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OILSEEDS focus

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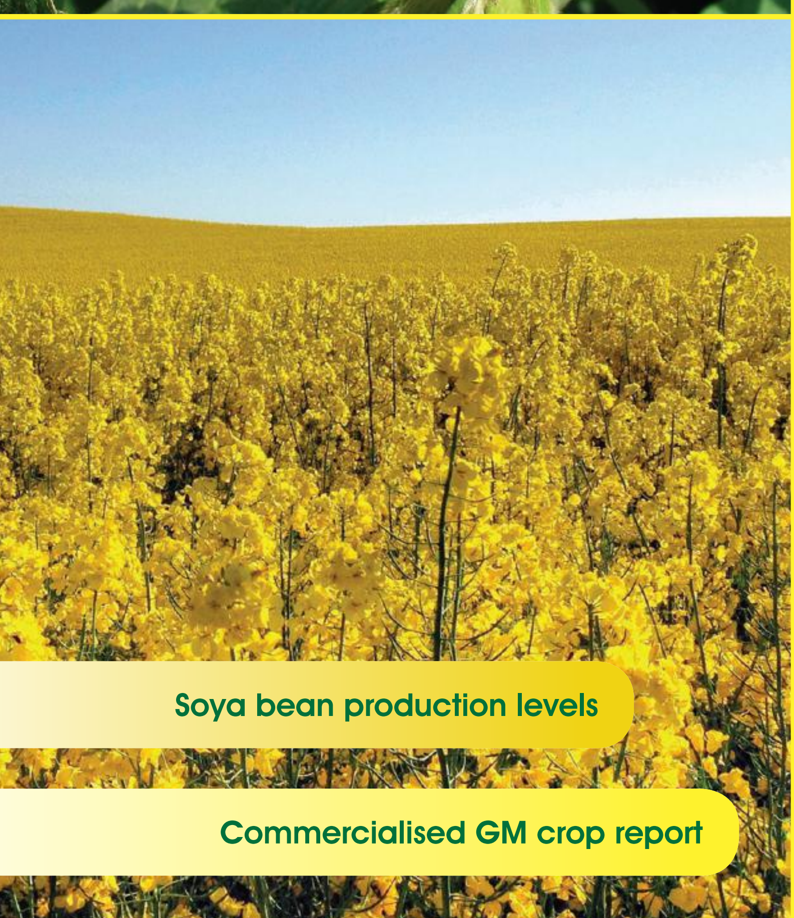
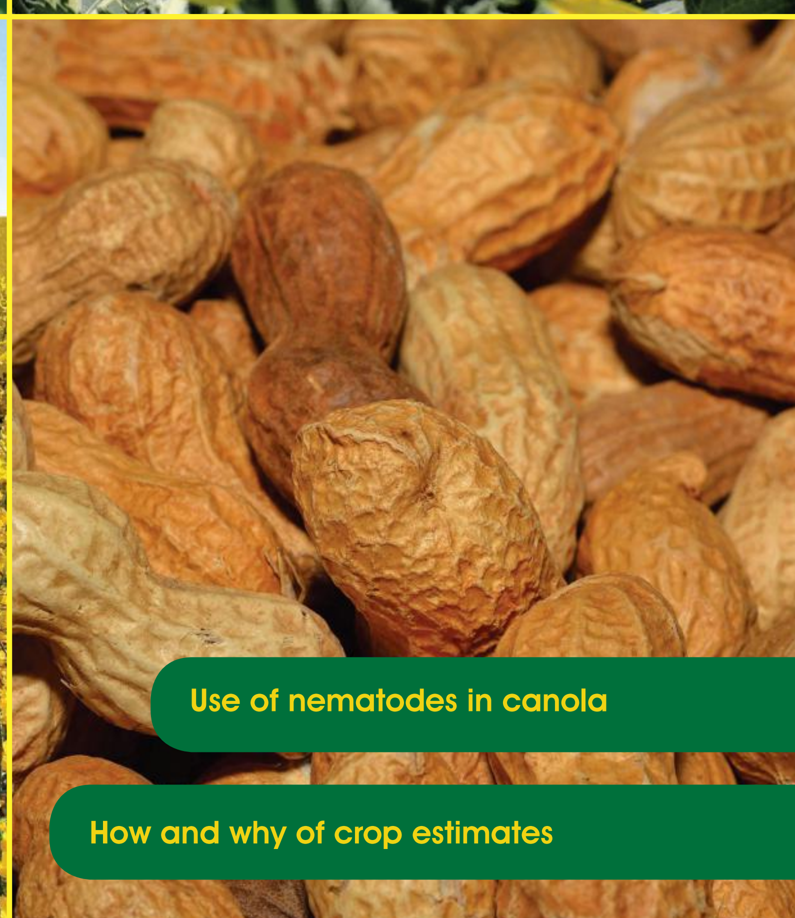
Soya beans • Sunflower • Canola • Groundnuts





Soya bean production levels

Commercialised GM crop report

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Soya bean crushing:
An industry comes of age

By Russell du Preez, Russellstone

Historically, soya meal did not have a place in the South African feed industry. In the 1970s, fish meal supplemented animal feed requirements. Soya bean production was minuscule and only received real attention after 1996.

As production increased, raw soya beans were an export orientated product, while the local feed industry depended on soya meal imports. Being of an 'inferior' quality, it was believed that South African soya bean cultivars were not suited to value-add crushing. But bean quality was not the whole problem.

Crushing machinery had not been adapted to suit the unique characteristics of South African cultivars. Local soya bean crushing only really took off in 2012 when industry players began importing state-of-the-art crushing machinery, which was adjusted to optimise the crushing of South African cultivars into the highest quality value-added soya bean products.

The client is king

The client is king in the crushing industry. Consumers of soya products have precise specifications regarding protein content, urease, and fibre and moisture, as deviations cause complications in animal feed rations. Further, product specifications differ according to the consumer, forcing soya bean crushers to be versatile with a meticulous understanding of industry, machinery and beans. A holistic approach to soya bean crushing is the key to producing international standard meal consistently.

"In the ideal world, soya bean cultivars would be engineered to have a higher oil and protein content, variations that are currently not possible."

While soya meal is the core output of any soya crushing operation, real industry players ensure nothing is wasted turning by-products into value-added marketable outputs. Crude oil is one by-product with a significant market, but with resourcefulness and an entrepreneurial drive there is always the potential of breaking new ground.

An industry specific example is the growth of the South African soya hull market, which initially was non-existent. Soya hulls are competitively priced and their fibre content is unparalleled. With the right people bringing this undervalued product to market, local soya hull production does not satisfy South Africa's annual demand.

South Africa's soya crushing industry has grown considerably in a relatively short period of time. Once dependent on imports, the whole of the reef region now consumes locally crushed soya meal. Coastal regions are still reliant on imported meal. Product delivered directly to ports is more competitively priced than meal sent from inland depots. But this is soon to change.

Higher production needed

In the ideal world, soya bean cultivars would be engineered to have a higher oil and protein content, variations that are currently not possible. For crushers to produce the volumes needed to outcompete meal imports, it is essential that farmers increase production. This can be achieved by planting high yielding and drought resistant cultivars.

Soya bean genetic selection is an industry on the rise. Role-players target regions with superior soya bean cultivars and carefully select those that are suited both geographically and agronomically to specific South African growing regions.

Synergies created by integrating the value chain are vitally important for growth. The challenges in the immediate future are capturing the coastal animal feed market and increased local human consumption, opportunities that leave space for considerable growth and a prosperous short to medium term future.

Can Africa **feed** itself in **ten** years?

Africa's agricultural imports of USD35 billion per annum is considerably higher than their exports. Africa needs to produce not only more basic agricultural commodities, but move into the realm of further processing. Moving up the value chain will result in higher revenue, and assist in creating key agribusiness employment.

The high technology and manufacturing sector has been slow and is likely to continue to develop slowly in the African scenario, hence the importance of agribusiness manufacturing. Funding of farming operations is critical to growth – the lack of funding and access to funds can probably be highlighted as one of the major hurdles holding back expansion of agribusiness.

South African success

There are many hurdles, but the high unemployment is leading to unrest. To assist in stability, agribusiness may be an excellent solution. Numerous new African governments exist with exciting new ideas, and they should be encouraged to do everything possible to support agribusiness in Africa.

South Africa has reduced hectares of maize produced from 3,6 million to 2,6 million over the last 20 years, while at the same time increasing production from 7,7 million to 16 million tons, mainly through a drive for efficiency.

This drive for efficiency has been forced by global volatility in pricing, including all-time lows in pricing due to oversupply. The adoption of technology has played a critical role to remain internationally competitive and for the farming community to survive.

Value of technology

The oilseed industry has accomplished improvement from 125 000 hectares of soya bean 20 years ago to 574 000 hectares. At the same time production increasing from 197 000 tons to 1 340 000 tons is an illustration of not only growth in the industry, but also the value of technology.

In 2017, South Africa exported USD9,2 billion of agricultural products while importing USD7 billion, indicating a successful industry which needs to be nurtured and grown.

The target of the Protein Research Foundation to produce 2,5 million tons of soya beans by the year 2020 on the road to self-sufficiency, is a steep challenge. Yet this will be achieved if we can increase hectares mainly through crop rotation; achieve major increases in yield by continuously upgrading to the latest genetics; continued improvement in technology and favourable weather conditions.

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.

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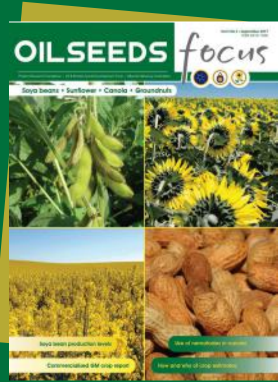

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NEWS

New peanut shelling plant opens

The Golden Peanut and Tree Nut company recently opened a new peanut shelling plant in Hartswater, South Africa. The official opening that took place on 24 August 2017 at The Venue in the Northern-Cape, was attended by role-players in the industry.

According to Alfonso Visser, CEO of Golden Peanut and Tree Nut company, they are positive about the peanut industry in South Africa. "The new shelling plant, which is the largest in the Southern Hemisphere, was engineered to function as do the company's plants in the United States. The plant will make use of the latest technology and mechanisation," says Visser.
– RSG Landbou

First large-scale rapeseed plant in UK since 1980s

The RCMA Group, which was launched 230 years ago as a maize trading company but has since grown into a global commodities trader, is building the first large-scale rapeseed processing plant in the United Kingdom since the 1980s.

The facility, which will be located in Atherstone on Stour, will process only UK-grown rapeseed in answer to growing demand from UK food buyers for a rapeseed supply chain that offers complete traceability.

The facility is also being built with a high level of sustainability integrated into its infrastructure. It will be able to generate its own internal energy from a combined heat and power plant that will use UK forestry residues and offcuts as its biomass fuel, and is being situated near rapeseed production to reduce transportation needs.
– Oilseeds and Grain

New breed of oil palm could double yields

A new type of oil palm that was developed using traditional breeding methods by SMART Tbk, a subsidiary of Golden Agri-Resources, may double crude palm oil yields while also having a quicker time to harvest of 24 months.

Two clones of palm planting material called Eka 1 and Eka 2 were granted approval for use in April by Indonesia's Ministry of Agriculture and have been registered in Indonesia's Catalogue of Seeds.

While Indonesia's current average yield stands at 4 tons per hectare, expectations are that Eka 1 seedings will produce yields of 10,8 tons of crude palm oil per hectare once prime age of 10-18 years is achieved, while Eka 2 seedings are expected to see yields of 13 tons per hectare, raising oil extraction levels by 32% and 36% respectively. *– Dairy Reporter*

Wheat no longer Canada's king crop

Farmers planted more canola this year for the first time since Canada developed the oilseed used to make the cooking oil used in everything from salad dressing to French fries.

Canadian farmers planted a record-high 22,8 million acres of canola in 2017, up 12,1% from 20,4 million acres reported in 2016, according to Statistics Canada. The area seeded to wheat in 2017 declined by 3,7% from 2016 to 22,4 million acres.

Canola planting rose 12% to a record 22,8 million acres from a year earlier, Statistics Canada data showed on June 29. Wheat seeding fell by 3,7% to 22,4 million acres, trailing the 23,2 million the government forecast in April and the 22,8 million expected by analysts in a Bloomberg News survey.

Canola is "one of Canada's greatest crop inventions" and started with 3 200 acres planted in 1943, Statistics Canada said. The survey among 24 500 farms for the latest data was taken from May 26 to June 12, and the final 2017 tally will be released on 6 December. – *AgUpdate*

Closing of historic chemical merger

Dow Chemical Co. and DuPont Co., the two largest United States chemical makers, have received all the regulatory approvals needed to close their historic merger.

The deal will be completed after the stock market closes on 31 August. Shares of DowDuPont Inc. will begin trading 1 September under the ticker DWDP.

The companies, with a combined market value approaching $150 billion, would surpass BASF SE as the world's largest chemical company. Within 18 months of closing, DowDuPont has said it will split into three separate companies focused on agriculture, specialty products and materials.

In response to investor concerns, the boards of both companies are reviewing the planned three-way separation to determine what combination of spinoffs would create the most value for shareholders. The review is being led by Dow CEO Andrew Liveris, DuPont CEO Ed Breen, DuPont lead director Sandy Cutler and Dow lead director Jeff Fettig.
– *Bloomberg*

Sunflower seed overview for August

The relatively lower sunflower seed prices have led to an increase in consumption or usage. As shown in Sagis data for June 2017 that South Africa's sunflower seed consumption (crushed oil and cake) increased by 48% month-on-month and 14% year-on-year in June 2017 to 68 482 tons.

The supply in the market remains solid, despite the aforementioned uptick in usage. This, too, is evident from Sagis data for June 2017 which showed that South Africa's sunflower seed ending stocks were recorded at 711 486 tons, up 30% from the previous month and 68% from the corresponding period last year.

In the western parts of North Western province, some farmers were still finalising the harvest process in August. Worth noting, however, is the areas that planted late received lower yields of between 0,6 and 0,7 tons per hectare. This is well below the national average yield of 1,3 tons per hectare. However, the National Crop Estimate Committee still believes that South Africa will have large supplies this season.
– *Wandile Sihlobo, Agbiz*

Record soya bean imports congest China's ports

Huge soya bean imports in recent months by China, the world's top buyer of this commodity, led to severe congestion in Chinese ports. Ships carrying as much as 700 000 tons of soya beans were lined up along China's coast waiting to discharge early in July 2017.

The worst congestion was at Rizhao, one of China's main ports for soya bean imports, where six or seven vessels carrying about 400 000 tons of the oilseed were waiting to discharge.

"The beans can't be discharged because they don't have enough warehouses," said a trader with an international firm who declined to be identified.

Eleven boats were waiting to anchor at Rizhao the previous week, with two more waiting to unload, according to data from Shanghai JC Intelligence Co.

More vessels elsewhere in China, with around 300 000 tons of soya beans, were also stuck at ports, said another trader at an international firm that also runs processing plants in China.

China imported a record 9,59 million tons of soya beans in May, and arrivals last month probably reached approximately 9 million tons, traders said. But while buyers rushed purchases, tougher customs inspections have slowed movement of cargoes through ports.

The slowdown at ports and long waiting times to clear customs may threaten a recent rally in Chinese soya meal prices and may stir concern about demand from major exporters Brazil and the United States. – *reuters.com.*

Global status of commercialised biotech/GM crops: 2016

Agricultural Biotechnology Industry Press release, 20 June 2017

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) publishes an annual global review of biotech crops commercialisation or the ISAAA Briefs. It is one of the most cited references in modern agri biotechnology due to its credibility and accuracy. Since the adoption of biotechnological crops in 1996, ISAAA has remained the single most prominent source of this information.

The year 2016 was momentous, since for the first time Nobel Laureates released a statement in support of biotechnology, condemning critics for their stance against the technology and the development of golden rice. Guided by the 2030 Agenda for Sustainable Agriculture, the Food and Agriculture Organisation of the United Nations, International Food Policy Research Institute, G20 countries and other like-minded bodies have committed to eradicate hunger and malnutrition within 15 years.

More importantly, the United States (US) National Academies of Sciences, Engineering and Medicine has published a review of 900 studies on biotech crops since 1996 and found that genetically modified (GM) crops and conventionally bred crops do not differ in terms of probable risks to human health and the environment.

Biotech crops have had an unblemished record of safe use and consumption for over 20 years. Future generations can benefit greatly from wide choices of biotech crops with improved traits for high yield and nutrition as well as safety regarding use and the environment.

Highlights of 2016 adoption

Planting of hectares worldwide: A year after the second decade of commercialisation of biotech/GM crops in 2016, 26 countries grew 185,1 million hectares of biotech crops – an increase of 5,4 million hectares or 3% from 179,7 million hectares in 2015. Except for the 2015 adoption, this is the 20th series of increases each year; and notably 12 of the 20 years consisted of double-digit growth rates.

Global area of biotech crops: Global hectarage of biotech crops has increased around 110-fold from 1,7 million hectares in 1996 to 185,1 million hectares in 2016. This makes biotech crops the fastest-adopted crop technology in recent times. An accumulated 2,1 billion hectares or 5,3 billion acres were achieved in 21 years (1996–2016) of biotech crop commercialisation.

Global adoption rates: The 185,1 million hectares of biotech crops were grown by 26 countries, of which 19 were developing and seven industrial countries. Developing countries grew by 54% (99,6 million hectares) of the global biotech crop area compared to 46% (85,5 million hectares) for industrial countries.

The four major biotech crops – soya bean, maize, cotton and canola, in decreasing area – were the most adopted biotech crops by 26 countries. The area planted to biotech soya bean was the highest at 91,4 million hectares, making up 50% of the global hectarage of 185,1 million hectares for all biotech crops.

Although the soya bean area only showed a marginal decrease of 1% from 2015 (92,7 million hectares), the area is still substantial at 91,4 million hectares. Based on the global crop hectarage for individual crops, 78% of soya bean, 64% of cotton, 26% of maize and 24% of canola were biotech in 2016.

Biotech countries

Of the top five countries growing 91% of biotech crops, three are developing (Brazil, Argentina and India) and two are industrial (US and Canada).

The US leads biotech crop planting in 2016 at 72,9 million hectares, followed by Brazil (49,1 million hectares), Argentina (23,8 million hectares), Canada (11,6 million hectares) and India (10,8 million hectares) for a total of 168,2 million hectares, 91% of the global hectarage.

- **Ten countries in Latin America grew approximately 80 million hectares of biotech crops.**
  Except for Chile and Costa Rica which continuously plant biotech crops for export, biotech crop countries in Latin America grew biotech crops for food, feed and processing. Brazil obtained the highest increase of 11% or 4,9 million hectares of biotech crops in 2016, occupying 27% of the global biotech crop area.
- **Eight countries in Asia and the Pacific grew approximately 18,6 million hectares of biotech crops.**
  Biotech crops planted in the eight biotech crop countries of Asia and the Pacific ranged from fibre (cotton), feed (maize and canola) and food (maize and eggplant). Adoption of these biotech crops varied in 2016: India and China's biotech cotton planting was extremely affected by low global

cotton prices, while Pakistan and Myanmar maintained their biotech cotton area. The area planted to biotech maize in the Philippines and Vietnam increased due to high demand for livestock and poultry feeds, as well as favourable weather conditions. In Australia, favourable weather conditions after two years of drought permitted increased planting of biotech cotton and canola.

- **Four countries in the European Union (EU) continued to plant biotech maize at more than 136 000ha.**
  Four countries in the EU continued to plant biotech maize [imidazolinone-resistant (IR) maize event MON 810] in 2016. They consisted of Spain with 129 081ha, Portugal (7 069ha), Slovakia (138ha) and the Czech Republic (75ha) for a total of 136 363ha. Thus, a significant difference of 19 493ha or 17% increase from 116 870ha in 2015 was achieved. The more than 95% of the total biotech maize in the EU was planted in Spain.
- **On the African continent, South Africa and Sudan increased planting of biotech crops.**
  By 2016, at least four African countries had in the past placed a GM crop in the market – Burkina Faso, Egypt, South Africa and Sudan. However, due to a temporary setback in Burkina Faso and Egypt only South Africa and Sudan planted biotech crops at 2,8 million hectares. South Africa is one of the top ten countries planting more than one million hectares in 2016 and continued to lead the adoption of biotech crops on the continent. Biotech maize, soya bean and cotton area increased to 2,66 million hectares in 2016, a 16% increase from the 2,29 million hectares in 2015.

Contribution of biotech crops

Biotech crops contributed to food security, sustainability and climate change by:

- **Increasing crop productivity** by 574 million tons valued at US$167,8 billion from 1996 to 2015 and 75 million tons valued at US$15,4 billion in 2015 alone.
- **Conserving biodiversity** from 1996 to 2015, by saving 174 million hectares and 19,4 million hectares in 2015 alone.
- **Providing a better environment** by saving 620 million kilograms of active ingredient of pesticides from 1996 to 2015 and by 37,4 million kilograms in 2015 alone.

South Africa's status

South Africa planted its first biotech crops – insect-resistant cotton – 19 years ago in 1998. Insect-resistant maize and herbicide-tolerant soya bean followed in 2000 and 2001, with herbicide-tolerant maize in 2003. In 2016, the country planted 2,66 million hectares of biotech crops comprised of maize (2,16 million hectares), soya bean (494 000ha) and cotton (9 000ha).

This was a 16% increase from the reported biotech crop area of 2,29 million hectares in 2015. The average biotech crop adoption increased marginally to 91% in 2016. The total area planted to maize, soya bean and cotton was 2,93 million hectares, a 15% increase from the last report in 2015.

The El Niño weather pattern persisted from 2015 through to November 2016, seriously damaging all agricultural sectors, water resources, grazing for livestock and resulting in raised food prices. A La Niña pattern developed later during December, with good rainfall in most parts of the country except for the far western provinces. Promising outcomes include increased late planting of food crops and expected higher crop yields per hectare.

Since 1998, the 70 events approved for planting in South Africa include five Argentine canola events, ten for cotton, 42 for maize, one rice event (for food) and twelve soya bean events.

Biotech maize

South Africa is set to harvest the largest maize crop on record, estimated at 15,63 million tons. The average maize yield is

WEMA project

In partnership with Kenya, Mozambique, Tanzania and Uganda, South Africa is involved in the development and deployment of biotech maize under the Water Efficient Maize for Africa (WEMA) project. Maize varieties with stacked drought tolerance and insect resistance were approved in June 2015, but seeds will only be available in late 2017 to a limited number of smallholders. The official wide-scale release to commercial farms is planned for 2018.

Maize production in South Africa indicates the long-term trend of producing more maize on less area, with the use of more efficient and effective farming methods and practices. These are accompanied by the use of less marginal land in the maize production systems, better seed cultivars and adoption of biotechnology.

With biotechnology, maize yield has doubled over the past 20 years in South Africa (USDA, A*gricultural Biotechnology Annual* for South Africa, 2016).

estimated at 5,95 ton per hectare, which is also the highest ever and constituting the highest national maize average in Africa.

Maize is the main field crop in South Africa and is used for both human consumption (mainly white maize) and animal feed (mainly yellow maize). Biotech maize was planted on 2,16 million hectares at an adoption level of 90%, 22% higher than 2015. This hectarage comprised of 19,5% (420 000ha) insect-tolerant, 18,9% (407 000ha) herbicide-tolerant (HT) and 61,7% (1,33 million hectares) of stacked IR/HT maize.

Biotech white maize was planted on 52% (1,123 million hectares) of the total biotech maize, with yellow maize at 48%. Maize is the most critical staple food in the country and the Southern African Development Community region. The severe drought had hit food production very hard in this area. It soon became clear that South Africa would become a net importer of maize and early 2016 indications were that some three million ton of commodity maize will have to be imported.

The country requires 10,5 million tons to be produced annually, but only 7,5 million tons were produced in the 2015 harvest season. The price of white maize escalated to a peak of R5 500/ton (US$408), which prompted the government to intensify the issuance of import permits. Approximately 94,9% of the 628 permits were for white maize.

New information on imported volumes and late rains showed higher-than-expected yields of crops on the field and more stocks available with US grain entering, creating a possible surplus, and presenting challenges for local farmers as white maize prices dropped to approximately R2 300/ton (US$170).

Despite these setbacks, farmer confidence has been improved and normalcy returned in early 2017. Hence, the latest estimate on the area of biotech maize planting indicated a 22% increase of up to 2,16 million hectares.

Biotech soya bean

Soya bean has been planted in South Africa since 2001 and in 2016 it was planted on 520 000ha, a 3% decrease (15 000ha) from 535 000ha planted in 2015 due to drought. Biotech soya bean was planted on 494 000ha, 95% of the total soya bean area.

Experts believe that the increasing trend in soya bean hectarage before the onset of the drought in 2015/16 will continue due to the demand created by the growing investments in the oilseed-processing industry in the country. The United States Department of Agriculture (USDA) post estimates that there will be a 39% growth in the area planted with soya beans in 2016/17, due to the added soya bean crushing capacity and increased affinity by farmers to use soya beans as rotational crop with maize (USDA *FAS GAIN Agribiotechnology*, South Africa, 2016).

The Oilseed Industry Office has been stimulating and supporting soya bean adoption by way of new imported varieties, better use of Rhizobia and farming systems. The Industrial Development Council has provided funding through the Department of Trade and Industry to boost oilseed pressing facilities.

Biotech cotton

Cotton with insect resistance [*Bacillus thuringiensis* (Bt)] has been planted in South Africa since 1998, and in 2016 there were 9 000ha planted to IR/HT cotton, a 25% decrease in planting due to drought and low global cotton price. All cotton is GM with Bt-Bt stack and glyphosate tolerance. It is expected that cotton prices will increase as global prices stabilise, leading to increased prospects for cotton in the 2017/18 season.

Economic benefits

It is estimated that the economic gains from biotech crops for South Africa for the period 1998 to 2015 was US$2,1 billion, and US$237 million for 2015 alone (Brookes and Barfoot, 2017, Forthcoming).

Biotechnology continues to be a good investment for millions of farmers across the globe. In 2015, for each additional dollar invested in biotech crop seeds globally, farmers netted an average US$3,45. In developing countries, farmers received US$5,15 for each extra dollar invested in biotech crop seeds, whereas farmers in developed countries received US$2,76 for each extra dollar invested. Biotech crops are here to stay and will continue benefiting the ever-growing population with new GM crops and traits to cater to the needs of farmers and consumers alike.

Big year of the soya bean

By Jan Dreyer, Protein Research Foundation

The past season has favoured soya beans by presenting us with several records. For the first time the total harvest exceeded 1,34 million tons with a production figure of more than 2,34 tons per hectare – the highest ever. Add to this a very favourable soya bean/maize price ratio, which resulted in positive profit margins in favour of soya beans. Sadly, though, these records did not coincide with even bigger soya bean plantings.

The coming season would probably see a re-entry of players, and especially new entrants, while it would also benefit the old hands who may want to reconsider some production aspects for a moment.

Why soya beans?

The crop fits into the summer crop area as though it was made for it. It provides the ideal opportunity for crop rotation using maize – where maize follows soya beans, there is a strong possibility that a producer can expect a 10% greater maize yield.

The past season once again put strong emphasis on the importance of risk management. Not only is physical yield at stake, but the last season certainly and specifically underlined price risks. A single crop cultivated year after year, poses more disadvantages than benefits. Add to this the shift from conventional to conservation farming, and rotation with especially soya beans becomes a given. Seasons vary with very low predictability, so spread your crop risk, as well as your price risk, as this will benefit you over the long term.

Production aspects

Field selection is an aspect that requires close attention. If a particular field was planted with sunflowers, peanuts, dry beans and even soya beans last season, then soya beans are not a good follow-up choice.

Fields with a history of sclerotinia contamination and root-knot nematodes should be avoided.

Weeds in a field cannot only steal your joy, but also your profit. Now is the time to ready your game plan to ensure that soya beans are planted in a weed-free field the coming season. Planning includes ensuring that the waiting period of the herbicides applied last season has already expired. Make sure which pre-emergence intervention will be used and how post-emergence weeds will be controlled.

To apply effective weed control, a farmer needs to know which weeds will harm his crops and how it can be controlled. Weed control is only as good as the efficiency with which it is executed. The nozzles must be right – pump pressure and water volume per hectare are just as important. Where tank mixtures are used, ensure that the various chemical substances are compatible.

Are soil samples necessary?

Don't venture guesses as to what is going on in your soil – rather use soil analyses to formulate your fertiliser strategy. Soil samples are only useful if it is representative of the field, so try to take samples correctly. This is something a reliable fertiliser consultant can help you with.

Use the soil information to make corrections ahead of time, and remember that liming will activate certain herbicides. Remember that after a record year, a record amount of nutrients will be extracted from the ground. Potassium in the soil (including substrate) will probably be low. Soya beans require at least 25kg potassium for each ton of production.


Make sure the combine harvester is ready at harvest time. (Photograph: Infoworks)

Fertilisation guidelines are freely available on the Protein Research Foundation (PRF) website, *www.proteinresearch.net*. It remains a good policy to fully supplement the nutrients extracted from the soil during a particular season as soon as possible.

Cultivar choice

This topic can cover numerous pages and generate many arguments. To select cultivars for a specific region, you must utilise all of the reliable sources in your area. The soya bean cultivar recommendations by the Agricultural Research Council (ARC) are a good starting point. Add to this information regarding cultivar trials conducted by seed companies, and do not forget about producer trials which are carried out with great dedication and accuracy.

Regardless of cultivar choice, make sure the cultivar resides in a growth class (maturity group) that applies to your area. The boundaries, of course, are blurred, but in general they can be divided into cool, moderate and warm areas. Consider normal entry dates of frost.

Choose cultivars that have been adapted to the three climate zones in your area. Preferably choose four cultivars from different maturity groups, if practically possible, because they spread risk and offer producers a buffer against fluctuating environmental conditions and diseases.

Non-negotiable requirements for the selected cultivars are purity of seed, good germination and especially growth potential.

Because there is a significant possibility that larger soya bean plantings will take place this season, one needs to acquire the seed of desired cultivars as soon as possible and guard against 'over the fence transactions'.

Prepare all equipment

Regardless of which production programme is followed, the planter remains one of the most important components of any programme. Accurate depth placement (preferably not deeper than 4cm) and kernels (not closer than 3cm) in the row are the beginning of a record harvest. Production areas and fields differ.

Where diseases are not a problem, the following rule of thumb applies: the narrower the rows, the higher the yield. Practical conditions on a farm usually determine row widths. All equipment, but especially nozzles, must be serviced and calibrated.


Make sure the planter is correctly calibrated in terms of plant depth and plant condition. (Photograph: WF van Wyk, PRF-contractor)

Make sure that there is harvesting capacity when you start to harvest. A so-called 'flexi' table would be preferable because soya beans may bear low pods. Especially important is the timelines of harvesting, as open pods can lead to substantial damage.

Seed inoculation

Nitrogen binding is a prerequisite for bumper soya bean harvests, and requires Rhizobium bacteria. Buy your inoculant from a reputable supplier. Handle this inoculant like medicine: avoid sunlight, store it according to directions and administer it according to the instructions. Be sure to check the expiration date and to use the inoculant before that date.

Inoculants can be applied in the furrow or on the seed, or use both methods to be sure. Inoculate all soya bean seeds, irrespective of whether soya beans were planted in a field previously. Low pHs can limit nitrogen binding. Consult an expert for the application of molybdenum.

Select the planting date

Select the planting date according to the area in which you farm. A guideline will be:

- End October to end November for cool areas.
- Early November to early December for mild areas.
- Mid November to mid December for warm areas.

In the majority of cases, rain determines the planting date. Take into account, however, that the later the optimal planting date, the lower the yield potential will be. Soil temperature must be at least 15 degrees or higher before planting.

The golden rule remains: do not plant soya beans in dry soil – transfer moisture or good rains received prior to planting time, tend to reduce yield risk. Plant when moisture is sufficient throughout the root zone. Use all available information regarding soya beans to ensure success. Remember the PRF website and the soya bean production manual, as well as the ARC-Grain Crops Institute as sources of information, to name only a few.

Closing wish

Join a soya bean research group – not only will it save you a large sum of money, it will also offer a learning experience that you will thoroughly enjoy.

Make sure you do not miss the year of the soya bean – your crop partner through good and bad economic and production seasons.

Soya beans – research to your advantage

By Willem Otto and Roean Wessels, Sensako, Bethlehem

Soya bean production is currently on everyone's lips. The crop continued its growing trend in hectares planted and according to the National Crop Estimate Committee, 573 950ha were planted in the past season (*www.sagis.org.za/CEC*). Especially in the Free State the area planted increased.

Product price per ton, adjustment in planting time with the new cultivar series available, as well as other crop management options make the crop more attractive for placement in crop planning. The input and dedication of the Protein Research Foundation (PRF) and other role-players in this regard deserve applause. The industry expansion has come about with vision, insight and hard work.

As expected, the demand for information from producers regarding the best soya bean practices has also expanded. New cultivars have been developed and released for the growing market, responses to new production problems and difficulties have been researched and developed, and several further developments are currently under way.

Information on a wide range of soya bean cultivation aspects is available on the PRF's website (*www.proteinresearch.net*). This includes various videos about soya bean cultivation compiled by Wessel van Wyk.

Production considerations

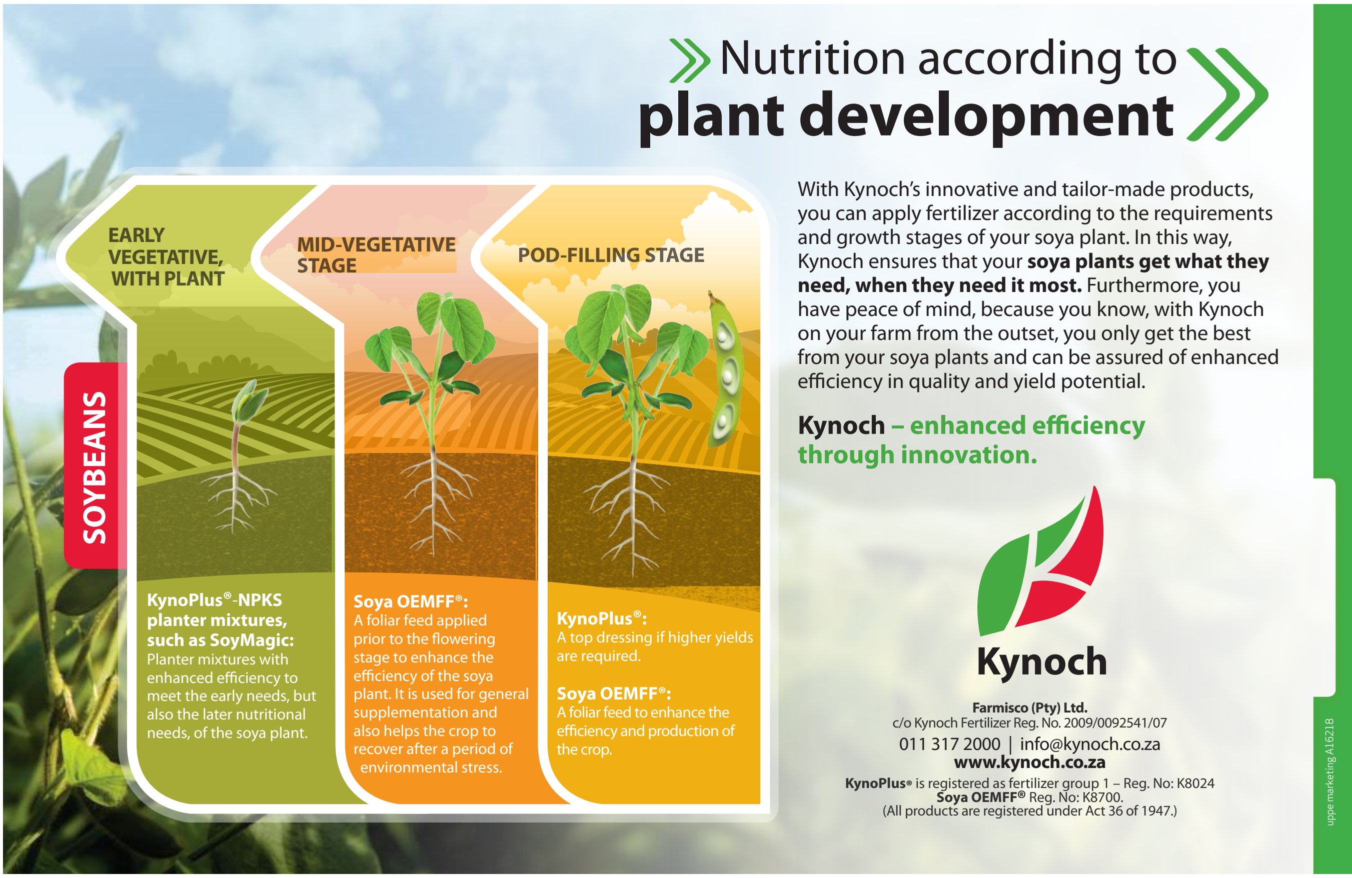
What information does a producer need to consider in the decision-making process and planning phase of soya beans?

According to an investigation conducted by Blignaut and Taute (2010), the potential production areas in South Africa are divided into zones suitable for soya bean cultivation as well as the growth classes that would be recommended in these areas.

The categorisation was based on soil classification and climatic conditions that include temperature, humidity, rainfall and heat units. Are there possibilities for soya beans to form part of crop rotation in a given production area? Financial considerations such as income per hectare, operating budgets and mechanisation planning all play an important role.

Under irrigation, the plant and harvest dates of the different crops in rotation are critically important to assist in deciding when the plant window for soya beans will be

The soya bean plant is a photoperiodic crop that responds to daylight length during the development stages of the season.



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available. The planting time in a given area determines the choice of growth class of the cultivar which will best match this and deliver optimal results.

According to Van Wyk and De Beer (2009), the soya bean cultivars' maturity grouping (MG) in South Africa is divided according to the four cultivation zones identified, namely: Cold – MG 4 and 5, Cool – MG 5 and 6, Moderate – MG 6 and Warm – MG 6 and 7.

Daylight length

The soya bean plant is a photoperiodic crop that responds to daylight length during the development stages of the season. The period from plant to flower is determined by temperature and daylight length, and a larger plant with more leaves (leaf factory) that can intercept sunlight for a longer time and translocate plant sugars during the grain-filling period, leads to the highest grain production. The transition phase to flowering and thus the reproductive phase of development is specifically initiated by shorter daylight length (longer dark phase).

Daylight length changes throughout the year for a given area according to a fixed and predictable pattern and is not as volatile as other climate factors. Cultivar selection and growth class must, therefore, be chosen to optimise the two yield factors, namely leaf factory size (length of vegetative growth phase) and grain filling period.

The planting date is an integral part of the process because the daylight length pattern for the rest of the season is linked to it. Consequently, changes in this date will necessitate the adjustment in growth class selection which will be affected least by the planting date. If the planting date is delayed, row width and planting position should also be adjusted. Under dryland production conditions, the planting time is determined by groundwater conditions influenced by rainfall and processing actions.

Production factors

The question thus is, given that the choice of the most suitable cultivar should be determined by the planting time, what are the optimal production practices that must be followed to obtain the best yield result with the cultivar selection?

From literature, several production factors can be identified that can influence returns, and the most important ones are as follows: climate, soil fertility (fertiliser included), cultivar selection, seed treatments (fungicide,

Soil fertility, residual nutrients and fertilisation play a major role in the success story of soya beans.

insecticide, nematode control and biological inoculation), biomass protection (fungicide and insect control) and row spacing (including planting density). These factors have always contributed positively to returns, although some variation is found.

The climate, as mentioned earlier, cannot be predicted, but daylight length and temperature during the growth season are known factors as well as the entry date for frost, especially in the Eastern Highveld. This is an important time as it may impair the development of pods, especially with cultivars with longer growth seasons. Seed treatment (for biological nitrogen bonding), plant- and biomass protection against diseases (such as Sclerotinia) and insects are important management practices.

Soil fertility, residual nutrients and fertilisation play a major role in the success story of soya beans, along with the importance of management practices. An important factor that must also be considered is the use of germinating seed sources.

Research on plant condition and plant loss during the growth season from plant to harvest, indicated that greater losses in plant condition and potential yield can be expected if poor seed resources are used. This includes seed that was not effectively stored, poorer grain quality characteristics (damaged seed husk, split kernels, green kernels and especially disease infections) and seed treatments that have not been performed optimally.

Research conducted

Research worldwide confirms that narrower rows increase yield potential of soya beans. In production articles by VKB, results are shown on plant dates and growth classes of different cultivars of the last two production seasons in the East Free State (Steynberg and Van Zyl, 2017).

From the above as well as the research results of the Sensako soya bean programme on row widths and planting conditions, the following conclusions were made:

- Narrower rows (38 and 50cm) significantly increased the yield of soya bean cultivars compared to 76 and 91cm row widths in the past two production seasons, although the yield differences were smaller in 2016/17, which was a high rainfall season.
- The research showed that the postponement of soya bean planting, especially with MG 6 growth class cultivars, resulted in yield losses due to lower biomass development, less pod formation and also frost damage. This was compared to the MG 4 and 5 cultivars tested that still yielded good yields. The conclusion is that in the cultivation area MG 6 cultivars only come into their own during early planting times, and for the rest of the growth season the MG 4 and 5 growth class cultivars will deliver the best yield. When the planting date is delayed, narrower rows ensure that the leaf canopy covers the soil surface faster, resulting in maximum use of sunlight, optimised yield potential and reduced water evaporation and weed penetration.
- Lower plant density promote bushy side-branch development but lower pod height and irregular ripening, especially in wide rows. A higher plant density is recommended as optimal and increases pod height, but also increases the plant's potential to fall over and less pods to develop per plant. The risk of disease contamination with this practice also exists because air flow between rows is limited and a micro-climate conducive to disease development can be created.
- Be adaptable in cultivar selections depending on the plant window available. Choose the growth class and cultivar accordingly, and adjust row width and plant positions which will result in the best yield reaction.

(References available from the authors at email willem.otto@sensako.co.za.)

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Seed funding model needed in local soya bean industry

Retention of seed in the soya bean industry is a legal and common practice. According to the South African National Seed Organisation (SANSOR), up to 80% of the harvest is planted with farm-saved seed. Unfortunately, this situation creates a vicious circle that cause seed companies to lose income from soya bean seed sales, which, in turn, demotivate investment in the soya bean seed industry. It also makes seed prices more expensive.

Because so much seed is retained, companies that develop new technologies do not have a method through which to recoup their investment. This has also kept the latest GMO technology out of the grasp of local soya bean producers. Monsanto's Round Up Ready 2 Yield® and Intacta RR2 PRO™ technology, which offers higher yields for producers, are already available in the US and South America, but not locally because of this situation.

Breeding and technology levy

The good news, however, is that it has allowed the industry to work on a breeding and technology levy for South Africa – abroad it is called the End Point Royalty Programme. To counteract the effect of the retention of seed, the system has been developed so that soya bean producers pay a levy when they sell their product to the processor/silo.

This levy would be statutory, and must be paid by every producer. These funds are then paid to seed companies according to market share. It will, therefore, also be very important that soya bean producers declare the cultivar they have planted per consignment delivered.

Information from both producers and the consolidates information by soya bean buyers will be of utmost importance to be able to calculate the market share of each cultivar or seed company. A non-profit company, the SA Cultivar and Technology Agency (SACTA) has been established to administer this levy.

The statutory application has been submitted to the National Agricultural Marketing Council (NAMC) at the end of 2016. Their decision is still pending, but industry is positive that the breeding and technology levy could be implemented by March 2018.

Positive change is already evident

After careful consideration, Monsanto South Africa has obtained approval to test the next generation of soya bean biotechnology products in South Africa. These tests are conducted under strictly regulated conditions and are required to deregulate the genes for commercial cultivation.

The new gene package consists of two events. The first is composed of a herbicide that includes the second-generation Roundup Ready gene. This gene is more effective than the previous one and provides excellent tolerance of the crop to the Roundup herbicide.

The second part of the gene pack consists of a gene that controls the African bollworm. At this stage, many insecticides are applied to control these worms. This gene is known as Intacta and will add a lot of value if it can be used effectively.

The regulatory trials will be repeated in the 2017 season.

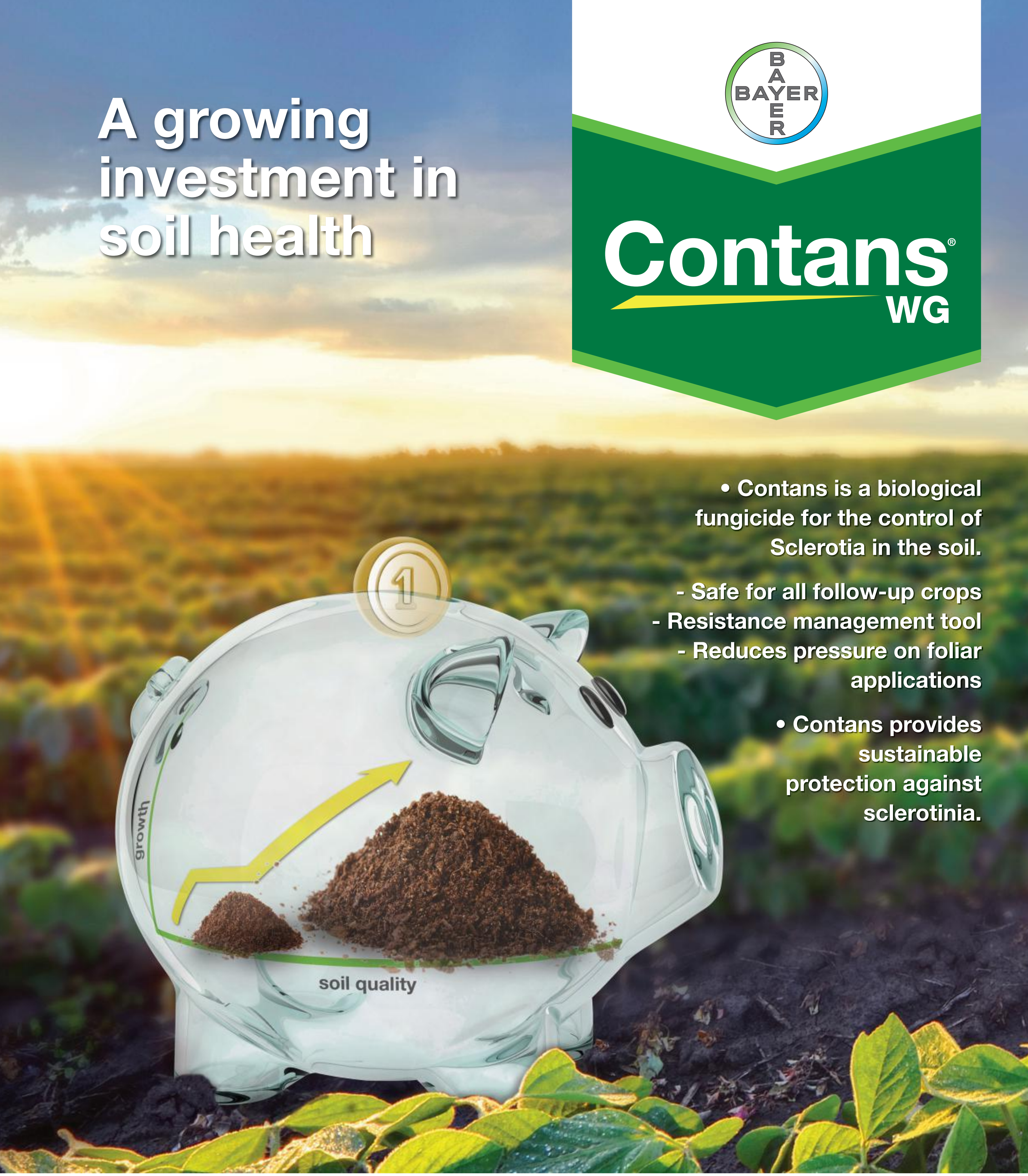
Approval process

Producers and the industry are very excited about the new technology that is on its way. Registration documents for the gene package will hopefully be submitted by the end of 2018. Commercial availability will depend on the speed of the approval process, and how fast the technology can be made available by seed suppliers.

With a value collection method on its way for South Africa, it would bring new technology to the soya bean seed market. It is still to be tested in local conditions, but the second-generation Roundup Ready gene has shown significant yield increases (up to 15%) in countries where it is already available.

Since work has started on the breeding and technology levy, new interest into the local soya bean seed market has also been experienced from companies not yet involved in South Africa. All of this are good signs that the proposed levy might be a step in the right direction in creating a healthy competitive soya bean seed market in South Africa, benefitting the producer, the seed company and, in the end, the whole soya bean value chain.

The breeding and technology levy applied for, constitutes 1,2% of the soya bean price, whereas 1% is budgeted for germplasm and 0,2% for the old GMO technology. The amount applied for came to R65 per ton for the first year and R80 per ton for the second year.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1
growth
soil quality

By Nelia Rousseau, grower and channel marketing manager, Bayer

Focus on an economically relevant disease in oilseeds production

Investing more in understanding and growing higher yielding oilseeds crops, could prove to increase and improve our long-term cultivation practices. For the reality of producing more from less available arable land remains a global agricultural challenge, and the improvement of soil health is critical in long-term sustainable production systems. Improved soil health will support the fight against economically relevant diseases.

One of these diseases that can have a grave impact on the potential yield is *Sclerotinia*.

The environmental disease triggers:

- Wet conditions on the soil surface with a temperature of 11-15°C trigger sclerotia germination and result in spore release from apothecia after 10-14 days.
- Extended wetness particularly during flowering (>25mm rain).
- High humidity and leaf wetness during petal drop and lodging will result in stem infection. This is linked to temperatures of 15-20°C (infection is stopped when it is dry).

Bayer solution

To address this problem, Bayer created a biological product called Contans.

Two important things to consider when using Contans are:

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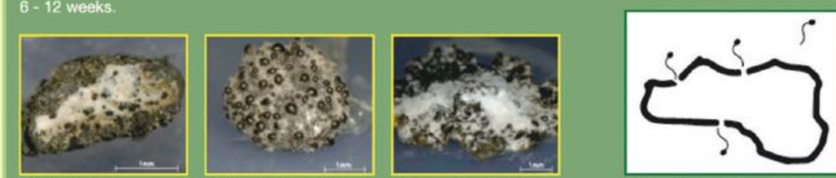
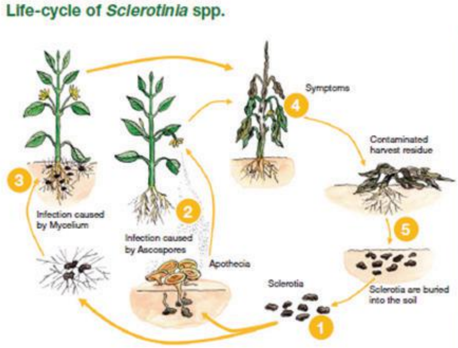
Coniothyrium minitans attacks the sclerotic phase of the disease, which is the resting stage.
Following the application and incorporation of **Contans® WG** into soil, the spores of *Coniothyrium minitans* germinate and produce mycelium. *C. minitans* attacks and destroys the sclerotia and their mycelium.
The infected sclerotia are unable to generate apothecia or to produce mycelium. Total destruction generally takes 6 - 12 weeks.



Intact sclerotium · *Sclerotium spp. attacked by C. minitans* · *Sclerotium spp. being degraded by C. minitans* · *Illustrative picture of a sclerotium attacked by C. minitans spores*

Life-cycle of *Sclerotinia* spp.



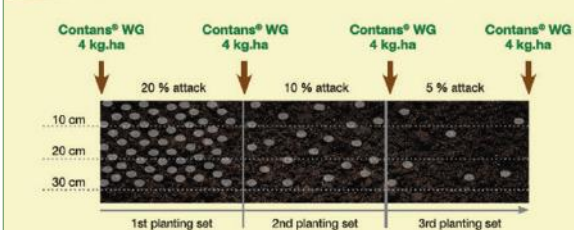
1) Sclerotia of Sclerotinia can survive in the soil for several years. Viable sclerotia have been seen in the soil even after 10 years. Sclerotia germinate and develop apothecia if within the top 3-5 cm of the soil.
2) These apothecia produce ascospores that are released into the air. They attach to senescent parts of the plant such as old leaves and fallen petals. Depending on climatic conditions (temperature and moisture), these spores can germinate and infect the plants. Leaves, flowers, fruit and stems can be infected.
3) Meanwhile, the mycelium resulting from the sclerotia germinating in the soil can infect the roots of certain host plants. The symptoms of infection vary between plants species and can appear rapidly.
4) White mycelium develops and new sclerotia appear on the infected plant parts or inside the stem. The plant starts senescing and dies.
5) The newly formed sclerotia reach the soil and can be viable for several years.

Surviving structures (sclerotia) of Sclerotinia are viable in the soil for several years.

Sclerotia germinate and develop apothecia.

Apothecia formed from *S. sclerotiorum*, can develop up to 5 cm long.

Initial infestation:



Storage conditions and timelines:

Storage temperature	Maximum period of product viability from the date of dispatch
20 °C	2 weeks
< 15 °C	3 weeks
< 4 °C	6 months
< -18 °C (Freezing)	1 year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- The required seed volume is 20 to 25 containers of maize per 1 500ha or 60 containers of soya beans per 800ha.
- You only fill the planters with maize once a day, and five times for soya beans!
- Remember that you can load different cultivars on the trailer.

Weedy plants are designed for grabbing lion's share at nutrient fest

By Prof Charlie Reinhardt

"I will go root away
The noisome weeds,
which without profit suck
The soil's fertility from
wholesome flowers."
- William Shakespeare
(1564 – 1616)

"Noisome" describes something as being harmful, unhealthy, revolting, unpalatable – from a human perspective, especially in the case of those of us having to cope with weeds on a daily basis, such an impression of certain plants in Nature's plant kingdom is warranted.

On the other hand, it should be recognised that when weeds occur in situations where they do not interfere with human interests or aspirations, these plants have important functions in nature, and many have properties that are exploited by us, e.g. medicinal plants, food for humans and animals, soil stabilisers, etc.

The most damaging weeds in crop production systems tend to be those plants classified as annual plants, which complete their life cycles within one year, and endowed by nature in wondrous ways to act as "pioneer" plant species. Such plants tend to be the bane of crop producers because the former are wont to establish in areas where natural vegetation and/or soil have been disturbed by either natural (e.g. erosion) or unnatural (e.g. agriculture) forces.

In their nature-driven attempt to stabilise disturbed areas, the pioneer species rely on their unique abilities to acquire growth factors (water, nutrients, light) in highest quantities in the shortest possible time.

Plant-to-plant competition

In crop production systems where the time-span is less than 12 months from seeding to harvest at the end of the crop's life cycle, the crop is obviously an annual plant. All annual crops on any given piece of land are likely to face a host of other plant types (weeds) that also have an annual life cycle and, hence, the weeds have the potential to interfere strongly with the crop's growth and development.

Because all plants basically have the same requirements for growth, *i.e.* water, sunlight and nutrients, there will be plant-to-plant competition in situations where one or more of the essential growth factors become limiting by not satisfying the needs of all plants involved in the interaction. The same rationale applies to determining the optimum number of crop plants on a unit area (hectare) basis.

Exceeding the number of crop plants that are sustainable by growth resources available on a given field, will mean that crop plants will compete with each other for water and/or nutrients in situations where any of these factors drop to growth-limiting levels at some point in time.

A distinct advantage

Perennial crops in orchard and vineyard situations have a distinct advantage in the competition battle with annual (pioneer type) weeds in particular. Crops that establish well before weeds take hold, and crops that have a longer life cycle than the weeds present, are likely to have the edge in plant-to-plant competition through sheer difference in size.

The business end of weeds as far as competition for nutrients and water is concerned, is the root system, in this case that of the highly competitive weed Eleusine indica (goose grass; "jongosgras"). (Photograph: C Reinhardt)

Plant size is measured in terms of the extent to which the canopy (foliage) and root system have developed – bigger plants usually have better ability than smaller plants for acquiring water, nutrients and light. However, there are exceptions to the rule.

Weeds that are adapted to low-light (shady) conditions that occur under trees, can compete with the crop for water and nutrients, especially where supply of these growth factors is through drip-irrigation. In such a scenario, shallow-rooted weeds that occur in high numbers can compete with the crop for both water and nutrients, therefore warranting management of even those weeds that are much smaller than the crop.

Remember, competition for water and nutrients occurs below ground – therefore it is more the root system than the above-ground plant parts of the weed that need to be taken into account!

The upper hand

If one considers the top ten plant characteristics that bestow "noxious or noisome weed" status on plants, it is manifestly clear that those same properties would bestow "super crop" status if they could be built into crop plants. Properties such as rapid seed germination, vigorous seedlings, rapid stem extension and leaf development, an extensive root system that deploys quickly and early canopy development, are examples of desired attributes in annual crop plants, which most of the serious annual weeds also possess.

Rapid plant growth and development imply high requirements for water, nutrients and sunlight. Weeds are well-known for tolerating low soil fertility, but in order to thrive, weeds same as crops, respond positively to added nutrients (Blackshaw, Brandt & Jenzen, 2002). They found that a number of common weed species in Canada showed a greater response to fertilisation with N (nitrogen) and P (phosphorus) than either spring wheat or canola.

This study also revealed wide variation among weed species in their response to added nutrients. Some species exhibited a strong growth response to either N or P, while others responded strongly to both nutrients; biomass of many weeds increased more with added P than with N.

High soil fertility levels

Ditomaso (1995), referenced by Zimdahl (2007), reports that weeds generally show greater growth responses to added nutrients than crops do at already high soil fertility levels. Ditomaso and others have reported "luxury" nutrient uptake by certain weeds, which implies that weeds can accumulate in their system higher nutrient levels than they actually require – an attribute that obviously will boost their competitiveness with the crop.

Because nutrient uptake occurs in water medium, highly competitive weeds likely are lavish users of both these growth factors. Fertiliser is a high cost item in crop production and water is mostly a scarce resource in South Africa. Therefore, weeds that compete with a crop to the extent that unacceptable yield losses are incurred, cannot be tolerated.

There is very little information available in South Africa on weed-crop interaction with regard to plant nutrition. The fact that we have many crops and weeds in common with the rest of the world is somewhat of a reprieve, since international knowledge can serve as springboard for local research on this topic. Overseas research on this aspect is so far advanced that it promises the development of fertilisation strategies, such as timing and placement of nutrients, which reduce weed interference with crops (Blackshaw *et al*., 2002).

Competition with crops

The ability of plants (crops and weeds) to produce and release biochemicals that can

A crop like soya bean that can relatively quickly form a dense canopy, can be effective for suppressing weeds with a high light requirement, for example Cyperus esculentus (yellow nutsedge) visible in the inter-row following treatment with glyphosate herbicide. (Photograph: C Reinhardt)

inhibit the growth of other plants, is known as "allelopathy", and the chemicals involved are collectively called "allelochemicals". Allelopathy and competition phenomena act in unison in plant-plant interactions, for example, by allelochemicals exuded by one species causing a reduction in the rates at which another species' seeds germinate and seedlings emerge, thus making the affected species more prone to competition from the one exerting the allelopathic effect.

Allelopathy is no longer regarded as a "fairytale" phenomenon and since the 1980s its relevance in plant-to-plant interactions has been proven through diligent research (Belz, 2007). Both crop and weed species have proven allelopathic potential, but in some plant species this attribute is more strongly developed than in others.

We exploit allelopathy in several positive ways, *inter alia*, through the practices of cover crops and organic mulches for weed suppression (Duke *et al*., 2002). Live cover crop plants and/or plant litter, release allelochemicals that inhibit weed seed germination and seedling development. Simultaneously, that same cover crop and organic mulch have a competition effect through preventing adequate sunlight from reaching the soil surface where it stimulates the germination and growth of certain weeds.

Tighter weed management

If "climate change" is to evolve as predicted, progressively more harmful "super weeds" could well be in store for us. The term "super weeds", in the context it is used here, implies that such plants will be superlative in terms of their adaptation to changed environments (e.g. higher temperatures and increased variability in rainfall patterns).

Hence, in future, crops could be more prone to suffer weed competition, which will require ever tighter weed management, and concomitant higher input costs. Hopefully, the current focus of crop industries on developing crop plants that can cope with harsher environments associated with climate change will serve to abate the "super weed" spectre.

Villa ACADEMY

Strategies for management of herbicide-resistant weeds are well documented and frequently communicated on the South African Herbicide Resistance Initiative (SAHRI) website: *www.up.ac.za/sahri*. Prof Reinhardt is project leader at SAHRI, which is based in the Department of Plant Production and Soil Science, University of Pretoria (UP), dean of Villa Academy, extraordinary professor of weed science, UP, and extraordinary professor at the Department of Agronomy, Stellenbosch University (SU). References are available from the author on 083 442 3427 or email: dr.charlie.reinhardt@gmail.com.

Indigenous nematode use in canola

By Annika Pieterse, Jenna L Ross, Willem F Sirgel and Antoinette P Malan, Stellenbosch University

Invasive European molluscs (slugs and snails) have become significant economic pests in South Africa, especially in the Western Cape province, where the climate is favourable. One crop that is particularly targeted is canola (*Brassica napus*), which is a winter-arable crop that is commercially produced for animal feed protein.

Canola is sown between March and May in the Western Cape, with the seedlings being most susceptible to mollusc damage during the first four weeks after planting. The three mollusc species that are particularly pestiferous in canola are *Milax gagates*, *Deroceras panormitanum* and *Deroceras reticulatum*. All three species, which are slugs (as opposed to snails), are European exotic invaders.

Current methods for controlling the invasive European slugs rely on chemical molluscicide pellets containing *metaldehyde* and *carbaryl*, but they are often ineffective and toxic to non-target organisms. Therefore, it is important that a method of biological control be identified.

Control method

The most effective commercial method for the biological control of molluscs in Europe is the mollusc-parasitic nematode, *Phasmarhabditis hermaphrodita*. The product, which is available in Europe from BASF, is sold under the trade name of Nemaslug®. The product provides protection against many terrestrial mollusc families, including *Agriolimacidae*, *Arionidae*, *Limacidae*, *Milacidae*, and *Vagnulidae* (Rae *et al*., 2007).

To date, Nemaslug® cannot be sold in South Africa due to current legislation (amendment of Act 18 of 1989 under the *Agricultural Pest Act* 36 of 1947), thus an indigenous method of biological control must be developed. Consequently, methods of indigenous control require investigation. In 2012, a study was published on nematodes associated with terrestrial slugs in South Africa (Ross *et al*., 2012).

"The Western Cape has a unique climate, with warm, damp winters that provide the ideal conditions in which European molluscs can thrive.

The five slug species collected during the survey: (a) Deroceras reticulatum; (b) Deroceras panormitanum; (c) Milax gagates; (d) Chlamydephorus gibbonsi; and (e) Lehmannia valentiana.

The authors identified four true slug-parasitic nematodes, two of which were previously undescribed *Phasmarhabditis* spp, indicating that South Africa is rich in indigenous species (Ross *et al*., 2012). Expansion of the existing understanding with the knowledge to be gained from further surveys, in order to identify, characterise and mass-produce the nematodes, is, therefore, of great importance.

The overall aim of the current study is to develop a nematode as a biological control agent for slugs and snails in South Africa.

Diversity and distribution

The current research was focused on slugs, as opposed to snails, as the former lack a shell, causing them to have greater exposure to nematode parasites in the soil than do snails. Sample sites, including canola crops and commercial nurseries, were found with the assistance of local farmers and growers.

After identification by means of morphological characterisation (Ross *et al.*, 2012), the slugs were then rinsed to remove surface nematodes. The slugs were dissected and examined for the presence of internal nematodes. Nematodes showing similar infection methods as the European isolate, *P. hermaphrodita* (*i.e.* infection of the mantel region), were placed on white traps with organic matter (frozen dead slugs). The nematodes that showed good growth were then used for mass production.

A total of 1 944 slugs were collected from twelve sample sites from around the Western Cape, with the sample sites concerned including those of canola crops and commercial nurseries. A total of five slug species were identified, representing four different families.

Seven of the twelve sample sites examined were found to have slugs infected with nematode parasites, which amounted to 58% of the sample sites. Eight percent of all slugs were found to be infected with nematode parasites. Nematodes were found parasitising all four exotic species, leaving *Chlamydephorus gibbonsi* free from nematode parasites (*Table 1*).

Of the seven sites that had nematodes present, *Caenorhabditis elegans* was found at six sites, *Angiostoma margaretae* at four sites, with the other nematodes, namely *Angiostoma* sp, *Phasmarhabditis* sp SA3, *Phasmarhabditis* sp SA4, and a mermithid species, being found at single sites. The nematodes concerned represented three families: *Angiostomatidae*; *Mermithidae*; and *Rhabditidae*.

Non-harmful molluscicide

The Western Cape has a unique climate, with warm, damp winters that provide the ideal conditions in which European molluscs can thrive. One of the many crops in the Western Cape that is affected by molluscs is canola. The most common mollusc control method that is currently used in canola is the surface broadcasting of molluscicide pellets containing *metaldehyde* and *carbaryl*.

However, the chemicals concerned have been shown to cause adverse effects on non-target organisms. Therefore, a control method is required that can be effective against molluscs, but which is non-harmful both to the environment and to non-target organisms.

The mollusc-parasitic nematode, *P. hermaphrodita*, has been developed into a highly successful, commercially available biological molluscicide, known as Nemaslug®. Although the product is currently sold in fifteen different European countries, the nematode has not yet been isolated in South Africa, and, for the reason mentioned, its importation is prohibited under the amended Act 18 of 1989, which falls under the *Agricultural Pests Act* (No 36 of 1947).

Therefore, the objectives of the study were to conduct a survey of slugs to isolate the local nematode isolates, to determine their mollusc control capabilities, to describe their morphology, biology and phylogeny, and to establish monoxenic cultures, with optimum growth temperatures.

Table 1: Prevalence and intensity of nematodes and their associated hosts collected from sites in the Western Cape province of South Africa.

Slug family/species	Native/ introduced	Number collected	Species
Agriolimacidae:			
Deroceras panormitanum	Introduced	1100	Mermitid sp. *Angiostoma margaretae* *Caenorhabditis elegans* *Phasmarhabditis* sp. SA3
D. reticulatum	Introduced	173	*A. margaretae* *C. elegans* *Phasmarhabditis* sp. SA4
Limacidae:			
Lehmannia valentiana	Introduced	387	*A. margaretae* *C. elegans*
Milacidae:			
Milax gagates	Introduced	112	*A. margaretae* *Angiostoma* sp. *C. elegans*
Chlamydephoridae: *Chlamydephorus gibbonsi*	Native	172	-

Parasitic nematode survey

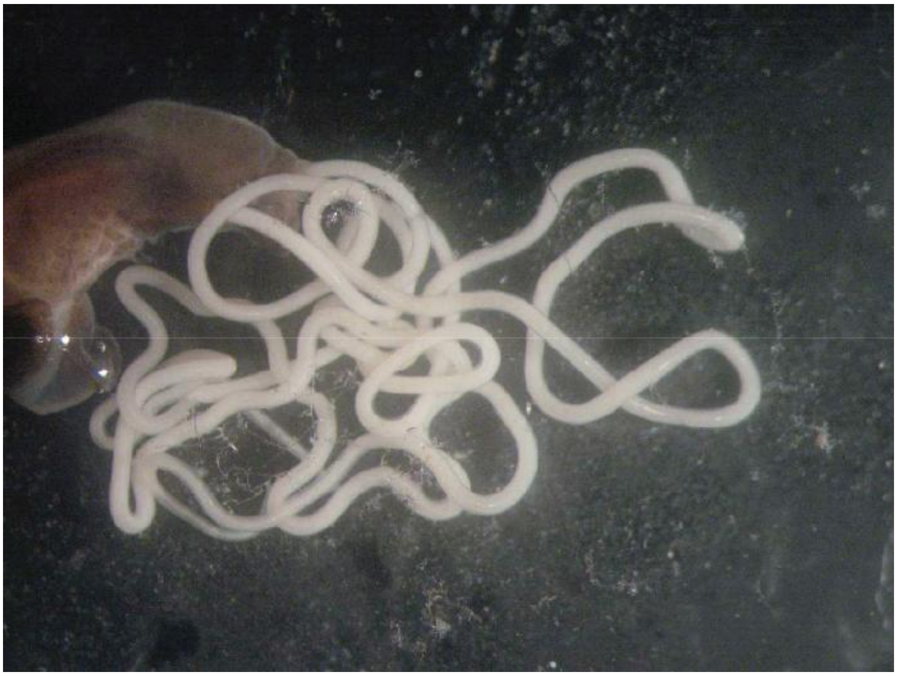
The first objective involved a survey of parasitic nematodes associated with slugs in the Western Cape. Slugs were investigated as opposed to snails, as slugs have been identified as being the main pests of canola crops, with their absence of an external shell meaning that they can burrow deep into the soil, thus increasing their exposure to nematode parasites. Sample sites focused on canola crops and commercial nurseries.

A total of six nematode species were identified, including: *Angiostoma margaretae*; *Angiostoma* sp; *Caenorhabditis elegans*; mermithid sp; *Phasmarhabditis* sp SA3; and *Phasmarhabditis* sp SA4. Of these species, four were previously undescribed (*Angiostoma* sp; mermithid sp; *Phasmarhabditis* sp SA3; *Phasmarhabditis* sp SA4).

The discovery of these undescribed nematode species indicates that South Africa is rich in biological diversity, and that additional surveys are required to increase the understanding of nematodes that are associated with molluscs in Africa.

Test results

Nematodes isolated in the survey were tested for their ability to reproduce on decaying organic matter (consisting of dead frozen slugs), with the results showing that one of the nematodes, *Phasmarhabditis* sp SA4, could complete its life cycle under such conditions. *Phasmarhabditis* sp SA4 is characterised



A mermithid species found after dissecting Deroceras panormitanum, collected from a nursery in George in the Western Cape.

by the shape and length of the female tail, and by the presence of males.

Phylogenetic analysis demonstrated that *Phasmarhabditis* sp SA4 was placed in a monophyletic clade along with *Phasmarhabditis* sp SA2 (previously identified by Dr Jenna Ross), *Phasmarhabditis papillosa*, and the mollusc-parasitic nematode, *Angiostoma dentiferum*.

Monoxenic cultures of *Phasmarhabditis* sp SA4 were established using methods described for the *in vitro* production of *P. hermaphrodita*. Monoxenic cultures are known to offer a relatively predictable result, and to help to create high numbers of infective juveniles with consistent infectivity. Bacterial isolates were obtained by means of swabbing the intestines and internal cavities of *D. reticulatum* specimens, and their pathogenic effects were tested by means of injecting them directly into the haemocoel of *D. reticulatum* hosts, and then monitoring the mortality.

Although five bacterial isolates were identified, *Kluyvera* sp had the highest mortality rate, leading to it being chosen for the monoxenic cultures. The monoxenic cultures were then optimised, using growth temperatures. Three different temperatures were tested, namely 15°C, 20°C, and 25°C. The results showed that the infective juvenile numbers were highest at 15°C.

The pathogenicity of the *in vitro* nematodes was then tested, with the results showing that *Phasmarhabditis* sp SA4 grown in monoxenic cultures with *Kluyvera* sp was found to cause significant mortality in *D. panormitanum*. The above, therefore, demonstrates that the nematode/bacterial combination would make an ideal biocontrol candidate.

Future work should focus on optimising the *in vitro* production of *Phasmarhabditis* sp SA4 and *Kluyvera* sp by means of manipulating the growth conditions concerned, such as extreme temperatures, overcrowding, inoculum density, alteration of the growth medium, and variation of the pH. The pathogenicity of new bacterial isolates should also be tested, both on invasive and native mollusc species, as well as on non-target organisms.

Current project importance

The results of the current project are extremely important, as they indicate that an indigenous nematode could be developed as a biological control agent in South Africa. The commercialisation of this nematode would result in the control of the relevant molluscs in agriculture, horticulture, and viticulture. In order to achieve such control, we must conduct further research into nematode mass production, as well as into formulating a suitable product. Further field trials must also be undertaken to obtain data on application rates and methods.

The results from the present project have been presented at a number of meetings, including at the integrated pest management meetings held monthly at Stellenbosch University, and at canola-related meetings. Details of the project, which has obtained international recognition, were previously presented at the International Congress of Nematology, and at the Nematological Society of Southern Africa.

In addition, outputs from the project have been used as teaching material for both undergraduate and postgraduate research progranunes at Stellenbosch University, with the results having been published in two peer review papers. An additional two papers are currently ready to submit for review. Results from this study have also been included in a book chapter published by Springer in 2017.

An MSc student, Annika Pieterse, who had successfully completed her MSc (*cum laude*) thanks to funding from the project, has since acquired funding from the National Research Foundation (NRF) to continue the project for her doctoral studies. In addition, a fully detailed business plan is being compiled, thanks to the contribution made by Dr Jenna Ross, with the aim of seeking funds from the Technology Innovation Agency, in order to move the project forward into a commercialisation phase.

Conclusion

The extreme importance of the results of the current project is to indicate that an indigenous nematode isolate could be developed as a biological control agent in South Africa, which should have a significant impact on the agricultural, horticultural, and viticulture industries. The aim is to continue the project to the commercialisation phase.

References are available from the authors. This article has been shortened for publication in *Oilseeds Focus.*

Soya beans and soya bean byproducts **for dairy cattle**

Article courtesy of PennState Extension

Incorporating soya beans and their byproducts in the rations of dairy cattle is a fairly common practice. They are an excellent source of essential amino acids and complement most forages. Depending on how they have been processed, soya beans can provide high quality degradable, undegradable and soluble protein, energy, fat and fibre.

However, as with any feed, there are some limitations that need to be recognised so their full benefits to the dairy cow can be achieved.

Raw soya beans

Soya beans that have not been heat-treated can be incorporated successfully into dairy cattle rations. They provide a source of degradable and soluble protein as well as energy in the form of fat. The suggested feeding level is 10% of the total ration dry matter. For lactating cows, the suggested feeding level would probably be no more than 1,8 to 2,3kg as-fed.

Raw soya beans do contain enzymes that may result in some deterioration in the fat portion of the beans. These enzymes include lipase and lipoxidase. Lipase may result in the hydrolytic rancidity or liberation of free fatty acids from the oil present in the soya beans. They can be inactivated at temperatures greater than 79,4°C. Lipoxidase promotes oxidative rancidity or peroxide formation. Peroxides may be toxic to the rumen microbes at high levels of intake. Young calves appear to be especially susceptible to peroxide toxicity and therefore raw soya beans should be avoided in rations for calves less than four months of age.

Lipoxidases are destroyed at temperatures exceeding 48,9°C. To avoid problems associated with lipase and lipoxidase, *i.e.* rancidity, it is recommended to store raw soya beans whole. If they are not going to be fed whole, they should be rolled, crushed, or ground prior to inclusion in a grain mix. Ideally the grain mixture should be prepared every two weeks in winter and weekly during summer.

Raw soya beans also contain the enzyme urease, which hydrolyses ammonia from urea. For this reason, it is generally not recommended to include urea in a complete feed containing raw beans. Urea that is in contact with raw cracked or raw ground soya beans, can release ammonia in a relatively short period of time. Cows are fairly sensitive to gaseous ammonia, so when too much nitrogen is present in the ration as ammonia, a drop in dry matter intake can occur.

In a total mixed ration (TMR) system, if whole raw soya beans were used rather than raw cracked or raw ground beans, it is doubtful that urea would be exposed to appreciable urease activity. However, that's provided few beans were broken during handling and mixing. Ensiling material made with urea as an additive can be used with raw beans since little or no urea remains as such after normal ensiling.

> **Based on several good studies it has been concluded that feeding roasted soya beans as whole/half and half/quarter is the optimum particle size to retain the RUP value of the feed.**

Raw soya beans do contain a trypsin inhibitor and possibly other anti-enzymes, which may reduce protein digestion and utilisation by single-stomached animals. Soyin, a protein, is also present in raw beans. This is toxic to some single-stomached animals. These factors in raw beans, however, do not appreciably affect cattle, because of their unique rumen metabolism.

Heat-treated soya beans

Heat-treated soya beans, on a dry matter basis, can range between 33 to 44% crude protein, 15 to 22% fat, and generally have a moisture content of 12%. An average rumen undegradable protein (RUP) value as a percentage of crude protein for properly heated soya beans is 50%. The two most common methods of heat treatment are roasting and extrusion. They both have their advantages and disadvantages.

Roasted soya beans

Roasted soya beans are a very popular way of feeding soya beans, supplying both RUP and fat. They work well in most forage type rations with the greatest benefits being observed in heavy haycrop silage diets. They can be included in the ration up to 18% of the total ration dry matter. However, in many situations, when used with other concentrate ingredients, RUP and/or fat will limit the amount of beans that can be fed.

Two main types of roasters are used in the field – a drum roaster and high temperature air dryers where soya beans are conveyed over a perforated floor through which hot air is blown. With drum roasters soya beans are dropped into a rotating drum where air temperatures may range from 204,4°C to 315,5°C. Soya beans will remain about one minute in the hot air environment before exiting. If beans remain in the roaster longer than one minute, they can get scorched. The amount of damage to scorched beans typically is minimal.

Equipment that conveys soya beans across a perforated floor through which hot air is blown causes less scorching and may be more energy efficient than the drum roaster. This type of equipment usually is more expensive.

The main objective in the roasting process is to achieve even heating and allowing the beans to be steeped or held without cooling for additional time. Soya beans passed through a drum roaster can produce a fairly consistent product. The most commonly used method is open-flame roasting. This is where more variation occurs with respect to RUP levels.

Factors affecting RUP levels when using open-flame roasters are moisture content of the beans, how clean the beans are, and the environmental temperature. It is not unusual to see RUP range from 40 to 65% of the crude protein. This may explain some of the variable results observed in milk production response in both controlled research and field trials.

Measuring for proper heat treatment

Some of the variation in animal production responses when roasted soya beans have been fed may be from improper roasting procedures. If soya beans are roasted with too little heat, the amount of RUP supplied in the ration may be greatly reduced.

When too much heat is used Maillard products can be produced, which makes the protein unavailable in the small intestine. The amount of lysine available post-ruminally can also be diminished due to improper roasting procedures. For these reasons, it is necessary to implement some quality control measures so dairy producers know that they are purchasing a high-quality product.

There are tests available to determine whether the heat treatment has been adequate and not excessive. A common method is the urease activity test. It is expressed as increased units of pH. Beans with values of 0,05 to 0,30 are considered to have reasonable evidence of proper cooking. If used in a TMR or a high moisture grain mix containing urea, a range of 0,05 to 0,10 is preferred.

Particle size of roasted soya beans

Most research indicates that there is an influence of particle size on the protein degradability characteristics of roasted soya beans.

Particle size of roasted soya beans can affect how the high producing dairy cow utilises the protein. The concern is that the protein in small particles is likely to degrade more rapidly in the rumen than the protein in large particles.

Researchers from the University of Wisconsin looked at the response of lactating dairy cows to increasing levels of whole roasted soya beans. Cows were fed a ration containing a 50:50 forage to concentrate ratio with 0, 12, 18, and 24% of the diet dry matter as whole roasted soya beans. Production and milk composition are listed in *Table 1*. The researchers found that milk production was improved by supplementing the roasted beans at 12-18% of the diet dry matter.

Table 1: Production and milk composition from cows fed different levels of whole roasted soya beans.

	Whole roasted soya beans, % dry matter basis 0	Whole roasted soya beans, % dry matter basis 12	Whole roasted soya beans, % dry matter basis 18	Whole roasted soya beans, % dry matter basis 24
Source: Knapp D.M. *et al*. 1991. J. Dairy Sci. 74:2563 -2572. a,b,c Means in the same row with different superscripts differ (P < 0,05). Note: diets contained 26-27% neutral detergent fibre, 16,8-19,7% crude protein, 0,76-0,79 NE_L Mcal/lb., and fat levels for diets 0, 12, 18, and 24 were 3,0%, 5,1%, 6,4% and 7,0% respectively (dry matter basis).				
Milk, pounds/day	76,7 c	82,5 b	85,4 a	85,4 a
Milk fat, pounds/day	2,46 c	2,62 a	2,55 b	2,57 b
Milk protein, pounds/day	2,37 c	2,49 b	2,55 a	2,57 a

Based on several good studies it has been concluded that feeding roasted soya beans as whole/half and half/quarter is the optimum particle size to retain the RUP value of the feed. In TMR the whole/half particle size should result in little or no separation, however, in grain mixtures or supplements, a half/quarter particle size may work better. If the goal of feeding roasted soya beans is to supply RUP, then grinding and pelleting is not recommended.

Extruded soya beans

Extruded soya beans are exposed to high temperatures, with the exit temperature of the beans ranging between 132,2°C to 148,9°C. Extrusion has a consistent, uniform type of heating. In the process, soya beans are ground, heated, and pressed through a screw, producing a ribbon-like product. Heat penetration is facilitated by physically shattering the seed. Because this process ruptures the fat vesicles within the soya bean, there can be a rapid release of the oil in the rumen when fed to dairy cattle. Feeding extruded soya beans can result in milk fat depression.

Table 2 contains a summary of published and unpublished studies where roasted and extruded soya beans were compared to soya bean meal and unheated soya beans in dairy diets. The average milk production

Table 2: Summary of animal response to feeding heated soya beans.

Treatment	Milk, lbs./d	Change in milk fat, %	Change in milk protein, %	Dry matter intake, lbs./d
Source: Cornell Nutrition Conference Proceedings, 1994. Use of heat processed soya beans in dairy rations. L.D. Satter, T.R. Dhiman, and J.T. Hsu. 1 Soya bean meal or unheated soya beans served as the control. 2 Number in parenthesis is the number of comparisons.				
Roasted soya beans	3,5 (16) 2	+0,06 (16)	-0,07 (16)	-0,2 (16)
Extruded soya beans	2,9 (20)	-0,17 (19)	-0,06 (17)	+0,2 (18)

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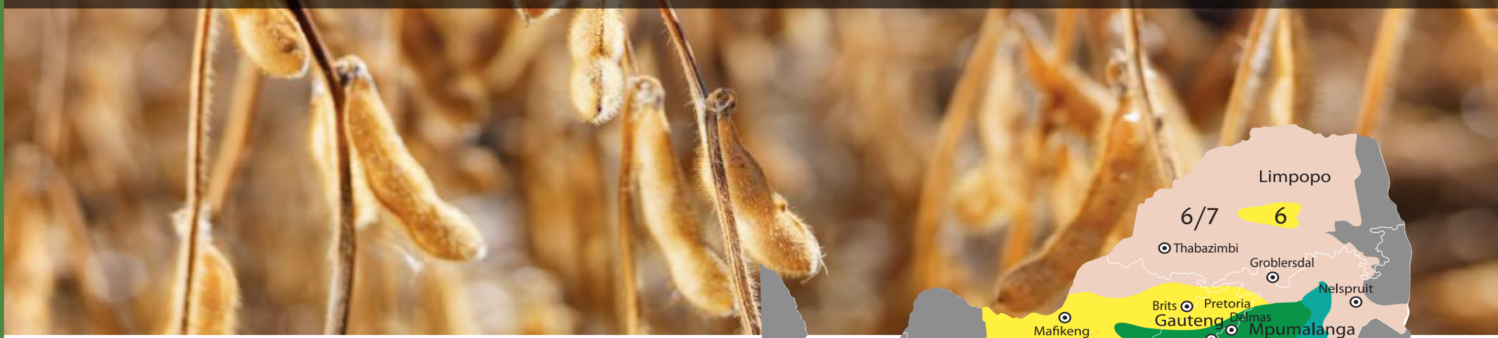


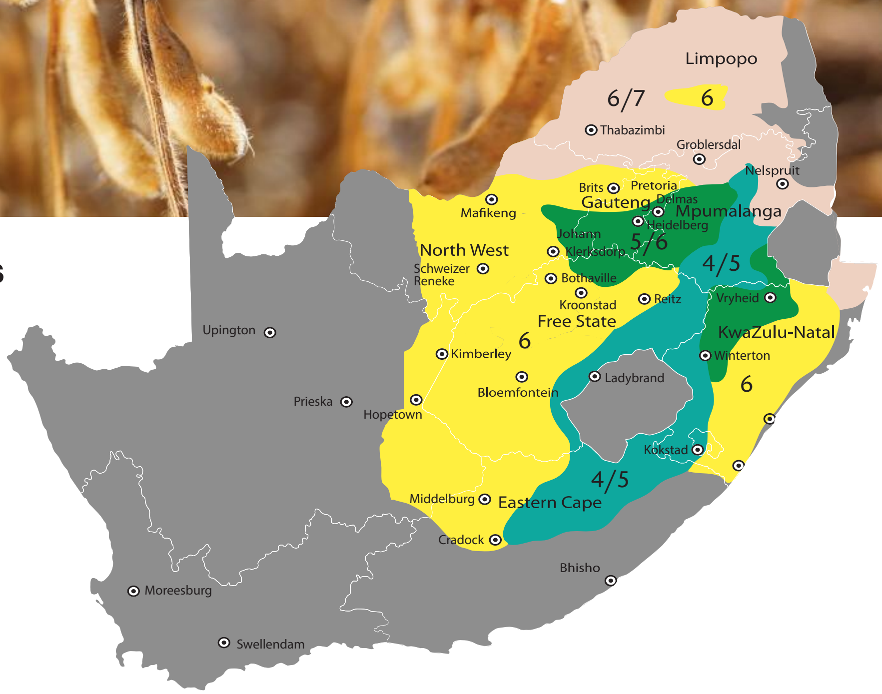
Soybean Production Regions

- Cool Region (MG 4/5)
- Temperate Regions (MG 5/6)
- Warm Regions (MG 6)
- Hot Regions (MG 6/7)

**MG = Maturity Group*

Map data courtesy of University of Pretoria

Map exclusive copyright of PANNAR SEED (Pty) Ltd



Pannar Soybean Package

Soybean cultivar recommendations for the different regions

Growth Class (MG)	Cool Regions	Eastern Temperate Regions	Dry Warm Regions	Hot Regions (Irrigation)
Early (4-5)	PAN 1454R*	PAN 1454R*		
Medium (5-6)	PAN 1532R PAN 1521R	PAN 1532R PAN 1521R	PAN 1521R	PAN 1532R PAN 1521R
Late (6-7)	PAN 1614R PAN 1623R	PAN 1614R PAN 1623R	PAN 1614R PAN 1623R	

* *PAN 1454R should be limited as a smaller portion of the total package.*
PAN 1521R and PAN 1623R are two new cultivars with exceptional performance and are complemented by the stable cultivar, PAN 1614R.

Yield Probability (%)

2013/14, 2014/15 & 2015/16

COOL AREAS YIELD POTENTIAL (t/ha)

Cultivar	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
PAN 1454R	**59**	55	50	45	40	36	32	29
PAN 1500R	**67**	**66**	**63**	**62**	**59**	56	53	51
PAN 1521R	49	57	**64**	**72**	**78**	**83**	**86**	**89**
PAN 1614R	32	35	39	43	48	52	57	**60**
PAN 1623R	**73**	**73**	**71**	**70**	**67**	**65**	**62**	**59**

TEMPERATE AREAS YIELD POTENTIAL (t/ha)

Cultivar	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
PAN 1454R	18	18	18	19	20	21	23	24
PAN 1500R	47	44	42	40	37	36	34	33
PAN 1521R	**63**	**69**	**73**	**78**	**81**	**84**	**86**	**88**
PAN 1614R	**65**	**61**	**57**	53	49	44	40	37
PAN 1623R	**89**	**91**	**93**	**94**	**95**	**95**	**95**	**95**

WARM AREAS YIELD POTENTIAL (t/ha)

Cultivar	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
PAN 1454R	55	51	46	40	35	31	28	25
PAN 1500R	46	41	34	29	23	20	17	16
PAN 1521R	**66**	**74**	**80**	**86**	**90**	**92**	**93**	**94**
PAN 1614R	**65**	**64**	**61**	**59**	56	53	49	47
PAN 1623R	**77**	**76**	**75**	**73**	**70**	**66**	**62**	58

response is an increase of 1,36 to 1,58kg of milk daily. This may be an underestimate, because under-heated soya beans were used in many of the comparisons.

Soya bean meal

Soya bean meal is palatable, nutrient dense, high in digestibility, and a relatively consistent source of protein. It has an excellent amino acid profile. It is a concentrated source of protein and energy and is lower in fibre than most other oilseed meals.

There are two main types of soya bean meal. One is solvent extracted soya bean meal, which contains 44% crude protein. The other is dehulled, solvent extracted soya bean meal, which contains 48% crude protein. There are also high RUP soya bean meal products, which have been heat treated and supply RUP in dairy cattle rations. The incorporation of soya bean meal type products should be evaluated based on what they supply to the ration and their price per unit of nutrient provided.

Making decisions on which product works best should be based on a review of controlled research data.

Solvent-extracted meal

This product contains either 44% or 48% crude protein on an as-fed basis (50% and 54,5% on a dry matter basis, respectively). The 48% meal contains about 8% neutral detergent fibre (NDF) whereas the 44% meal is adjusted to 14% NDF by blending it with toasted ground soya bean hulls.

Soya bean meal is made by grinding soya beans, removing the fat with an organic solvent such as hexane, resulting in a low-fat soya product. This is the most common product on the market and utilised by the feed industry.

Expeller-extraction

Soya bean meal is produced by mechanically squeezing out the oil. Less oil is removed in this process and cows may find it more palatable because of less dustiness and fines. Because this product contains more oil compared to solvent-extracted, the energy value is slightly higher. Product availability is usually limited.

High RUP soya bean meal

The inclusion of regular soya bean meal in a ration usually supplies a source of degradable protein. Only a small amount of soya bean meal protein escapes the rumen. Heating or processing soya bean meal initiates chemical reactions between sugars and amino acids, which increases its RUP value. Depending on the process used to treat soya bean meal, RUP can range from 50 to 70%.

Fewer lactation studies have been conducted using heat-treated soya bean meal than with heated soya beans. Minimal information is available regarding optimum heating conditions for soya bean meal.

Commercial methods for producing high RUP soya bean meal include cooker-expeller processed, extruder-expeller processed, and non-enzymatically browned. Making decisions on which product works best should be based on a review of controlled research data. Also, consider the impact the level of RUP will have on the feed and economic value of the soya bean meal product.

This article has been shortened for publication in *Oilseeds Focus*.

Global stocks at high levels
despite weather concerns

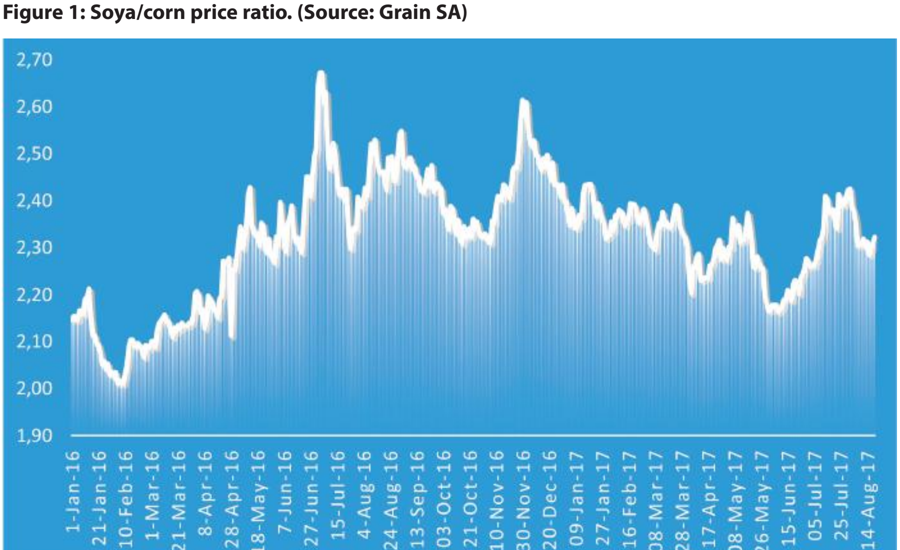
By Dr Dirk Strydom, Grain SA

Currently, the global market has more than enough supplies in terms of oilseeds. The International Grains Council (IGC) has projected a soya bean ending stock of 38 million tons for the 2017/18 year, which is lower than the previous year (43,5 million), but higher than the five-year average of 33 million tons. The United States Department of Agriculture (USDA) expects world oilseeds ending stock levels at 109 million tons, which is higher than the previous two years.

According to the USDA, the global oilseeds production for 2017/18 is projected at 576,7 million tons, up 2,8 million, mainly on a 2,3 million ton increase for soya bean production. The USDA has increased the United States (US) soya bean production forecast for the season to 119 million tons, which will be a new record production for the US. By the end of August, the US soya bean prices deceased to a seven-week low due to the higher than expected production from the US. However, despite the lower soya price the soya corn price ratio in the US market is still more favourable towards soya and is currently at 2,3.

In terms of the US market, there is still a bit of uncertainty. If the estimates realise at harvest due to crop condition reports, it could be less favourable compared to the previous season. However, for the rest of the production season the weather forecast looks more favourable.

Figure 1: Soya/corn price ratio. (Source: Grain SA)



Soya bean production

Palm oil production increased in the current season, but is not at favourable levels yet, which provide some support for the soya beans on the demand side. World soya bean stocks are ample, keeping international prices under pressure. The lower prices dampened farmer selling that leads to lower crushing margins for soya beans in many countries. Therefore, margins will need to be more positive for crushers to crush the large quantities of soya beans.

In the local market, the Crop Estimates Committee (CEC) expects a record soya bean crop of 1,3 million tons, sunflower seed of 821 970 tons and groundnuts of 90 550 tons.

In the Southern Hemisphere, more specifically Argentina, expectations are that soya bean plantings are likely to decline to a six-year low for the season with more other crops such as maize, wheat and sunflower seed expected to take up many of the soya bean hectares.

The profitability of soya beans is still under pressure due to the high export taxes on the soya beans from Argentina. These taxes are as high as 30% and it is expected that the taxes would gradually decrease, but not enough to make a large impact within this coming season.

Other oilseeds

In terms of other oilseeds, in the Commonwealth of Independent States (CIS) countries another good sunflower seed crop is in the making, but the expectations are that the crop is not likely to reach the levels that were seen last

Table 1: Most important oilseeds products (US $/ton and R/ton). (Source: Oilword and Grain SA)

Product	17 Aug 2017	Jul 2016	% change
Soya beans (US CIF Rotterdam)	384	432	-11
Soya beans (Brazil)	754	695	8
Sunflower seed (EU)	397	403	-1
Groundnuts (VSA 40/50)	1 400	1 400	0
Palm oil (Malaysia)	643	615	5
Soya bean oil (US)	787	711	11
Sunflower oil (Arg)	735	871	-16
Soya meal (Arg)	304	414	-27
Rand/$	**13,18**	**13,4**	**-1**
Sunflower seed	4 656	5 950	-22
Derived sunflower	5 152	5 585	-8
Soya beans	4 490	6 430	-30
Derived soya beans	5 681	6 315	-10
Soil canola	5 042	6 335	-20

season as there were a new record world production of sunflower seed.

It is therefore anticipated that the supplies of the oil of sunflower seed are likely to be tighter this season. In Argentina, the expectations are that there will be more sunflowers planted, and the area is estimated to reach close to a six-year high level, given that soya bean production is less profitable in Argentina.

The world exports of rapeseed and canola are estimated to decline by approximately two million tons in the 2017/18 season, mostly due to sharply reduced supplies in Canada and Australia. The crop conditions in these two countries are unfavourable and showed some further deterioration lately. This curbs the production of rapeseed and canola and contributes to the pressure on the supplies which are already low due to last year's unfavourable conditions.

Better crop conditions in the European Union (EU) and Ukraine will be insufficient to offset the losses in the Canadian and Australian markets. The canola prices in Canada as well as in the EU have appreciated the last few weeks and the expectations in the market are that the price gap is likely to continue to widen between canola and soya beans.

In the local market, the Crop Estimates Committee (CEC) expects a record soya bean crop of 1,3 million tons, sunflower seed of 821 970 tons and groundnuts of 90 550 tons. The crushing figures in the first three months of the marketing season were slower than expected, but expectations are that these figures will increase for the rest of the season. This is mainly because crushing margins are currently positive within the oilseeds industry.

Figure 2: Maize/soya bean price ratio. (Source: Grain SA, SAFEX)

In terms of the new production season, the expectation is currently that more hectares will shift to the oilseeds industry. This is mainly due to the fact that maize prices are at levels which is only profitable at high yields, therefore oilseeds will be used as risk diversification. The current maize/soya ratio is 2,5 which is favourable for soya bean production.

In terms of canola production, many hectares were lost mainly due to late rain in the Western Cape and poor germination. By the end of August, the crop was still under stress and later rain can assist the crop, however, yields will be compromised.

On the international market, prices are under pressure mainly due to the large stocks available. The large stocks in South Africa also put pressure on prices, but the local prices are already below the derived oilseeds prices. It will be important to monitor the next three months in terms of the US crop progress, exchange rate and the rate of processing within the local market.

Exceptional yields drive the economics of soya bean production

By Prof Ferdi Meyer and Divan van der Westhuizen, Bureau for Food and Agricultural Policy (BFAP) and University of Pretoria

Can the exceptional soya bean and maize yields for the 2016/17 cropping season point to a potential step change in trend yields of these two key summer crops in South Africa? That is the question the market is asking in anticipation of the 2017/18 planting season. Within the next few weeks, farmers will be deciding on their crop mix for the new season.

BFAP recently published its Baseline 2017, which presents a ten-year outlook of the agricultural industry. The baseline clearly illustrates (*Figure 1*) that the gradual switch in area from grains for human consumption (mainly white maize and wheat) to feed grains (yellow maize) and oilseeds (soya beans and canola) is expected to continue over the outlook period.

Despite the sharp recovery in 2017 of the area under white maize production, the area under production is projected to decline again over the long run. Following the setback due to the drought in 2016, the area under soya bean production is expected to continue to expand consistently over the outlook period to approximately 900 000ha.

Looking at the projected expansion in the area under production only presents one side of the coin. The BFAP sector model generates the outlook for the area, based on the projected returns per hectare for the various commodities. The expected net returns are determined by the projected price (driven by market fundamentals) multiplied by the projected growth in average yields minus the costs of production per hectare.

Growth shares

Figure 2a, b takes the projected growth shares in South Africa for both area and yield into consideration and compares it to the global growth shares projected by the OECD-FAO ten-year outlook. South African growth shares are similar to global growth shares, with the majority of growth in grains coming from the growth in yields over the outlook period with very little expansion in the area under production.

Figure 1: Area under commercial grain and oilseeds production in South Africa.

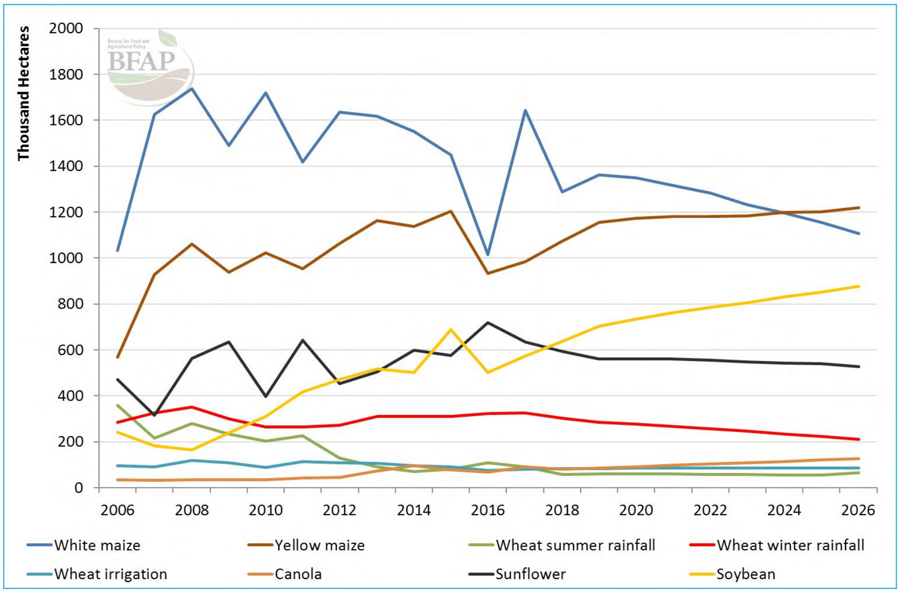


Figure 2a: Global growth shares in area and yields. (Source: OECD-FAO, August 2017)

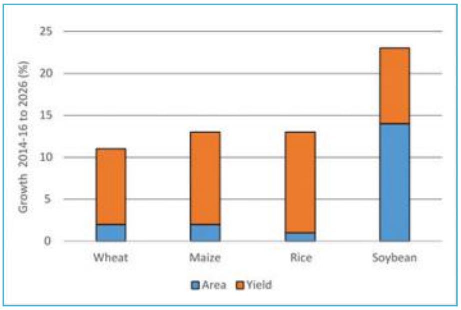
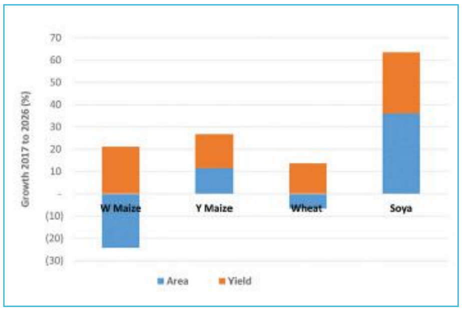


Figure 2b: South African growth shares in area and yields. (Source: OECD-FAO, August 2017)



However, increasing yields and a further expansion in the area under production will drive soya bean production over the outlook period. Global production of soya beans is projected to grow by 25% by 2026 compared to South Africa's expected growth of 63% over the next decade.

Industry competitiveness

Bringing these global and general market trends closer to the realities on the ground, one must take the relative competitiveness at farm-level into consideration. Modern agriculture is faced by increased volatility in macroeconomic drivers, instability in commodity prices, rising input costs and extreme weather fluctuation.

To remain competitive, both locally and in a global environment, producers will have to continue to engage in more sustainable and efficient cultivation practises, input acquisition and allocation, efficient marketing, and adopting risk mitigation strategies. These approaches are complex and despite better information, decision-making has become more complicated compared to a decade ago.

An appropriate point of departure is to measure the existing status quo of the farm business's competitiveness by using available information on historic performance and how it fits into existing and likely future scenarios.

Figure 3 illustrates the concept of competitiveness in a global environment given input cost and the associated yield for soya bean production in the Eastern Free State. The prototype farm is compared against key global players such as Argentina, Brazil and the United States (US). The graph represents (for 2013 and 2014) the cost to produce a ton of soya beans, calculated by dividing establishment cost by yield. The implication of the dry season is clearly observable in 2013 where a yield of only 1,2 tons per hectare realised on the Eastern Free State prototype farm.

The graph further indicates that at the yields of 2,4 tons per hectare that were achieved in 2014, the competitiveness of the Eastern Free State farm improved significantly, yet the costs of production were still higher than the international sample space average of $121 per ton soya beans produced. The challenge is not necessarily at farm-level, but across the entire value chain.

Benchmark studies suggest that South Africa is ranked among the most expensive countries with regard to the cost of fertilisers. Among 22 countries, South African producers paid on average 38% more for nitrogen, 44% more for phosphorus and roughly 50% more for potassium. In terms of nitrogen costs, the inclusion of soya beans in a rotational cropping system will drive down the cost of nitrogen, but the higher costs for phosphorus and potassium will remain.

Furthermore, diesel expenses also seem to be significantly higher on the South African farm compared to the other countries. Argentinian farmers make extensive use of contractors and diesel expenses are hidden in this cost item, but for the Brazilian and US farmers, the diesel costs appear to be lower.

Figure 3: Soya bean international competitiveness. (Source: BFAP and agri-benchmark, 2016)

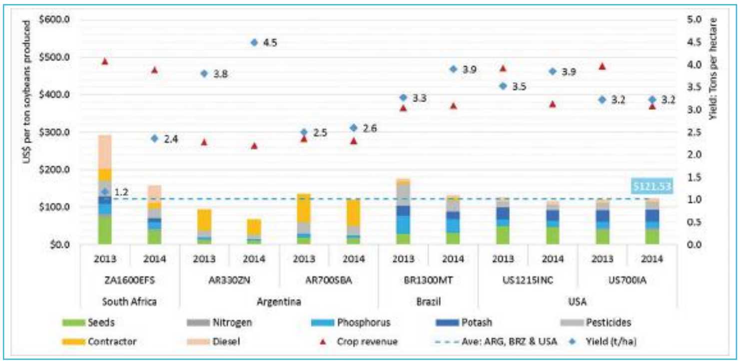
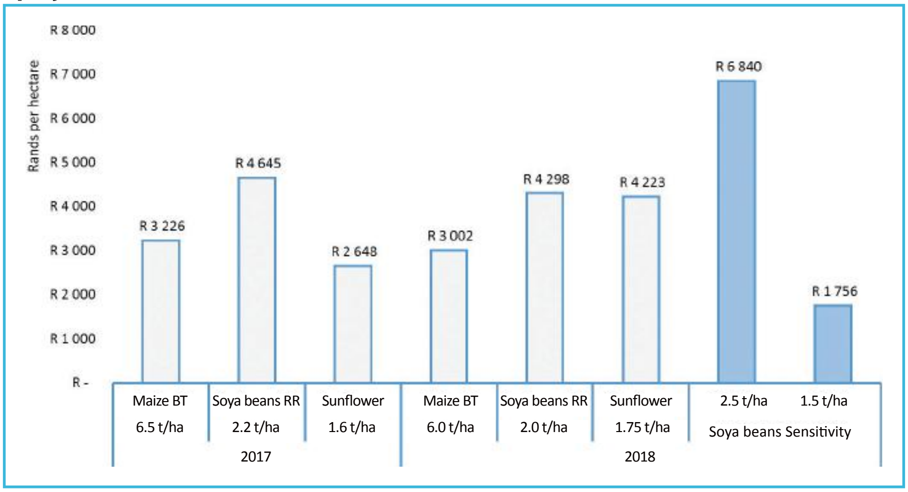


Figure 4: Eastern Free State – crop gross margins: 2017 (estimate) and 2018 (projection). (Source: BFAP and Grain SA, 2017)



Economics of soya beans

Figure 4 takes the economics of soya bean production one level deeper into the micro-environment of the producer in the Eastern Free State by considering the competition between crops. The competitiveness of soya beans among alternative crops is based on gross margins for the 2017 and 2018 seasons.

Given the current market prices and the estimated average yield of 2,2 tons per hectare for the Free State (Crop Estimates Committee 6th production forecast), soya beans are most likely outperforming maize and sunflower margins in the Eastern Free State in the current season.

Under the assumption that yields will return to trend levels under normal rainfall conditions in 2018, the margin for soya beans is still projected to be higher compared to maize and sunflower if BFAPs projected prices for 2018 materialise.

However, selecting the crop mix does not only depend on expected returns but also the risk associated with the expected return. This is where the variability in yields for soya beans has been a source of concern for farmers. The soya bean sensitivity analysis (*Figure 4*) illustrates the importance of yields, which could either result in margins well above competing crops or well below.

A high yield scenario of 2,5 tons per hectare will increase a farmer's soya bean margin by almost 160% from the baseline. This can push the gross margin to almost R7 000 per hectare. Yet the opposite is also true given a low yield scenario of 1,5 tons per hectare, which could reduce the margin by more than R2 500 per hectare.

In conclusion, there is significant potential for the expansion in soya bean production based on the growing demand for feed, and the potential financial returns and rotational benefits for subsequent crops at farm-level. However, the consistency of yields under adverse weather conditions will remain a key driver in the rate of growth of the industry. Therefore, continuous investment in the development of improved seed varieties, efficient production practises, continuous research and technology adoption will pay off in the long run.

For more information, contact Prof Ferdi Meyer on 012 420 4583 and Divan van der Westhuizen on 012 420 5021, or visit *www.bfap.co.za*.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The how and why of crop estimates

By Ursula Human

Aerial surveys are conducted by a field observation team in a very light aircraft, to determine area estimations. (Source: DAFF)

According to crop forecasts for the 2016/2017 summer crop season, a record crop of 15,63 million tons for maize and 1,34 million tons for soya beans is expected.

Each month the agricultural sector awaits the revised forecast estimates to keep updated with production figures as the season progresses. But why are these forecasts so significant and what exactly is measured? How are crop estimates conducted and who is involved in the estimate processes?

Why are crops estimated?

Crop forecasts are primarily undertaken to give an early indication of the expected production of grains to decision-makers in the agricultural sector. Crop estimates provide all role-players in the grain and oilseeds industries with data that aids them in planning and make informed decisions for the trading, transport, storage and marketing of crops.

Crop estimates in South Africa became especially important when the agricultural market converted to a free market system. A reliable crop estimate also ensures that buyers and sellers have equal bargaining power. It also allows the government to plan imports for staple grains such as maize, as was necessary during the 2015/2016 production season, when imports were required following a much lower crop production figure following the severe drought.

What is measured?

A production forecast (tons) requires knowledge of the area planted (hectares) and the crop yield (tons per hectare) of the crop. Production figures are derived by multiplying the planted area by the yield. Summer crop forecasts are done for white maize, yellow maize, sorghum, groundnuts, sunflower seed, soya beans, and dry beans.

Winter crops include wheat, malting barley and canola. Forecasts published are monthly area and production figures for each of the crops at a provincial and national level. Final production estimates are released at the end of the season.

Who determines estimates?

In South Africa, the Crop Estimates Committee (CEC), together with the Department of Agriculture, Forestry and Fisheries (DAFF) acting as secretariat, deliver the official crop forecasts of commercially produced summer and winter field crops.

The committee is made up of members that do not have a vested interest in the outcome of the estimate. Currently the CEC consists of the members from government and research organisations such as DAFF, one representative from each of the nine provincial departments of agriculture (PDAs), the Agricultural Research Council (ARC), Statistics South Africa (SSA), and the Bureau for Food and Agricultural Policy (BFAP).

The Crop Estimates Liaison Committee (CELC) acts in advisory role to the CEC and evaluates the results of the CEC forecasts and final estimates. Any interested party in the industry can be part of the CELC.

Currently, its participants include producers organisations such as Grain SA (GSA), seed companies, JSE Equity Derivatives Market (formerly Safex), South African Grain Information Service (Sagis), National Chamber of Milling (NCM), Agbiz Grain, the South African Cereals and Oilseeds Trade Association (SACOTA), CEC members, and DAFF.

DAFF, the PDAs and the National Crop Statistics Consortium (NCSC) are the main suppliers of data to the CEC. The NCSC was formed in 2001 and supplies the primary area estimate and yield forecast data to the CEC. The NCSC is a public-private sector consortium consisting of the ARC, SIQ (Pty) Ltd, and GeoTerraImage (Pty) Ltd. The CEC also receives information from various organisations and institutions such as agricultural risk specialists, fertiliser companies, financial institutions, producer organisations, traders and trade organisations.

Area estimations

The CEC uses two main sources for area estimations. The first is a postal/email/telephonic survey undertaken by DAFF to determine the intentions to plant and preliminary area estimate. For the remainder of the forecasting season it uses the second and main source of area estimates, namely the Producer Independent Crop Estimates System (PICES).

PICES is a method developed by the NCSC to estimate the areas planted to summer and winter grain crops combining and integrating satellite imagery, remote sensing, point frame statistical platforms, GIS and aerial observations from light aircraft.

Each season an aerial survey with light aircraft of sample points is conducted to determine the crop planted on the field represented by each sample point. Using this methodology, an area of approximately 13 million hectares of fields can be covered in a two-month period using three field observation teams. An added advantage is that it is a much more cost-effective system than a ground based system that uses motor vehicles.

The CEC estimates the area planted for all purposes and not only the area harvested for grain. For summer field crops, the first area estimate is made in January and may be adjusted in February and March, if there is sufficient evidence to support a revision. For winter field crops, the first area estimate is in July and the area may still be adjusted in August.

A light aircraft and the crop estimates team in action. (Source: SIQ and Grace Air)

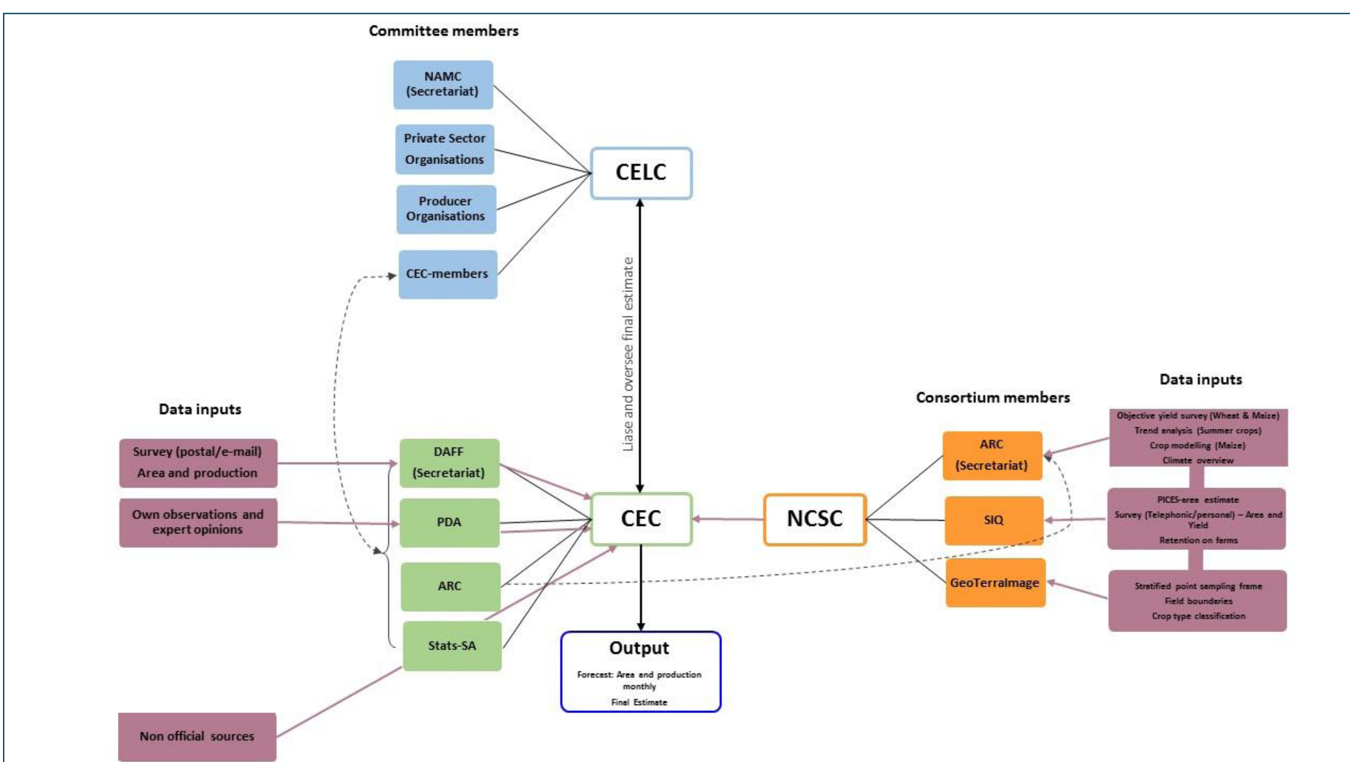
Yield forecasts

For yield forecasts the CEC uses three or more sources: surveys done by DAFF (through the post, email and per telephone), an objective yield survey (OYS) for wheat and maize – coordinated by the ARC through the NCSC, and a producer interview telephonic survey by the NCSC.

DAFF sends questionnaires to a non-probable sample of co-operators, approximately 2 000 questionnaires for summer crops and 1 000 for winter crops. The farmer is requested to provide a production estimate of the planted crops on his or her fields, based on the prevailing production conditions. The estimated production by the respondents for the present month with their declared area planted is taken to reach an average yield in a magisterial district or province.

The telephonic survey collects information regarding estimates of expected yields of farmers during February and March (summer crops) and during August and September (winter crops). Farmers must indicate the expected yield for each crop on his or her farm.

OYS locations are selected from the point frame where crops of interest were found. OYS samples are selected within each province with a probability proportional to size, making it a self-weighting sample. Enumerators visit the selected fields and collect background information relating to the crop planting. This is followed by measurements of plants and cobs within randomly selected sites on the field, while following a strict set of procedures.



Cutting-edge technologies and the collaboration of many role-players are the foundation of producing a reliable crop production forecast and estimate. (Source: ARC)

A median is determined to derive an average size of maize cobs in a selected site during an objective yield survey. (Source: ARC)

Enumerators undergo hands-on practical training. The OYS for maize is undertaken annually, covering the three major maize producing provinces of Mpumalanga (April), Free State and North West (May) where 700 locations are sampled. The annual wheat survey, with 600 sampling locations, is undertaken during October in the Western Cape and November/December in the Free State.

Other yield inputs are obtained from the provincial representatives, whilst crop yield modelling and trend analysis results are supplied by the ARC through the NCSC.

Production forecasts

The CEC releases eight monthly production forecasts for summer field crops from February to September, and seven production forecasts for winter field crops from August to February the following year. For summer field crops, there is an "intentions to plant" survey in October followed by a preliminary planted-area estimate in January, whilst for winter field crops this is in April and July respectively.

Final production estimates are released at the end of a production season when there is a finalisation of the crops, which for the summer field crops is in February the following year and for the winter field crops in May following the season.

The estimate is based on actual producer deliveries (as reported by Sagis), projected future producer deliveries and the retentions on farms for own use. This figure is submitted to the CELC for approval. The calculated production for both summer and winter field crops is compared to the monthly production forecasts and final production estimate.

According to the CELC accuracy parameters, the final crop numbers should be within 8% for the first to the fourth production forecast and within 5% from the fifth to the final production estimate. In the last couple of years, the CEC has been within its mandate of a 5% accuracy to the final production estimate.

For more information, contact the CEC committee on 012 319 8454 or DAS@daff.gov.za.

The credibility of Sagis's information

By Nico Hawkins, general manager, South African Grain Information Service NPC

A while ago an interesting statement was made on social media that Sagis uses file 13 to balance its books. This statement was not taken lightly and led to some serious introspection. The conclusion was that the main reason seems to be that some people are still uninformed regarding Sagis's role in the grain and oilseeds market. Therefore, it is appropriate to clarify perceptions by providing facts.

Perceptions versus facts

Perception: Government involvement.

Fact: It seems that many role-players in the industry are under the impression that Sagis has a connection with government, and is instructed to manipulate information from time to time that will affect commodity prices.

It does not receive any funds from government. The only "intervention" from government was the approval of statutory measures that were requested by various market participants to ensure that all relevant role-players register and supply information to Sagis.

Perception: Certain groupings in the marketplace deliberately supply wrong information to manipulate market prices.

Fact: To be successful, such an act will involve a huge and coordinated collusion including Sagis's audit inspectors. There is absolutely no gain for Sagis to become involved in such an action.

Perception: Sagis does the crop estimates.

Fact: Crop estimates are done by the Crop Estimates Committee (CEC), which is a Department of Agriculture, Forestry and Fisheries (DAFF) committee. It is important to note that crop estimates and Sagis's figures can and will never be equal in a particular marketing season. This is because Sagis reports on actual deliveries received and not what is estimated to be produced in a production season.

Perception: Not all role-players in the commercial grain and oilseeds industries are registered with Sagis.

Fact: Commercial storage owners and processors of grain and oilseeds form the core of the system by which Sagis acquires and makes information available. All grain and oilseeds move through both or only one of the institutions at some point to eventually reach the consumer.

It is, therefore, very difficult for a commercial role-player to hide from Sagis over the long term. Informal movement, e.g. between a producer of grain and oilseeds and his neighbour's feedlot as well as on-farm use by a producer himself, is unfortunately not reflected in its figures.

Short overview on Sagis

The *Marketing of Agricultural Products Act*, 1996 (Act 47 of 1996) put an end to single-channel marketing and control boards after deregulation. Role-players in the maize, winter cereal, oilseeds and sorghum industries, however, realised the need for reliable information for the proper functioning of a free market and collaborated to establish Sagis. These role-players, through the different trusts (Maize Trust, Winter Cereal Trust, Oil and Protein Seeds Development Trust and Sorghum Trust), also provide the funding of Sagis.

Sagis, a non-profit company, will commemorate its 20-year existence on 11 November 2017. The main goal, since its establishment, is the gathering, processing, analysing and timeous distribution of reliable agronomic information to all role-players.

Market participants (co-workers), e.g. traders, stores, processors, importers and exporters of grains and oilseeds, are statutory compelled under the above act to register with Sagis and to submit information. A co-worker who does not adhere to the requirements of the statutory measure is guilty of an offence and can be prosecuted. Fortunately, co-workers realise the importance of reliable information and cooperate by submitting returns timeously and regularly.

Reliable information hub

Since its humble beginning, Sagis has distinguished itself as a reliable information hub where a wide spectrum of information on nine grains and oilseeds is available and is used nationally and internationally.

How do role-players feel about the credibility of its information? The feedback from three recent surveys are shown in *Figure 1*.

It seems that mainly primary producers (according to a survey at the Grain South Africa congress) are in doubt about the accuracy and credibility of its information. Other role-players, as reflected in a survey held at a Grain Handling Organisation of Southern Africa (GOSA) conference as well as on Sagis's website, consider Sagis's information to be more reliable.

Although Sagis's own web survey cannot identify the role-players, the website is visited locally and internationally by the whole spectrum of stakeholders.

Correctness of Sagis's data published

Over the years, Sagis has developed methods and systems to validate data received to ensure its correctness and integrity.

Internally it has a sophisticated computer system that performs various

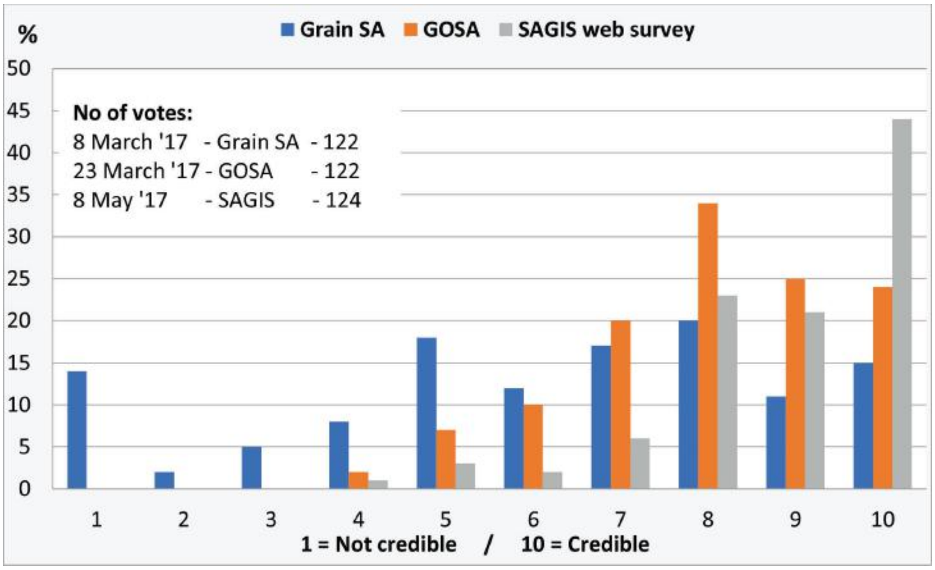


Figure 1: Feedback on the credibility of Sagis's information.

tests when processing a return on the system. It creates reports that help the staff to identify errors and deviations quickly for follow-up. Information from external sources, e.g. Sars, the Perishable Products Export Control Board (PPECB), Portnet and Spoornet, is used to test Sagis's information.

By physically taking stock, Sagis's inspectors play an important role in measuring the reliability of the information independently, and also physically on the premises. Source documents are audited on a sample basis and figures are consequently followed through to determine the reasonable accuracy and completeness of the return.

Although inspectors regularly find adjustments to the returns provided are needed, it has virtually no effect on its already published information.

Sagis's future existence depends on the integrity of the data and information we publish. It is important that the data is regarded as trustworthy and relevant to be used for decision-making by all role-players in the grain and oilseeds markets. Therefore, there is no benefit for Sagis in manipulating information. However, it can only consistently verify the information provided by the role-players (co-workers) through various internal and external controls to ensure its correctness before it is disclosed.

For more information, contact Nico Hawkins at nicoh@sagis.org.za.

The role of soya in human nutrition for South Africa

By Prof Wilna Oldewage-Theron and Prof Abdulkadir Egal, Vaal University of Technology

In South Africa, 22,3% of the population still has insufficient food for an active and healthy life, and 11,8% experience chronic hunger. Undernourishment is characterised by protein-energy malnutrition (stunting, wasting and underweight) as well as micronutrient deficiencies (e.g. vitamins A, D, B6, B12, zinc and iron).

On the other hand, South Africa has the highest prevalence of overweight and obesity in sub-Saharan Africa with approximately 70% and 33% of women and men categorised as either overweight or obese respectively. Women are affected most with 40% being obese. However, this is not only an adult problem as 25% of girls and 20% of boys, aged 2-14 years old, are overweight or obese.

Obesity is often associated with non-communicable diseases (NCDs) such as heart disease, type 2 diabetes, cancer and high blood pressure. Behavioural and modifiable risk factors, namely a sedentary lifestyle, an unhealthy diet, and substance (mainly alcohol and tobacco) use contribute to approximately 45% of all NCD deaths globally. In 2017, 48% of all deaths in SA were due to NCDs, many of which were associated with nutrition and lifestyle.

Prevalence rate

The South African National Health and Nutrition Examination Survey (SANHANES-1) indicated self-reported family history of 30,9% high blood pressure, followed by 20,7% high blood sugar, 8,9% stroke and 7,6% heart disease.

Nationally, a prevalence rate of 31,8% for high blood pressure, 9,5% diabetes, and 23,9% and 24,6% with abnormally high serum total cholesterol (TC) and low-density lipoprotein-cholesterol (LDL-C) respectively and 47,9% with abnormally low high-density lipoprotein-cholesterol (HDL-C) was measured. The situation of under- and over nutrition may sometimes occur in the same population or household and is called the double burden of disease.

The benefits associated with the regular consumption of soya, in combination with other healthy foods, have been scientifically proven and are becoming more relevant to prevent or address the negative consequences of this double burden. High-quality protein is often missing from undernourished children's diets.

Not only does soya contain all the essential amino acids children need to grow, but it also provides some of the essential micronutrients such as folic acid, vitamins B1, B2 and E, zinc, iron, magnesium and calcium to the diet. It is lactose free and can be used instead of cow's or goat's milk when infants or children have a lactose intolerance or are allergic. Soya is also gluten free and can be included in gluten free diets.

Heart-healthy food

Soya is not only beneficial for the undernourished, but is a heart-healthy food because of the low content of saturated fat and high content of omega-3 and omega-6 fatty acids. Soya further contains no cholesterol and protects against heart disease by assisting with the reduction of both blood cholesterol levels and -pressure. It is also a good source of dietary fibre that promotes not only gut health, but also provides a feeling of satiety and fullness.

Soya has a lower glycemic index that keeps blood glucose levels more stable and is therefore also recommended as a diabetic food. The anti-cancer properties of soya (isoflavones and phytochemicals) provide protection against various cancers such as breast, prostate, skin, stomach and colon cancer.

Besides all the health benefits, soya is an affordable and very versatile food for use in South Africa. Soya protein is much cheaper compared to other high-quality protein sources such as eggs, chicken and beef. Soya beans are also more economical to farm and can be produced by small scale farmers. It is versatile and can be used on its own as soya milk, yoghurt or tofu or as an ingredient in high-protein meat replacements, energy bars, protein-enriched cereals and baked goods.

Incorporated into recipes

A study was undertaken in QwaQwa, where a baseline survey was conducted to determine the main challenges to be addressed in the community. A household soya gardening programme was

Table 1: Descriptive statistics anthropometric and biochemical parameters measured.

Variable	Unit of measure	Normal range	Cholesterolaemic group (HC) (n=36, 40%)		Normocholesterolaemic group (NC) (n=54, 60%)	
			Baseline Mean±SD	Follow-up Mean±SD	Baseline Mean±SD	Follow-up Mean±SD
Height	metre (m)		1,6±0,1	1,6±0,1	1,6±0,1	1,6±0,1
Weight	kilogram (kg)		77,2±14,9	77,4±17,2	76,1±17,7	78,0±16,2
BMI	kg/m2		30,0±6,5	30,4±7,0	30,0±6,3	30,8±6,3
Serum cholesterol	mmol/L	<5,2 mmol/L	6,8±1,9^{a}	7,2±2,2^{c}	4,4±1,5^{a,b}	7,4±2,6^{b,c}
HDL-cholesterol	mmol/L	>1,68 mmol/L normal	0,8±0,5^{a,b}	1,4±0,5^{a}	0,9±0,6^{b}	1,4±0,6
LDL-cholesterol	mmol/L	<3,3 mmol/L normal	5,4±1,8^{a}	3,9±1,9^{a,c}	3,0±1,3^{a,b}	2,0±1,9^{b,c}
Serum triglycerides	mmol/L	<1,7 mmol/L normal	2,7±0,9^{a,b}	2,0±1,0^{a}	2,3±0,8^{b}	2,2±1,2
HDL:LDL ratio		>0,4	0,18±0,14^{a,b}	0,27±0,1^{a}	0,37±0,33^{b}	0,39±0,85

a,b,c in the same row refer to statistically significant differences between the variables p≤0,05 (Independent [between groups] and paired [within groups] t-test for equality of variances).

implemented and soya recipes developed and tested for sensory acceptability. Minced whole soya beans, soaked for more than eight hours, were incorporated into 20 household recipes most frequently prepared in QwaQwa.

Skills training in 2010 included teaching the women to prepare the soya recipes, which contained 40g of whole soya beans per person per day, and how to include the recipes in the household menu planning. The soya consumption intervention was undertaken over 18 months.

Ninety women were randomly recruited for the intervention study to measure the impact of soya consumption on lipid profile and risk factors of Metabolic syndrome (MetS). These include high blood pressure, obesity (measured by waist circumference [WC]), low serum high-density lipoprotein-cholesterol (HDL-C) (good cholesterol), high LDL-C (bad cholesterol) and high glucose levels.

MetS is a condition where three or more of the risk factors are prevalent. During the 18-month intervention study, the respondents were instructed to follow their usual diet, but to replace one of the recipes with a soya-based one each day to ensure the intake of at least 40 grams of whole soya beans per person.

Significant differences

The researchers visited the women every month to measure compliance, checking on the availability of soya beans and discussing problems regarding soya recipe preparation and side-effects. Dietary intake, anthropometric and blood pressure measurements were recorded and blood was drawn one week before and one week after the 18-month period.

The results in *Table 1* indicate statistically significant differences in all the lipid parameters between the hypercholesterolaemic (HC) and normocholesterolaemic (NC) groups at baseline. The HC group showed abnormal mean values for all the lipid parameters at baseline whereas the NC group showed TC and LDL-C values in the normal range, but abnormally low mean HDL-C and high mean triglyceride (TG) levels.

The HDL:LDL ratio is a good indicator of cardiovascular disease (CVD) risk than the individual HDL- and LDL-C levels. The observed HDL:LDL ratio was significantly lower in the HC group than in the NC group. However, the HDL:LDL ratio was lower than the recommended >0,4 ratio in both groups, thus indicating a high risk for CVD in this sample of women.

At follow-up, the HC group had significantly improved HDL-C, LDL-C and TG levels. A similar trend was observed in the NC group, but no significantly improved TG values were observed. The HDL:LDL ratio improved in both groups, but was only significant in the HC group at follow-up. In both groups, the HDL:LDL ratio was still lower than the recommended >0,4.

Beneficial effect

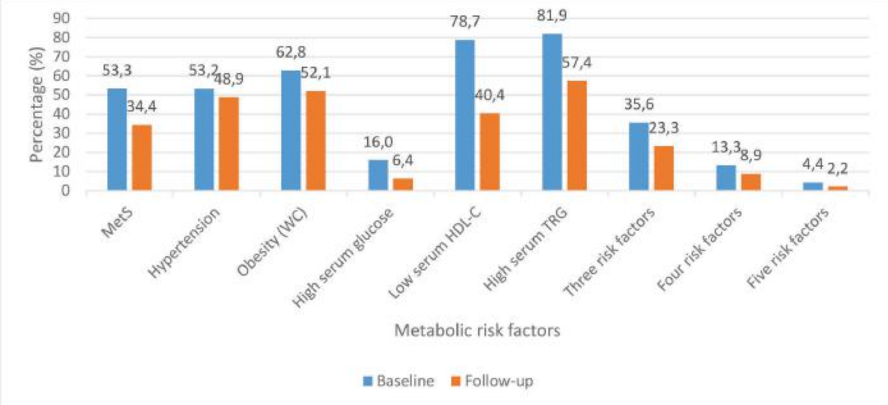
The results in *Figure 1* show a significant reduction in the prevalence of MetS after the intervention and an improvement in all the risk factors for MetS. The soya consumption intervention therefore had a beneficial effect on blood pressure, blood glucose, HDL-C and TG levels as well as obesity (WC).

Although our research has proved that soya protein has a beneficial effect on TG and LDL-C, the daily consumption of 40g of whole soya bean, equivalent to 15g soya protein, had no significant positive effect on TC, but had a beneficial effect on LDL-C of the HC and NC women in QwaQwa.

The HDL:LDL ratio was also improved in both groups, consequently reducing the risk for CVD. It was thus proven that soya consumption has a beneficial effect on HC in women. In addition, the soya consumption intervention also proved to be effective for the treatment of MetS.

To conclude, soya has been identified as an economical and versatile food item that will not only provide essential nutrients for under-nutrition, but also add additional and unique health benefits addressing the increasing prevalence of over-nutrition in developing countries.

Figure 1: MetS classification of the women before and after the intervention.



The Southern African Grain Laboratory:

Services to the oilseed industry

By Ursula Human

The Southern African Grain Laboratory NPC (SAGL), an independent ISO 17025 accredited testing laboratory, acts as the reference laboratory for the grain and oilseed industry in Southern Africa. The crop quality division of the SAGL performs national crop quality surveys on different crops, including soya beans and sunflower seeds.

These oilseed surveys are funded by the Oil and Protein Seed Development Trust. Results of the surveys are available on the SAGL website. During the season, results are updated weekly on the website and at the end of the season hard copy reports are distributed to directly affected groups and interested parties.

Training and research

Technical and quality training courses, developed and presented by SAGL staff to participants from South Africa and the rest of Africa, consist of theoretical and practical modules. The training presented at the SAGL's premises include grading and milling, conducting of analytical methods and quality procedures to comply with the requirements of the international ISO 17025 standard. There is a special focus on improving the testing capacity of the Southern African Development Community region.

Through participation in international proficiency schemes as part of the ISO 17025 accreditation process, SAGL is continuously providing proof of technical competency, traceability and comparability to global standards. The South African National Accreditation System conducts surveillance audits within an 18-month cycle to confirm that the SAGL complies with the requirements of the standard.

The sieving of soya beans on a 4,75mm round hole sieve.

The SAGL offers ring tests to local and international participants to be used as independent assessments of their quality control measures relating to the monitoring of equipment, staff and analytical methods. Results of collaborative research studies conducted with tertiary educational and research institutions as well as national annual crop quality surveys are shared with the industry. Reports of the national cultivar trials on soya beans and sunflower conducted by the Agricultural Research Council are also included in the survey reports.

> **Soya beans are the main oilseed crop produced and expanded crushing capacity resulted in higher demand.**

Services to the oilseed industry

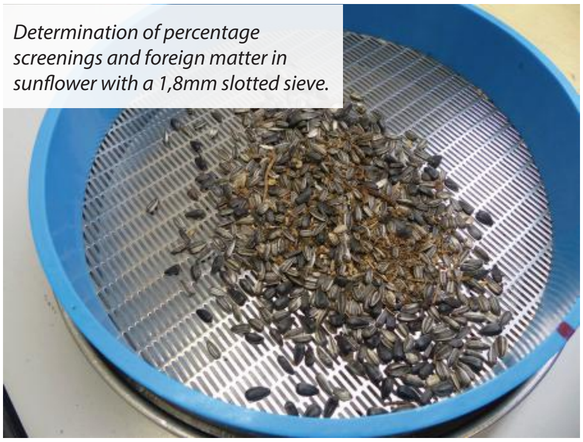
In a reference laboratory capacity, the SAGL makes use of accredited international primary test methods in the different laboratories. The methods of importance to the oilseed industry include:

Grading: Grading and physical testing on oilseeds are services available to all stakeholders in the value chain.

Nutritional analyses: Nutritional analyses, including moisture, protein, oil, ash and fibre content are conducted. Soya beans are the main oilseed crop produced and expanded crushing capacity resulted in higher demand. Results from the crop surveys can provide useful information regarding quality of locally produced soya beans from different production regions and seasons.

Amino acid profiling: Soya protein is a major component in both animal feed and human food. Soya protein contains all 11 essential amino acids. Analyses on isolated soya bean protein or heat processed soya bean meal

Foreign matter (left) and pieces of soya beans (right) removed on a 4,75mm round hole sieve.



Determination of percentage screenings and foreign matter in sunflower with a 1,8mm slotted sieve.

Shelling (dehulling) of sunflower using the Barley Pearler.

Dehulled sunflower with heat-damaged nucleus portions and sound sunflower.

can provide the industry with information on factors such as over- or under -processing.

Mycotoxin testing: Changing climatic conditions over regions and seasons require more regular mycotoxin testing of oilseed commodities and related food and feed products to ensure safe levels in compliance with regulatory requirements. The specific mycotoxins included in the SAGL multi-mycotoxin method are based on the mycotoxins of generic importance to the industry. Reports are published annually.

Time, volume and cost

Turnaround times at the laboratory are determined by the volumes of samples submitted as well as the number and type of analyses requested per sample. The workflow in the laboratory, the time required for sample preparation and analysis time are all determining factors to be taken into account.

Arrangements for batches of samples to be submitted simultaneously for analyses, such as amino acid determination, can shorten turnaround times and reduce unit costs. This will enable the SAGL to offer the service at a more affordable fee for quality control and research study purposes. Requests to develop capacity for specific analyses that are not part of the current scope of services are encouraged. This will ensure a better service to the stakeholders in the oilseed value chain.

For more information, contact the SAGL on 012 807 4019 or email info@sagl.co.za. Visit *www.sagl.co.za* to learn more.

Reviewing high oleic vegetable **oil substitutions**

By Peter J Huth, Victor L Fulgone and Brian T Larson

The role of edible fats and oils in health and disease continues to evolve as further knowledge is gained about the relation between dietary fats and fatty acids (FAs) and chronic diseases, particularly coronary heart disease (CHD). For instance, in response to early public health recommendations to move away from animal fats and tropical oils to reduce CHD risk, the food industry adopted the use of partially hydrogenated vegetable oils (PHVOs) to achieve the same functional characteristics provided by animal fats in food products.

PHVOs and the trans-FA (TFA) components produced by partial hydrogenation of liquid vegetable oils appeared to be a suitable alternative because of their ability to replace animal fats high in saturated fat while providing adequate functionality for a wide range of product applications, increased flavour stability and shelf life, resistance to oxidation, lower cost, and consistent availability.

However, based on evidence from numerous clinical and prospective cohort studies it is now recognised that the consumption of TFAs, in amounts achievable in Western diets, adversely affects CHD risk factors and is associated with a higher risk of CHD.

Dietary guidelines

Current United States (US) government dietary guidelines recommend keeping TFA consumption as low as possible by limiting the intake of foods that contain TFAs and by limiting other solid fats. In addition, since 2006, food manufacturers are required to state the quantity of TFAs per serving on the nutrition facts panel of all packaged food labels. As a result, many food products were reformulated to contain lower amounts of TFAs and have led to substantial reductions in TFA intake.

Many ingredient alternatives are available to replace PHVOs in oil-based food products. In general, most edible fats and oils are used in three areas of food product applications: salad and cooking oils, solid fats (e.g. margarines and shortenings), and frying oils. Salad and cooking oils is the largest category, accounting for 65% of the total fats and oils consumed in the US.

The need for TFA alternatives in this category is low, because most of these products contain little or no TFAs and typically include oils rich in polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs) such as soya bean oil (SBO), maize oil, canola oil, and others.

In contrast, solid-fat products that contain PHVOs such as margarines and shortenings present greater product challenges. These include management of functional properties such as melting point, lubricity, moisture barrier, and creaming ability to produce a product low in TFAs with parity performance to its PHVO counterpart.

Fats and oils in food preparation

To minimise TFAs while meeting functional and stability requirements many of the current approaches have typically used oil blends that contain small proportions of saturated fats high in palmitic acid (e.g. palm and palm fractions) and a high proportion of high oleic acid (HO) oils or oils moderately high in linoleic acid (LA) and alpha-linolenic acid (ALA).

Frying fats and shortenings used in restaurants for preparing deep-fried foods and for commercial frying of packaged foods such as snacking chips, represent a large source of PHVOs and are known to contain relatively high amounts of TFAs.

Alternative oils with increased amounts of oleic acid (50–65%), decreased amounts of LA (20–30%), and low amounts of ALA (<3%) have proven effective replacements for PHVOs. This is because they can withstand the high temperatures of commercial frying, provide relatively long fry-life, and are resistant to producing off flavours because of thermal deterioration and oxidative processes.

The replacement of PHVO frying fats with alternative oils was examined in a FA-analysis of 327 fast-food items by Health Canada, which suggested that products achieving a goal of ≤5% TFAs was accomplished by using predominantly HO vegetable oils. Examples of these oils (>70% oleic acid) include olive oil, HO sunflower oil, HO safflower oil, and newer trait-enhanced oils such as HO canola oil, and HO soya bean oil (H-OSBO).

Traditional use of soya bean oil

SBO is the most consumed edible oil in the US because of its availability, cost, and versatility in food product applications. In 2004, of the 12,3 billion kg of edible oils used in the US, SBO accounted for 7,9 billion kg (67%). SBO is high in LA and ALA.

Therefore, for use in baking and frying, shortenings in which high heat stability is required, SBO was traditionally partially hydrogenated to produce stable solid or semisolid fats. In 2006, an estimated 41% of the total SBO used in edible products was partially hydrogenated. This accounted for nearly 82% of the 3,45 billion kg of baking and frying shortenings produced in the US, and considerable amounts used in production of margarines – particularly the hard-stick variety.

Yet, because of US and Canadian regulatory requirements for mandatory labelling of trans fats on packaged foods and mounting consumer concerns about the health effects of TFAs, the food industry has been reducing or eliminating TFAs in its products.

Move to high oleic oil

Between 2007 and 2011, 66% of identified brand-name products in US supermarkets that contained ≥0,5g TFAs per serving had reduced its content to <0,5 g per serving. Although SBO continues to be the dominant edible oil in the US market, in 2011–2012 it accounted for 50% of the disappearance of all edible fats and oils used, down from 65% a decade earlier.

The market trend away from SBO and SBO-derived hydrogenated ingredients has made development and expanded production of H-OSBO a compelling alternative because of its high heat and oxidative stability for use in both high temperature and ambient temperature food applications, and because of potential cost advantages due to the economy of scale of US soya bean production.

Because H-OSBO requires no hydrogenation to be used in many processed food applications, including deep frying and baking, its use in processed food products provides opportunities for consumers to reduce their intake of TFAs. Large-scale substitution of SBO with H-OSBO could affect the intake of other FAs, including the essential FA and ALA.

The ALA content of H-OSBO is 2,5–3,0% compared to 7% for SBO. However, SBO is hydrogenated for use in many food applications which reduces its ALA content. Therefore, the FA content of foods produced from H-OSBO and partially hydrogenated SBO (PHSBO) will differ primarily in the amounts of TFAs and not ALA content.

Dietary effect impact studies

In a study that estimated the impact of substituting low ALA-SBO, a SBO variety that contains only 2,4% ALA, for PHSBO in several food categories, dietary TFA intake was reduced by 45%, whereas no reduction was found in ALA intake. Because the levels of ALA in low ALA-SBO and H-OSBO are similar, the dietary effect of substituting H-OSBO for PHSBO on ALA intake would be expected to be similar to that estimated for low ALA-SBO.

In the only randomised controlled trial, to our knowledge, that compared the effects on blood lipids of a diet high in H-OSBO with a diet with an isocaloric amount of SBO (high PUFAs), no substantial differences were observed in any of the lipid biomarkers, suggesting that MUFAs and PUFAs are interchangeable for their effects on blood lipids.

Both diets were effective in substantially lowering LDL cholesterol, apolipoprotein B, and the ratio of total cholesterol (TC) to HDL cholesterol compared with a diet that contained TFAs from PHSBO.

Previous reviews that assessed the clinical evidence on the effects of MUFAs on traditional cardiovascular disease risk factors concluded that the MUFA class of FAs favourably affects plasma lipids and lipoproteins when substituting for SFAs or carbohydrate-containing diets.

In a meta-analysis of 13 RCTs that estimated the change in CHD risk when TFA-containing diets are substituted with unsaturated FA containing vegetable oils, replacing 7,5% of energy from PHVOs with an equivalent amount of HO- or PUFA-containing vegetable oils resulted in risk reductions of 9,2% and 8,8%, respectively.

Clarity is still needed

Although these studies indicate that replacing saturated fats or PHVOs with high MUFA-containing vegetable oils has a favourable effect on CHD risk, there is a need for additional clarity. Given the predicted increased presence of H-OSBO in the US diet, there is a need to understand the quantitative and qualitative impact of HO oils on CVD risk compared with other fats and oils in the diet.

The complete research piece can be read in *Advances in Nutrition*: *An International Review Journal.* Visit *www.advances.nutrition.org* for more information.

High Oleic Sunflower Oil

High oleic sunflower oil is very high in oleic (monounsaturated) acid. It is usually defined as having a minimum of 80% oleic acid.

The oil has a neutral taste and provides excellent stability without hydrogenation. High oleic sunflower oil offers a trans-free oil solution for customers. It has many uses which include bakery applications, spray coating oils for cereal, crackers and dried fruit, and can be used in non-dairy creamers and many types of frying.

The patent on high oleic sunflower oil and seed has expired. Consequently, more companies are getting involved in producing and merchandising this oil. However, for the near future at least, it will continue to be grown on a contracted acre basis with customer needs driving total acres. As with all sunflower, high oleic hybrids have been developed through conventional breeding methods.

The potential benefits to lower cardiovascular risk were achieved through increases in HDL cholesterol and further reductions in the ratio of total to HDL cholesterol.

Monounsaturated fat

Summary: A higher intake of monounsaturated fat may raise high-density lipoprotein (HDL) cholesterol without raising low-density lipoprotein (LDL) cholesterol.

Findings: For patients who consumed a dietary portfolio high in monounsaturated fat, HDL cholesterol rose, whereas for those consuming a dietary portfolio low in monounsaturated fat, HDL cholesterol did not change.

Monounsaturated fat increased the effectiveness of a cholesterol-lowering dietary portfolio, despite statin-like reductions in LDL cholesterol. The potential benefits to lower cardiovascular risk were achieved through increases in HDL cholesterol and further reductions in the ratio of total to HDL cholesterol.

A more detailed abstract of this research is available via the *Canadian Medical Association Journal* website (*www.cmaj.ca*).

High oleic sunflower oil

Summary: A diet rich in high oleic acid sunflower oil favourably alters low-density lipoprotein cholesterol, triglycerides, and factor VII coagulant activity.

Findings: Substitution of foods rich in saturated fat with foods rich in high oleic acid sunflower oil and margarine has favourable outcomes on blood lipids and factor VII coagulant. This oil presents another useful source of monounsaturated fatty acids for diets aimed at prevention of heart disease.

A more detailed abstract of this research is featured in the *Journal of the American Dietetic Association*. The research appeared in the July 2005 issue, pages 1071-1079.