in silencing undesirable genes such as disease susceptibility and late crop maturity, while seed and oil quality could be enhanced by silencing the linoleic acid and high-fibre encoding genes. At present, it does not appear as if these new technologies have led to any concrete progress yet.

Canola

Research in canola has also been undertaken using new SDN technologies, with most of it being focussed on improving the quality and/or composition of fatty acids. Work has been done to reduce the saturated fat content, reduce flavonoids, the phytic acid content and the erucic acid level, as well as increase the linoleic, linolenic and oleic acid content. These have all relied on SDN-1 CRISPR/Cas9 technologies.

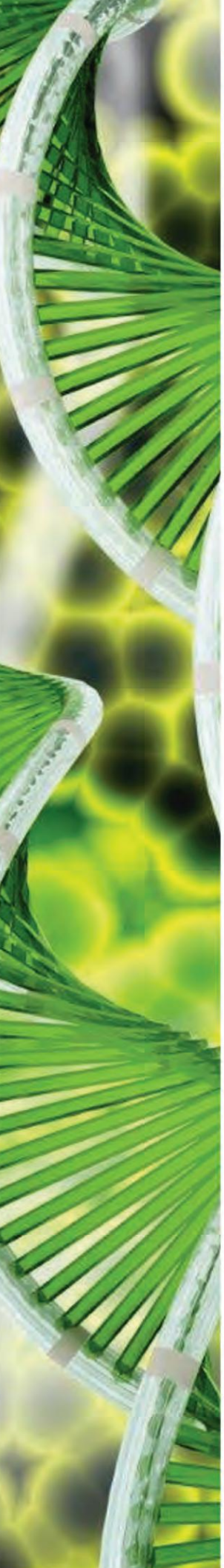
SDN-1 research related to improving plant yield and growth has focussed on increasing shatter resistance to reduce seed loss during harvesting, higher seed weight, altering plant architecture and developing semi-dwarf phenotypes. Manipulation of flowering times to develop cultivars with desired maturity dates has also received attention.

Reducing sunflower's susceptibility to *Sclerotinia sclerotiorum* and *Verticillium longisporum* has also received attention using SDN-1. An interesting focus has been to optimise glyphosate tolerance in rapeseed using CRISPR/Cas9 as an alternative to transgenic transformation. Recently, there have been major public concerns about transgenic food crops harbouring bacterial genes. The research successfully altered the binding site for glyphosate, rendering new plants resistant to the herbicide. Again, CRISPR/Cas9 was used to achieve this.

In conclusion, much progress may be expected in oilseed research as new genetic/molecular technologies are expanded and applied in these fields of research. It is imperative that South Africa finalises its regulatory approach to SDN-1 and SDN-2 technologies, so that the country may benefit from these new scientific approaches.

Andrew Bennett.

Should you have any enquiries, contact the author at email andrew@sactalevy.co.za or visit *www.sactalevy.co.za.*



SciCorp LABORATORIES

BEYOND WHAT YOU SEE

Providing a wide range of scientific services to the food, feed and agricultural industries.

- Plant Breeding Support
- GMO Testing (ISO/IEC 17025)*
- Seed Testing (ISTA-ZA05)
- Chemical Analysis
- Plant Health
- Food Safety Tests (ISO/IEC 17025) (Chemical and Microbiological)
- Research Support
- Testing Kits
- Germination Products

*Adventitious Presence, Qualitative & Quantitative, Identification of Released Events & Trait Homogeneity on food, feed and seed.

Contact us:

+27 (0) 33 386 1560

admin@scicorplab.com

www.scicorplab.com

Preferred partner of Eurofins Dr Specht

SANSOR

sanas Testing Laboratory T0758

MEMBER

New seed breeding technologies can benefit the oilseeds industry

By Dr Lukeshni Chetty, general manager, SANSOR

New breeding techniques (NBTs) are innovative research and breeding methods that enable scientists to improve and modify crops more precisely, and in a shorter timeframe. NBTs enable plant breeders to develop novel plant varieties that might provide solutions to environmental challenges, crop and food quality issues, as well as food supply challenges. By using these techniques, researchers can enhance, silence, insert or remove desired plant traits.

In recent years, global agriculture has overcome many difficulties. Climate change remains one of the most crucial environmental threats, but it is equally important to address food security. The agricultural sector is expected to provide safe and nutritious food to a growing population. In addition, many people rely on the agro-food sector for jobs and income.

Agriculture stands firm

Even in the face of these challenges, South Africa's agricultural industry has been able to provide in local consumer needs and could even export over the past couple of years. A major part of this ability to remain relevant and competitive is based on producers' access to new technologies and inputs, many of which are supplied by multinational companies.

South African regulators and producers have always been willing and able to adopt new technologies that helped the country to be almost on par with countries such as Brazil in terms of crop yields per hectare. Over the years, the introduction of biotechnology traits has resulted in the growth of particularly the local soya bean industry.

In 2021, the South African regulatory authority approved a new genetically modified (GM) soya bean trait for the first time in almost 20 years. As a result, new soya bean germplasm can now be sourced from across the globe and used in local breeding programmes. This one action increased the competitiveness and profitability of soya bean producers and the industry.

Breeding programmes focus on the development of varieties with improved yield, good agronomic adaptation to growing conditions, disease resistance and that can respond to lower inputs, as well as create new opportunities in agricultural production. Advancements in plant genetics and genomics, when used in breeding, increased support in the production and cultivation of crops that are resistant to pests, pathogens and other environmental conditions, as well as qualities required in the value chain.

Access to improved technologies

For producers to remain relevant, competitive and profitable, they must be able to mitigate uncertainties. Therefore, they need to have continued access to a variety of improved technologies and seed choices to sustain food and fibre production.

Breeders in South Africa must be given the opportunity to tap into new and innovative breeding technologies available to the seed industry to enable producers to address many of the challenges they are facing. An enabling environment and mutual appreciation of the value of technology will create a platform for the seed industry to remain relevant and provide for their customers' needs. The future of the agricultural industry lies with breeders having access to and being able to use a variety of new breeding techniques.

The South African government has designated agriculture as one of the sectors to help drive economic recovery and growth, as well as rural economic activity for the coming years. This will, however, mean that the seed industry in particular will have to be able to supply superior quality seed using modern breeding techniques to enable agricultural progress. This endeavour must be supported by the regulators to achieve this national goal.

As an industry, we understand and acknowledge that government needs to regulate new agricultural technologies and inputs to ensure human, animal and environmental safety. Often, some of the new inputs are urgently needed to counter pertinent on-farm production challenges. Government must therefore employ an agile, fast and rigorous process based on independent scientific assessments and evaluation of the trial data provided by technology developers to ensure the timely release of these new inputs to producers and businesses.

Safe introduction of NBTs

From the South African National Seed Organisation's (SANSOR) side, we would like to see that science-based regulations are in place for the safe introduction of products derived from NBTs. Our common interest is a prosperous and inclusive South African agricultural sector where our people can be fed.

We must apply a practical working solution and balance and, given the scale and complexity of the challenges that face our society, we need to experiment with new recipes to provide solutions that are to everyone's taste.

For any further enquiries, contact SANSOR at 012 472 9500 or visit *www.sansor.org*.

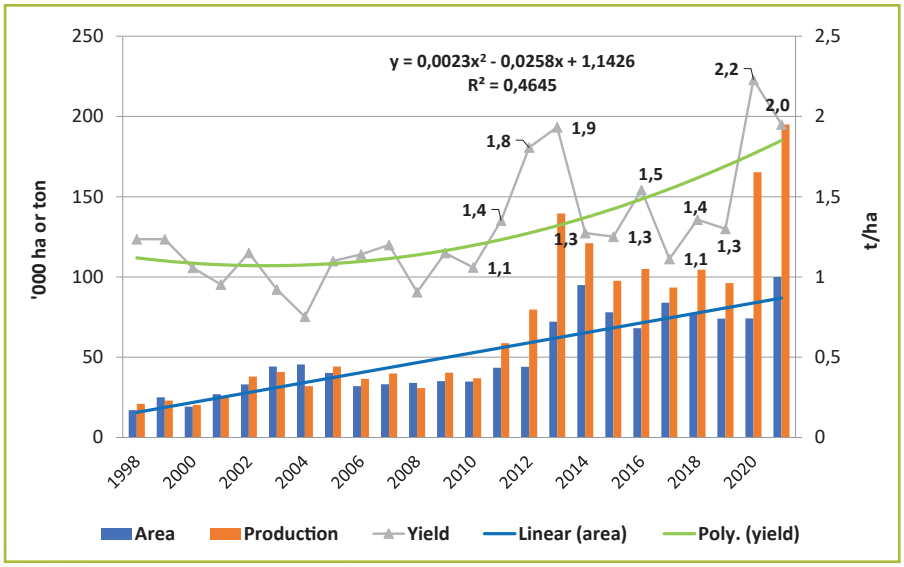
Canola yield potential in the Western Cape is on the rise

By Piet Lombard and Dr Johann Strauss, Western Cape Department of Agriculture

Over the past ten to 11 years there has been a significant increase in the commercial canola yield per hectare in the Western Cape (*Figure 1*). The average seed yield for the period 1998 to 2011 was 1,1t/ha^{-1} but has increased to 1,56t/ha^{-1} over the last ten years. The last two production seasons, however, realised yields of 2,2 and 2t/ha^{-1}, respectively.

To understand the increase in the yield potential for commercial plantings and national cultivar trials, we must look at the breeding and selection programme in Australia and the northern hemisphere. Australia (with international collaboration) was and is the only supplier of canola seed for production in South Africa.

Figure 1: Annual canola production from 1998 to 2020. (Source: Grain SA)



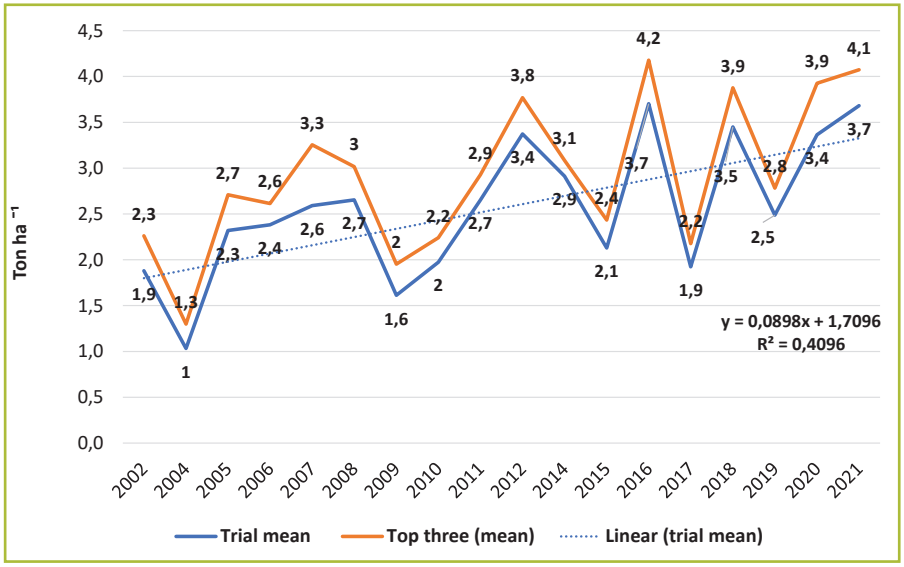
Why Australian seed?

Australian canola breeders have successfully improved seed yield and the adaptation of rapeseed (*Brassica napus*) from 1970 to 2000, in a closed population (18 ancestral varieties). Although the original parents were very diverse, the breeding potential declined through a loss of genetic diversity that impacted their future breeding progress.

Of the varieties released in Australia from 1995 to 2002, a total of 11 contributed 98,7% of the pedigree composition, with two varieties that were present in the pedigrees of all varieties. There was a slow decay in polygenic blackleg resistance with an average of -0,15 resistance units per year. The importance of new genetic material to maintain a positive net improvement rate in blackleg resistance and seed yield was very important for Australia, and consequently the Western Cape.

Two breeding programmes (Butruille *et al*., 1999a; Quijada *et al*., 2004) developed spring-type lines from winter x spring *B. napus* crosses. Those breeding programmes showed that winter *B. napus* germplasm can be used for the improvement of seed yield in spring *B. napus* hybrids, which outyielded the commercial spring hybrid cultivars by 13% (Rahman, 2011; Rahman and Kebede, 2012). Those programmes made it possible to increase the genetic diversity and consequently yield potential (including blackleg resistance and other breeding traits) of the commercial cultivars we currently use.

Figure 2: Annual canola production at Langgewens in the Swartland.



Five major influences on yield

Canola yield is the result not only of the genetic potential but also of our management strategies. The Canola Council of Canada identified five areas with the biggest impact on seed yield improvement and included genetics, plant establishment (genetic improvement of canola establishment, Grains Research and Development Corporation 2022), fertility, integrated pest, and harvest management.

Shatter resistance plays a major role in the harvest management strategy. Shatter resistance is a multi-gene trait; however, Australia followed an indirect selection method for tolerance to field shattering. Australian breeding programmes practised direct heading of breeding trials.

Varieties from these programmes have not been directly selected for shatter resistance; however, there appears to be a substantial improvement in field shatter tolerance in these varieties relative to older varieties. This is also present in the Western Cape with the current cultivars. Better shatter tolerance and the adoption of windrowing in the Western Cape played a role in the increase in seed yield.

The yield increase experienced in the Western Cape (*Figure 1*) is the result of a combination of factors, including plant genetics and management practices. Hyola 50 and possibly Agamax were the first cultivars tested in 2009 out of the winter x spring breeding programme and were for many seasons thereafter top yielding in the cultivar trials.

The cultivars that followed them were from a more diverse genetic origin and, subsequently, the commercial yield started to increase. The improvement in the seed yield at Langgewens (*Figure 2*) can mainly be attributed to the genetic improvement of the cultivars. However, a no-till planter has been used since 2013.

The yield increase at Langgewens was on average 4,3% per annum over the past 20 growing seasons. It is important to emphasise that the canola crop is highly sensitive to climatic conditions, as the variation in *Figures 1* and *2* indicates. The effect of climate change can be mitigated to an extent through good agricultural practices and the selection of cultivars with the genetic ability to cope with extreme climatic conditions.

Conclusion

The seed production of canola has increased significantly over the past decade, mainly due to better genetics. Western Cape producers can expect to see further increases in yield based on the results from the National Cultivar Evaluation Programme. However, the best cultivars in these trials are currently only available in small quantities or are not yet commercially available in the province.

For any further information, send an email to Piet Lombard at pietl@elsenburg.com or Dr Johann Strauss at JohannStrauss@westerncape.gov.za.

Effect of seed-applied technologies on groundnut production

By SB Coetzee, regulations and technical specialist, Microbial Biological Fertilizers International
(Graphics and illustrations by Anja Bornman and Chanelle Snyman)

Seed-applied technologies represent a revolution in farming. Today's sophisticated seed-applied products offer producers multiple benefits, including protection of high-value seed right from the start, flexibility in application, prevention of plant damage or loss, increased plant health and vigour, and fewer environmental and stewardship worries.

To get the best from seed-applied technologies, a combination of different biologicals and chemicals can be used for different functions.

Rhizobium inoculants

Rhizobium inoculants are used on legumes such as groundnuts and soya beans for biological nitrogen fixation (BNF). BNF is the process where bacteria such as *Bradyrhizobium* spp. use freely available nitrogen (N_2) and convert it enzymatically to a plant-available form (NH_3).

In this process, *Bradyrhizobium* can fixate between 100 to 120kg of nitrogen (N) for groundnuts and between 180 to 250kg for soya beans. The *Rhizobium* bacteria, or more specifically *Bradyrhizobium*, which develop in nodules on the groundnut plant's roots, live off the plant itself. They also give back to the plant by producing enough N to meet all its needs.

The development of a nodule marks the beginning of legume nitrogen-fixing (*Figure 1a*). Rhizobia bacteria from the soil infiltrate the root and grow inside its cortex cells. The plant gives the bacteria all the nutrition and energy required. Small nodules become evident to the naked eye a week after infection (*Figure 1d*).

Depending on the variety of legumes and the germination circumstances, tiny nodules may appear two to three weeks after planting. Nodules typically have a white or grey interior when they are young and not yet nitrogen-fixing. They gradually change colour from grey to pink or reddish, signifying that nitrogen fixation has begun. Leghaemoglobin, which is analogous to the haemoglobin in the blood and regulates colour, is what gives the pink or red hue.

There are seven primary steps that are crucial for the infection and nodulation process to develop successfully. First, the plant roots emit flavonoids that bind to receptors in the plasma membranes of compatible rhizobia (*Figure 1a*). In response to these flavonoids, the rhizobia secrete nodulation (NOD) factors that bind to receptors on the membranes of the host plant root hairs. This completes communication between the bacteria and the host roots.

The binding of the NOD factors to the root hairs increases the movement of calcium ions (Ca^{2+}) into the root hair, causing the root hair to swell up and curl around the rhizobia (*Figure 2a* to *b*). Once this occurs, the rhizobia inject infection proteins into the root hair, causing the development of an infection thread (*Figure 2c* to *f*).

After the induction of the infection thread, the rhizobia secrete proteins called nodulins that cause the cortex cells of the root to start cell division and form the root nodules. At this stage the rhizobia divide and transform into *Bacteroides* (*Figure 1d*). The nodules develop vascular tissue that transports N compounds to the plant shoots and organic carbon from the shoots to the nodule *Bacteroides*.

For effective BNF, a good quality inoculant needs to be used with a high concentration of viable bacterial cells. Once integrated into the soil, factors such as soil pH, temperature and salinity have a significant impact on rhizobia survival.

The most effective *Rhizobium* strain, being free of unwanted microbial contamination, having a long shelf life, a high concentration of bacteria, being properly packaged and stored, and being able to survive in harsh environments, are all requirements of high-quality inoculants.

Fungicide treatments

Stem-end rot, collar rot and damping off are a few examples of diseases that might threaten groundnut production. Although resistant plant varieties and changes in cultural practices can help manage some plant diseases, other diseases can only be properly treated by using the right chemical and biological fungicides.

For chemical and biological control products to be effective on the seed for disease prevention, the products need to be effective in controlling the desired

Figure 1: Infection process of *Rhizobium* with host roots to induce nodulation.

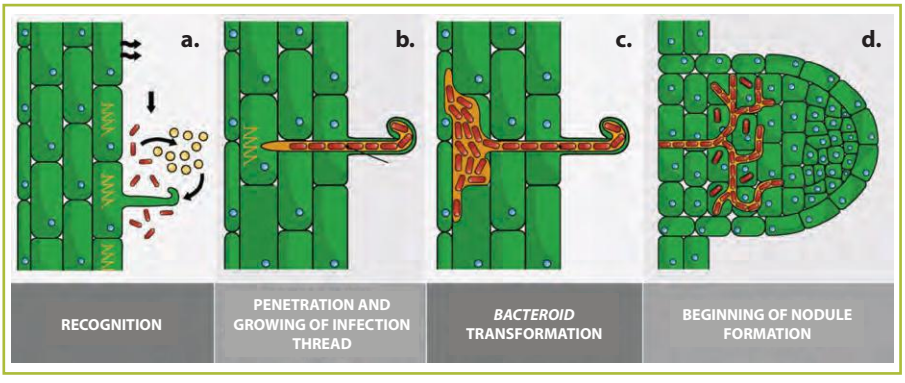
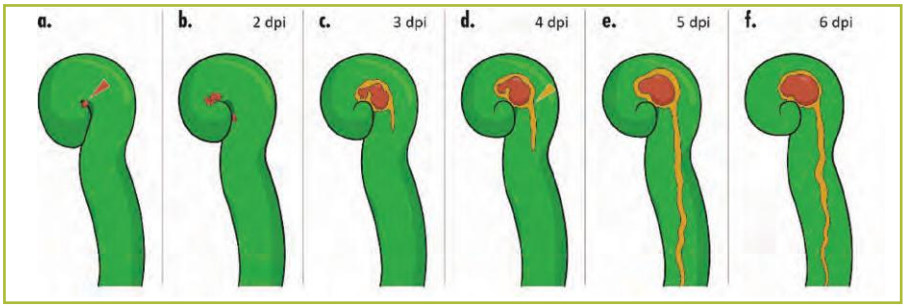


Figure 2: Curling of root hair around rhizobia and formation of infection thread.



pathogen, as well as being compatible with other seed-applied technologies such as the rhizobia inoculant that is applied to the seed coat. The use of multi-active products plus a mixture of systemic (carbendazim) and contact (thiram) action is used in controlling seed-borne diseases such as *Rhizopus* spp., *Rhizoctonia solani*, *Aspergillus niger* and dry-stem rot caused by *Fusarium monoliforme*.

This dual action guarantees early season protection for groundnuts to ensure the desired plant population is reached at harvest time. Carbendazim is a broad-spectrum systemic fungicide that stops and inhibits hyphal growth, affects conidia formation (reproduction) and inhibits fungal spore germination.

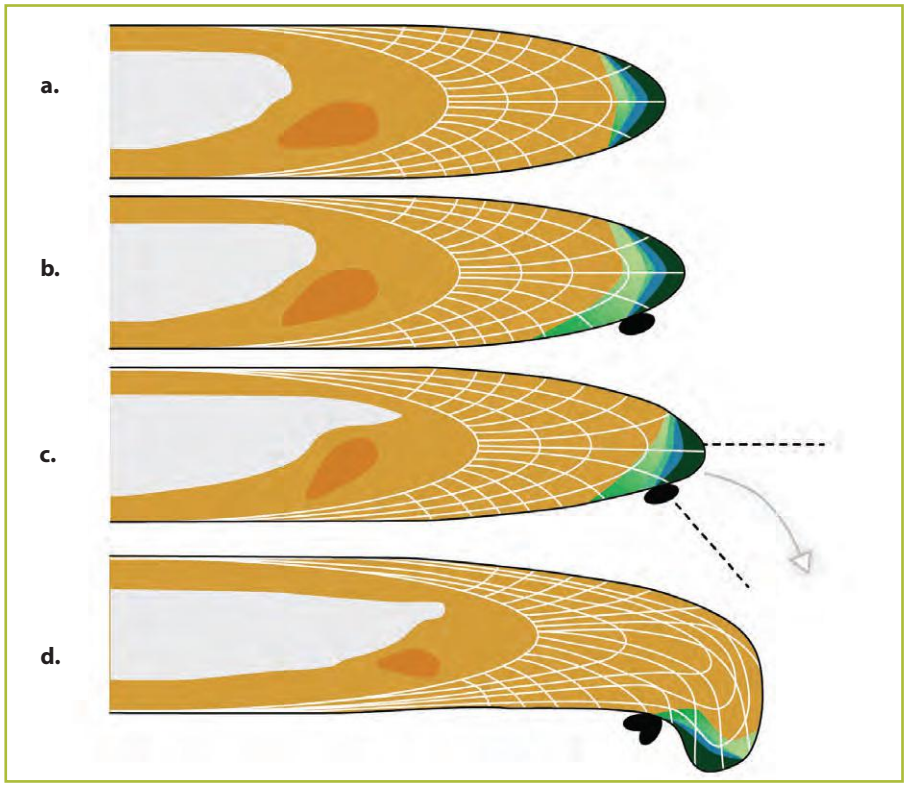
Thiram is a contact fungicide that interferes with the normal respiration of fungi and some bacteria. This interference with the metabolism causes mortality of the fungal pathogens, attacking the emerging roots of the germinating treated seed.

A critical consideration in choosing a fungicide treatment to be used in combination with rhizobia inoculants on legumes, should be the compatibility of the fungicide with the inoculant.

Trace element nutrients

Micronutrients are essential for plants to grow. The most common ways to provide micronutrients are through soil and foliar applications; however, finding high-quality micronutrient fertilisers is a challenge.

Figure 3: The role of calcium in the growth and curling of root hairs around attached rhizobia.



To guarantee optimal nutrient usage, micronutrient seed treatments such as seed priming and seed coating are a simple alternative. Germinating groundnut seeds need rhizobia for effective BNF (inoculant application), as well as micronutrients for effective germination and growth.

In the initial stages of groundnut nodule development, calcium (Ca) plays a vital role in the growth and curling of the root hair around the rhizobia (*Figure 2a* to *b*). The function of Ca in the growth and curling is shown in *Figure 3*. Firstly, the growth of a root hair is directed towards the highest Ca concentration that is usually accumulated in the tip of the root hair. If Ca inflow stops, so does the growth of the root hair.

Calcium influences cell wall strength and elasticity, controls actin filament dynamics, and the incorporation of Golgi-derived vesicles to increase the plasma membrane and cell wall (*Figure 3a*). When the *Rhizobium* is attached to the root hair (*Figure 3b*), it releases NOD factors that induce the inflow of Ca.

This inflow concentrates around the site of attachment and changes the Ca gradient dynamics of the root hair (*Figure 3c*). This change in gradient leads to the root hair growth shifting towards the higher Ca gradient near the attachment site, and the new growth leads to the curling of the root hair around the attached *Rhizobium* (*Figure 3d*).

Understanding this influence of Ca on plant growth and the effect that it can have on the nodulation process in legumes can increase the nutrient-use efficacy of micronutrients as a seed treatment. Using a liquid fertiliser formulated with plant growth regulators, in combination with plant-available amino acid chelated Ca, can stimulate vigorous root growth and improved nodulation.

A holistic approach

Seed-applied technologies have improved greatly over the past few years on different crops, but understanding the interactions between the different types and combinations of products can greatly influence the efficacy of these technologies.

For enquiries, contact the author at 084 444 7038 or sb@mbfi.co.za or visit *www.mbfi.co.za*.

Impact of harmful Palmer amaranth on maize, cotton, soya bean and groundnut production

By Prof Charlie Reinhardt, North-West University

The previous article on Palmer amaranth (*Amaranthus palmeri*), which appeared in the March issue of *Oilseeds Focus*, marked four years since the confirmation of the United States' (US) 'number one weed' in South Africa in 2018.

To date, no data exists on the effects this weed will undoubtedly have on local crop production. Because Palmer amaranth is indigenous to the US, where its origin (endemism) is the Sonoran Desert, most of the knowledge about it was accumulated there.

Since about 2010, numerous scientific studies in the US have revealed the reasons behind this weed's ability to cause economically crippling yield losses in diverse annual cropping systems, and the threats it poses for the economic viability of crop production (DJ Mahoney *et al*., Agronomy 11, 2021, 1734).

Continuous eradication efforts

Since Palmer amaranth was first discovered in the Douglas district in the Northern Cape early in 2018, the South African Herbicide Resistance Initiative (SAHRI) based at the University of Pretoria has led mitigation efforts against this potentially ruinous botanical foe by means of active advocacy and research.

The hype around Palmer amaranth, which is an annual summer plant, is justified by its exceptional ability to compete aggressively with basically all annual crops. Because the sexes are on separate plants, female plants are of particular interest since they carry seed and have greater biomass than male plants. Plant biomass is positively correlated with competitive ability.

Studies in the US report that Palmer amaranth, without competition, can attain plant heights of 160 to 270cm, and female plants produce more than 600 000 seeds per plant. In the Potchefstroom district in South Africa, such heights were observed in dense stands of the weed located outside crop fields (*Photo 1*). Crops on their own tend to fight back and reduce the growth of Palmer amaranth (*Photo 2*).

It is an annual plant and completes its life cycle in a single calendar year, thus it competes aggressively with annual crops that are arguably less driven by nature for survival than weedy plants. Palmer amaranth adapts to different cropping systems – the seed-carrying female plants tend to grow just a bit taller than the crop it infests (*Photo 1*).

Extremely rapid growth rate

US data shows that Palmer amaranth emerging with the crop attains a 10cm height within about 17 days after emergence; thereafter, its growth rate exceeds 5cm per day. Even if this weed is 100% controlled for the first three weeks after planting the crop, the growth rate of new cohorts exceeds 4cm per day. Therefore, the window for applying post-emergence herbicides at the ideal growth stage of weeds is extremely narrow in the case of Palmer amaranth.

In US cotton production, the final biomass of female Palmer amaranth plants was reduced between 50 and 80% when the weed was 100% controlled for the first three weeks after planting the crop and then left to grow uncontrolled to maturity. This proves why it is important to include effective pre-emergence herbicides in the weed control programme.

Maize and soya bean have denser canopies than both cotton and groundnuts; therefore, these crops compete differentially with the weed for sunlight. Plant height of Palmer amaranth which was 100% controlled for the first three weeks after planting the crop and subsequently left to grow to maturity,

Palmer amaranth plants outside crop fields tend to grow to full capacity. This infestation was discovered along a main road in the Potchefstroom district. The person serving as an indicator of the plant height is Sebastian Janse van Rensburg, a final-year agriculture student at North-West University. (Photograph: Prof Charlie Reinhardt)

was reduced by 87, 32, 25, and 15% in maize, soya bean, cotton, and groundnut, respectively.

This confirms the ability of crops to perform weed suppression on their own. Besides its exceptionally strong interference with crop growth and development, Palmer amaranth is incomparable because of its superior ability, which is ascribed to high genetic diversity to evolve resistance relatively rapidly to a wide range of herbicide mechanisms of action.

Resistance to over 70 herbicides

As of October 2022, a total of 72 cases of herbicide resistance have been reported globally for Palmer amaranth (*www.weedscience/org*). This weed has proven resistant to a staggering total of nine extremely important herbicide modes of action or sites of action (SOA).

The following herbicide groups, according to the Herbicide Resistance Action Committee (HRAC), are implicated:

- Group 2: Acetolactate synthase inhibitors, specifically chlorimuron-ethyl, imazethapyr, imazaquin, flumetsulam, halosulfuron-methyl, and sulfometuron methyl.
- Group 3: Microtubule assembly-inhibitors, specifically trifluralin and pendimethalin.
- Group 4: Auxin mimics, specifically 2,4-D and dicamba.
- Group 5: Photosystem II inhibitors, specifically atrazine.
- Group 9: 5-enolpyruvylshikimate-3-phosphate inhibitors, specifically glyphosate.
- Group 10: Glutamine synthetase inhibitor, specifically glufosinate-ammonium.
- Group 14: Protoporphyrinogen oxidase inhibitors, specifically fomesafen.
- Group 15: Long-chain fatty acid inhibitors, specifically s-metolachlor.
- Group 27: 4-Hydroxyphenylpyruvate dioxygenase inhibitors, specifically mesotrione, tembotrione and topramezone.

The above herbicide resistance scenario paints a particularly grim picture for the future of glyphosate use in glyphosate-tolerant crops such as maize, cotton, and soya bean that are infested with Palmer amaranth. From a crop perspective, the weed control prospects are equally dire because of the serious limitations that weed resistance in general places on herbicide options. At present, there are 514 confirmed cases of herbicide-resistant weeds globally, with 267 weed species and 165 different herbicides involved (*www.weedscience.org*).

A female Palmer amaranth plant in a soya bean planting in the Potchefstroom district. The yellow leaves on the plant are in response to treatment with a glyphosate herbicide, which this weed survived due to its resistance. (Photograph: Prof Charlie Reinhardt)

Continued effective herbicide use is nowhere more challenged than in no-till systems with glyphosate-tolerant crops. The worst-case scenario in the US regarding herbicide resistance of Palmer amaranth was recorded in 2016 in Arkansas in cotton and soya bean plantings, with multiple resistance to five SOAs, i.e., HRAC Groups 2, 14, 9, 3, and 15.

In this case, the herbicides implicated were flumetsulam, fomesafen, glyphosate, imazethapyr, pendimethalin and s-metolachlor. The most common herbicide resistance of Palmer amaranth in the US is multiple resistance to the combination glyphosate (HRAC Group 9) and ALS-inhibitors (HRAC Group 2). As with any highly competitive weed, Palmer amaranth must be effectively controlled during the first three weeks after planting the crop. Pre-plant and pre-emergence herbicides are important tools in this regard.

Palmer amaranth emerges in flushes throughout the growing season, therefore post-emergence herbicides and persistent herbicides with residual action must also be included in the control programme.

Zero tolerance to seed production, especially in the case of herbicide-resistant weeds, must be the basic objective in order to prevent fresh seed deposits into the soil seedbank.

Readers are encouraged to contact Prof Charlie Reinhardt about sightings of real or suspected Palmer amaranth. The *Manual for Identification and Reporting of Palmer amaranth (Amaranthus palmeri) in South Africa* is available free of charge in Afrikaans or English.

Prof Reinhardt works in the agricultural sciences programme at North-West University, Potchefstroom campus, and is also research leader at the South African Herbicide Resistance Initiative at the University of Pretoria. For enquiries, contact him at 083 442 3427 or dr.charlie.reinhardt@gmail.com.

Fundamental principles of fertilisation – apply even in tough times

By Dr John Tolmay and Renier Bothma, agronomists: Kynoch Fertiliser, central region

Sunflower and soya bean fertilisation is often neglected when drafting the farm's fertiliser plan. Fact is, the anticipated global shortage of oilseeds and good current product prices are putting a renewed focus on these crops as favourable alternative crop rotations.

However, fertiliser prices have skyrocketed following recent world events and producers are trying to make sense of the situation. This article attempts to revisit the basic principles of fertilising sunflower and soya bean crops within the current context.

Fundamentals of fertilising

The fundamental point of departure in fertilising any crop is to provide sufficient nutrients in the field for the yield, while simultaneously maintaining essential levels of nutrients in the soil and supplementing where necessary.

While fertilisation planning is always based on a pre-determined yield target, there may at any given time be either less or more fertiliser required by the crop than was applied during the season. Thus there can be either a surplus or a shortage of specific nutrients.

If the crop requires less nutrition than was applied (a surplus situation), nutrients can in many cases be transferred to the following season. However, if a shortage occurs, according to Liebig's law of the minimum, the yield will be limited to "the shortest stave in the barrel" (which represents the limiting factor).

A holistic approach

It is therefore vital that the fertilisation of any crop be approached holistically, with soil fertility as the starting point of fertilisation planning. Inherent soil fertility acts as a buffer during the good seasons when the plant's needs exceed the nutrition received from the bag of fertiliser.

Sunflowers usually respond very well to supplementary nutrition such as foliar sprays in combination with growth stimulants and regulators.

Strengthening soil fertility must always be part of long-term planning to ensure sustainable and profitable production.

These days, there is a strong focus on grid and precision analyses to improve soil fertility. This way, the liming of the soil is varied according to the liming requirements on different sections. Hence, the pH is provided for, along with the availability of essential elements such as calcium (Ca), magnesium (Mg) and potassium (K). In fact, the correction of soil fertility plays an important role in the production of sunflowers and soya beans as both of these broadleaf crops are sensitive to soil acidity and have limited root systems.

The basic principle of good fertility management is therefore just as or even more important for these crops than for maize.

The previous tendency to plant these crops on shallow, infertile or marginal land, and to grow maize on the more fertile fields never allowed the production of the crops to come into their own or to fully develop their production potential.

Uptake of nutrients

The uptake of nutrients according to the expected yield and the availability of nutrients in the soil (according to recent soil analyses) remain the basis of any good fertilisation plan.

Since maize is mostly considered the main crop and is normally well fertilised, the misconception can occur that sunflowers and soya beans are light feeders that do not require much fertilisation. However, if one compares the uptake quantities of sunflower and soya beans with the uptake quantities of maize (*Table 1*) at the same yield levels, it is clear that these crops are actually heavy feeders that absorb large amounts of certain elements.

A soya bean yield of 2t/ha absorbs the same amount of potassium as a 15t/ha

If you're looking for the best solutions for farming cotton, you can trust our team at GWK. Whether you've been planting for years or considering adding cotton to your crops, we have experts to support you every step of the way. Our established international market channels guarantee that your product ends up in the right hands.

Fanus Linde | Manager | 082 888 0016 | fanusl@gwk.co.za

gwk.co.za

GWK

innovate agriculture

maize yield! If these crops are fertilised poorly (or not at all) – as is sometimes the case with soya beans – it means that the soil is being 'mined' and the reserves that will be needed in the future will be depleted.

The soil might be able to temporarily provide a part of what is required, but in the long term this can have serious consequences, especially if reserves are needed for a subsequent season to produce in a good year.

Fertilisation of sunflower

Although sunflower has the lowest requirement for N, K, and phosphate (P) at normal planned yield levels, a sufficient supply of these macronutrients (as well as sulphur [S]) is essential for the successful cultivation of the crop.

Sunflowers usually respond very well to supplementary nutrition such as foliar sprays in combination with growth stimulants and regulators. The challenge, however, is that the crop suddenly grows tall and that it is difficult and/or expensive to apply further fertilisation or even foliar feeding after the budding stage. It is therefore important that the necessary nutrients are available early in the season.

While sunflower, like all plants, requires the full range of micronutrients, the supply of boron (B) remains extremely important with this crop. Boron moves with difficulty in the plant and a deficiency thereof can lead to serious losses if flowers start to fall.

Although there are fertiliser mixes available that contain B, their effective supply to the plant with fertiliser (through the soil and the roots) is not guaranteed and the spraying of B and other micro-elements must be continued throughout the season.

Fertilisation of soya beans

Fertilising soya beans is essential because the crop absorbs large amounts of P and especially K throughout the season. Unfortunately, there is a perception that soya beans can only be planted on acidic, infertile soils and that they do not respond well to 'fresh' fertiliser. However, the practice has proven otherwise, and good producers know that soya bean production on fertile and well-developed soil produces the best results.

Since the banding of fertiliser poses a risk that can harm the inoculation, producers often prefer to broadcast the fertiliser beforehand and then plant without fertiliser close to the seed. It can only be effective on well-developed soils where the P status is sufficient to make enough P available for the young seedling. Phosphate that is then given for the season replaces the P that will be used throughout the season.

It is also advisable to provide additional P even in soils that normally test high in this element because not all P found in the soil analysis is necessarily available.

Like sunflowers, soya beans respond very well to growth stimulants, additional micro-elements, and biological supplements. Most soya beans produced are genetically modified (GM) to be glyphosate-resistant. This, however, does not mean that the crop is not restricted due to the application of glyphosate, and additional stimulation and strengthening before spraying usually helps to reduce its effect.

Furthermore, the rhizobium associated with soya beans binds nitrogen and the plant uses extremely large amounts of it (similar to a 10-ton maize yield) with a 2t/ha soya bean crop.

At particularly high yield levels in high-potential areas, it has become common practice to apply additional N and S at the R4-R5 growth stages to help increase yield levels. At these growth stages, the ability of the rhizobium to bind N is no longer impaired.

Table 1: Comparative uptake quantities taken from 1,5 to 2,5t/ha maize, sunflower, and soya bean plantings. (Calculated according to guidelines in the *Fertiliser Association of South Africa's Fertiliser Manual*, 2016).

	N			P			K		
Yield (t/ha)	1,5	2	2,5	1,5	2	2,5	1,5	2	2,5
Maize	22,5	30	37,5	4,5	6	7,5	6	8	10
Sunflower	42	56	70	5,6	7,4	9,3	9	12	15
Soya beans	112,5	150	187,5	12	16	20	45	60	75

Fertilising soya beans is essential because the crop absorbs large amounts of P and especially K throughout the season.

Strategies for the coming season

In these times of price instability and high input costs, planning for the coming season becomes increasingly difficult. There is a great temptation to adjust fertilisation programmes downwards and thereby try to cut costs.

However, if one takes into account crop requirements, it does not really make sense to cut down on fertilisation on a large scale as this can have unforeseen and serious negative implications in the long term. Instead, stick with what works in the specific environment and cut out marginal lands that carry high risk.

Opt for the best possible production on the good sections and use the time to improve marginal sections for the next season. This way, you will give yourself the best chance of survival during tough times.

This article first appeared in *Graan SA/Grain SA* in September 2022. For enquiries, contact Kynoch Fertiliser at 011 317 2000.

NOU!
GAAN ONS BOER™

BASF
We create chemistry

AgCelence®
Expect more

Big stems, bigger roots, biggest leaves.
Bigger yield with Bellis®

Bellis® - The newest addition to the BASF AgCelence® portfolio not only ensures effective disease control for Sunflowers, it also gives additional physiological benefits for the optimum yield. We call it the AgCelence® effect:

- Increased plant growth efficiency with better photosynthesis efficiency, better use of nitrogen and increased bio-mass development
- Increased tolerance to stress in situations such as drought by inhibiting ethylene production

Get the AgCelence® advantage with Bellis®

Clearfield® Plus
Production System

BASF
We create chemistry

Protect your investment with the latest Clearfield® Plus system

The Clearfield® Production System has been widely accepted by South African producers since its introduction in 2010. BASF's continuous investment in the latest technologies has one primary aim: offering value to producers.

With this goal at the forefront of its objectives, BASF and its partners have developed the latest Clearfield® Plus system, which has grown by leaps and bounds due to its high level of performance.

Clearfield® Plus qualified seed

Before sunflower cultivars can be classified and sold as Clearfield® Plus seed, BASF's seed partners undergo years of internal development and stringent qualification trials. It is important to highlight that Clearfield® Plus cultivars are not genetically modified and contain a naturally occurring herbicide-tolerant gene that is bred into the seed companies' existing cultivars.

Euro-Lightning® Plus herbicide

Added to the high-performing Clearfield® Plus seed, BASF also offers Euro-Lightning® Plus – the Clearfield® Plus herbicide for sunflower. Euro-Lightning® Plus boasts significant improvements, with the main advancement being its improved formulation designed for improved weed control in Clearfield® Plus sunflower fields through higher levels of herbicide adherence to target weeds.

Euro-Lightning® Plus eradicates yield-robbing weeds. Under no-till conditions, excellent weed control has been observed during the growing season in fields where Euro-Lightning® Plus was applied. There has also been a decrease in stubborn overwintered weeds, which cause challenges during the following season's pre-plant burndown applications.

Using Euro-Lightning® Plus

Euro-Lightning® Plus can only be used on Clearfield® Plus sunflower cultivars (original Clearfield® sunflower cultivars are also excluded). Refer to the Euro-Lightning® Plus waiting periods on the label.

The following is recommended:

- Clean spray tanks, hoses and nozzles with a suitable tank-cleaning solution prior to mixing the Euro-Lightning® Plus solution.
- Only use a flowable (50%), high-quality ammonium sulphate.
- Do not use any ammonium sulphate that contains additional acidifying agents or additional adjuvants, spreaders, stickers or surfactants.
- Applications must be done within 32 days of planting.
- For good control, thorough coverage of the actively growing target weeds must be completed by the two- to six-leaf stage.
- Do not add any other crop protection products to the spray mixture, other than what is recommended on the label.
- Do not mix Euro-Lightning® Plus with any organophosphate or carbamate insecticides, and do not apply where these products have already been used as soil or foliar treatments.

BASF and its seed partners strongly advise and endorse the use of Euro-Lightning® Plus as the only supported herbicide. If other solutions are used, neither BASF nor the seed company can support the producer if problems occur. Read the Euro-Lightning Plus® label for full instructions and details.

Bellis®

Bellis®, BASF's flagship sunflower fungicide, contains two key active ingredients: Boscalid and F500®. These ingredients are a powerful combination offering excellent control of *Alternaria* leaf spot, as well as the AgCelence® effect. With AgCelence®, producers can expect yield increases and therefore a higher return on investment.

Bellis® Active

BASF now offers an AgCelence® solution for producers in lower disease pressure areas. Bellis® Active is the latest fungicide in row crops for the control of rust and *Alternaria* leaf spot in sunflower. But what is the difference between Bellis® and Bellis® Active?

Bellis® Active's optimised formulation and active ingredient composition are more suitable for lower disease pressure areas, while still delivering the AgCelence® effect of yield increase and ultimately a higher return on your investment.

BASF solutions on sunflower

BASF is known for offering reliable and innovative fungicide solutions across numerous crops, and sunflower is no exception.

Yield-reducing diseases have a major impact on crop productivity, which increases the risk to producers' investment. Protect your investment from fungal diseases by using preventive measures before being forced to take remedial action. Use a suitable BASF fungicide to protect both your crop and your income.

Bellis® *Reg No L7817 (Act 36/1947). Active ingredients: F500® 128g/kg, Boscalid 252g/kg. Caution.* ***Bellis® Active*** *Reg No L10777 (Act 36/1947). Active ingredients: Boscalid 150g/ℓ, F500® 250g/ℓ. Harmful.* ***Euro-Lightning® Plus*** *Reg No L10316 (Act 36/1947). Active ingredients: Imazapyr 7,5g/ℓ, Imazamox 16,5g/ℓ. F500® – Pyraclostrobin. AgCelence®, Bellis®, Bellis® Active, Clearfield® Plus, Euro-Lightning® Plus and F500® are registered trademarks of BASF.*

For more information, contact BASF South Africa on 011 203 2461 or visit *www.agro.basf.co.za.*

Seaweed extracts:
A key to unlocking nutrients during fertiliser applications

By Dr Anneli Heyns, Nutrico SA

Effective fertilisation has become a critical component in sustainable crop production. However, the effects of higher fertiliser prices and the lack of availability thereof will impact this important step in crop production.

The use of seaweed extracts in combination with fertiliser programmes is increasingly acknowledged as a regenerative and sustainable solution to improving the efficiency of fertiliser applications. Seaweed extracts contain biologically active molecules with biostimulant effects, such as enhancing crop nutrient acquisition. Applying seaweed extracts throughout the growing season can provide potential benefits to emergence, crop development, plant stress response and yield.

Seaweed extracts

Seaweed extracts are derived from the extraction of several macro-algae species, which, depending on the extraction methodology, produce complex mixtures of biologically active compounds and plant growth regulators.

These metabolites comprise auxins, cytokinins, ethylene, gibberellins, polyamines, abscisic acid and brassinosteroids. The mixture of natural active compounds in seaweed extracts can act individually or synergistically to deliver favourable physiological responses upon exogenic application to plants.

The benefits of seaweed extract applications include improved root structures, flowering and leaf development, fruit set, plant-disease tolerance, tolerance of abiotic stresses, soil structure, soil water-holding capacity and soil microbiology. Most important in the current fertiliser supply environment is the enhancement of nutrient acquisition.

Enhanced nutrient acquisition

Plants treated with seaweed extracts show improved nutrient acquisition capabilities, growth and vigour. This enhancement in plant nutrient uptake could be attributed to seaweed extracts' role in enhancing the functioning of root nutrient transporters. Nutrient uptake is further enhanced by established root development, which is regulated by some of the phytohormones (auxin and cytokinins) found in concentrated seaweed extracts.

Auxin is a plant hormone that is primarily involved in regulating plant growth. It is mainly responsible for the elongation of cells in plants and especially the development of different types of plant roots. Auxin affects the positioning of the root hair outgrowth site and promotes root hair elongation.

The increased root volume and number of root tips increase moisture and nutrient uptake from the soil, boosting the overall growth and health of plants. Furthermore, a positive effect on nutrient distribution within treated plants can occur even when no extra nutrients are supplied.

Cytokinins are a class of phytohormones that promote cell division, shoot and root growth, cell enlargement and auxiliary bud release. Cytokinins serve many important functions in plant development and morphogenesis, and induce salicylic acid accumulation and a plant defence response. Treated plants are therefore more resilient against disease and harsh environmental conditions, ultimately enhancing all physiological and developmental processes, including nutrient-use efficiency (NUE).

Nutrico's seaweed-based range

Nutrico has developed a nutrient range that supplies essential micro- and macro-

nutrients, as well as biostimulants at the correct physiological growth stage. The active components in each of these products are expertly combined in a seaweed extract matrix which improves NUE, boosts resilience to abiotic/biotic stress factors, and conditions the soil, creating the ideal conditions for growing seeds during planting, vegetative and reproductive growth.

Our seaweed-based range* includes, among others, STSA, EZ Gro, Nutrivo™ and Molboro X®, and is designed to be complementary to other fertiliser, biological and chemical treatments (*these products have been submitted for registration as Group 3 fertilisers, as set out in the newly published biostimulant requirements of the *Fertilizers, Farm Feeds, Seeds and Remedies Act, 1947 [Act 36 of 1947]*). The instructions and time of application of this range are shown in *Table 1* as an example programme for soya beans.

Table 1: Nutrico's seaweed-based nutrient programme for use in soya beans.

Product	Growth stage and application	Dosage
STSA	During planting	1,25 to 2,5g/kg seeds
EZ Gro	In the plant furrow or foliar spray	1 to 2ℓ/ha
Nutrivo™	Foliar application at early growth stages	2 to 4ℓ/ha
Molboro X®	During flowering	1 to 2ℓ/ha

Sources: O Ali, A Ramsubhag, and J Jayaraman. Biostimulant Properties of Seaweed Extracts in Plants: Implications towards Sustainable Crop Production. Plants (Basel). 2021 Mar 12;10(3):531.

STSA *(B4304, Act 36 of 1947)*

Concentrated dry seed treatment provides seeds access to nutrients at an early growth stage. The microfine particles of STSA ensure even coverage and effective dressing of seeds. STSA is specially formulated for safe use on all types of seeds and equipment. It is formulated with graphite and talc to reduce wear on machinery. It is also compatible with most other chemical seed treatments and is further enhanced through the inclusion of seaweed extract.

EZ Gro *(B4307, Act 36 of 1947)*

A concentrated combination of nutrients, growth hormones and seaweed extracts to promote root initiation and growth. It can be applied as a foliar spray or in-furrow and drench application.

Nutrivo™ *(K8794, Act 36 of 1947)*

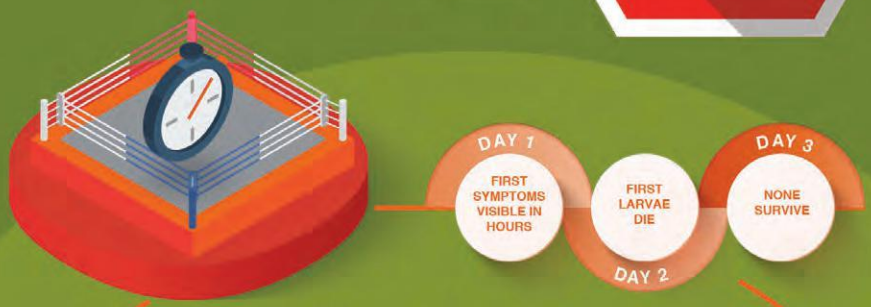
A liquid foliar fertiliser formulated to address the nutrient deficiencies resulting from glyphosate use on Roundup Ready (RR) crops. Nutrivo™ is registered for use in glyphosate tank mixtures. The formulation includes micro-nutrient complexes manufactured by patented technology and contains manganese (Mn), zinc (Zn), boron (B) and molybdenum (Mo), especially added to support the crop during stress conditions. Seaweed extract is added for additional support in systemic resistance and nutrient uptake efficiency.

Molboro X® *(B5122, Act 36 of 1947)*

A liquid foliar fertiliser combining the benefits of B, Mo, Zn and biostimulants, encompassing patented technology to deliver nutrients to crops in a highly mobile and absorbable format. The formulation contains seaweed extracts and other proprietary ingredients to boost crop growth, seed yield and quality.

For more information on how you can add value with Nutrico's seaweed-based nutrient range, contact your local Nutrico representative at 011 392 4072, 021 807 5922 or info@nutrico.co.za.

Lepidoptera halt, check 1, 2...!



rapid knockdown stops feeding immediately with no further crop damage

controls all life stages
moths, eggs and larvae

long residual
ensures effective control with less applications

stabilises the product in the spray tank

ensures better coverage

protects against degradation by sunlight

due to patented **Zeon** technology AMPLIGO is formulated as unique and uniform micro capsules

SmartFarm Inspired

Ampligo®

syngenta

READ THE LABEL FOR FULL DETAILS
AMPLIGO® contains chlorantraniliprole and lambda-cyhalothrin (Reg No. L8685, Act No. 36 of 1947). HARMFUL.
Syngenta South Africa, Private Bag X60, Halfway House, 1685. Tel: 011 541 4000. www.syngenta.co.za

@SyngentaSA

Technological challenges in oilseed crushing and refining

By Gabriel Krapf, agro-industries expert

World Health Day in April 2015 focussed on food safety under the slogan: "From farm to plate, make food safe", in order to draw global attention to the importance of food safety and its quality as a major challenge throughout the century.

Agricultural evolution is needed

For more than 150 years, the world has been on an unwavering mission to sustainably nourish the global population. And now, as the population will grow to more than nine billion people by 2050, consumer values shift and climate change becomes all the more real, the food processing and agricultural systems must evolve. That being said, one of the biggest challenges faced by the oilseeds processing industry is to maintain the food supply while diminishing waste and reducing greenhouse gas emissions (Carre, 2021a).

> The safety of edible oils and edible proteins is a major challenge and one that must be tackled not only for the protection of human health, but also to assure the protein and fat autonomy of the territories.

Innovation in all its forms – technology, digitalisation and applications – provides the means to address some of the challenges of the global food system: whether it's achieving zero hunger, delivering on consumer preferences, creating safer workplaces, offering transparency in our food system, replacing fossil compounds or improving farming technology.

Innovation is not a matter of a single company, universities or a technological platform. In this article, we look at different approaches to technological improvements that could help the oilseeds processing sector to evolve.

Sustainable processing methods

The safety of edible oils and edible proteins is a major challenge and one that must be tackled not only for the protection of human health, but also to assure the protein and fat autonomy of the territories. This plays an important role in trade and economy as a whole (Broudiscou *et al*., 2020). The challenge is getting the oil fraction from the oilseeds while preserving the proteins' quality more efficiently and eliminating undesirable compounds with sustainable processing methods (Carre, 2021b).

An important challenge for the oil extraction process is the use (or not) of a solvent taking care of the economic, health and environmental issues. The well-known hexane extraction process could be replaced by alternative and greener solvents or the use of specific surfactants.

But the scientific approach to the behaviour of oilseeds in expellers (Bogaert *et al*., 2020) and in general in the whole process of oilseeds processing, is an important step forward to understanding and optimising oilseeds processing, and reducing the energy or solvent utilisation keeping the proteins and oils quality intact.

Society is now focussing much more on all-natural food products. In this regard, innovation is needed in the oil purification/refining process, whereby undesirable compounds are eliminated. This can be done by exploring soft refinery either via enzymatic actions, bio-sourced solvents or mechanical processes (Bou Orm *et al*., 2020).

The challenges also imply the need to develop a system for the recovery of the co-products, effluent, and waste from the agribusiness sector, by converting them into chemical molecules used to create new materials and products (Laguna *et al*., 2020).

Adding value

Creating a model through which biodegradable organic carbon can be reused to produce materials is the challenge faced by the industry. This will assist in releasing new chemical products derived from the recovery of products from the agricultural sectors to the market for industrial and pharmaceutical applications, adding value to the oilseeds processing industry.

Finally, we should not forget the environmental impact of agriculture itself. Studies show that agriculture accounts for nearly 15% of global greenhouse gas emissions, while also being at risk of rapid climate changes. The fact remains that agriculture can meet the rising demand for food, as producers are resilient entrepreneurs who are increasingly doing more with less.

A partnership with producers by means of investments in innovation and training will give them the tools they need to increase productivity and meet tomorrow's food demand. Better technology, better seeds, more scale and mechanisation without significantly expanding land use, and combining it with technology innovation on the oilseeds processing side to mitigate the challenge of tomorrow's food demand, could be satisfying.

This article has been shortened for use in *Oilseeds Focus*. To access the original article and a list of references, visit *www.ocl-journal.org/articles/ocl/full_html/2021/01/ocl210007s/ocl210007s.html.*

An extensive analysis of South Africa's animal feed industry

By Louw Pienaar, senior analyst, and Ferdi Meyer, managing director, Bureau for Food and Agricultural Policy

South Africa's animal feed industry started to develop in the 1930s in response to severe drought conditions and the devastating impact of the Great Depression. From the initial need to have access to animal feed at affordable prices during dry spells, the industry developed into what it is today – a modern, competitive, and capital-intensive operation that supplies a variety of quality feed to producers.

Indeed, on the global front animal feed and improved nutrition are critical for future sustainability and the competitiveness of value chains, since feed costs are often the biggest expenditure in livestock production systems.

Demand continues to rise

Globally around one billion tons of feed are produced each year, and demand is rising due to an increasing need in developing countries such as China and India. Some of the macro-economic drivers of demand growth are attributed to population growth, urbanisation, and growth in income levels, which cause general dietary changes that move away from cereals toward greater protein intake.

South Africa is a small producer in global feed manufacturing, producing only around 1% of the total. The United States and China are by some margin the largest producers, with 19 and 15%, respectively, as reported in 2020.

South Africa's animal feed industry plays a significant economic role due to its interconnectedness to both farming operations and other agro-processing industries. It serves as a major buyer of raw agricultural and agro-processed products on the one hand, and is a critical input supplier to animal farming industries on the other. It therefore supplies critical inputs to animals to support adequate, balanced diets, free of toxins and contaminants, which are essential to promote productivity and animal welfare.

Total animal feed production was estimated at around 13 million tons in 2020, of which around 6,7 million tons were produced by feed manufacturers. Feedlots and other on-farm mixing of feed made up 40% of the total, while an estimated 7% was unaccounted for and classified as informal feed milling. The product flow map (*Figure 1*) provides a snapshot breakdown of the different products utilised in producing feed, the agro-processing volumes, feed milling and offtake markets.

Feed industry product flow

Typical South African feed mills spend around 82% on raw material purchases, 6% on labour, 7% on other direct costs, and 5% on overhead expenses. Like many other countries, South Africa's largest market for feed sales is poultry, followed by beef and pork. Since raw material purchases are such a big component of feed milling operations, overall market trends in commodities such as maize and oilseeds are key drivers of the feed industry. In terms of the latter, soya beans stand out since around 183 000 tons of full-fat soya is used in animal feed manufacturing, while another 49% of all oilcake utilised comes from soya beans.

The country's soya bean cake import replacement success story is well documented, coming down from 1,2 million tons in 2007 to 487 000 tons in 2020. However, the report also emphasises that due to South Africa's geographic distribution of soya bean area planted and the location of the bulk of oil crushing, there remains a distinct location differential in that imported soya bean cake will remain very competitive in coastal areas in the

Figure 1: The product flow map indicating a breakdown of different products used in producing feed, the agro-processing volumes, feed milling and offtake markets.

absence of cheaper transportation costs from inland regions.

Feed mill profitability is highly dependent on the competitive sourcing of raw materials and requires high utilisation rates of manufacturing capacity in a market with thin margins. In the past decade, the average net profit per ton of feed produced was on average R417 per ton and achieved net earnings before interest and tax of only 4% of the total income generated. It is expected, based on the *Bureau for Food and Agricultural Policy (BFAP) Baseline Outlook*, that some growth is forthcoming in animal feed demand, with volumes growing by 1,2% per annum towards 2030 under baseline conditions.

In total, the animal feed industry in South Africa generated around R55 billion in gross sales in 2020 and employed around 17 000 individuals, which suggests that it continues to make a valuable contribution to the economy of South Africa.

The local industry

More details on South Africa's feed industry can be found in a recent study on BFAP's website. The study was commissioned by the Animal Feed Manufacturers' Association of South Africa. It provides important insights into the current structure, performance and critical factors affecting the ability of feed manufacturers to drive further success and future growth.

The report is unique in South Africa's context since very limited public reports have attempted to describe the importance of the industry in terms of its contribution to the economy, trade, employment and the interlinkages with agriculture and agro-processing. This article provides a brief summary of the major findings.

To read the report on the aforementioned study, visit BFAP's website at *www.bfap.co.za*. For any additional enquiries, contact BFAP at admin@bfap.co.za.

Oilseeds outlook:
Focussing on Argentina's 'soya bean currency'

By Christiaan Vercueil, junior agricultural economist, Grain SA

Unfavourable weather conditions in South America are currently a cause for concern. In Brazil, heavy rains have partly damaged established soya bean areas and halted the progress of additional plantings. Overall, this has caused progress with the soya bean planting to lag behind that of previous seasons. Chinese soya bean imports have also been slumping lately, but there have been reports of insufficient soya bean meal supplies on the local market, leading to an increase in prices.

Sunflower seed

The European Union (EU) is showing noticeable increases in sunflower seed crushing, and sunflower oil and meal supplies. Crushing of sunflower seed increased by 31% compared to the previous year due to favourable crushing margins.

Sunflower seed stock was still unusually high in the EU at the beginning of the new season. It is estimated that opening stock was almost double that of the previous season, partly due to increased exports from Ukraine and large volumes of crops harvested in Romania, Bulgaria, Hungary and France.

Canola

Canadian canola production recovered significantly in 2022. Favourable weather conditions in September and October allowed producers to complete harvesting before the arrival of cold and wet weather.

Following large shipments in August and September, canola exports from Ukraine declined seasonally in the first half of October, but were still higher than expected.

Reasons for uncertainty as well as price-determining factors to keep an eye on in the oil complex are:

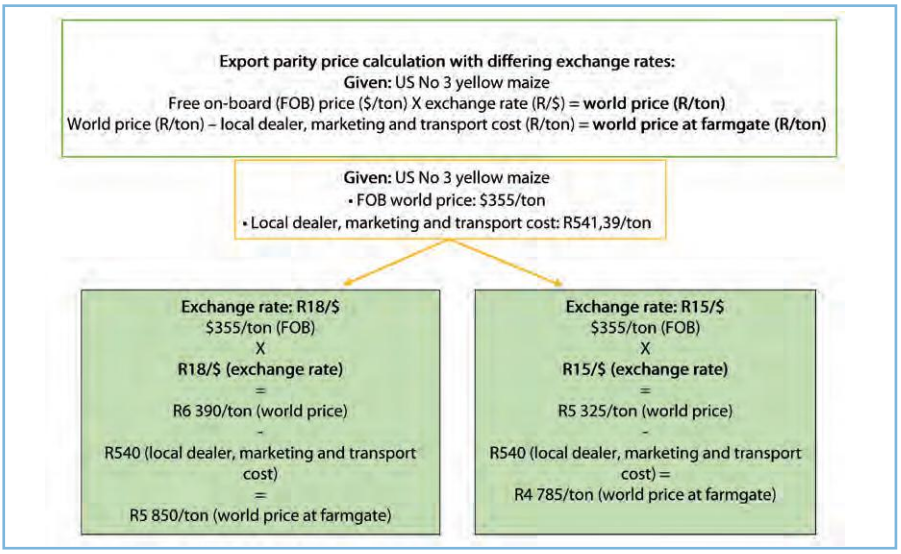
- Harvest progress, yield and producer sales of sunflower seed in Russia and Ukraine, as well as canola in Canada.
- The size and timing of purchases from importing countries, considering that palm oil prices have reached very low levels, and the recovery of soya, sunflower and canola oil prices.
- Developments in China. The demand for soya bean meal and crushing has increased of late. The size and timing of Chinese purchases are key factors.
- Continued uncertainty regarding the export corridor for Ukrainian grain from Black Sea ports.
- The situation regarding Indonesian and Malaysian palm oil production, exports and stock which will influence prices.
- Uncertainty regarding weather conditions in South America, which will significantly influence yields and production.

Argentinian soya bean prices

Inflation can be described as the decline in the purchasing power of a currency. This causes the holder of a certain currency, which is influenced by high inflation, to exchange that currency for another (for example the American dollar [US$]) for protection against the loss of purchasing power.

To reduce the flight of capital from Argentina, the government decided to temporarily regulate the international

Figure 1: Export parity price calculation showing the outcome of higher and lower exchange rates in rand terms. (Source: South African Grain Information Service, Grain SA)



exchange rate of Argentina's currency, the peso (*Figure 1*).

With the exchange rate regulated, local Argentinian soya bean prices declined, and it was no longer profitable for producers to sell their products. This led to slow producer selling. In response to the situation, the Argentinian government introduced a 'soya bean dollar' scheme that applies a better exchange rate than the official exchange rate to the selling of soya beans by producers.

At the time of the introduction of the scheme, the official exchange rate to the dollar was around ARS$138,5/US$. The 'soya bean dollar' scheme offered producers around ARS$200/US$ for selling soya beans in the local market.

This meant that for local producers, prices increased by 44%, which is much more in line with the international value of soya beans. In this situation, soya beans have become equivalent to a currency because the value of the underlying asset is fixed and very clearly determinable, as opposed to the peso which is subject to extremely high inflation.

Conclusion

With the regulation of the exchange rate by the government of Argentina, exportable products are not traded for the actual value of the product. Therefore, interventions via regulation of the exchange rate is not a suitable way to battle inflation and the effects thereof. However, this intervention did accumulate dollar currency for the Argentinian government, which is needed to import materials into the country.

For more information, contact Grain SA at 086 004 7246 or visit *www.grainsa.co.za*.

Update on the effect of fertiliser prices on the grain industry

By Christiaan Vercueil, intern agricultural economist, Grain SA

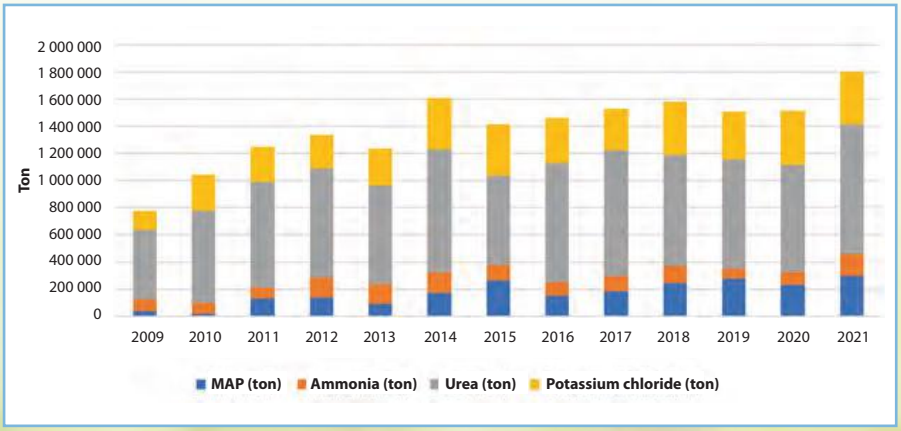
Traditionally, between 30 and 50% of a grain and oilseed producer's existing input costs are spent on fertiliser. Fertiliser makes up such a large portion of input costs that any change, especially a price increase, can affect profitability drastically.

Because South Africa is a net importer of fertiliser, it further aggravates the situation since all imported fertilisers are not only affected by their actual price, but by a whole range of factors such as the exchange rate and transport costs.

Import volume and price changes

Figure 1 illustrates South Africa's fertiliser imports of monoammonium phosphate (MAP), ammonia, urea and potassium chloride from various countries since 2009. Although not the only fertilisers imported, these are four of the five most important products imported.

Figure 1: Four of the five most important fertilisers imported to South Africa.



As of 2009, fertiliser imports for these five products have increased by 165% in total. During 2021, South Africa imported a total of 2 155 233 tons of just these five fertiliser products from various countries. Besides the increase in import volume, the exchange rate of the rand to other major currencies also weakened sharply from 2009 onwards, which further intensified the effect of price increases.

For the year 2022 up until August, more than 800 000 tons had already been imported, which comprises approximately 47% of 2021's total.

Table 1 shows the average price changes for nitrogen (N), phosphate (P) and potassium (K) during July last year, compared to October 2022. It is staggering to see how sharply the prices for these products have increased in a matter of a year.

When looking at the fertiliser requirements of different parts of the country, one notices that on average, the Western Free State uses 72 units of N, 16 units of P, and 14 units of K per hectare. The Eastern Free State uses 100 units of N, 19 units of P and 27 units of K per hectare. Irrigated areas use 286 units of N, 52 units of P, and 80 units of K per hectare.

Table 2 provides a comparison of the average fertilisation requirements for these three regions for October 2021 and October 2022. On average, the cost of fertiliser increased by 41%.

Figure 2: The affordability of fertiliser.

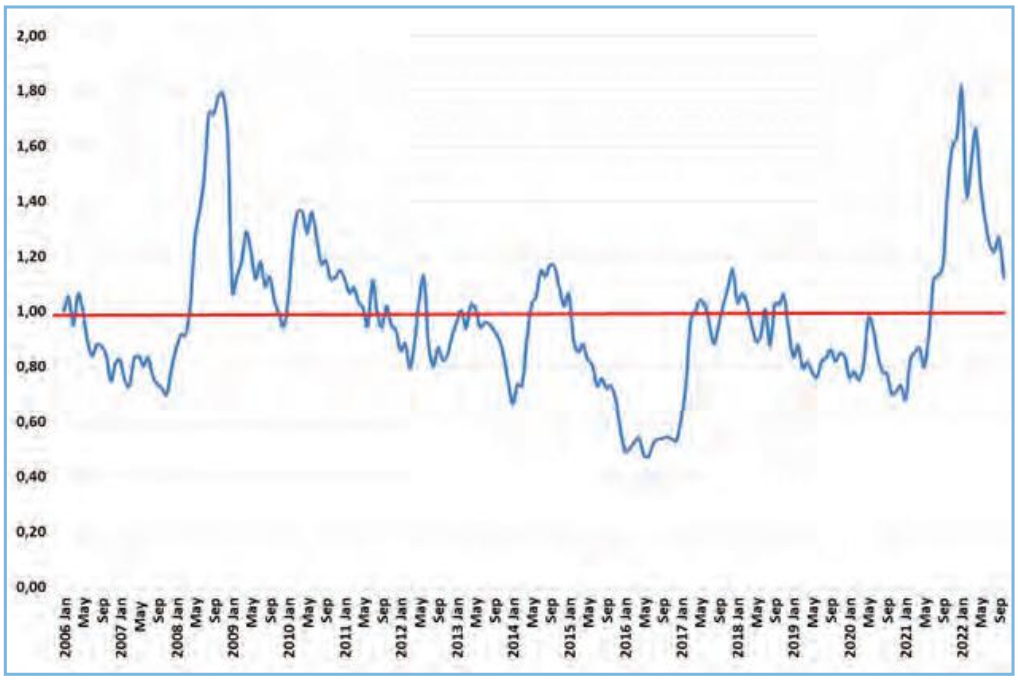


Table 1: Price comparison of nitrogen, phosphate and potassium for October 2021 and October 2022.

	Nitrogen	Phosphate	Potassium
Average price: October 2021 (R/kg)	R30,6	R61	R26,4
Average price: October 2022 (R/kg)	R43,9	R78,7	R40,6
Change (year-on-year)	43%	29%	54%

Fertiliser affordability

Figure 2 provides an indication of the affordability of fertilisers compared to the SAFEX price of maize. Fertilisers, which account for between 30% and 50% of input costs, have become less and less affordable, which means that the producer's margin for trade has weakened excessively. This puts pressure on the producer's profitability and can result in fewer hectares being planted, especially maize.

This information paints a clear picture of the extreme challenges that producers face every day to try and stay afloat. Fertiliser is not the only input cost that has seen sharp price hikes; the costs of energy sources such as fuel and electricity have also risen sharply, as has the price of seed and chemicals. It is becoming progressively more difficult for farming operations to remain profitable and sustainable.

Since there is little room for mistakes, producers must make sure they are not being taken for a ride by fertiliser suppliers. Do the homework, make sure the representative's prices are market related, compare offers to find the best price, and select the most suitable offer for your purposes.

Table 2: Change in fertiliser cost per hectare for July 2021 compared to July 2022.

	Nitrogen	Phosphate	Potassium	Price: July 2021	Price: July 2022	Change
Eastern Free State: Average units (kg/ha)	100	19	27	R4 931	R6 981	42%
West Free State: Average units (kg/ha)	72	16	14	R3 548	R4 988	41%
Irrigation: Average units (kg/ha)	286	52	80	R14 035	R19 895	42%

For more information, contact Christiaan Vercueil of Grain SA at 086 004 7246 or visit *www.grainsa.co.za*.

Oilseeds:
Change, opportunity and growth

By Bernard Schultz, general manager, South African Grain Information Service

The oilseeds industry has seen growth, as well as many new opportunities and changes over the years. We are proud to have been entrusted to supply the industry with accurate and timeous data while so many things have come across the industry's path that required new or additional information.

Canola

It is exciting to see certain oilseeds in this industry growing (*Figure 1*) and expanding into new markets. We have seen canola being exported to Germany for the first time in 2021/22 and then again in the 2022/23 marketing year.

At the preliminary closing of the 2021/22 marketing year at the end of September, stocks stood at a new high of 173 425 tons, with another big crop expected – we are eager to see whether this becomes a new trend for canola.

Soya beans

The most significant growth for the oilseeds we report on is seen in soya beans. Soya bean production has grown exponentially over the past few years, with deliveries directly from farms at commercial premises increasing during the 2022/23 marketing year to a new record high of 2 133 754 tons delivered for the first seven months (March to September), which is 14,18% higher than the total deliveries during the previous marketing year.

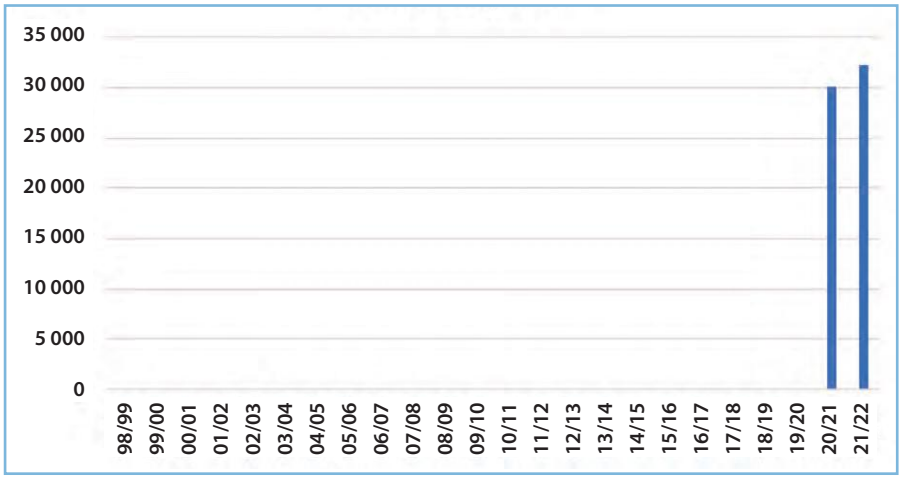
Crushing facilities have seen some development over the years, creating new opportunities and growth in the local market.

Crushing reached 1 520 462 tons during the 2021/22 marketing year and is expected to surpass that during the current marketing year, according to the Supply and Demand Estimates Committee (*Figure 2*).

Soya beans continue to take some hectares from maize as the latest crop estimates indicated intentions to plant 1 075 000ha of soya beans the coming season.

With the increased crushing of soya beans, there is a surplus of soya beans available for the export market. A total of 103 500 tons was exported to mainly Malaysia during the first seven months

Figure 1: Canola exports in tons from 1998 to 2022.



SAGIS: Evolving with the industry

The South African Grain Information Service (SAGIS) has grown and evolved as the industry required it to do so, with various new statutory measures and amendments to existing measures to make the market more accessible to all through reliable data.

- **1997:** SAGIS was incorporated in November 1997 after the deregulation of agriculture in South Africa. *The Monthly Data and Weekly Bulletin* have been published since its establishment.
- **2003:** Establishment of statutory measures: weekly wholegrain import and export data for maize and wheat.
- **2005:** Weekly producer deliveries for maize and wheat are published (voluntary submission). Import and export tariff lines of SARS are published.
- **2008:** Historic import and export parity prices dating back to 2001 for maize and wheat are published.
- **2014:** Establishment of statutory measures: manufacturers, importers and exporters of maize and wheat products.
- **2016:** Establishment of statutory measures: manufacturers, importers and exporters of oilseeds products.
- **2018:** Amendment of statutory measure – weekly intentions to import and export maize. Oilseeds weekly producer deliveries are published (voluntary submission).
- **2022:** Amendment of statutory measure – maize monthly class and grade with regard to producer deliveries and closing stock; establishment of statutory measure – weekly producer deliveries for maize, wheat, sunflower seed and soya beans; amendment of statutory measure – wheat weekly intentions to import and export.

(March to September), with quite a significant quantity still expected to be exported, according to the Supply and Demand Estimates Committee.

Sunflower

There is some fluctuation with regard to sunflower seed, but within range. Imports, however, have decreased over the past few years, which helps to ensure that the entire locally produced sunflower crop is crushed in the local market – this is evident by the low closing stock at the end of the 2021/22 marketing year (*Figure 3*).

South Africa still imports a significant quantity of crude oil, so there is a constant need to increase the sunflower oil content to supply the food market. The oil content has barely changed over the past five years when comparing the wholegrain and product data supplied by registered co-workers.

With a higher oil content on increasing demand, this might change in the coming years and maybe provide some incentive to produce more of these high-yield cultivars.

Groundnuts

Groundnuts have enjoyed superiority over sunflower seed from 1936 to 1973 with regard to hectares planted. Unfortunately, since 1979, groundnut production started declining and is now at a level last seen in the 1940s.

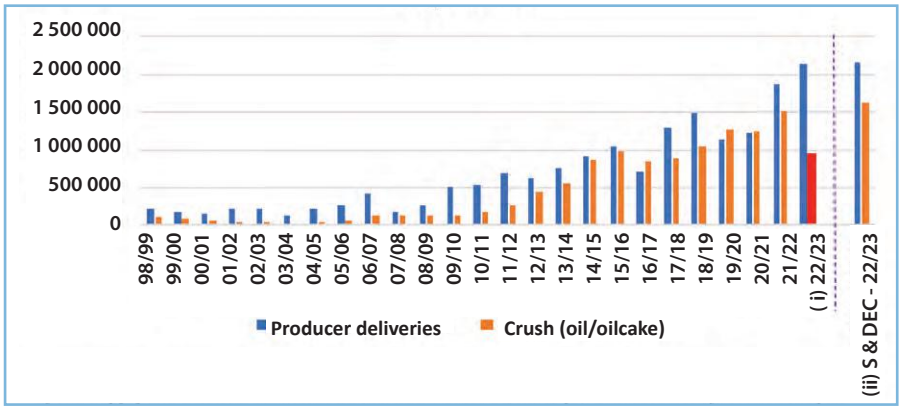
The market for peanut butter continues to grow and imports make up the shortfall in local production. It is interesting to note, however, that choice-grade groundnuts have made a comeback in the processing of peanut butter over the last five years (*Figure 4*).

Given the challenges and changes we've experienced as an industry and as a country, we remained consistent and dedicated, ensuring that inspections and reporting took place to guarantee accurate and timeous data.

Our inspectors conduct physical visits during which physical stocktakes (one of the various tasks performed during an inspection) are done to ensure that stock is correctly declared on the monthly returns. Over the past five financial years, an average of 829 inspections took place for all wholegrain and oilseeds.

We continue to receive good co-operation and quality data from our co-workers with regard to the variances found with the physically counted stock, as well as the stock that was declared on the monthly returns. When compared with the monthly stock published, the differences are negligible. Differences are discussed with the management of each co-worker to ensure that discrepancies are communicated and that corrective measures resolve any problems.

Figure 2: Soya bean producer deliveries and soya beans crushed for oil and oilcake (in tons) from 1998 to 2023.



i) 2022/23 marketing year (March to September) data published by SAGIS.
ii) Supply and Demand Estimates Committee's latest estimate (27 October 2022) for the 2022/23 marketing year.

Figure 3: Sunflower seed imports and closing stocks in tons from 1998 to 2022.

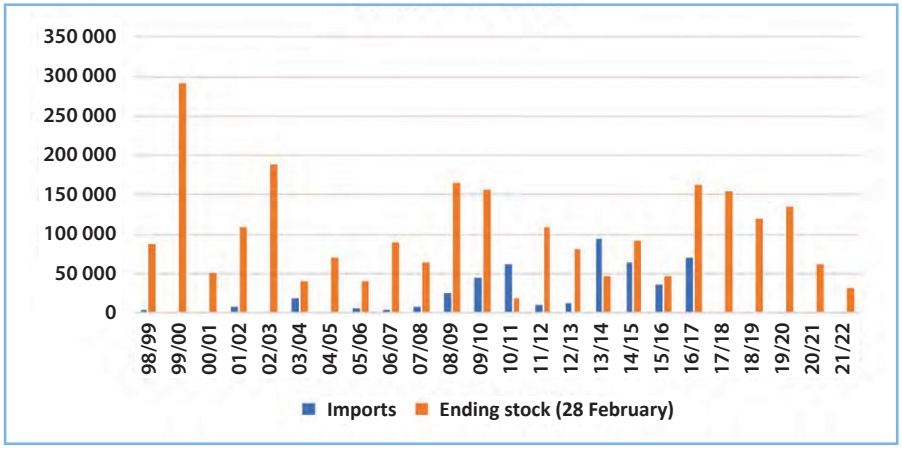
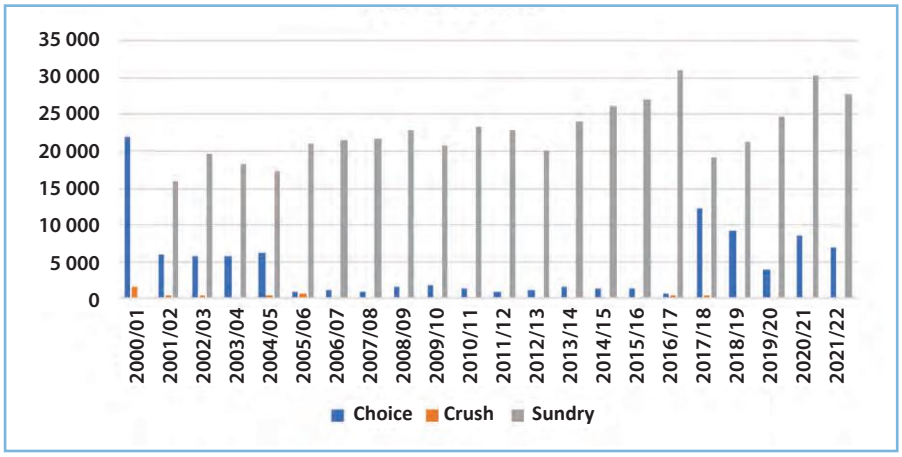


Figure 4: Tons of peanut butter manufactured from 2000 to 2022.



This article has been shortened for use in *Oilseeds Focus*. For more information or any related enquiries, contact the South African Grain Information Service at 012 941 2050 or info@sagis.org.za. Alternatively, visit *www.sagis.org.za*.

The PRF's soya value chain initiative

By Prof Ferdi Meyer, Bureau for Food and Agricultural Policy (BFAP)

The Protein Research Foundation (PRF) initiated the Soybean Value Chain (SVC) initiative in December 2018. The SVC provides a platform for all stakeholders in the soya value chain, related segments in agriculture and government to gain deeper insights into the interconnectedness and linkages between different sections in the value chain.

Through discussions via this platform, matters of strategic importance are tabled and debated, and potential solutions or action points are carefully considered and implemented as a collective. The vision of the SVC initiative is to unlock the full potential of the soya value chain and related industries by focussing on long-term competitiveness, resilience and adaptation within an ever-changing industry and political environment.

The SVC follows an end-to-end approach where all sections in the value chain and their interconnectedness are carefully considered to identify opportunities for improvement and to address bottlenecks regarding a wide range of drivers such as legislation, logistics, infrastructure and services.

Areas for further research and information sharing are identified, which are then also shared on other platforms and with other organisations that are geared to execute the tasks at hand. Since its inception, a number of matters have already been identified and have been or are currently being addressed.

Farm-level economics

In major producing countries, producers are delivering soya beans with significantly higher moisture content (up to 17%), which is potentially reducing harvest losses. A pilot study was launched in collaboration with producers and agri-businesses to determine the cost-benefits and practical execution of delivering high-moisture soya beans to the local market, and the results of the first season are expected soon.

Content and quality

A reliable supply of soya beans and soya bean oilcake with consistent content and quality is a key driver of competitiveness of the local soya, feed and intensive livestock industries. Although a tremendous amount of progress has already been made in this regard, the SVC initiative identified various areas where more work could be done to shed light on this critical aspect of the value chain.

For example, through the Oilseeds Advisory Committee (OAC), the Bureau for Food and Agricultural Policy (BFAP) was commissioned to undertake a comprehensive study that identifies the key drivers of the quality of soya bean products for feed use in South Africa. This study was completed in March 2021 and is available online to inform the critical debate on content and quality.

Furthermore, the issue of inconsistent results of soya beans for the same quality test over various laboratories was raised in the value chain discussions. Following discussions with the South African Grain Laboratories (SAGL), the option of introducing proficiency testing is currently a work in progress.

Markets and integrated value chains

In the past, the impact of import duties on soya beans, soya bean oilcake and poultry has often been debated in isolation, without taking an integrated approach that takes into consideration the potential impact of duties across all sections in the value chain and consumers versus unfair competition from imported poultry meat, which has an adverse impact on local poultry production and consequent feed demand.

Consequently, the OAC commissioned BFAP to undertake a study to quantify the impact of reduced import tariffs on soya beans and soya bean oilcake on the South African soya value chain, and to determine the most beneficial relationship between

poultry import tariffs and tariffs on soya beans and soya bean oilcake. This study was completed and served as a discussion point on various public platforms.

Through various commissioned discussions regarding the SVC and research – from a strategic perspective – the ideal position remains for South Africa to become competitive and economically sustainable in soya bean production closer to export parity levels.

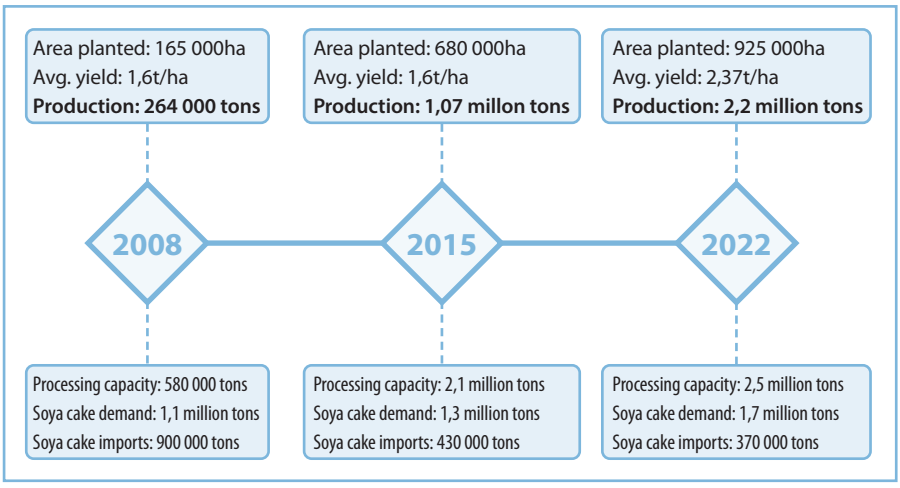
Investing in the future of soya

The overall competitiveness of the integrated soya bean and livestock value chain will be improved with the introduction of new seed technology and germplasm, as well as a constant drive for improved farming practices and efficiency in the handling and processing of soya beans. Competitiveness will also be boosted with the investment in logistics, especially in the transport of soya bean meal to the coastal areas where almost one-third of it is consumed.

It is interesting to note that this SVC initiative is not the first activity by the PRF that takes a broader approach to unpack potential future outcomes of the soya bean value chain and related segments in agriculture.

In July 2008, the PRF commissioned a comprehensive scenario planning exercise to develop alternative future outcomes for replacing imported protein for animal feed, specifically soya bean meal, with locally produced protein for animal feed, specifically soya beans. Much has happened since then.

Figure 1: Progress made in the South African soya bean value chain from 2008 to 2022.



As is seen in *Figure 1*, staggering progress has been made over just more than the past decade.

For more information, contact the author at 082 777 6892, email ferdi@bfap.co.za or visit *www.bfap.co.za*

Ek kan 'n volhoubare boerdery bou met die regte vennoot

Met meer as 'n honderd jaar se ondervinding in die finansiering van landbou, het ons generasies boere gehelp om te floreer. Laat Absa u help om u gesin die toekoms in te neem.

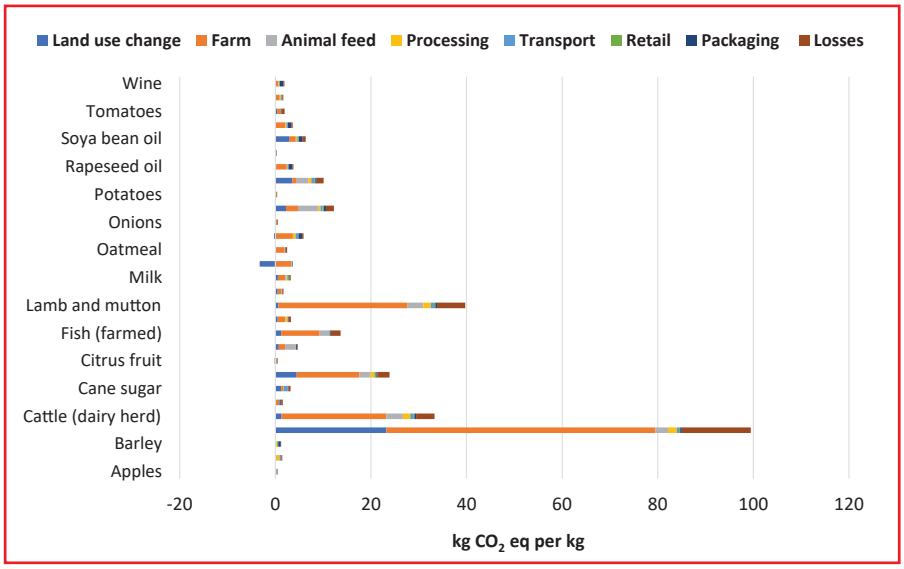
Besoek gerus ons webtuiste by www.absa.co.za

Ons doen meer sodat u u familie nalatenskap kan bewaar.
Dis Africanacity.

Climate issues require a contribution from every link in the cost chain

Climate issues and sustainability are receiving increasing attention from consumers and shareholders alike. Businesses are under mounting pressure to develop strategies in a bid to do their part in reducing global warming and using resources sustainably. Agriculture is not exempt from this. On the contrary, agriculture in general, but also specific sub-sectors within the industry, are frequently singled out as major players in the release of greenhouse gases (*Figure 1*).

Figure 1: Average greenhouse gas emissions per product. (Source: Poore and Nemecek, 2018)



In this article, we look at important concepts and developments which, if properly understood and applied, will benefit agricultural producers. We also elaborate on Absa's strategy in respect of sustainability and climate change.

Impact on producers

There are several ways in which the increasing drive to manage climate issues can affect agricultural producers. The first is the implementation of future carbon regulations in certain markets. This includes carbon taxation and declaring carbon emissions on food labels.

Carbon trading, on the other hand, can offer producers potential opportunities. While there are no established markets for this in South Africa yet, numerous developments are taking place in this regard.

Producers will have to respond to the intensified climate focus in two ways. The first is getting to grips with what their carbon footprint looks like. In this regard, it is important to determine how the footprint of different production methods presents itself, for example traditional versus zero or minimum tillage, and how the application of fertilisers and chemicals contribute to a producer's carbon footprint.

The second is to implement methods that will reduce the producer's impact. Here, increased efficiencies are one of the first elements that can ensure a smaller agricultural production impact. Examples of efficiency-enhancing solutions are nets that reduce evaporation from irrigated orchards, and help to ensure consistent fruit quality. Another example is precision farming which can limit the application of synthetic fertilisers and chemicals to a minimum.

The negative effect of livestock production on the environment is attributed largely to overgrazing and the release of greenhouse gases, specifically in intensive livestock production units. Solutions to these problems include regenerative agriculture and proper grazing management.

Climate finance

Financing plays an important role in efforts aimed at keeping climate change at bay and managing the challenges of a changing climate. In recent years, commercial banks around the world have been introducing numerous services and products relating to this.

This so-called 'green' financing can take different forms, which include offering beneficial terms for climate-friendly projects, or creating innovative financial products that reward producers or businesses for sustainable practices.

Absa is committed to effecting sustainability and limiting climate change. The bank has committed itself in this regard by becoming a signatory to the United Nations Environment Programme and Financing Initiative (UNEP FI) for Responsible Banking.

Absa has a dedicated team of specialists who can offer clients in primary agriculture and the rest of the value chain advice on investing in renewable energy sources. We realise that climate and environmental issues can no longer take a backseat, but must form part of regular conversations with our customers.

If you have financing queries or need advice on sustainability and climate-related issues, contact Absa AgriBusiness on 0860 040 302 or send an email to marlene.louw@absa.africa.

Sterk produsente, gehalte produkte, tevrede verbruikers.

GWK Oliesade

Gesels met ons span:

Andreas Snyman
andreass@gwk.co.za
082 801 1849

Cloete Nortje
cloeten@gwk.co.za
082 803 0687

Francois Cilliers
Francoisc@gwk.co.za
079 510 8474

GWK

innoveer landbou

gwk.co.za

Is load shedding leaving agriculture powerless?

By Elmarie Helberg

South Africa has literally been plunged into darkness with the continued load shedding. The ongoing impact of power outages on the agricultural sector poses serious implications for food security and the survival of the sector.

As South Africa enters the summer crop planting season, the current energy crisis might have implications for food security in the coming year. Load shedding also contributes to inflation and could result in producers planting less due to rising costs and disruption in planting schedules.

Power outages is also leading to additional increases in the cost of production for producers, at a time when South Africans are already facing food price increases. They have already been reporting major losses as processing machinery, irrigation equipment, and other machinery are damaged and coming to a standstill due to power outages.

An adverse ripple effect

According to the Department of Agriculture, Land Reform and Rural Development's statistics, the agricultural sector spent approximately R9 billion on electricity in 2021. This is more than 7% of the sector's expenditure on intermediate goods and services. Reliable power supply is especially critical for irrigation and water treatment.

Kulani Siweya, chief economist at Agri SA, says the agricultural sector is very irrigation reliant. Missing out on an irrigation window means one needs to make up for it in some other way. It usually takes up to an hour to resume irrigation once load shedding comes to an end. This is costing producers time and incurs additional labour costs. Blackouts also disrupt cooling and packing, which has ramifications for food quality and poses a health hazard for humans and animals alike. The ripple effect is even greater as access to clean water can be disrupted and wastewater treatments are brought to a standstill.

The consequences for export commodities include disruption to cold chain protocols, as mandated by foreign markets, and late shipments. These outcomes will diminish South Africa's standing as a reliable source market.

Ultimately, the greatest threat of load shedding is to the country's food security. As crops fail due to lack of irrigation or producers planting less for fear of losses, the country will bear the brunt of load shedding in the near future as the produce anticipated from this summer's crop will fail to materialise. The result will be food shortages and higher prices.

Light at the end of the tunnel?

The red tape in terms of the self-generation of electricity continues to hinder this process. "As it stands, we still don't have much clarification as to what that entails – we still don't know how this programme will work or how soon these producers will be entirely integrated into the grid," says Siweya.

"We feel like there is also lost opportunity from government involving the agricultural sector, based on that particular red tape. We have seen the lifting of the threshold with regard to licencing, producers have expressed that they have enough land to set up the power generation units, and they also got private capital, but because of the red tape, they are still limited with the amount of electricity they can produce.

"We see many producers who need to consider alternatives; some of them are leaving the grid, but spending even more on diesel for generators.

"The agricultural sector in South Africa is in a very peculiar situation because producers are receiving little to no support from the government and they still have to produce food using their own capital – this shows how resilient and agile our agricultural sector is, but we cannot use that as an excuse going forward. Government and Eskom need to deliver on what they mandated to do," says Siweya.

For enquiries, contact Agri SA at 012 643 3400 or email agri@agrisa.co.za. Alternatively, visit *www.agrisa.co.za.*

Sunflower quality in the 2021-2022 production season

By Wiana Louw, general manager of the Southern African Grain Laboratory

The Oilseed Advisory Committee (OAC) and Oil and Protein Seed Development Trust (OPDT) has been providing funding for annual crop quality surveys on sunflower seed since 2012. The samples analysed for the purpose of these surveys are submitted to the laboratory under an agreement with the commercial storage industry through Agbiz Grain and its members.

Sampling procedure

According to the procedure described in the grading regulations, samples are to be taken during the harvesting season for grading purposes at the receiving points. A sampling protocol, as developed by industry, prescribes the procedure to prepare composite samples per region for submission to the laboratory for quality analyses.

The samples are graded and milled and nutritional analyses such as protein, oil, fibre and ash are performed on the milled samples. The results of these analyses are updated on the Southern African Grain Laboratory's (SAGL) website on a weekly basis throughout the season. Once all the analyses have been completed, the SAGL compiles a report with all the results, including summaries and comparisons across seasons and regions.

One of the benefits of compiling and maintaining a database of quality data is that it enables the sunflower value chain to evaluate long-term trends on which to base decisions.

2021/2022 seasonal data

During the 2021/2022 production season, the samples for the survey were submitted to the laboratory later than in previous seasons – the production and environmental conditions cited as the main reasons for late deliveries.

The extreme climatic conditions are also suggested as a possible reason for the change observed in the quality parameters measured in this season's samples. The results of the protein and fat analyses are summarised per province along with South African averages over the last five seasons (*Figures 1* and *2*).

The weighted average crude protein content this season was 13,96%, which is the lowest of the ten seasons for which the crop survey results are available. Since the 2018/19 season, there has been a downward trend from 16,4% protein content in 2018/19 to 13,96% measured during the 2021/22 season. This trend was observed in all provinces.

The weighted average crude fat was 38,3% and lower than the 39,5% of the 2020/21 season, which was the third highest average since the commencement of the survey, and also the highest average since the 2014/15 season. Like the observation with the average crude protein

Figure 1: Average crude protein content per season.

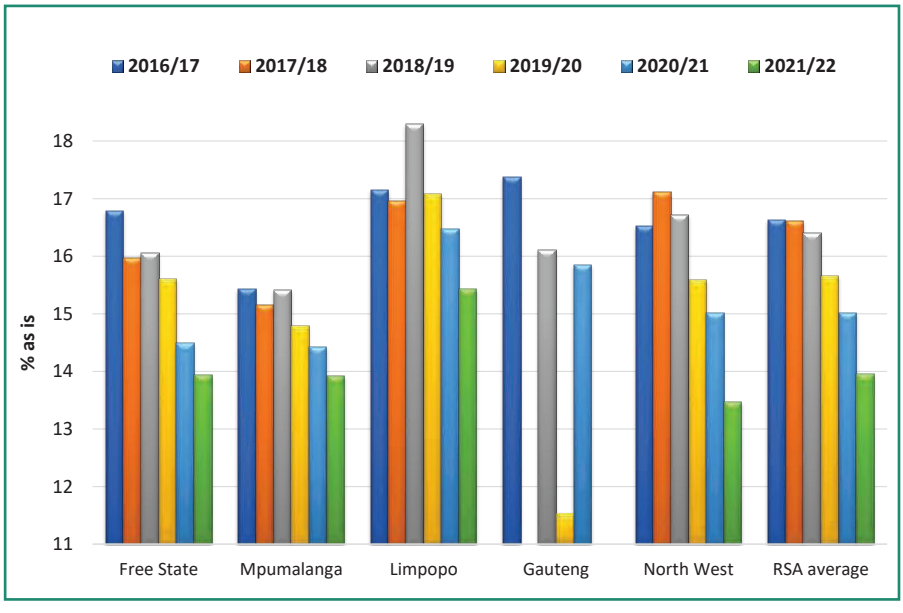


Table 1: Approximation of test weight per province over four seasons.

Province	Test weight, kg/hl											
	2021/22			2020/21			2019/20			2018/19		
	Weighted average	Range	No of samples	Weighted average	Range	No of samples	Weighted average	Range	No of samples	Weighted average	Range	No of samples
Free State (regions 21-28)	40,1	33,1 - 43,9	46	41,1	38 - 44,9	*44	40,3	27,3 - 47,3	84	40,7	33,1 - 46,8	95
Mpumalanga (regions 29-33)	39,8	35,2 - 44,5	13	41,6	40,4 - 42,5	7	43,9	43,7 - 44	6	41,2	39,8 - 42,8	8
Limpopo (region 35)	42,2	39,9 - 47,3	27	42,7	40,5 - 44,4	19	43,7	38,7 - 47,4	13	42,6	37,8 - 45,4	12
Gauteng (region 34)	41,1	–	1	42,5	–	1	34,2	–	1	42,9	42,5 - 43,6	3
North West (regions 12-20)	38,7	29,6 - 42,4	*88	40,5	30,4 - 43,7	85	39,9	30.9 - 48.4	72	40,1	30,9 - 46,5	58
South Africa (RSA)	**39,7**	**29,6 - 47,3**	**175**	**41**	**30,4 - 44,9**	**156**	**40,5**	**27,3 - 48,4**	**176**	**40,7**	**30,9 - 46,8**	**176**

**One sample with an outlier value was not taken into account for calculation purposes.*

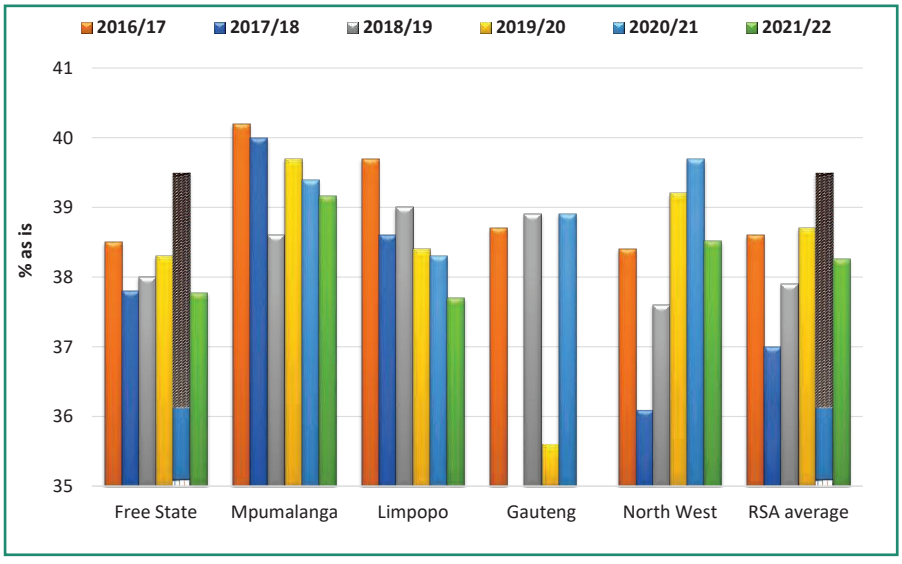
content, this trend was also observed in all the provinces.

The weighted average percentage crude fibre was 21,8%, the same as that of the previous season. The values measured in three of the provinces, namely the Free State, Limpopo and Gauteng, were higher than in the previous season. The Free State averaged 23,6%, and Limpopo and Gauteng 23,2%. This is compared to 22,3% for the Free State in the previous season and 21,4% and 22,5%, respectively, for Limpopo and Gauteng.

A total of 76% (133) of the 176 samples analysed as part of the survey were graded as Grade FH1, with 43 (24%) of the samples downgraded to COSF (class other sunflower seed). The percentage of FH1 samples is lower than the 83% of the previous season.

Test weight as a measure of bulk density of grain and oilseeds does not form part of the grading regulations for sunflower seed in South Africa. An approximation of the test weight was done by determining the g/1L using the Kern 222 instrument and converting the result according to the *Conversion Chart for Sunflower Seed, Oil* of the Canadian Grain Commission. The results are summarised in *Table 1*, comparing the test weight values over the last four seasons.

Figure 2: Average crude fat content per season.



The results of the survey are available on the Southern African Grain laboratory NPC (SAGL) website, *www.sagl.co.za.*
With gratitude to the OAC as well as the OPDT for their financial support in conducting the survey and to the members of Agbiz Grain for providing the crop samples.

Saad is die hoeksteen van landbou, daarom moet jy hoë-kwaliteit saad kry om sukses te behaal.

InteliSeed is jou vennoot met 'n spesialisfokus op hoë-kwaliteit saad en saadbehandeling.

Wat doen ons?

Deur ons tegniese bystand aan produsente op die plaas, top genetiese materiaal, omvattende en uitgebreide saadportefeuljes, en 'n landwye netwerk van ondersteuning, is ons doelwit om optimale opbrengs en kwaliteit gewasproduksie vir jou te verseker.

Watter sade verskaf ons?

Top kwaliteit groente-, olie- (sonneblom en sojaboon), mielie-, koring-, droëboon- en weidingsade, asook dekgewasse.

Besoek ons webtuiste om die Saadspesialis in jou area te kontak, of deur ons volledige produkportefeuljes te blaai.

InteliSeed
intelligent crop solutions

www.inteliseed.co.za | info@inteliseed.co.za

Evictions and emergency housing:
Should municipalities dig into their own pockets?

By Clarissa Pienaar, Moolman & Pienaar Incorporated

There are often immense delays in eviction proceedings due to differences over who is responsible for providing alternative housing to an evicted occupier.

This issue was, however, addressed in detail in the case of *Baron and Others vs Claytile (Pty) Ltd and Another (CCT241/16) [2017] ZACC 24*. The Constitutional Court ruled that the ultimate responsibility lies with the state, and not the landowner.

According to Section 26 of *The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996)*, everyone has a right to have access to adequate housing and the government must take reasonable measures within its available means to continuously ensure that this is realised. The Constitutional Court made it clear that occupiers can enforce this right against the state, and not against private individuals.

Municipal obligations

All three tiers of government (national, provincial and local) are obliged to provide suitable housing. This is especially relevant to municipalities. The Constitutional Court ruled that the municipality cannot shy away from this responsibility by indicating that no temporary alternative housing is available. Municipalities are obligated in terms of both the *Extension of Security of Tenure Act, 1997 (Act 62 of 1997)* and *The Constitution* to provide such housing.

In order to meet this obligation, the minister of human settlements, in terms of the *Housing Act (Act 107 of 1997)*, introduced a national housing programme and published a *National Housing Code* that, inter alia, contains the national housing policy. The *Housing Act* states that the *Housing Code* is binding for both provincial and local spheres of government.

Part 3 of the *Housing Code* comprises an emergency housing programme that is primarily aimed at providing temporary relief to people in emergency situations, as defined in the code. Assistance in the form of a grant is made available to municipalities (after submitting an application to the province), in order to swiftly address emergency situations by, for example, making land or housing available.

Failure to provide housing

It often happens, however, that the municipality fails to submit the application for a housing grant and then, when a situation does arise, simply states that no funds are available to provide emergency housing.

As in the Baron case, the Western Cape High Court recently ruled in the case of *Eric Lolo and Another vs Drakenstein Municipality and Four Others*, that the municipality may not rely solely on the funding from the provincial government, but is legally obligated to use its own financial resources to provide emergency housing.

The facts in the Lolo case

Mr Lolo (who had already reached the age of 60) lived and worked on a farm in Wellington until he was laid off in 2014. His daughter, Bernice Fransman, who had a minor child, was unemployed at the time of the application to the Cape High Court.

During 2015, the farm owner launched eviction proceedings against Mr Lolo and Ms Fransman, as Mr Lolo's right of tenure had come to an end along with his employment on the farm. If the eviction order were to be granted, Mr Lolo and his daughter (the applicants in the Lolo case) would allegedly have had nowhere to go.

The applicants mainly wanted the municipality to disclose to the Court the manner in which it implements its obligations to provide emergency housing to people facing eviction and distress. The applicants also challenged the municipality's emergency housing policy and housing programme, as well as the implementation thereof.

The Supreme Court held that:

- The municipality's acts conflicted with its constitutional and statutory obligations since it failed to provide emergency housing to people in its jurisdiction.
- The municipality's policy (or practice) of relying mainly on funding from the provincial government in order to provide emergency housing is unlawful.
- The municipality is legally obligated to use its own financial resources to make reasonable provision for emergency housing.

No more excuses

Municipalities can no longer hide behind the excuse of an alleged lack of housing or funding by the provincial government. The Supreme Court's ruling makes it clear that municipalities must use their own financial resources to make emergency housing available to people in need and who have been evicted, and that no more excuses will be accepted for non-compliance with the municipality's constitutional and statutory obligations.

For more information, contact Clarissa Pienaar on 033 032 0421 or clarissap@mmlaw.co.za.

Can you summarily dismiss an employee?

By Abrie Bronkhorst, senior legal advisor, LWO Employers Organisation

Case study:
You have been suspecting for months that one of your employees is helping himself to diesel from your plant's surplus tanks. One afternoon you catch him in the act. As this is a serious offence, you summarily dismiss him from your employment. But did you act according to the law?

South Africa's labour environment is strictly regulated, and employers must manage labour relations in line with legislation. However, there are several myths concerning labour law in practice, causing employers to believe they are acting in accordance with legislation, when in fact they are putting their businesses at risk.

The myth of summary dismissal

One of these myths is that an employee may be summarily dismissed when he or she has committed a serious offence. The reality is that under no circumstances (even if the employment contract makes provision for this) may an employer dismiss an employee without a disciplinary hearing first having taken place. A disciplinary hearing ensures that the procedure followed is fair and that there is a valid reason to justify the dismissal.

The majority of cases referred to the Commission for Conciliation, Mediation and Arbitration (CCMA) relate to unfair dismissal, most of which concern misconduct that led to the dismissal.

Generally, arbitration orders granted in the employee's favour are directly linked to the employer failing to follow the correct procedure. Employers must therefore understand and apply the principle of summary dismissal in the correct manner.

The disciplinary code

Every workplace must have a relevant disciplinary code, with clear rules and appropriate sanctions in place. When these rules are broken, the employer can apply progressive discipline, or in cases of serious misconduct, proceed directly with a disciplinary hearing. The employer must keep a complete record of offences and the sanctions applied.

Applying workplace discipline

The employer must consider the seriousness of the offence and apply progressive discipline accordingly. The seriousness of an offence is influenced by the type of work the employee performs, his or her level of responsibility, the (possible) consequences of the offence, and the impact the offence has on the employee-employer trust relationship.

Examples of once-off offences that may warrant summary dismissal are gross dishonesty (theft, fraud, false statement), wilful damage to property, assault or attempted assault, gross negligence, extreme cases of contempt, and intentionally endangering people's lives.

Discipline in the workplace aims to adjust and improve behaviour through corrective action, consultations and warnings, rather than punishing or dismissing an employee. Dismissal should always be the last resort.

Follow the correct procedure

For a dismissal to be considered fair in terms of labour law, two aspects must be met: substantive fairness (a valid reason for the dismissal) and procedural fairness (the correct procedure, which includes a disciplinary hearing).

However, once the employee has been found guilty at the conclusion of the hearing, he or she can be dismissed immediately. This means that from that moment on, the employee is no longer in your service and must leave the premises. A notice period does not apply.

Discipline in the workplace aims to adjust and improve behaviour through corrective action, consultations and warnings, rather than punishing or dismissing an employee.

Before dismissal for misconduct can take place, the following must be taken into account:

- Has a rule been broken and is the rule related to the workplace?
- Is this a valid rule?
- Was the employee aware of the rule or can it reasonably be expected that the employee was aware of the rule?
- Is this rule applied consistently?
- Was dismissal the appropriate sanction for the offence?

Employers must act proactively and ensure that employment contracts, the disciplinary code, procedures and policies are in place, and that this documentation complies with applicable legislation.

The LWO Employers Organisation assists employers to comply with labour law, and to use it to their advantage to protect their business. As a registered employers' organisation with the Department of Employment and Labour, the LWO has the right to represent members at the CCMA. Contact the LWO on 086 110 1828 or send an email to info@lwo.co.za.

LWO
WERKGEWERSORGANISASIE
EMPLOYERS ORGANISATION

A NON-PROFIT ORGANISATION THAT SUPPORTS FARMERS DURING TIMES OF NEED

SCAN AND DONATE

Simply scan the QR code with your banking or Snapscan app to donate.

OR

Donate directly to our bank account:

Account Name: AGRI RELIEF FOUNDATION
Bank: Absa | Branch Code: 632006
Account Type: Cheque account
Account number: 4101472019

(Email us for information on tax relief for donations)

Together, we make it better

For more information:
info@agrirelief.co.za | www.agrirelief.co.za | 012 843 5660

AGRI RELIEF FOUNDATION

Agri Relief Foundation will start accepting applications for donations from 01/01/2022.

What benefits our farmers,

benefits us all ...

Combined solutions for optimal performance ...

BAYER

What does your farm's future look like?

At **Bayer**, your success, is our success, your family is our family, and the vision you have for your farm is our vision too. With hands-on support in every step of your farming journey, we help you plant, grow, and reap your success. Creating a better tomorrow – not only for your farm, but also for our people, and our planet.

Let's partner in our goal to shape agriculture and build a future where there is ...

Your pride *our passion*

Health for all,
Hunger for none

www.cropscience.bayer.co.za /// www.bayer.co.za /// **Tel:** +27 11 921 5002
@DEKALBSA | @Bayer4Crops

Bayer (Pty) Ltd. Reg. No. 1968/011192/07. 27 Wrench Road, Isando, 1601. PO Box 143, Isando, 1600.

A33619