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The importance of oilseeds in the food value chain

By Wouter de Wet, chairperson, Animal Feed Manufacturers' Association

As we near the end of 2020, we look back on one of the most extraordinary years most of us have ever experienced. While our economy is reeling as a result of a very harsh lockdown governed by long lists of regulations, these events highlighted the importance of understanding the entire agricultural and food value chain, and why a holistic approach that involves all role-players is essential.

You cannot declare food and feed essential services and then close the ports and cut off critical supplements and medication. You cannot simply close restaurants as this causes a sharp drop in demand, with no home for large quantities of chicken and other produce. You cannot turn the food value chain on and off at will.

One of the biggest strengths of the food value chain during lockdown was the ability to work together and leverage its combined voice to lobby government to remove these bottlenecks and ultimately gradually reopen these channels.

Impact on the feed industry

The best way to illustrate the importance of oilseeds and the oilseeds industry in the food value chain, would be to look at the feed industry. But first, some context.

Members of the Animal Feed Manufacturers' Association (AFMA) produce 6,7 million tons of feed per year, which represents roughly 57% of all feed produced in South Africa. In the past year, AFMA members utilised 270 000 tons of sunflower oilcake, 950 000 tons of soya oilcake and 130 000 tons of full-fat soya. The local feed industry consumed the entire local oilcake production and another 470 000 tons of soya bean meal had to be imported to meet local demand.

Most of the oilcake is formulated into poultry feed, and with that comes a few important realities. Firstly, sensitivity to the quality and nutritional value of the oilcake, and secondly, the significant impact oilcake has on the price of chicken. The cost of oilcake has a direct impact on the price of poultry and its affordability, the cost competitiveness of the poultry industry on the international stage, and ultimately on the per capita consumption of our most affordable animal protein.

Acknowledging the gap

It is clear that there is a gap in local supply. The impact of dumped chicken on our local market is well documented; before COVID-19 more than 500 000 tons of imported chicken were dumped in our local market. That is more than one million tons of feed and grain we could have produced locally. If we add the almost 500 000 tons of soya oilcake being imported, the current oilseeds supply gap is significant.

The future demand for local oilseeds is bright and the critical role the oilseeds industry will play in providing more affordable food on the tables of our nation, is significant.

The success story of the local soya industry over the past few decades is legendary and the way in which the various role-players continue to work together on critical areas such as yield and quality improvement, ease of trading and many other efficiencies is commendable. But there is significantly more growth potential.



Wouter de Wet.

Unlocking the sector's potential

Not only will this growth opportunity unlock economies of scale for the oilseeds value chain, it will also provide the opportunity to address other challenges, such as introducing more developing or informal producers into the value chain. The critical factor here is to align everyone around a common goal, a growth target – to become a net exporter, be it in the form of meal or beans or both.

The future demand for local oilseeds is bright and the critical role the oilseeds industry will play in providing more affordable food on the tables of our nation, is significant. 🌱

For more information,
email the author at
wdewet@countrybird.co.za.

The new normal

On 24 October, global COVID-19 cases reached the highest level of new infections since the beginning of the pandemic, recording close to 530 000 new cases in a single day. On the same date, new infections in South Africa had decreased dramatically, from a peak of nearly 14 000 new cases on 24 July, to 1 834.

At the time of writing, some countries were imposing stricter regulations and even entering hard lockdown again. In South Africa, however, we were experiencing some relief and a sense of near normality. The population had played their part in curbing the infection rate and, considering what other countries were going through, South Africans were breathing a sigh of relief. (I realise that things may be vastly different by the time you read this.)

Commodity prices skyrocket

On 24 July this year you would have been able to purchase yellow maize at R2 681/ton, soya beans at R6 975/ton, sunflower seeds at R6 180/ton and soya bean meal at R7 000/ton. Skip ahead three months to October, and the prices of these commodities had increased exponentially to R3 615/ton (+36%), R8 523/ton (+22%), R8 255/ton (+34%) and R8 900/ton (+27%), respectively.

Increased demand and purchasing from China, weather concerns in South America, as well as the funds

purchasing these commodities, all contributed to this price rally. Locally the question was not only how long these high prices would last, but whether these increases could be passed on to the end consumer in the form of meat, milk, and eggs. As consumers continue to struggle, the entire supply chain will likely be facing a difficult period for some time.

The best remedy for high prices is high prices; high prices will reduce demand and increase production, resulting in a return to more normal prices. Producers should take the opportunity to lock in these excellent prices while maximising output.

We are confident that this excellent spirit of collaboration will continue to make the industry increasingly competitive, leading to prosperity and enhancing growth.

Supply chain optimisation

Over the course of the past two years, various opportunities have been created for members of the oilseeds supply chain – producers, input suppliers, handlers, processors, policymakers, intermediate and end users – to sit around a table and deliberate the challenges faced by the industry, and to look at solutions and interventions that would benefit the industry as a whole.

We are confident that this excellent spirit of collaboration will continue to make the industry increasingly competitive, leading to prosperity and enhancing growth.

Enjoy this issue of *Oilseeds Focus*.

Dr Erhard Briedenhann

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

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

Associate editor
Gerhard Keun • 011 803 2579

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

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

Sub-editor: Danielle Barfoot
+27 12 664 4793 • danielle@plaasmedia.co.za

News editor: Ursula Human
+27 64 890 6942 • ursula@plaasmedia.co.za

Design & layout: Annemie Visser
+27 12 664 4793 • annemie@plaasmedia.co.za

Advertising

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

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

Esmarie Moodie
+27 76 330 0745 • esmarie@plaasmedia.co.za

Rowena Simmons
+27 79 568 6025 • rowena@plaasmedia.co.za

Accounts: Marné Anderson
+27 72 639 1805 • marne@plaasmedia.co.za

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

Printed and bound by: Typo
+27 11 402 0571

Oilseeds Focus, Plaas Media and its staff and contributors do not necessarily subscribe to the views expressed in this publication.

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

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Oilseeds Focus is a magazine aimed at addressing issues that are relevant to the canola, soya bean, sunflower and peanut industries. To subscribe, please contact Beauty Mthombeni on +27 64 890 6941 or email beauty@plaasmedia.co.za. Subscriptions are free.



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Syngenta Group acquires Valagro

In a major boost to its sustainability initiatives and goals, Syngenta Group announced it has agreed to acquire leading global biologicals company, Valagro, for an undisclosed sum. From its beginnings 40 years ago in a remote area of Italy, Valagro has grown to become a global multinational company with a leading research and development (R&D) programme.

The company's biostimulants and speciality nutrient solutions form a portfolio backed by best-in-class biological R&D, production, and commercialisation capabilities.

Valagro's assets include eight production facilities in Italy, Brazil, India, Norway, and the United States.

Between 2009 and 2019 the company saw a compound annual growth rate of approximately 10% to post revenue of US\$175 million in 2019. – *Oilseed & Grain*

Rapeseed gives soya a run for its money

A study being conducted by scientists at the Martin Luther University Halle-Wittenberg's (MLU) Institute of Agricultural and Nutritional Sciences found that the benefits of rapeseed protein for human metabolism are comparable to that of soya protein. Furthermore, rapeseed offers better glucose metabolism and satiety compared to soya.

Soya has been generally considered the best source of protein for humans due to its particularly beneficial composition of amino acids. However, rapeseed protein, which can be sourced from the by-products of rapeseed oil production, is showing potential to replace soya as the best source.

So far data on rapeseed protein's effects in connection with human consumption has been limited. However, rapeseed contains phytochemicals that could have beneficial effects on human health. Another advantage is that the by-products of rapeseed oil production, which are currently being used only for animal feed, could be used to make new, nutritious foods. – *Oilseed & Grain*

Brazil suspends import tariff on soya

Brazil has suspended the import tariffs on maize, soya beans, soya meal and soya oil from countries outside the Mercosur trade bloc to help reduce food prices that are pushing up inflation.

Before it came into force, the tariff on maize and soya imports was 8%, while the tariffs on soya meal and soya oil were 6 and 10%, respectively. The waiver applies to all incoming imports with no quota and will be in effect until 15 January 2021.

Record-high prices for maize and soya have affected food prices in Brazil. This has fuelled inflation, adding further pressure on the income of Brazilians who have already been hit hard by the COVID-19 pandemic. – *All About Feed*

Cargill constructs multi-waste biodiesel plant

In a move to further strengthen its commitment to fight climate change and deliver a more circular economy, Cargill is constructing a multi-waste and residues-based biodiesel facility at its existing integrated oilseeds crushing and biodiesel site in Belgium. The ground-breaking US\$150 million project will help meet global renewable energy demand while protecting natural resources.

"The new Cargill facility in Belgium will be the first plant in Europe capable of processing all kinds of feedstocks, including acid oils from vegetable oil refining, liquid residues from industrial processes, and even the fat recovered from sewage sludge from local municipalities," says Roger Janson, president of Cargill's agricultural supply chain across Europe, the Middle East and Africa.

The new facility will have a biodiesel production capacity of 115 000 metric tons per year. Construction commenced in October this year, with the facility due to open in June 2022. – *Feed & Grain*

Grow for Gold Awards celebrate yield

The Grain SA Grow for Gold National Yield Awards were hosted in October. The event was established to encourage South African producers to increase their yields. According to Jannie de Villiers, CEO of Grain SA, yield increase is critical to ensure food security for the growth in population predicted for the years to come. Sunflower and soya bean winners include:

Sunflower

- Winner: Johan Meyer with a yield of 4,44 tons/ha (competition record).

Soya bean

- KwaZulu-Natal winner: Clinton Frey with a yield of 5,12 tons/ha (competition record).
- Eastern Highveld winner: Gareth Allen with a yield of 3,6 tons/ha.
- Eastern Free State winner: Josef van Eeden with a yield of 3,65 tons/ha.
- Central Free State winner: Japie Breedts with a yield of 5,29 tons/ha (competition record).
- North West winner: Wayne Preece with a yield of 4,65 tons/ha.
- Water table winner: Willie Dreyer/IG Venter with a yield of 5,28 tons/ha.
- Irrigation winner: Tommie Scholtz with a yield of 23,47 tons/ha.

– *Ursula Human, AgriOrbit*

New soya bean varieties developed

Soya bean products such as tofu and tempeh are staples in Indonesia. With national soya bean production unable to meet even half of the demand, the country depends on imports – a situation the government is looking to change by using new soya bean varieties developed with irradiation.

In 2018, the government launched a programme to reinvigorate the national soya bean industry. As part of the programme, the government is using new soya bean varieties developed by the National Nuclear Energy Agency of Indonesia (BATAN). BATAN has developed twelve varieties of soya bean through plant mutation breeding, where seeds or cuttings are exposed to radiation to induce changes in the plant's characteristics.

One soya bean variety that continues to be popular with farmers ten years after its original release, is Mutiara 1. Released in 2010, it has higher productivity when compared to local varieties due to its super large seed size. Muhammad Yunus, who works for the Ministry of Agriculture, has overseen farmers in the Polewali Mandar area – a western coastal region of Indonesia – grow 500 acres of Mutiara 1.

"Farmers like this variety not only because of its large seeds which allow higher yields, but also because of the improved taste. But the availability of enough seeds – even for local cultivation – remains a challenge due to the short shelf-life of soya bean seeds," said Yunus.

Two of the newest soya bean varieties, Kemuning 1 and Kemuning 2, thrive in dry, acidic soils where local soya bean varieties struggle to grow. Released in 2019, these varieties produce 3 tons/ha compared to 2,2 tons/ha of the local variety. BATAN will also release a soya bean variety that matures faster than local varieties. – *International Atomic Energy Agency*

Peanut consumption reaches all-time high

Per capita peanut consumption in the United States (US) rose to an all-time high of 7,6 pounds (nearly 35kg) this year, up 3,2% from 2019. This was driven in part by increased demand for peanut butter and snacks during the coronavirus pandemic, said Bob Parker, president and CEO of the US National Peanut Board.

US retail sales of peanut butter were up 75% year-on-year in March and up almost 20% in April. While peanut candy and in-shell peanuts experienced declines during the first months of the pandemic due to closures and restrictions, they ended the year with increases.

On the peanut farming front, aflatoxin (mould) had caused major headaches for the 2019 crop owing in part to extremely hot and dry weather late in the growing season, said Parker, who noted that a lot of peanuts had been sent to China and crushed for oil (instead of going into the domestic food and snacking market).

While aflatoxin is an ongoing issue for non-irrigated crops (around half the acreage in the US), this year's crop is looking far more promising, he said, noting that acreage is up significantly in 2020. Work is also progressing on marker-assisted breeding to conventionally breed new peanut varieties that are more drought tolerant, he added. – *Food Navigator*

EU approves XtendFlex soya beans

The European Commission has authorised XtendFlex soya beans for food and feed use in the European Union (EU). This genetically modified soya bean has gone through a comprehensive authorisation procedure, including a favourable scientific assessment by the European Food Safety Authority. The authorisation is valid for ten years, and any products produced from XtendFlex soya beans will be subject to the EU's strict labelling and traceability rules.

XtendFlex soya beans are built on the high-yielding Roundup Ready 2 Xtend soya bean technology with the additional tolerance to glufosinate herbicides and provide growers with additional flexibility to manage tough-to-control and resistant weeds. – *International Service for the Acquisition of Agri-biotech Applications*

New tech could boost grain storage safety

Technology company TeleSense says it is revolutionising grain storage, which will help add security to the food supply chain. The start-up just secured financing of US\$10,2 million.

TeleSense is using artificial intelligence and predictive analytics to provide actionable insights for farmers and other grain handlers. Having 'inside' information about what the grain is doing, could reduce the need to enter grain bins to monitor quality. In addition, if there are warnings about the risk of spoilage, there could be an opportunity to offset the risk through drying, heating or even selling the crop before it goes bad.

"TeleSense provides the data-driven actionable insights needed to improve postharvest grain management decisions that can have a tremendous impact on supply chain economics," says Mark Palmquist, CEO of United Malt and a TeleSense investor. – *AgWeb*



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Evaluating soya bean cultivar tolerance to *Sclerotinia* stem rot under field conditions

By MC Meiring and LA Rothman, University of the Free State, and
AS de Beer and NM Cochrane, Agricultural Research Council

Sclerotinia sclerotiorum is a devastating, yield-limiting fungal plant pathogen with an extensive host range of more than 500 plant species, including soya beans. The severity of *Sclerotinia* diseases is highly dependent on environmental factors and host crop susceptibility. Several studies have reported strong genotype x environment interactions, emphasising the importance of screening for tolerance to *Sclerotinia* under various field conditions.

Managing *Sclerotinia* diseases through host tolerance or potential resistance may contribute to yield stability or increases. Currently, South African soya bean cultivars do not have complete resistance to *Sclerotinia* stem rot, but some do show tolerance to this disease.

It is internationally recognised that complete resistance does not exist in soya beans, although there are promising genotypes which indicate partial resistance (Kim & Diers, 2000; McCaghey *et al.*, 2019). A tolerance to plant diseases is a response of the plant to infection and having the ability to endure disease without serious yield loss or death (Agrios, 2015). However, resistance is the plant's ability to completely or partially overcome the damaging effects caused by a pathogen (Politowski & Browning, 1978).

Cultivar field trials

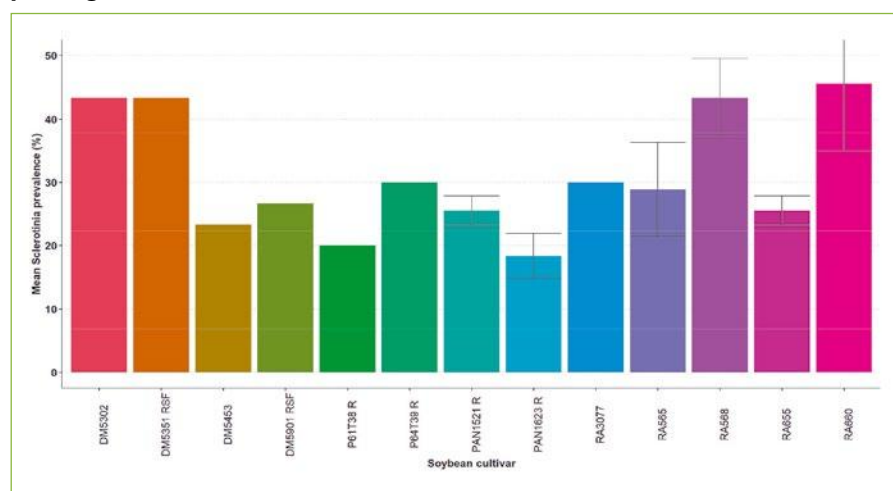
Soya bean cultivars from the National Cultivar Trials were evaluated in field trials in Delmas, Mpumalanga, during 2018/19 and 2019/20. Plantings were conducted sequentially from November to December, creating a range of weather conditions during each season of evaluation. Soya beans were inoculated with *S. sclerotiorum* in the form of milled grain mycelium at flowering and were given a second inoculation after two weeks to ensure successful disease development.

To produce milled grain mycelium inoculum, sorghum grain is inoculated

Figure 1: Average *Sclerotinia* stem rot prevalence (%) in soya bean cultivars on three different planting dates in the 2018/19 season.



Figure 2: Average *Sclerotinia* stem rot prevalence (%) in soya bean cultivars on one planting date in the 2019/20 season.



with a single isolate of *S. sclerotiorum*, incubated for a few weeks until the grain is fully colonised with the mycelium of *S. sclerotiorum*, air dried and milled into a powder. This inoculation technique does not require injuring plants before application, therefore ensuring no induced resistance mechanisms are triggered through wounding (Bester, 2018). The

presence or absence of *Sclerotinia* on the stems was measured at R3 and the disease prevalence was calculated. Data analyses were conducted using R and R-studio.

The bar graphs illustrate the mean *Sclerotinia* prevalence (%) observed in the different soya bean cultivars at each planting date from the 2018/19 season (Figure 1) and one planting date from the 2019/20 season



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(Figure 2). During the 2018/19 season, the least *Sclerotinia* stem rot, ~4%, was observed in the second planting date, 30 November 2018, while those of the first planting date (19 November 2018) and third planting date (13 December 2018) were ~6 and ~8%, respectively.

Impact of environmental conditions

During the 2018/19 season the majority of the soya bean cultivars varied in their response to *S. sclerotiorum* across the different planting dates. This indicates the significant impact of weather conditions during each planting date and the seasonal variation on disease development. During the three planting dates in the 2018/19 season, only three cultivars presented no *Sclerotinia* stem rot symptoms, namely DM5953 RSF, RA 3077 and RA 437 R.

In the 2019/20 season the *Sclerotinia* prevalence in RA 3077 was ~30%. The average *Sclerotinia* prevalence in the soya beans planted on 26 November 2019 was ~32%. A higher prevalence in the 2019/20 season may indicate a more conducive environment for disease development. Cultivars will respond differently to *S. sclerotiorum* under different environmental conditions.

These results – together with results from the 2020/21 season – will be incorporated into a study by the University of the Free State, where the response type of each cultivar at changing disease potentials will be determined. Disease potential is defined as the mean disease incidence in a planting across all cultivars.

Three cultivar response types can be observed: Cultivar tolerant to increasing

disease potential; cultivar intolerant to increasing disease potential; and cultivar having a linear relationship with increasing disease potential. This regression methodology can be an effective and accurate tool to quantify the response of cultivars to different disease potentials and subsequently promote the selection process of cultivars for environments which may have a higher risk for *Sclerotinia* disease development.

Importance of adapted cultivars

Sclerotinia is a yield-limiting disease, meaning higher disease severity is usually associated with lower soya bean yield (Grau & Radke, 1984). The ability of a soya bean cultivar to tolerate *Sclerotinia* and the cultivar's yield potential at different localities are important aspects to consider when choosing a cultivar.

The purpose of the National Cultivar Trials for soya beans is to support local soya bean producers in the identification of adapted cultivars for the different climate regions. The trials facilitate cultivar comparisons for agronomic/economic performance that should be well adapted for the particular soil and climate conditions.

Combined Analysis of Variance (ANOVA) was done for the yield over localities and cultivars for the cool, dry areas. Figure 3 shows the yield for the main effect cultivar for eight of the overlapping cultivars inoculated with *S. sclerotiorum* for the variable yield, where it also was tested for *Sclerotinia* stem rot prevalence (%).

The standardised residuals were acceptable and normally distributed (Shapiro-Wilk test) and therefore the

means of the significant effects were separated using the unprotected Fisher's Least Significant Difference (LSD) test at the 5% confidence level (Snedecor & Cochran, 1980). All data analyses were performed using SAS 9.4 statistical software (SAS, 2014).

Field trial results

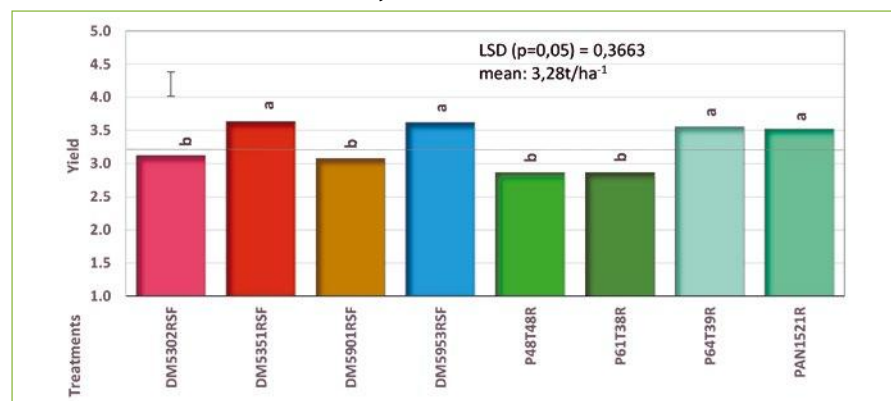
The cultivars DM5351 RSF, DM5953 RSF, P64T39 R and PAN1521 R performed significantly better than DM5302 RSF, DM5901 RSF, P64T64 R and P61T38 R over the 2018/19 and 2019/20 production seasons.

Relatively large differences in annual yields existed among cultivars. The difference between the highest- and lowest-yielding cultivars varied from 2,58 tons/ha⁻¹ (P61T31 R) to 3,5 tons/ha⁻¹ (P64T39 R) during the 2018/19 season, and 2,88 tons/ha⁻¹ (P48T48 R) and 4,1 tons/ha⁻¹ (DM5953 RSF) for the 2019/20 season.

Consequently, the 2018/19 production season's results indicated that the mean yield of the best-performing cultivar was 0,92 tons/ha⁻¹ higher than the yield of the poorest-performing cultivar, while the difference is 1,22 tons/ha⁻¹ for the 2019/20 season. This relates to R5 520/ha⁻¹ and R7 320/ha⁻¹, respectively, at a product price of R6 000 t⁻¹.

The selection of a high-performance cultivar suitable for a specific climate region has a significant financial impact for the producer. When selecting a high-yielding soya bean cultivar for the coming seasons, producers must keep in mind that these cultivars are still at risk of being infected with *S. sclerotiorum*. Being equipped with the yield and *Sclerotinia* disease potential for cultivars will enable producers to select those that may perform best under their production conditions. 🌱

Figure 3: Average yield and t-groupings for soya bean cultivars during the 2018/19 and 2019/20 seasons in the cold, dry areas over the different localities.



We would like to acknowledge Dr Derick van Staden from Agronomy Info Services for his commitment to the field trials, and the Department of Science and Innovation as well as the Oil and Protein Seeds Development Trust for the research funding.

For enquiries or references, send an email to LA Rothman at coetzeeLA@ufs.ac.za or AS de Beer at DeBeerAnnelie@arc.agric.za.

Maintaining water purity for agricultural use

By Claudi Nortjé



South Africa is considered a water-scarce country. The ever-increasing demand for water, combined with dry and unfavourable climate conditions, exert pressure on available water resources. However, pollution-driven water scarcity is also a factor to consider.

According to the Food and Agriculture Organization (FAO) of the United Nations, water quality can be degraded to such an extent that it can no longer be used. In order to manage water properly, Grain SA says its quality must be determined, monitored and allocated based on its quality, or by treating it until the quality matches its intended use.

The Department of Water and Sanitation (DWS) is the primary custodian of South Africa's water resources. One of its main objectives is to maintain the usability of water and continually ensure its quality.

The four broad categories of water usage recognised in the *National Water Act, 1998* (Act 36 of 1998) includes domestic, industrial, agricultural and recreational use. This article focuses on water purity for agricultural use in terms of livestock and irrigation.

According to the DWS, water quality requirements are determined by the following:

- Typical water quality problems associated with specific water usage.
- The effects of poor water quality on its use.

- Benchmarks used to measure the impact of water quality on specific water usage.
- The various water quality components that are of concern.

Water purity in irrigation

Irrigated agriculture is considered one of the largest water consumers in South Africa. The Milk Producers' Organisation (MPO) reports that agriculture consumes approximately 75% of South Africa's rainfall. From this, natural vegetation uses 60%, dryland crop production uses 12%, and irrigation uses 3%.

According to the *National Water Quality Guidelines* published by the DWS, water supply for irrigation often originates from several sources, including farm dams, large reservoirs, groundwater, rivers or municipal supply. It is important to note that the quality and quantity of water from rivers vary greatly and is mostly influenced by seasonal drought or floods.

Producers can experience a range of problems due to changes in water quality, including reduced crop yields, poorer crop quality, degradation of soil health, and corrosion or encrustation of irrigation equipment.

Water testing and treatment

In order for producers to ensure that the water they use for irrigation is of sufficiently high quality, they must implement effective measures to ensure

that the water is free of contaminants. This means that water should be tested regularly to assess its microbiological and chemical contents. Every water source should be tested, and reservoirs should be protected from contamination by birds, rodents, insects, and other organic and inorganic matter as far as possible.

Proper effluent disposal is another critical component in preventing contamination of nearby water sources. If effluent is applied to a pasture, it should be left undisturbed for at least 21 days before any further grazing or harvesting takes place. Water sources should also be kept safe from any potential pollutants, such as fertilisers or silage effluent.

According to a recent study by Stellenbosch University, the Water Research Commission and the former Department of Agriculture, Forestry and Fisheries (DAFF), a variety of bacteria, viruses and protozoa isolated from irrigation water subsequently contaminated cultivated produce. The study found that the pathogens in water were predominantly of faecal origin. Producers can help reduce the risk of microbiological contamination by manipulating feed rations or treating manure before using it as fertiliser.

In addition to water quality, the type of irrigation system used may also influence the extent of crop contamination. The study found that flood and spray irrigation represent the most significant contamination risk, since these irrigation techniques transfer water directly onto the edible parts of fresh produce.

Water for animal consumption

According to Grain SA, the norms used to determine water's suitability for animal use, include looking into issues that

Table 1: Disinfection techniques currently used to treat water used for irrigation.

Physical/mechanical	Chemical	Physical/photochemical	Combination treatments
Sand/media filtration Ultrafiltration	Chlorine-based bromine Hydrogen peroxide Peracetic acid Ozone	Ultrasound Ultraviolet light (UV)	Chlorine/UV Hydrogen peroxide/UV Peracetic acid/UV

Table 2: South African water quality guidelines (in mg/L⁻¹) for different water uses where no health effects are expected. (Source: Department of Water Affairs, 1996)

Water quality components	Aquatic water use	Domestic water use	Agricultural water use		
			Livestock	Irrigation	Aquaculture
Cadmium	0,00015	0,005	1	0,1	0,05
Chromium	0,007	0,05	0,01	0,01	0,0002
Copper	0,0003	1	1	0,1	0,002
Lead	0,0002	0,1	0,5	0,2	0,01
Mercury	0,00004	0,001	0,001	–	0,000001
Nickel	–	–	1	0,2	–
Zinc	0,002	3	20	1	0,03

– No guideline is given.

affect health, the environment, product quality and watering equipment. The environmental impact of confined animal feeding operations may affect water resources. This not only includes livestock, but also pertains to game ranching and water provision for wildlife.

In intensive production systems, the taste or aesthetic properties of water can also influence feed and water intake. Although water may meet the necessary water purity specifications for animal use, it may still have poor palatability, which can lead to reduced intake and a negative impact on growth.

As with irrigation operations where water usage is sufficiently allocated and monitored, animals' water intake should also be tracked so that any changes that indicate potential production problems can easily be detected.

Many intensive livestock producers go the extra mile to disinfect their water to reduce its impact on watering equipment. Scaling, corrosion and deposition of sediment in the water distribution system

often have a significant economic impact, which is why it is best to treat the water before distributing it to livestock.

According to Grain SA, the disinfection process depends on the water quality and requires the entire process to be adequately managed and monitored. The mismanagement of water quality for animal use can harm product quality, which can then lead to consumer health hazards.

According to the DWS, the following factors should be considered when establishing water quality guidelines since they can influence the level at which poor water quality will have an adverse effect on livestock production:

- Species tolerances.
- The impact climate has on the animal.
- Feed environment.
- Production system.
- Animal physiology.
- Animals' production phase.
- The length of exposure to a potentially harmful substance.

- The effect of concentrated intake over a short period.
- The physiological and economic impact of exposure to a potentially hazardous element.

Metals consumed via water may accumulate in the animal's tissue, specifically in the muscles, bone, liver, kidneys and brain. However, apart from pesticides and mercury, most metals cannot accumulate to such an extent that they will threaten consumers' health. In chickens, a decrease in egg production and a lower hatchability rate may result from high calcium concentrations and the subsequent interactions with zinc and manganese.

Where to begin

Whether for animal use or irrigation, the standard approach should always be to first determine the water's quality, followed by possible changes to storage, delivery and treatment options to improve water quality.

In addition, producers should determine how best to manage their water allocation so that the water quality is suited to its intended use. In order to ensure that crops and livestock won't be negatively affected by harmful metals, bacteria, fungi or other components that may be present in the water supply, water quality, allocation and the ultimate effect it has on production must continually be monitored. 🌱

For more information or references, send an email to the author at claudi@plaasmedia.co.za.



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Blackleg resistance and management in canola

By P Lombard, J Bruwer and J Strauss

Blackleg, which is caused by the fungus *Leptosphaeria maculans*, is one of the most serious canola diseases in the world. In instances where it has overcome cultivar resistance, it has been causing extensive damage resulting in huge losses.

Major vs minor resistance

Major or qualitative resistance genes prevent the blackleg pathogen from penetrating the plant, and can be observed in the field as a lack of leaf spots and crown cankers. While the qualitative gene is indicated in resistance groups from A to F, a plant can contain more than one gene, e.g. ABDF (Hyola 350).

The blackleg pathogen possesses the ability to quickly overcome qualitative resistance (in as little as three years). The resistance gene does not lose its efficiency as such. It exerts selection pressure on the pathogen population but, as the pathogen has so many races, those that are not suppressed by the particular resistance gene have the opportunity to multiply, thus becoming the dominant population within a few years. The resistance gene still suppresses the same races as before, but these races are now in the minority. This means that cultivars that rely mainly on qualitative resistance, can become susceptible to blackleg in future.

Minor or quantitative resistance genes are pieces of DNA (quantitative trait locus) that possess traits pertaining to blackleg resistance. It does not prevent leaf infections but partially suppresses the development of cankers in the crown area and stems. The greater the number of minor or quantitative genes, the lower the percentage of crown infection.

It is more difficult for the blackleg pathogen to overcome quantitative resistance as each gene carries some



Blackleg leaf spots.

degree of resistance. As such, cultivars can maintain their resistance for a longer period.

The quantitative genes in cultivars only become apparent once qualitative resistance has been lost. Canola loses its resistance at 0,15 units per year on a scale of 0 to 9 (1970 to 2000). There is no test for quantitative resistance prior to a plant losing its qualitative resistance.

Types of infection

Leaf infection or spots: Leaf infection does not affect yield. However, it does represent the onset of crown cankers as the pathogen grows from the seedling's leaves through the vascular tissue to the crown to form cankers. Leaf infection also spreads through spores to the canopy, causing upper canopy infection.

Crown cankers: These develop as a result of the fungus growing from young

leaves through the stem to the crown area. Crown cankers have the greatest potential of causing yield losses and plants must be protected against this. While the external symptoms may not appear to be that severe, the internal vascular damage can result in substantial yield losses. Interestingly, researchers have found that symptoms of internal vascular damage lead to stems turning black on the inside.

Upper canopy infection (UCI): Blackleg can infect all parts of the canola plant. UCI is a collective term used for infection of the flowers, peduncles, pods, and the upper part of the main stalk and side branches. UCI is often associated with an earlier flowering period as cultivars are planted earlier and crops undergo more rapid phenological development during autumn and winter. Physical damage by insects, hail or frost can also cause the fungus to

Manganese



Glyphosate + Mn source	Soybean yield (t/ha)
Glyphosate	3,83
Glyphosate + MnCO ₃	5,04
Glyphosate + MnSO ₄	4,71
Glyphosate + Mn EDTA chelated	4,84
Glyphosate + Mn Amino acid chelated	4,51



DNA Crop Protection
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Recommended usage

PRODUCT	DOSAGE / HA	APPLICATIONS
Manvert Manganese	500ml	With glyphosate application



Importance of manganese for Round Up ready crops

Glyphosate is responsible for chelating elements in soil, rendering them unavailable for plant absorption. Consequently, plant physiological processes such as chlorophyll formation and photosynthesis are negatively influenced. Round Up ready crops require 50% more manganese to be as physiologically active as their non-Round Up ready or conventional crops. Glyphosate induced Mn deficiencies are also responsible for deteriorating the natural immune system of plants¹.

¹ Huber, D. M., 2007. What About Glyphosate-Induced Manganese Deficiency?. Fluid, pp. 20-22.



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+27 56 212 1273

Janneman Kotze **Sales Manager**
janneman@dnaplantscience.co.za
+27 83 396 4574

Dinë Pretorius **Technical Advisor**
dine@dnaplantscience.co.za
+27 66 470 8424

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infiltrate the plant, which can lead to UCI symptoms on the main stalk and pods.

Impact of infection

The effect of blackleg on yield will depend on when infection occurred, and which parts of the plant had been affected. However, research has indicated yield losses of up to 30%.

Flower loss due to infection of the flowers or peduncles does not have a major impact on yield, as the canola plant compensates by producing more flowers. However, if the fungus infects the associated side branches, it can affect seed set and grain fill of the pods. Infection of the pods or peduncles after pod formation can result in substantial losses.

Infected side branches and infection of the upper part of the main stalk can influence all developing flowers and pods above the point of infection, resulting in reduced pod and seed set as well as the development of smaller seeds.

Serious infections can cause stems and side branches to break, can result in premature maturation which causes pods to open, and can cause difficulty in determining the correct cutting stage due to differences between infected and uninfected seeds.

Management strategies

Genetic resistance: Although not all qualitative resistance genes can protect against direct infection, it can prevent parts of the plant from developing spots. Genetic resistance can therefore prevent

blackleg crown cankers and UCI. It is important to alternate between cultivars with different resistance genes. (Local options are limited as there is substantial overlap between the qualitative genes in cultivars.)

Onset of flowering: There is a strong correlation between when canola plants start to flower and yield loss due to UCI. Trials performed under controlled conditions show that plants infected in the upper stalk and side branches at the onset of flowering, resulted in the greatest yield loss compared to plants which flowered or were infected at a later stage. Yield loss occurred as a result of a reduction in seed size, seeds/pods and/or pods/m². Oil content may also be lower.

Severe UCI can be prevented by slightly postponing the flowering period and not planting too early. This may, however, coincide with the increased release of ascospores, which in turn may result in an increase in crown cankers.

Fungal control of UCI: Where UCI does occur, findings indicate that fungal agents used for *Sclerotinia* control can be used to effectively reduce infection.



Crown cankers in canola, which led to the plants dying off.



Blackleg infection in the stem.



Typical symptoms of upper canopy infection. (Photograph: Steve Marcroft)

The application of certain agents for *Sclerotinia* at around 30% flowering can also protect against blackleg infection during early flowering. However, while it can control flower, peduncle, stalk and side-branch infections, it will not affect crown cankers. No products have been registered locally for treating UCI.

Keep in mind that high levels of pod infection occur during seasons characterised by late rainfall. As blackleg is seedborne, the seeds forming in those pods will already have been infected and must not be retained for planting during the following year. 🌱

For more information, send an email to Piet Lombard at pietl@elsenburg.com.

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GWK Oliesade



Gesels met ons span:

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

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

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

GWK



innoveer landbou

gwk.co.za



Groundnut production: Cultivar evaluation and development are vital

By Adri Botha and Lourens de Kock, SA Groundnut Forum

Groundnut production in South Africa has shown a significant decline over the past two decades. In the decade before the 2000/01 season, 92 935mt of groundnuts were produced on 113 725ha, with an average yield of 0,897mt/ha. The two decades since saw an increase in average yield to 1,13mt/ha, but hectares planted and yield declined to 56 318ha and 74 332mt, respectively (Figure 1).

Locally, the breeding of new groundnut cultivars could not keep up with growth in the development of new, higher-yielding cultivars of competing crops such as soya beans, maize, and sunflowers. These crops, which make a valuable contribution to the feed industry, are supported by local and international programmes which continuously make new genetics available to help producers realise greater financial rewards per hectare.

In addition, annual national trials and independent evaluations for these crops, supported by the Oilseeds Advisory Committee (OAC) and the Oil and Protein Seeds Development Trust (OPDT), provide

producers with valuable insights into cultivar choices and production decisions.

Evaluation highlights potential

Over the past few years, role-players in the groundnut industry have made substantial investments in cultivar selection and development as well as the evaluation of potential foreign cultivars. The OAC previously tested foreign cultivars in South Africa, but the results showed that locally bred, Spanish-type groundnuts performed better. The tests were subsequently terminated.

Producers and processing facilities have indicated that, despite the perception that there is not much in the line of new development, continuous groundnut evaluation and the information gathered from trials remain vital when considering planting decisions and future strategies. Although the trend is that trial yields cannot necessarily be replicated on a commercial scale, it does confirm the potential of specific cultivars.

Securing the industry's future

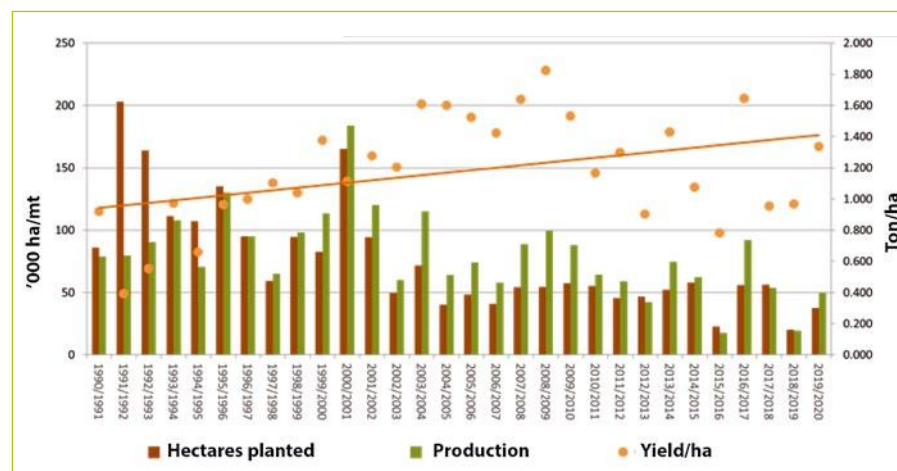
It takes approximately 14 years to develop a new, unique cultivar. In 2013

the Agricultural Research Council's (ARC) Grain Crops Institute registered two new groundnut cultivars, followed by two promising cultivars – Akwa Plus and Sellie Plus – two years later. These are now available commercially. Another two or three cultivars are currently in the pipeline, resulting in a total of six or seven new registrations in eight years.

To evaluate existing cultivars, as well as new ARC breeding lines, the industry has taken it upon itself to perform annual cultivar trials. This initiative, which takes place under the guidance of Lourens de Kock, vice-chairperson of the SA Groundnut Forum, is supported by several facilities and producers at own cost. The ARC supplies the seed and processes the data for publication and discussion at the annual cultivar meeting.

The ARC is currently the largest independent groundnut owner in South Africa and, for the sector to remain sustainable, it is crucial to ensure that the breeding and availability of ARC-registered seed is undertaken with industry input and support. Here, private initiatives have a crucial role to play in securing the future of the industry.

Figure 1: Groundnut hectares planted, production and yield from 1990 to 2020.



Latest evaluation

During the 2019/20 groundnut evaluation, ten registered cultivars – eight from the ARC and two from private companies – as well as eight potential ARC breeding lines, were successfully planted across five locations. Each area has a unique climate and soil type and is representative of the groundnut production areas in South Africa. Results from the trials are available from the SA Groundnut Forum. 🌱

For more information, send an email to Adri Botha at groundnutforum@opot.co.za.



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The Clearfield® Plus sunflower production system has grown by leaps and bounds due to its high level of performance and overall market acceptance.

Clearfield® Plus qualified seed

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

Euro-Lightning® Plus herbicide

In addition to the high-performing Clearfield® Plus seed, BASF also offers Euro-Lightning® Plus, the Clearfield® Plus herbicide for sunflower.

Euro-Lightning® Plus boasts significant improvements, the main advancement

being its improved formulation.

The new formulation is designed for improved weed control in Clearfield® Plus sunflower fields through higher levels of herbicide adherence to target weeds. Euro-Lightning® Plus eradicates yield-robbing weeds, thereby delivering cleaner fields.

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

Using Euro-Lightning® Plus

Euro-Lightning® Plus can only be used on Clearfield® Plus sunflower cultivars (original Clearfield® sunflower cultivars are also excluded). The following is recommended:

- Always clean spray tanks, hoses and nozzles with a suitable tank cleaning solution prior to mixing the Euro-Lightning® Plus solution.
- Always use flowable (50%) high-quality ammonium sulphate.
- Do not use any surfactants that contain acidifying agents.
- Applications must be made within 32 days of planting.
- To achieve good control, thorough coverage of the target weeds must be completed by the 2 to

6 leaf stage – take note that the weed must be actively growing.

- Do not add any other crop protection products to the solution.
- Do not mix Euro-Lightning® Plus with any organophosphate or carbamate insecticides and do not apply where these products have already been used as soil or foliar treatments.

Euro-Lightning® Plus label update

Some of the challenges experienced by producers using Euro-Lightning® Plus included waiting period limitations for follow-up crops. These waiting periods have been reduced and a few new crops have also been added (Table 1).

Bellis® on sunflower

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For more information, visit the BASF Agricultural Solutions website www.agro.basf.co.za.

Euro-Lightning® Plus Reg. No. L10316, Act No. 36 of 1947 – active ingredients: Imazapyr 7,5 g/ℓ; Imazamox 16,5 g/ℓ.
Bellis® Reg. No. L7817, Act No. 36 of 1947 – active ingredients: F500® 128 g/kg; Boscalid 252 g/kg. Caution. Bellis®, Clearfield® Plus and Euro-Lightning® Plus are registered trademarks of BASF.

Table 1: New waiting periods for follow-up crops.

Crop	Waiting period	Changes
Clearfield® Plus sunflower	None	
Wheat	Four months	
Maize	Nine months	One-month reduction
Dry beans	Nine months	New crop and waiting period
Soya beans	Nine months	New crop and waiting period
All other crops	20 months	

** BASF and its seed partners strongly advise and endorse the use of Euro-Lightning® Plus as the only supported herbicide. Additionally, it is vital to follow the label recommendations closely. If other solutions are used, neither BASF nor the seed company can support the producer or be liable for any problems that might occur. Please read the Euro-Lightning Plus® label for full instructions and details.*



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- Excellent risk management to grow your business.

Table 1: Summary of the 2019/20 ARC National Cultivar Trials: Six out of the top ten hybrids.

	Average 21 trials	% above average	% below average
	2,50	>100%	<100%
PAN 7156CLP	111	90	10
AGSUN 5270	110	62	38
P64LL23	108	81	19
PAN 7100	107	71	29
PAN 7170	106	71	29
PAN 7080	106	76	24
PAN 7160CLP	105	76	19
AGSUN 5278	105	67	33
AGSUN 5103CLP	104	62	38
PAN 7102CLP	104	76	24
AGSUN 8251	103	52	43
AGSUN 5106CLP	103	62	38
AGSUN 5102CLP	102	67	33
P65LL14	102	71	29
P65LP54	102	62	38
P65LL02	102	52	48
AGSUN 5101CLP	100	52	48

Table 3: Sunflower hybrid recommendations.

	Clearfield® Plus	Conventional hybrids
North Western Free State (Topsoil <10% clay)	PAN 7160CLP PAN 7102CLP PAN 7156CLP	PAN 7080 PAN 7100
North West and Limpopo (Topsoil >10% clay)	PAN 7160CLP PAN 7102CLP PAN 7156CLP	PAN 7100 PAN 7057 PAN 7080
Cooler, temperate production regions	PAN 7160CLP PAN 7102CLP PAN 7156CLP	PAN 7080



Pannar Seed customer, Jakob van der Westhuizen, in an exquisite crop of PAN 7102CLP, which contains the Clearfield® Plus trait with the benefit of improved weed control. In terms of yield potential and stability, it compares favourably with conventional hybrids. PAN 7102CLP is especially suitable for planting in alternating blocks with PAN 7156CLP to better manage the potential risk of Sclerotinia infection at flowering.

Table 2: 2019/20 ARC National Cultivar Trials: Yield probability as a percentage of yield potential.

	Yield potential tons/ha					
	1	1,5	2	2,5	3	3,5
PAN 7156CLP	58	63	67	72	76	79
AGSUN 5270	74	71	66	61	55	49
P64LL23	53	56	59	62	65	68
PAN 7100	58	60	61	62	63	64
PAN 7170	58	59	60	61	62	62
PAN 7080	40	49	58	67	75	81
PAN 7160CLP	46	53	60	66	72	77
AGSUN 5278	54	56	57	59	59	61
AGSUN 5130CLP	44	49	55	61	65	71
PAN 7102CLP	65	63	60	57	53	50
AGSUN 8251	41	47	52	59	64	70
AGSUN 5106CLP	39	45	52	58	65	70
AGSUN 5102CLP	46	49	53	57	61	64
P65LL14	49	51	54	57	59	62
P65LP54	61	59	56	54	51	49
P65LL02	43	46	49	52	55	59
AGSUN 5101CLP	45	47	48	51	52	55

Green blocks indicate excellent stability.

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Detection of plant-damaging herbicide residue in soil

By Prof Charlie Reinhardt

Crop damage due to the plant-damaging (phytotoxic) effects of herbicides is often confused with crop injury or growth limitation caused by various other factors, such as extreme climate conditions, pest infestations, soil properties, and/or poor farming practices. Such confusion is to be expected in semi-natural settings, such as field crop production, and often results in herbicides being wrongly implicated in crop damage. By the same token, damage caused by herbicides can go undetected or be ascribed to various other factors.

Damage to crop plants can occur as a result of freshly applied herbicide. Most cases of herbicide damage can be linked to direct injurious effects on the crop when unregistered products or mixtures of products are involved or, less likely, when registered products do not show sufficient selectivity in herbicidal effect, i.e. killing both weeds and the crop. However, herbicides could also have an indirect impact on crop plants long after application.

Damage due to herbicide residue

A somewhat surreptitious form of indirect crop damage caused by herbicides can occur when bioactive or phytotoxic herbicide residues are 'carried over' in the soil from the season in which it was applied to the next season/s, where it can cause injury to or even kill susceptible crops. Herbicide carryover is particularly difficult to diagnose, mainly due to the lapse in time since product application and the consequent relatively low concentration of residue which, in turn, can result in indistinct manifestation of symptoms of damage on affected plants.

Herbicide carryover damage to crops used to be less of a problem when

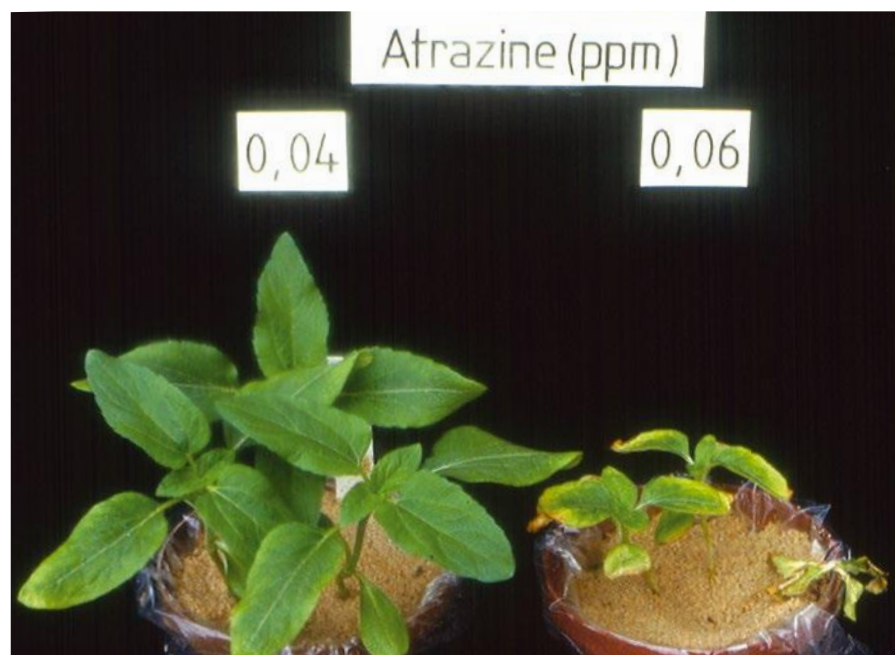
monocropping was in vogue because replanting the same crop and using the same herbicide in successive seasons, presented zero risks for crop damage.

Since the advent of crop rotation, cases of damage caused by herbicide residue to susceptible follow-up crops have been reported from time to time. Before dosage rates of triazine-type herbicides such as atrazine were capped at a maximum of 1kg active ingredient per hectare for use in maize in South Africa, high dosage rates (2kg active ingredient per hectare) and high use frequency of atrazine resulted in a high carryover risk of this herbicide to the following growing season and, consequently, a high risk for occasional damage to atrazine-susceptible crops such as soya beans, sunflowers and groundnuts.

Due to the low concentrations involved, the effects of herbicide residue in soil are not always obvious. Symptoms of plant damage that are described in literature as being typical of specific herbicides usually portray the effects of relatively high herbicide concentrations or dosages, and those symptoms often differ from symptoms caused by low (residual) concentrations of the same herbicide.

Herbicide persistence

Not all herbicides have the same capacity for extensive persistence in soil. Most soil-applied herbicides generally have some persistence. Some lose their bioactivity in a few days, whereas others only become inactive after several weeks or months have passed.



Sunflower seedlings showing typical symptoms caused by a triazine herbicide. In this bioassay experiment, atrazine concentrations represent those which could conceivably be encountered in soil to be planted to sunflower that follows on maize in which atrazine was used. Note that only the use of a control treatment makes such findings conclusive as various other stress factors can cause similar symptoms.



Soya bean plants showing severe damage ascribed to a particular herbicide. For such a diagnosis to be valid there must be compelling evidence to discount the role of other factors that cause lookalike symptoms, e.g. other herbicides or nutrient deficiency.

Factors such as the type of herbicide, environmental conditions, applied dosage and crop type, individually or in combination, determine how long a particular herbicide will persist and remain bioactive in soil. Thus, correct diagnosis of herbicide carryover damage on crop plants is complicated and best left to experts in the field.

Residue detection methods

In order to mitigate the risk for herbicide carryover in crop rotation systems, labels of herbicide products containing active ingredients, which have the propensity for carryover in soil, carry warnings in the form of specified waiting or crop-withholding periods in respect of susceptible crops. However, due to natural elements the rate of residue inactivation in soil is highly variable and hence, specified crop-withholding periods may fail to protect the next crop against damage from carried over herbicide residue.

Detection of herbicide residue present in soil, water or plants is generally done through laboratory or chemical analysis. Such analyses typically target the original molecule in its unaltered form for purposes of residue identification and, consequently, risk assessment.

By-products of original molecules that retain some level of bioactivity are generally ignored in standard laboratory analysis. Chemical analysis in the laboratory quantifies the total amount of residue present in a sample but does not reveal the response of susceptible plants to that residue concentration. Therefore, it is near impossible to directly link the

residue concentration to plant response, unless research findings exist for growth responses of the same plant to that same residue type and concentration in the particular medium (e.g. plant, soil or water).

The most sensible approach in risk assessment is to integrate the results of laboratory or chemical analysis with that of the bioassay technique.

The bioassay technique

This technique is used specifically for experiments aimed at identifying pesticide concentrations that either affect or have little or no effect on growth and development of the organism under investigation.

Organism response to a pesticide is usually measured as a growth response (e.g. biomass accumulated over the trial period) to a range of pesticide concentrations established in a dose-response experiment. A control treatment (i.e. zero pesticide applied) is included in bioassay experiments for determining the effects (relative to the control) of different concentrations of a pesticide in the so-called dose-response bioassay approach. In this way growth-inhibiting effects, and even growth-stimulating effects, can be revealed for different concentrations of the herbicide under investigation.

The bioassay technique can be adapted to estimate the concentration of a given herbicide, or its bioactive residue, in soil by comparing the growth response of a test or bio-indicator plant on a sample of said soil with its growth response to a range of concentrations

of this herbicide in a dose-response experiment that employs the same soil.

In a simplified way, producers can exploit the basic principles of the bioassay technique for assessing whether there is a risk for herbicide-susceptible crops grown in rotation with a crop in which herbicide/s had been applied at an earlier stage in the current season, or in previous planting seasons.

In situations where soil moisture and temperature allow test-planting of the crop well in advance of the actual planting date, a few rows can be planted diagonally across a field and crop development monitored for abnormal growth. Alternatively, because there is seldom time for this approach once the crop season commences, another approach can be to collect representative soil samples long before the planned crop planting period (e.g. sample soil during winter in the case of a summer crop). The sampled soil is placed in pots to conduct a bioassay experiment.

This technique will be most effective if soil sampling is done from different depths of the soil profile, and if the same crop and cultivar that is to be eventually cultivated on the field in question, are used as bio-indicator plant in the bioassay.

For example, when soya bean or sunflower is to be grown in rotation with maize, this technique can be valuable because these crops are highly sensitive to herbicides with potentially long persistence in soil, which are generally used in maize, such as mesotrione and the triazine herbicides, atrazine and terbuthylazine.

A significant drawback for the producer doing this bioassay work with reasonable accuracy is probable lack of suitable facilities for growing plants in pots under controlled conditions. As such, the task may be best left to herbicide experts who have access to controlled-condition facilities such as greenhouses. 🌱

Prof Charlie Reinhardt is a lecturer and researcher in the Faculty of Natural and Agricultural Sciences at North-West University, Potchefstroom Campus, and research leader in the South African Herbicide Resistance Initiative (SAHRI) at the University of Pretoria.

For more information and references, send an email to dr.charlie.reinhardt@gmail.com.

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North West & Eastern Freestate
pstrydom@villacrop.co.za
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Adjuvants: It's all about the numbers



By Brian de Villiers

Adjuvants have been used in South Africa for decades. However, many producers still do not appreciate the value these agents add to crop protection product (CPP) applications. Adjuvants are therefore often regarded as an optional extra; something that can be left out to reduce costs.

If the registered adjuvant is not used, or if it is replaced by another product, the efficacy of the CPP could be reduced or crop damage may occur.

In the past few years, however, it has been repeatedly proven that adjuvants are far more than a luxury

or nice-to-have – they form an integral part of CPP applications.

Creating balance

When it comes to adjuvants, it is a numbers game – it is all about *decreasing* or *increasing* the numbers. For example:

- Salt adjuvants *decrease* the effect of dissolved antagonistic cations in the spray water in order to *increase* the amount of herbicide that is available for absorption.
- Buffers *decrease* insecticide degradation in high pH water (alkaline hydrolysis) so that the product rate that is available to control the pest is *increased*.
- Deposition agents *decrease* fine, driftable droplets to *increase* coverage and depth of penetration while *decreasing* droplet evaporation and drift.
- Surfactants and oils *decrease* the surface tension of the spray solution to *decrease* droplet bounce and to *increase* retention, coverage and droplet spreading. They also *increase* absorption.
- Stickers *decrease* wash-off of certain contact fungicides and insecticides to *increase* the amount of product available over time.
- Humectants *decrease* the effect of low humidity conditions on CPP by *increasing* the droplet drying time of the spray droplet residual. By doing this, absorption is *increased*.

Adjuvants are integral

As adjuvants reduce limiting external factors to increase CPP efficacy, they should form an essential part of any crop protection programme. Remember, though, if an adjuvant is recommended with a particular CPP application, it is vital that it is included. If the registered adjuvant is not used, or if it is replaced by another product, the efficacy of the CPP could be reduced or crop damage may occur.

Scan the QR code to view articles and videos on adjuvants.



For more information about adjuvants and water quality, contact Brian de Villiers on 082 880 0974 or email bdevilliers@villacrop.co.za.



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Ca...400g/kg, Mg...30g/kg, Organies...30g/k



Kontak ons

082 452 8983 | 083 542 3106
admin@worldfocusagri.co.za

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An alternative to conventional lime

Article by World Focus Agri

Ultrafine lime or gypsum is preferred to conventional lime for its superior handling, ease of application and results. Ultrafine lime also achieves a more even and thorough application. This allows the calcium carbonate, the effective neutralising ingredient in limestone, to come into contact with and neutralise as much hydrogen in the soil as possible. Better coverage means that more hydrogen is neutralised or eliminated, which results in higher potential hydrogen (pH).

Ultrafine vs conventional lime

The difference between ultrafine lime and conventional lime is in the particle size. Ultrafine lime is difficult to make because it consists of insoluble limestone particles. Limestone on its own does not suspend very well in water.

Ultrafine lime or gypsum in combination with suspension agents can go into suspension with water. This means that the ultrafine lime or gypsum can be used in sprayers and hydroseeders. It can also be applied through centre pivots, drip and micro-irrigation systems. Limited agitation is necessary due to the suspension.

Advantages of ultrafine lime

- The increased reactive surface ensures an accelerated reaction time and a higher electrostatic charge for element or energy transfer.
- It initiates an instantaneous change of calcium (Ca): magnesium (Mg) ratio, acid saturation and cation exchange coefficient (KUK).
- The macro-nutrient Ca becomes available due to chemical and biological reduction reactions of Ca/Mg carbonates.

- It includes nitrogen (N) with improved nodulation in legumes and N fixation in free-living bacteria.
- It increases microbial life and activities with faster degradation of organic matter and more effective release of nutrient elements, specifically N.
- Soil texture and structure is improved.
- It leads to increased water penetration and moisture retention.

Comparing types of lime

Lime that raises soil pH the most, relative to the total cost of liming (lime + freight + spreading), will be the most cost-effective. The dominant cost component of liming is freight, which means a smaller amount of a higher quality product will reduce the overall cost. Quality or the effectiveness of lime per ton, is determined by two factors: neutralising value and particle size.

The neutralising value (NV) of lime represents the purity of the lime, based on

a scale of percentage of calcium carbonate (pure lime). Lime with an NV of 90% will be 50% more effective than lime with an NV of 60%, given the same particle size distribution.

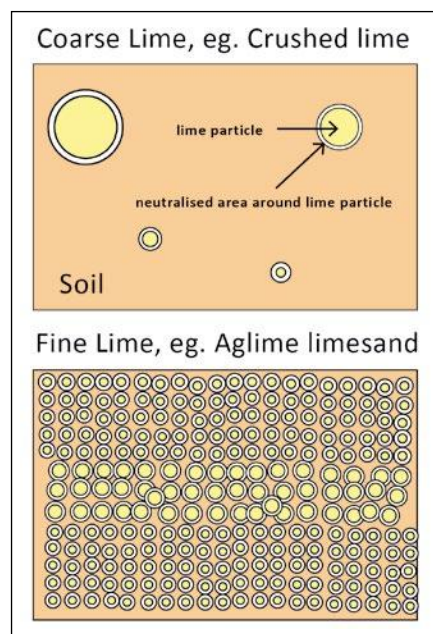
Do the homework

Before you buy lime, find out exactly what you are buying. Look at the specification sheets for particle size distribution and NVs and do the calculations. If you are looking at a blend, check the proportions of the various ingredients and look at the specification sheets for the different components. This way you can see what you are paying for and determine whether it would be more economical to buy the components separately.

Finer lime neutralises soil more effectively than coarser lime, and the pH rise from finer lime is greater than from coarser lime.

Acid eats away the surface of the lime particle and dissolves lime in soil. When the acid attacks the lime particle's surface, carbonate, which neutralises the acid, is released. This neutralises the soil next to the lime particle, which is then prevented from dissolving more lime. The lime particle sits in a pocket of neutralised soil and is no longer effective.

Don't be fooled into comparing lime particles by shaking them in liquid. Coarse lime particles remain in contact with fresh acid and therefore continue to dissolve – this does not happen in the soil. Lime particles smaller than 0,5mm are most effective at raising the soil pH. Choose your lime based on particle size but check the NV of the fine particle fraction to ensure that it is lime, and not clay, you are buying. 🌱



A schematic comparison between fine and coarse lime. Fine lime particles raise soil pH far more effectively than coarse lime particles.

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Soya beans: Choosing the right fertiliser to support the crucial reproductive stage

By Johan Bredenkamp

Even with today's advanced agricultural practices, many soya bean fertiliser recommendations are still based on research conducted in the mid-1900s, meaning it may not be sufficient in supporting the nutritional requirements of today's high-yielding hybrids. Providing your soya bean crop with sufficient nutrients is essential for achieving its true potential.

These days, producers are spoilt for choice when it comes to fertiliser options, with each claiming to be 'ideal' or the 'best' for a specific use. While choosing the right fertiliser is not always easy, it can make a significant difference in the profitability of your soya bean crop.

Tips for choosing fertiliser

Know your supplier: With so many companies supplying fertilisers to the South African market and with new ones appearing every other day, it has never been more important to partner with a reliable, established company

or distributor to supply your fertiliser requirements. Rolfes Agri is a proudly South African manufacturer of a diverse range of agricultural inputs and specialises in producing high-quality fertilisers for the entire agricultural sector.

Know your growth stages: Soya beans can be classified as entering the reproductive stage as soon as they start to flower. The reproductive stage is one of the most important growth stages in the soya bean plant's life cycle, as it will determine the crop's final yield potential. During this period, the crop is most susceptible to shortages due to the high nutrient demand for flowering, pod development, seed development and plant maturation.

Know the crop's nutrient requirements: When a nutrient deficiency occurs, processes such as photosynthesis, water transport, stress management and carbohydrate production will be lower than required, which can lead to a reduction in potential yield. It is therefore crucial to provide your crop with adequate nutrients. This will ensure

that you maintain plant health and increase the efficiency of photosynthesis. The plant needs to make use of as much sunlight as possible, which is converted into sugars (energy) to support optimal seed development and maturation.

Essential nutrients that play an important role are:

- **Macronutrients:** Nitrogen (N), phosphorus (P) and potassium (K) are considered the most important and are referred to as essential nutrients. Calcium (Ca), magnesium (Mg) and sulphur (S) also play a key role but are needed in much lower concentrations.
- **Micronutrients:** Elements considered essential micronutrients during the reproductive stage include boron (B), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn). Micronutrients are essential plant nutrients required by crops in small quantities but play a crucial role in helping crops reach their maximum yield potential.

Table 1: Rolfes Agri's Acticell® solutions that apply to soya bean production.

Solution	Description
Acticell® Bio-CalBor	A calcium and boron fertiliser for use as a foliar feed to maintain or increase calcium and boron levels.
Acticell® Bio-CalMag	A calcium, magnesium and boron fertiliser for use as a foliar feed to maintain or increase calcium and magnesium levels.
Acticell® Bio-Man	A manganese fertiliser for use as a foliar feed to maintain or increase manganese levels.
Acticell® Bio-Zinc	A zinc fertiliser for use as a foliar feed to maintain or increase zinc levels.
Acticell® Maintenance	A multi-dimensional, high-quality foliar feed for maintaining the nutritional status of crops.
Acticell® MoB	A boron and molybdenum fertiliser for use as a foliar feed to promote pollen germination and growth.
Acticell® Supreme	A potassium, phosphorous and boron fertiliser for use as a foliar feed to maintain or increase potassium, phosphorous and boron levels.

The Rolfes Agri solution

Rolfes Agri introduced the Acticell® range of products in 2019. This range consists of 16 unique products, seven of which can play a vital role in soya bean production. These products are made up of single nutrients as well as multi-nutrient mixtures, all containing plant biostimulants, protein hydrolysates and/or kelp extracts. Refer to *Table 1*.

For more information, contact Johan Bredenkamp on 012 803 0145 or visit www.rolfesagri.co.za.

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Canola proteins for human consumption: Extraction, profile, and functional properties

By Siong H Tan, Rodney J Maller, Christopher L Blanchard and Samson O Agboola

Canola protein isolate has been suggested as an alternative to other proteins for human food use due to a balanced amino acid profile and potential functional properties such as emulsifying, foaming, and gelling abilities.

This is a review of the studies on the utilisation of canola protein in human food, comprising the extraction processes for protein isolates and fractions, the molecular character of the extracted proteins, as well as their food functional properties. The majority of studies were based on proteins extracted from the meal using an alkaline solution, presumably due to its high nitrogen yield, followed by those utilising salt extraction combined with ultrafiltration.

Characteristics of canola (and its predecessor, rapeseed) protein fractions such as nitrogen yield, molecular weight profile, isoelectric point, solubility, and thermal properties have been reported and were found to be largely related to the extraction methods. However, very little research has been carried out on the hydrophobicity and structure profiles of the protein extracts that are highly relevant to a proper understanding of the functional properties of food.

Alkaline extracts were generally not very suitable as functional ingredients and contradictory results regarding many of the measured properties of canola proteins, especially their emulsification tendencies, have also been documented. Further research into improved extraction methods is recommended, as is a more systematic approach to the measurement of desired food functional properties for valid comparison between studies.

Factors affecting canola meal

Antinutritional factors in oil-free canola meal are the major obstacle for its use

in human food manufacture. Canola meal contains glucosinolates, phenolics, phytates, and a high amount of fibre that makes it problematic for food use (Wu and Muir, 2008; Yoshie-Stark *et al.*, 2008). The impact of these components leads to unacceptable properties of canola meal that include relatively inferior physicochemical properties, poor digestibility, objectionable colour, and bad taste (Wu and Muir, 2008).

Removal of antinutritional factors

Many studies have been carried out to remove or reduce antinutritional factors in rapeseed and canola. Naczek *et al.* (1985) reported a two-phase solvent extraction system to produce canola meal with glucosinolate content decreased to trace levels.

A protein extraction method, which is based on the formation of protein micellar mass (PMM), has proven to be efficient in removing glucosinolates with minimal loss of proteins (Tzeng *et al.*, 1990a), with the reduction in glucosinolate level being associated with the ultrafiltration step as the toxic compounds have significantly lower molecular weights than rapeseed proteins (Ser *et al.*, 2008).

Preparation of seed meals

Canola seeds are typically crushed or ground to aid the separation and defatting process, usually in a Soxhlet apparatus. Removal of fat from the crushed canola seed is normally carried out using hexane as solvent (Tzeng *et al.*, 1988a; Wu and Muir, 2008). The defatted meal is usually dried at room temperature in a fume hood (Aluko and McIntosh, 2001; Ghodsvali *et al.*, 2005) or under vacuum in an oven at 40°C (Tzeng *et al.*, 1990a).

The dried and defatted meal may then be ground to pass through a 40

mesh (Aluko and McIntosh, 2001) or 60 mesh (Wu and Muir, 2008) screen in order to assure thorough interaction of the meal with chemicals during the protein extraction process.

Extraction by alkaline solution

Alkaline extraction with sodium hydroxide (NaOH) solution followed by precipitation with dilute acid is the most typical procedure used in the preparation of canola protein isolates (CPIs) (Klockeman *et al.*, 1997; Aluko and McIntosh, 2001). The reported extraction procedures, however, had slight differences in pH of extraction, concentrations of NaOH used, centrifugation and filtration settings, type of acid, and pH for protein precipitation.

Generally, the alkaline solution was first added to the defatted canola meal and stirred or shaken for a given period to solubilise the proteins. The mixture was then centrifuged, and the pH of the supernatant was adjusted by dilute acid to precipitate the proteins. Precipitated protein was then separated by centrifugation and the precipitate was freeze-dried.

Extraction by PMM method

The PMM method is made up of four main steps that consist of extraction, ultrafiltration, dilution, and precipitation. The defatted meal was first extracted by sodium chloride (NaCl) solution, followed by an ultrafiltration process to concentrate and purify the proteins. This ultrafiltration step has proven to be efficient in removing glucosinolates with minimal loss of proteins (Tzeng *et al.*, 1990b).

The retentate was then diluted with cold water to reduce the ionic strength of the concentrated protein and promote precipitation. Burgess (1991) suggested a dilution factor of one to six to precipitate the purified salt extracted canola protein

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Photograph by Sergei S. Scrufield / feedipedia.org.

effectively through the formation of protein micelles. The protein micelles were then separated from the water through centrifugation. Precipitates were collected and freeze-dried.

Food functional properties

Functional properties of proteins have been largely classified into three groups, including those related to hydration mechanisms such as water-holding capacity and solubility, those related to structure and rheology such as thickening, viscosity, and gelation, and those related to protein surface such as foaming and emulsification (Damodaran, 1997). In this review, however, based on the relative amount of information available about canola or rapeseed meals and proteins, their functional properties will be classified largely into three groups: emulsifying, foaming, and gelling.

Emulsifying properties

Proteins are an important group of emulsifying agents used in food. Proteins reduce the oil-water interfacial tension and thus facilitate the formation of emulsions as well as stabilise the oil droplets against coalescence (Kinsella, 1982).

During the process of emulsification, proteins with satisfactory emulsifying properties can adsorb rapidly at the newly

created oil-water interfaces, followed by structural change and rearrangement at the oil-water interface, and subsequently the formation of a cohesive film with viscoelastic properties due to intermolecular interactions (Damodaran, 1989). Many physicochemical factors are involved in this formation, stability, and textural properties of emulsions (Khattab and Arntfield, 2009).

Foaming properties

Foams are two-phase systems composed of air bubbles surrounded by a continuous liquid lamellar phase (Sanchez-Vioque *et al.*, 2001). Foams can be formed and stabilised by either proteins or surfactants.

Literature shows that canola proteins as foaming agents have been studied mainly in terms of foaming capacity (FC) and foam stability (FS). FC is related to the readiness of proteins to bind to the air-water interface to form foam particles, whereas FS is related to the protein-protein interactions that form strong interfacial membranes that stabilise the foam particles (Kinsella, 1981).

Gelling properties

The gelling properties of canola proteins have been studied mostly in terms of least gelling concentration (LGC) (Gill and Tung, 1978; Khattab and Arntfield, 2009). Test tubes with various gelling

concentrations were prepared by heating respective solutions or suspensions, and LGC was determined as the concentration in which the gel in the inverted test tubes did not slip.

Properties of gels produced from canola proteins can also be improved by the addition of polysaccharides. The inclusion of low levels of polysaccharides has been shown to improve gel properties in comparison to canola protein alone (Cai and Arntfield, 1997).

Conclusion

The potential for the utilisation of canola meal proteins in food processing is supported by the fact that canola proteins are balanced in all essential amino acids, having a better amino acid profile than soya bean protein isolates and comparing favourably with the amino acid requirements for both adults and children.

Although antinutritional factors, colour and the taste of canola proteins are major obstacles for their use in human consumption, targeted extraction procedures should be able to overcome these problems. Various methods for preparing CPIs have been reviewed, with the majority of these studies being based on alkaline extraction. However, proteins extracted by alkali were not very suitable as food ingredients, probably due to irreversible denaturation during the isolation process.

As solubility is often considered to be a prerequisite for the performance of proteins in food applications, it is significant that protein isolates from alkaline extraction of canola meal have poor solubility at a neutral pH and poor technological functionalities. Meanwhile, there is evidence of significant amounts of water- and salt-soluble proteins in *Brassica* species.

Thus, a more comprehensive study is warranted that would be based on the utilisation of these soluble fractions in order to provide a better understanding of the characteristics and functionality of canola proteins in food application. 🌱

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

To read the full article, visit <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3038326/>.

AMINORed®: Accurate and rapid assessment of processed soya bean quality

By Chantelle Fryer, Technical Service Manager, Evonik Nutrition and Care

Soya beans are an important ingredient in animal diets. Unfortunately, raw soya beans contain anti-nutritional factors that can severely depress the performance of these animals.

Common soya products used in animal feed are soya bean meal (a by-product of soya oil extraction) and full-fat soya (the roasting and extraction of the entire dehulled bean). Both processes require the application of adequate heat to destroy the anti-nutritional factors, the most well-known of which are trypsin inhibitors found in raw beans. Trypsin inhibitors block sites where the enzyme trypsin binds with proteins during the digestion process, thereby reducing the ability to liberate amino acids and small peptides. This leads to performance and

Table 1: Chemical analysis methods for processed soya beans

	TIA	Urease activity	KOH	PDI	Reactive lysine: Total lysine
Underprocessing	+++	+++	+	++	No
Overprocessing	No	No	++	+	+++
Target values	<4mg/g	<0,3 pH rise <0,4mgN/g*min	73 to 85%	15 to 40%	>90%
Comment	Difficult	Most common		Simple method	Difficult

health issues such as poor growth and diarrhoea.

Although underprocessing of soya beans is always a concern, the opposite is also true. Overprocessing, where too much heat causes damage to the tertiary structure of proteins and reduces enzymatic binding, and thus digestibility of the amino acids of soya beans, is often overlooked.

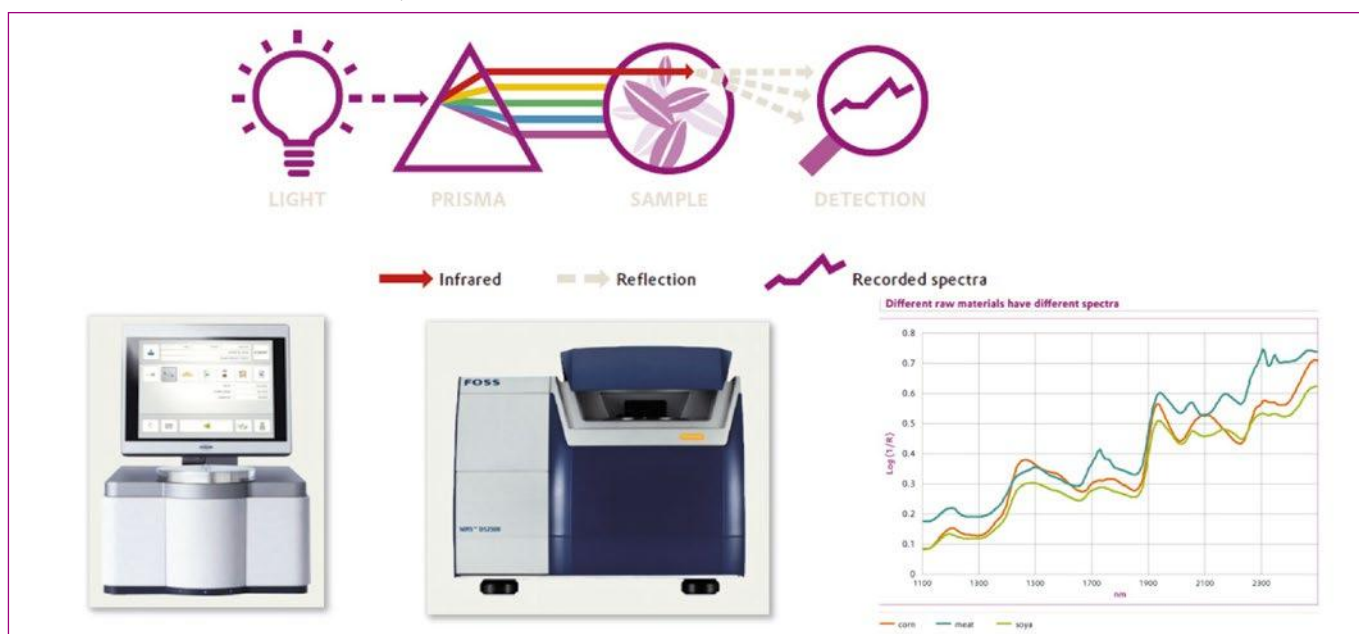
When formulating animal feed, nutritionists consider the amount of

digestible lysine in the soya bean meal or full-fat soya. Overprocessing leads to an overestimation of the amount of digestible lysine, and indeed many other amino acids, in the processed end-product.

Methods for processing evaluation

There are multiple chemical analysis methods to evaluate processed soya beans, all with various advantages and disadvantages (Table 1). Trypsin inhibitor

Figure 1: The basics of NIR technology





Different grades of processed soya bean meal used for the development of AMINOREd® 2.0.

activity (TIA) is the most accurate test for determining underprocessing, but it is very difficult and costly to perform.

A urease test is simple and can be performed by most mills and processing factories, but results can vary depending on various factors,

including particle size and even room temperature. TIA and urease cannot give any indication of overprocessing either, whereas methods such as potassium hydroxide (KOH) protein solubility can indicate overprocessing, but not underprocessing.

While lesser known, the reactive lysine assay is one of the most accurate ways to determine the effect of heat treatment on amino acid digestibility and availability.

Near-infrared technology

One of the biggest breakthroughs in ingredient analysis over the past few years has been the development of near-infrared (NIR) technology. NIR spectroscopy enables the rapid analysis of raw materials by the application of infrared light to a sample and measuring the spectra of that light.

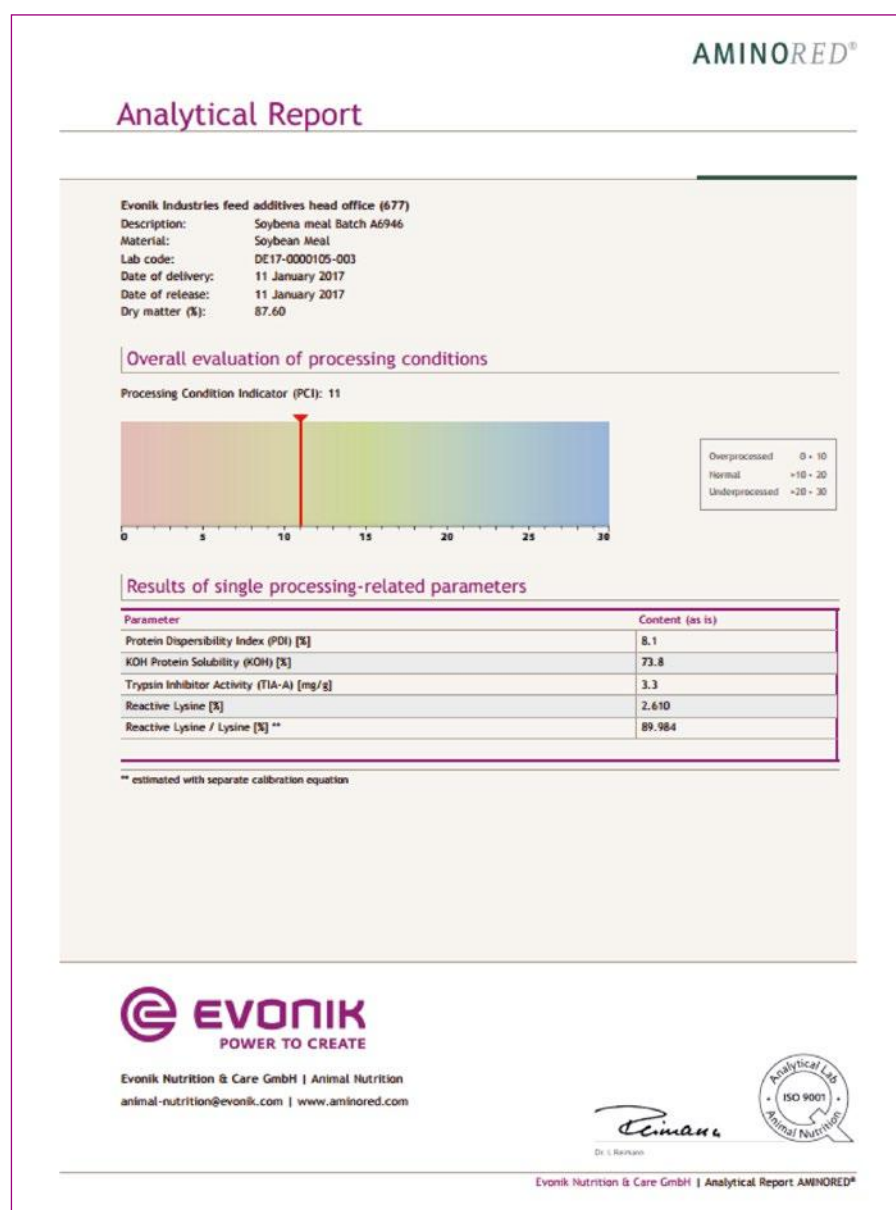
NIR is an excellent tool for quality control as it enables the analysis of thousands of samples per year with precision, accuracy and minimal cost per sample. Evonik's expertise in this technology has enabled the development of a new calibration for the rapid assessment of soya bean processing quality – AMINOREd® 2.0.

This calibration was developed for the quality assessment of soya products and delivers predictions on well-established quality parameters used by the feed industry, such as TIA, KOH, and the Protein Dispersibility Index (PDI).

These parameters were combined with Evonik's leading position in amino acid analytics, especially the reactive lysine assay, to design a new parameter – the Processing Conditions Indicator (PCI). The PCI can classify all soya products according to the degree of processing, from raw beans to heavily overprocessed samples, within minutes. (Figure 2).

Processed soya bean quality is a vital consideration for animal feed producers and soya bean processors alike. Using the latest technology will deliver benefits to all role-players in the soya bean value chain.

Figure 2: AMINOREd® analytical report depicting the PCI and predictions for parameters such as TIA and KOH



For more information,
 email Chantelle Fryer at
 chantelle.fryer@evonik.com
 or visit www.evonik.com.

Soya bean market overview

By Ikageng Maluleke, agricultural economist, Grain SA

Despite less than optimal weather conditions in South America, which slowed down planting and delayed harvesting in some areas, as well as economic and policy uncertainty in Argentina and fears of a second wave of COVID-19 infections in some regions, optimism around global soya bean production remains high. In fact, a record or near-record global export volume of soya bean is on the horizon for the 2020/21 season.

International market trends

World soya bean production is projected to reach a record of 370 million tons for the 2020/21 season (*Table 1*), with soya bean production in the United States (US) expected to increase as a result of a 10% increase in planted area and favourable seasonal conditions. This is likely to make export markets highly competitive in 2020/21.

Although a large crop was initially expected from Brazil, producers are struggling to plant due to drought conditions, meaning that production for the season might not be as high as

initially expected. Dry spells in Argentina during May affected the reproductive development of soya beans.

Demand for soya bean is expected to increase due to the need for protein meal for livestock feed, as China increases its demand in the poultry and aquaculture segments and continues to rebuild its pig herd after the African swine fever outbreak. Although China imported a record amount of soya beans from Brazil earlier this year, facilitated by a weak Brazilian currency, it is expected that China's demand will shift back to US soya beans in 2020/21, leading to a recovery in US exports.

The COVID-19 pandemic constrained growth in the otherwise strong global demand for meat. In the short term, the temporary closure of some US abattoirs because of the pandemic increased demand for meal to feed a backlog of animals ready for slaughter. Due to new regulations, this backlog could take some time to clear. As a result, there has been an increase in US crushing capacity because of greater domestic demand for

soya bean meal by the livestock industry.

The poultry industry in Australia relies heavily on soya bean meal imports, mainly sourced from Argentina. Recently the country also imported from the US, following disruptions to the largest processing plant and reduced overall supply in Argentina. Domestic poultry consumption in Australia is stabilising following an initial surge in demand at the start of the pandemic. This should result in domestic feed levels normalising in 2020/21.

The latest global developments

The latest reported developments in policies for soya beans include the following:

- In September, the US announced an additional US\$14 billion for agricultural producers as part of their extended Coronavirus Food Assistance Program 2 (CFAP 2). These payments will be for several commodities, including soya beans.
- In October, Argentina announced a temporary reduction in export

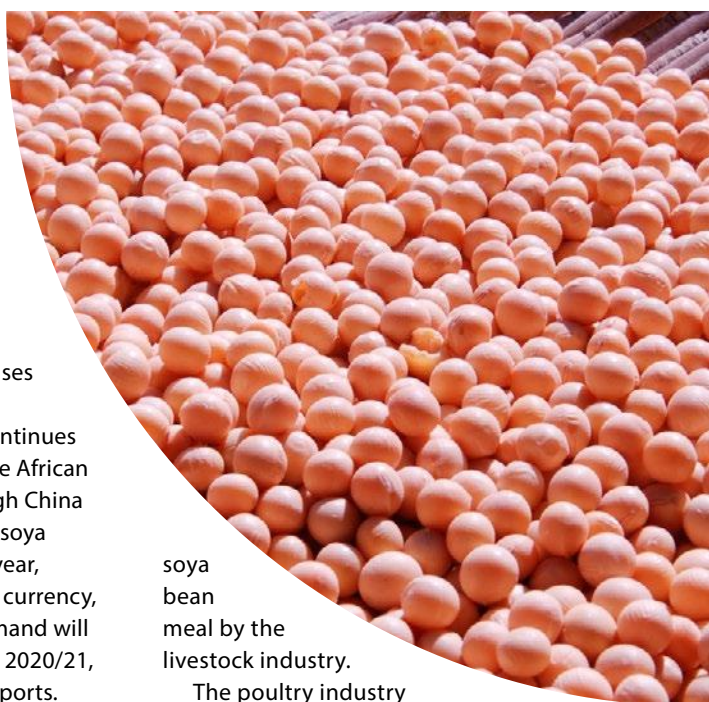


Table 1: Global soya bean supply and demand. (Source: International Grains Council, 2020)

	2019/20 Final (million tons)	2020/21 Projections (million tons)
Opening stocks	62	47
Production	338	370
Imports	163,5	163,2
Processed	353	370
Exports	165,9	166,8
Closing stocks	47	46

taxes for soya beans, soya bean meal and soya bean oil in an attempt to boost exports. However, all rates are scheduled to rise incrementally again until January 2021.

International price movements

On average the world soya bean price is estimated to average US\$346/ton in 2020/21, which is approximately 6% below the five-year average. Reflecting on sharp gains at all key origins, the International Grain Council's Grains and Oilseeds Index: Soybean Sub-index advanced by 8,5% month on month, moving to its highest level in more than four years.

In terms of US origins, price gains were supported by worries over climate conditions as well as lower stocks, strong demand from China and tightening port loading capacity. Brazilian origins made gains from stock level declines due to record exports and planting delays, while Argentina Up-River FOB prices remained firmer, mainly due to producers' reluctance to sell because of economic uncertainties.

Local market trends

According to South African Grain Information Service (SAGIS) figures, producer deliveries for soya beans as of 1 September, totalled 1 202 982 tons. This represents around 97% of the estimates by the Crop Estimates Committee (CEC) (Table 2). At the time of writing, soya bean imports totalled

Table 2: Local soya bean supply and demand. (Source: Grain SA, NAMC, 2020)

	2019/20 (tons)	2020/21 (tons)
Production (CEC)	1 170 345	1 261 250
Opening stocks (1 March)	502 241	138 455
Imports	9 098	150 000
Surplus	0	2 600
Total supply	1 646 518	1 519 305
Total demand	1 508 063	1 398 200
Ending stocks	138 455	121 105

60 308 tons or approximately 40% of the estimated 150 000 tons for the season.

The forecast for the new season in terms of production planning is looking favourable. The CEC reported that the intension to plant for 2020 could possibly increase by 80 800ha to 785 800ha, which is an 11,46% increase compared to the previous year's 705 000ha.

Projections for closing stock levels at the end of the season (28 February 2021) is estimated at 121 105 tons; this represents available stocks for a month, with average processing of 115 417 tons per month. This is tight, considering that we have pipeline requirements of one and a half months.

Local soya bean market demand remains good. According to the latest SAGIS figures, the overall year-to-date processing of soya beans is 882 506 tons, which is approximately 2,6% more than the previous season's year-to-date

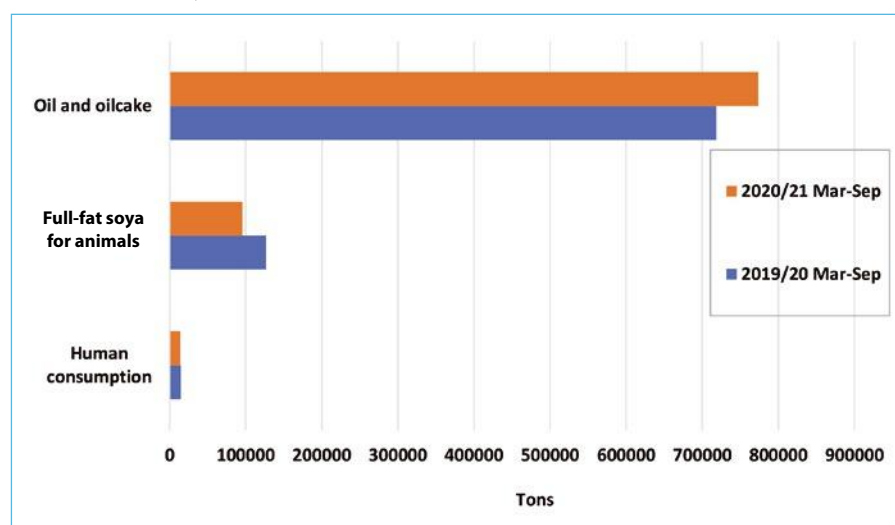
pace (Figure 1). This is mainly due to the processing of oil and oilcake, which is 7% ahead of last year's pace.

Local soya bean prices

Over the past few months, domestic soya bean prices continued to rise due to support from increasing international prices, depreciation of the rand and strong domestic demand. Local prices moved closer to import parity levels, following international price movements pushed by higher demand for US soya beans as well as uncertainties regarding weather conditions in South America. In addition, local demand for crushing has increased.

The December futures price increased by 22,7% since June this year, while the futures prices for July 2021 is currently (at the time of writing) trading at around R7 200. Prices are likely to remain relatively stable at current levels in the short term. However, as most of the actual plantings still need to take place, there is still a lot of production risk that may affect prices.

Figure 1: Local soya bean processing. (Source: SAGIS, 2020)



A final thought

Although soya bean prospects are looking good for the new season, the main concern is weather conditions and whether the intended hectares will be realised, as local stocks in relation to local consumption is very tight. China-US relations will also influence trade dynamics while uncertainties around COVID-19 still linger as the second wave is imminent in many regions. 🌱

For more information,
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Evidence of health benefits of canola oil

By Lin Lin, Hanja Allemekinders, Angela Dansby, Lisa Campbell, Shaunda Durance-Tod, Alvin Berger and Peter JH Jones



Over the past 40 years, canola has become one of the most important oilseed crops worldwide. Today, canola oil is the third-largest vegetable oil by volume after palm and soya bean oil. The worldwide production of canola oil in 2010/11 was 38 million metric tons, with Europe accounting for 63% and Canada accounting for 31% globally.

In the United States, canola oil is one of the most widely consumed oils, second only to soya bean oil. Canola oil is characterised by the following: low level (7%) of saturated fatty acids (SFAs); substantial amounts of monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs), including 61% oleic acid, 21% linoleic acid, and 11% alpha-linolenic acid (ALA); plant sterols (0.53 to 0.97%); and tocopherols (700 to 1 200ppm) – all of which have data indicating they are cardioprotective substances.

Recently, growing numbers of studies indicate that biomarkers beyond blood lipids are beneficially influenced by canola oil consumption. The objective of this review was to conduct a literature assessment to examine the health

benefits of intact canola oil, rather than focus on the effects of individual components in the oil. This approach can be considered more practical since consumers make choices between intact cooking oils for consumption.

Diets based on canola oil showed positive effects on TC levels regardless of the type of canola oil used compared to a typical Western diet.

The specific aim of this review was to describe the effects of canola oil consumption on, among others, cholesterol, inflammation, insulin sensitivity, energy metabolism and cancer.

Cholesterol

SFAs are found in animal fat and dairy products as well as certain types of vegetable oils, including coconut and palm oils. Typical Western diets are high in SFAs. A high amount of dietary SFA may increase total cholesterol (TC) and low-density lipoprotein (LDL-C) levels,

thus increasing the risk of developing cardiovascular disease. Efforts to substitute SFAs have typically relied on replacement of animal fat and dairy products with liquid vegetable oils high in MUFAs and PUFAs.

In terms of total cholesterol levels, five studies compared canola oil-based diets with typical Western diets, providing evidence that canola oil can reduce TC levels by an average of 12.2%. Diets based on canola oil showed positive effects on TC levels regardless of the type of canola oil used compared to a typical Western diet.

Seven studies compared canola oil-based diets with those high in SFAs. The high-SFA diets in these studies contained >12% energy from SFAs and >30% energy from total fat, mainly in the form of butter, margarine, mayonnaise, and other high-SFA food. Five of the seven studies examined the effects of margarines or mayonnaises made with canola oil on TC levels and all showed a lowering of TC levels, ranging from 3.3 to 21.7%, compared with a high-SFA-treated group.

Palomäki *et al.* and Valsta *et al.* fed their subjects diets containing canola oil or a high-SFA alternative rather than incorporating the oil into food products;

their results demonstrated significant lowering of TC levels with the canola oil, at 8,3 and 15,5%, respectively, compared with the high-SFA alternative. Results from all seven studies consistently showed that replacing higher SFA diets with canola oil, decreased TC levels.

Baudet and Jacotot, Iggman *et al.* and Karvonen *et al.* compared dietary canola oil with various high-SFA dairy products. Substituting canola oil for dairy fat caused TC levels to decrease by 18,4, 16,1 and 5,1%, respectively, in these three studies. Current food technology allows substitution of SFA with canola oil in dairy manufacturing, which may offer new options for regulating blood cholesterol levels and, thereby, reduce the risk of cardiovascular disease.

SFAs are not only found in animal fat but are also derived from vegetable oils such as coconut and palm oils. Some commercial food manufacturers have selected high-SFA vegetable oils as alternatives to animal fat because of taste. When comparing canola oil-based diets to palm oil-based diets, Sundram *et al.* found a 2,2% reduction in TC and Vega-López *et al.* observed a 12,5% decrease in TC levels with the canola oil-based diets.

Overall, clinical studies have shown that compared with high-SFA or typical Western diets, canola oil-based diets can reduce TC concentrations in healthy or hypercholesterolemic individuals.

Inflammation

Epidemiological studies in Greenland Inuit cohorts have shown that a lower incidence of coronary heart disease (CHD) mortality is not only associated with lower plasma TC and triacylglycerol (TAG) levels, but also with decreased platelet aggregation in vitro as well as lower thromboxane A₂ (TXA₂) synthesis rates.

TXA₂ is a prothrombotic agent contributing to platelet activation and aggregation and is the principal metabolite of arachidonic acid, an omega-6 fatty acid. In contrast, the omega-3 fatty acid eicosapentaenoic acid can be converted to TXA₃, having lesser platelet aggregatory activity relative to TXA₂. Several studies have investigated the effects of a canola

oil-based diet on biomarkers of antioxidant status, platelet aggregation, and inflammation in the context of CHD risk.

Kwon *et al.* examined the effects of diets high in MUFA (canola oil) or PUFA (safflower oil) on platelet aggregation and formation of thromboxane B₂ (TXB₂), the prothrombotic stable metabolite of TXA₂. After three weeks, the canola and safflower oil groups both showed decreases in platelet aggregation compared to the high-SFA baseline diet, but values returned to baseline levels at week eight. No significant differences in TXB₂ concentrations were observed between the dietary intervention groups.

In the United States, canola oil is one of the most widely consumed oils, second only to soya bean oil.

Taken together, canola and safflower oil-based diets both resulted in temporarily reduced platelet aggregation compared with an SFA-based diet. However, the canola oil-based diet resulted in longer beneficial effects on platelet function than the safflower oil-based diet.

Antioxidants

Södergren *et al.* examined the effects of a canola oil-based diet compared to an SFA-based diet on biomarkers of antioxidative capacity. Levels of g-tocopherol were higher following the canola oil-based diet compared to the SFA-based diet. Because of its antioxidant activity, the increased levels of g-tocopherol may have protected the PUFA in the canola oil diet from oxidation.

No differences in a-tocopherol were observed between the two diets, resulting in a decreased a- to g-tocopherol ratio with the canola oil-based diet compared to the SFA-based diet. The relevance of this finding is demonstrated by other studies that associated low g-tocopherol concentrations and a high a- to g-tocopherol ratio with CHD incidence.

In summary, canola oil may potentially promote immune and

cardiovascular health through its antithrombic and antioxidative effects.

Energy metabolism

Not all dietary fats undergo equivalent partitioning for energy expenditure, and some may exhibit satiety promoting actions. To help individuals maintain normal bodyweight and prevent obesity, studies have examined food intake, satiety, bodyweight, body mass index, and body composition following consumption of different types of oils.

Furthermore, dietary fatty acid composition plays an important role in metabolism and gene expression. Some studies have explored the possible actions of oleic acid-rich oils, such as olive and canola oils, given older data suggesting preferential partitioning of oleic acid for oxidation versus retention in body storage compartments.

A few studies examined the direct actions of canola oil-based diets on human energy metabolism. For example, Maljaars *et al.* analysed the satiating effect of fat and its physiochemical properties in a double-blind, randomised crossover study. In this study, fat emulsions consisting of 6g of shea, canola oil, or safflower oil were each provided to 15 healthy subjects. After four days, the canola and safflower oils significantly increased fullness and reduced hunger compared with the saline control treatment, but no effects on food intake were observed.

Gut peptides involved in the regulation of satiety and food intake were also analysed in this study. Cholecystokinin secretion increased with canola oil feeding compared with the control, but no dietary effect was observed on peptide YY secretion. This study concluded that canola oil can increase cholecystokinin levels, which may, in turn, mediate the satiating effects in the ileum, but not in peptide YY.

Insulin sensitivity

Evidence has shown that SFA intake is linked with insulin resistance, obesity, and metabolic syndrome. In a recent review by Gillingham *et al.* on the health benefits of MUFAs, it was concluded that MUFAs are capable of favourably modulating insulin sensitivity and glycaemic control when substituted for SFAs.

Many dietary intervention studies have tested the effects that substitution of SFAs with MUFAs or PUFAs has on insulin sensitivity. However, many other factors beyond dietary fatty acid composition may influence glucose tolerance and insulin sensitivity. In this arena, the focus has been on the clinical outcomes of canola oil-based diets on insulin sensitivity and glucose tolerance compared to diets higher in SFAs and unsaturated fatty acids.

Uusitupa *et al.* reported lower levels of glucose and steeper glucose disappearance rates in participants who consumed a canola oil-based diet compared with a high-SFA diet after an intravenous glucose tolerance test. Södergren *et al.* reported that consumption of a canola oil-based diet lowered fasting plasma glucose levels compared with an SFA diet while fasting insulin levels did not differ between the two diets. Results from Gustafsson *et al.* showed that fasting blood glucose levels decreased 6% following a canola oil-based diet compared to baseline values (containing SFA >15%). No significant differences were found between canola oil and sunflower oil diets.

Compared with partially hydrogenated soya bean oil, canola oil showed a lower insulin concentration and lower

homeostasis model assessment ratio. However, there was no difference between these two oils with regard to their effects on plasma glucose concentrations, which suggests canola oil may have a potential effect on insulin sensitivity. In general, canola oil-based diets show positive results in modulating glucose and insulin levels compared with SFA-based diets.

Cancer

The association between lipid intake and various cancers has been understudied, particularly in humans. While no human clinical trials specific to canola oil and cancer have been performed to date, in vitro and in vivo animal data exist and are examined here.

Jiang *et al.* pointed out that omega-3 fatty acids are toxic to tumour cells, but omega-6 fatty acids, such as linolenic acid, enhance carcinogenesis and tumour cell growth. Nevertheless, in a systematic review by Hooper *et al.*, no consistent effects of omega-3 fatty acids on the incidence of cancer were identified.

Over the past few decades, investigations of the protective effects of dietary fat quality, particularly omega-3 fats, on common cancers, including breast, colon, and prostate cancers, have not been exclusively focused on fish oil. Plant-based oils such as canola oil, which is a

good source (11%) of ALA, have also been examined for their potential to modulate cancer cell growth and death. Protective effects of canola oil compared with corn oil against breast and colon cancers have been reported in various cell and animal studies; however, more research is required to provide definitive direction in this area.

Certain human studies have investigated the clinical effects of canola oil on carcinogenic substances. Fang *et al.* found lower levels of DNA adducts of malonaldehyde in participants consuming a canola oil-based diet compared with subjects consuming a sunflower oil-based diet. This result was not surprising, as sunflower oil would be expected to be high in PUFAs, resulting in enhanced peroxidation of PUFAs compared with the rate of peroxidation in the canola oil group.

In a study by Nair *et al.*, however, DNA adducts, formed by carcinogenic agents, were not decreased in males but were, on average, 44 times lower in females on a canola oil diet compared to a soya bean oil diet.

To conclude, studies exploring linkages between canola oil consumption and cancer risk modification remain equivocal.

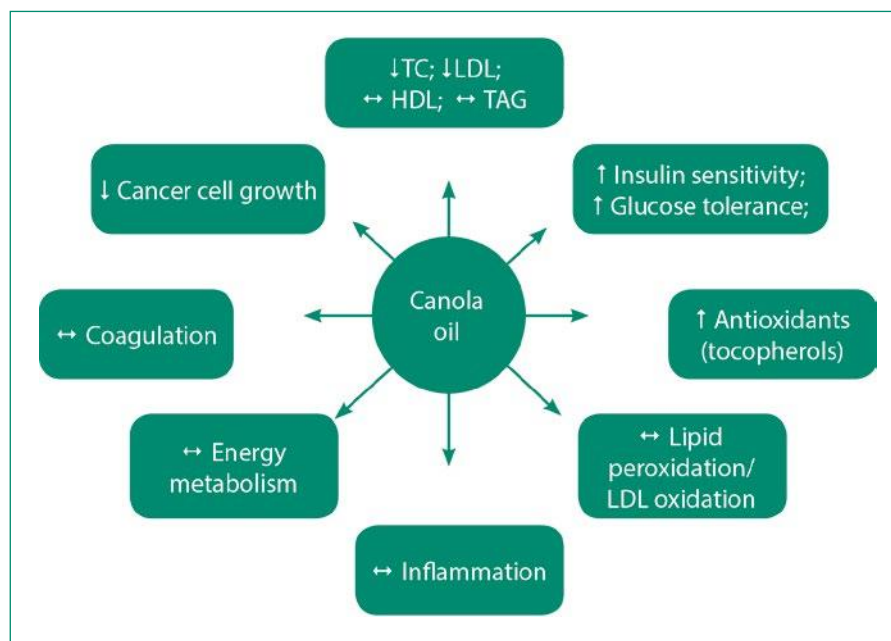
Findings

Results of this review regarding the biological efficacy of health benefits from canola oil have demonstrated both positive and neutral actions, as illustrated in Figure 1.

Evidence shows several potential health benefits of canola oil consumption. Canola oil can now be regarded as one of the healthiest edible vegetable oils in terms of its biological functions and its ability to aid in reducing disease-related risk factors and improving health. Current research is expected to provide more complete evidence to support the health-promoting effects of canola oil when consumed at levels consistent with dietary guidelines. 🌱

This article has been shortened for publication in *Oilseeds Focus*. To read the full article, visit <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3746113/>.

Figure 1: Effect of canola oil on health-related risk factors.



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Cardiovascular and renal benefits of dry bean and soya bean intake

By James W Anderson, Belinda M Smith and Carla S Washnock

Dry beans and soya beans are unique foods because of their rich nutrient content. These legumes contain complex carbohydrates, vegetable protein, dietary fibre, oligosaccharides, phytochemicals (especially the isoflavones in soya), and minerals.

Soya protein is recognised as a 'complete' protein, with a protein digestibility-corrected amino acid score of 1, equivalent to the gold standard, egg albumin. Its dietary fibre components include both soluble and insoluble fibres, which offer many health benefits, and the isoflavones genistein and daidzein, which are unique to soya beans, have numerous biologic functions. Finally, the minerals in beans are readily available, which is important in reducing several health risks.

Nutrient profile

Some of the major nutrients provided by dry beans and soya beans are shown in *Table 1*. Dry beans provide more complex carbohydrates than soya beans. Both types of beans have limited amounts of simple carbohydrates. The oligosaccharides – raffinose, stachyose, and verbascose – in dry beans and soya beans give legumes some of their notoriety because they are not hydrolysed in the small intestine and are fermented to short-chain fatty acids (SCFAs) and gas in the colon.

Dry beans are inexpensive sources of plant protein with the potential to be used worldwide as substitutes for animal protein sources. The protein content of most beans

(uncooked) averages 20 to 25% by weight, whereas the protein content of soya beans is approximately 36% by weight. Although dry beans are rich in essential amino acids, they fall short in methionine and tryptophan content, requiring the consumption of larger amounts of protein to meet the nutritional requirements for these essential amino acids. In contrast, soya protein food is equivalent in quality to animal protein sources.

Isolated soya protein has the same protein digestibility-corrected amino acid score as casein and egg protein. The fat content of dried beans averages only 1% by weight, with unsaturated fatty acids predominating. Soya beans are richer sources of fat (18 to 20% by weight) and contain saturated, monounsaturated, and polyunsaturated fatty acids (15, 23, and 58% of total fat, respectively). The polyunsaturated fatty acids in soya beans are linoleic acid and α -linolenic acid.

Dry beans contain a mixture of soluble fibre, which significantly lowers cholesterol and blood sugar concentrations, and insoluble fibre, which aids in gastrointestinal function. Beans contain an average 6g total and 2g soluble fibre per serving. Up to 30% of the fibre in soya beans is

soluble. Soya fibre measurably lowers the postprandial increase in serum glucose concentrations but has only a modest effect on serum cholesterol concentrations. Uncooked soya beans contain 5.4g total and 2g soluble fibre per serving. Many soya foods, such as soya beans, soya nuts, green soya beans, soya flour, textured soya protein and tempeh, are rich in fibre; isolated soya protein, however, does not include dietary fibre.

Dry beans and soya beans are low in sodium but are excellent sources of

Table 1: Nutrition profile of dry beans and soya beans, expressed per 100g dry weight.

Nutrient	Dry beans	Soya beans
Complex carbohydrates (g)	56	21
Simple carbohydrate (g)	4	9
Stachyose (mg)	1 848	3 300
Raffinose (mg)	336	1 600
Protein (g)	22	36
Total fat (g)	1	19
Saturated fat (g)	0,3	2,8
Monounsaturated fat (g)	0,11	4,4
Polyunsaturated fat (g)	0,55	11,2
Ratio of α -linolenic to linoleic acid (mg)	0,252:0,301	1,3:9,9
Insoluble fibre (g)	11	10
Soluble fibre (g)	6	7
Calcium (mg)	154	276
Magnesium (mg)	172	280
Potassium (mg)	1 140	1 797
Iron (mg)	6,4	16
Zinc (mg)	2,5	4,8

minerals, including calcium, copper, iron, magnesium, phosphorus, potassium, and zinc. The content and bioavailability of minerals in dry beans and soya foods vary according to the processing methods and phytate content.

Coronary artery disease

Cardiovascular disease is a major medical and public health concern in Western and developing countries all over the world. Dietary interventions to reduce heart disease risk include attention to the consumption of types of fatty acids, dietary fibre, isoflavones, and antioxidants. Dry beans and soya foods contribute to all these areas.

Fatty acids

Dry beans are essentially fat-free and act to displace fat from the diet. Many soya foods have moderate amounts of oil that is predominantly unsaturated. Linoleic acid (51%) is the predominant fatty acid of soya food and has specific actions on eicosanoid synthesis and metabolism, lipid peroxidation, and platelet aggregation, some of which may be detrimental.

Soya food also provides α -linolenic acid (7%), an n3 fatty acid not commonly found in plant food, which has specific effects on eicosanoid synthesis and metabolism and appears to have favourable effects on platelet reactivity. Although effects of the individual fatty acids in soya have not been documented, the low saturated fat content makes soya food a good choice for a heart-healthy diet.

Dietary fibre

In a thorough literature review of clinical studies in humans, Glore *et al.* reported that soluble fibre produced significant reductions in total serum cholesterol concentrations and LDL cholesterol concentrations in 88 and 84%, respectively, of the studies reviewed.

Most clinical studies in humans have used either high-fibre food or fibre supplements. Many studies have documented the hypocholesterolaemic effects of dry beans. Metabolic ward studies suggest that dry bean intake has the potential to decrease

serum cholesterol concentrations of hypercholesterolemic subjects by approximately 10%. Soya fibre supplementation has a modest hypocholesterolaemic effect in animals and humans. Because most of the studies with soya protein have used isolated soya protein that does not contain soya fibre, the hypocholesterolaemic effects of soya protein were unrelated to soya fibre intake.

Soya beans, with or without their fibre, appear to decrease serum cholesterol concentrations through their protein or isoflavone contents.

Legume protein

Soya beans and dry beans may exert a major cholesterol-lowering effect through their vegetable protein content. In experimental animal models, feeding a variety of different plant proteins is associated with lower serum cholesterol concentrations than with feeding a variety of different animal proteins. Legume proteins appear to have specific hypocholesterolaemic effects.

Clinical studies using soya protein for cholesterol reduction date back to 1967, when Hodges *et al.* showed the cholesterol-lowering properties of soya in male prison inmates. More than 40 studies have found soya to be effective at reducing cholesterol when added to or replacing animal protein in the diet.

Isoflavones

Soya isoflavones, structurally similar to oestrogens, interact with oestrogen receptors and may decrease serum cholesterol concentrations by similar mechanisms. Anthony *et al.* reported that monkeys fed isoflavone-rich soya protein isolate diets had significantly better serum lipid values (lower total cholesterol and higher HDL cholesterol concentrations) than monkeys fed isoflavone-poor soya protein isolate diets. Whereas the administration of the antioestrogen tamoxifen is accompanied by an increase in serum triacylglycerol concentrations, soya protein administration is associated with a decrease in serum triacylglycerol concentrations.

Antioxidants

Soya isoflavones have antioxidant properties. Because LDL oxidation has

a central role in the pathogenesis of atherosclerosis, these soya isoflavones may have protective effects against atherogenesis in humans. LDL oxidation initiates a cascade of events that includes accelerated platelet aggregation, injury to arterial endothelial cells, and, in the subendothelium, the production of cytokines, adhesion factors, growth factors and other molecules that facilitate development of foam cells and fatty streaks. In vitro studies suggest that genistein and daidzein inhibit LDL oxidation in the subendothelium of vessels in a similar manner to that of vitamin E.

Kidney disease

The relation between excess protein intake and reduced kidney function has long been recognised and is considered when making dietary recommendations, especially to persons at risk of diabetic nephropathy. The Brenner hypothesis states that excessive protein intake causes hyperfiltration and glomerular hypertension, which results in the progressive deterioration of kidney function and leads to nephropathy.

We put forth the 'soya protein and diabetes kidney disease hypothesis', suggesting that substituting soya protein for animal protein will protect against development of kidney disease in diabetic individuals and be effective in reversing or slowing the progression of established kidney disease in diabetic individuals.

Limited evidence suggests that protein from dry beans may also have renal protective effects, but more investigation of this area is required. This section will review evidence supporting our hypothesis that substituting soya protein, or perhaps other vegetable protein, for animal protein has protective or restorative benefits for diabetic individuals with or at risk of nephropathy.

Protein and kidney function

After a large protein meal, blood flow to the kidneys increases significantly. In healthy subjects, an increase in renal blood flow of 10% occurred after a large protein meal, whereas an increase of 33% occurred in subjects with chronic renal disease.

Beef meals increase renal blood flow and glomerular filtration rates more than chicken or fish. Soya protein does not affect renal blood flow or glomerular filtration rates. The mechanisms responsible for these changes are not understood and are still under investigation.

Protein-restricted diets remain the mainstay in nutrition management of chronic renal disease. Most recent clinical studies indicate that dietary protein restriction can slow the progression of renal disease in nondiabetic or diabetic patients. In a comprehensive meta-analysis of the effects of protein-restricted diets on the progression of renal disease, data suggested that these diets reduced the risk of renal failure or death in nondiabetic patients.

Soya protein and renal function

Meal studies indicate that soya protein does not alter postprandial renal blood flow or glomerular filtration rates, whereas animal protein significantly increases these indexes.

Longer-term intakes of soya protein diets were associated with lower renal blood flow, glomerular filtration rate, and fractional clearance of albumin than animal protein diets. Of interest in this area, vegan and lacto-ovo-vegetarian subjects without renal disease had lower glomerular filtration rates and less urinary albumin excretion than omnivores; however, the vegans also

had lower protein intakes, on average, than the omnivorous subjects.

Long-term studies also indicate that soya protein intake protects kidneys, whereas excessive animal protein intake may be harmful to kidneys. In animal models of kidney disease, rats fed soya protein had much slower progression of renal disease than rats fed casein. Human studies have not been optimally controlled but suggest that substituting soya protein for animal protein decreases proteinuria in individuals with chronic glomerular disease. In a study of diabetic individuals with nephropathy, Jibani *et al.* noted that a vegetarian diet significantly decreased proteinuria compared with their baseline omnivorous diet.

Diabetic nephropathy

In diabetic individuals, long-standing hyperglycaemia leads to chronic renal vasodilatation, glomerular hyperfiltration, cellular injury, glomerulosclerosis, mesangial proliferation, and, finally, proteinuria and uraemia. Hypertension, almost universal in people with type 2 diabetes, accelerates this process.

Many individuals with type 1 and type 2 diabetes have higher renal blood flow and glomerular filtration rates and lower renal vascular resistance than nondiabetic individuals. Only one-third of diabetic individuals develop nephropathy, and it is likely that those that do have a genetic predisposition for this condition. Hyperfiltration may be an

early indicator that diabetic individuals are at high risk of developing nephropathy.

Dietary protein restriction appears to slow the progression of diabetic nephropathy. In a carefully controlled and random parallel study in diabetic individuals, a low-protein diet was associated with a decline in glomerular filtration rate and a slight decrease in proteinuria with nephropathy compared with the usual diabetic diet. A meta-analysis also concluded that protein-restricted diets slowed the progression of diabetic nephropathy.

Further research is required to examine our hypothesis that substituting soya protein for animal protein will protect against the development of kidney disease in diabetic individuals and will be effective in reversing or slowing the progression of established kidney disease in diabetic individuals.

Because of the extensive evidence of detrimental effects of excess protein intake and of the beneficial effects of restricting protein and substituting vegetable for animal protein, it seems prudent to recommend that diabetic individuals moderate their protein intake and select vegetable protein instead of animal protein when practical.

Practical considerations

Dry beans and soya beans are good sources of quality protein and can be substituted for animal protein sources. Dry beans bring complex carbohydrates with low glycaemic indexes and a favourable mixture of soluble and insoluble fibres to the table, and soya beans provide high-quality protein and unique isoflavones. Information about the isoflavone content of various soya products is provided in Table 2.

In our experience, most consumers can find ways of incorporating soya products into their daily diets. The health advantages far outweigh the slight inconvenience involved in changing shopping habits and eating patterns. 🌱

Table 2: Protein and isoflavone contents of selected soya products.

Food	Serving size		Protein content	Isoflavone content	
	Weight	Volume		Per protein	Per serving
	g		g/100g	mg/g protein	mg/serving
Mature soya beans, uncooked	46,5	¼ cup	37	5,1	87,8
Roasted soya beans	43	¼ cup	35,2	5,5	83,5
Soya flour	21	¼ cup	37,8	5,5	43,8
Textured soya protein, dry	30	¼ cup	6	5,2	94
Green soya beans, uncooked	128	½ cup	16,6	3,3	70,1
Soya milk	228	1 cup	4,4	2	20
Tempeh, uncooked	114	4 oz	17	3,1	60,5
Tofu, uncooked	114	4 oz	15,8	2,1	38,3
Soya protein isolate, dry	28	1 oz	92	2,2	56,5
Soya concentrate, dry	28	1 oz	63,6	0,3	12,4

Values are representative and presented for illustrative purposes. Isoflavone content varies widely among soya bean varieties and from product to product depending on the manufacturing process and source of soya protein.

This article has been shortened for publication in *Oilseeds Focus*. To read the full article, visit <https://pubmed.ncbi.nlm.nih.gov/10479219>.

Climate change: Lessons from Australia

By Prof RM Gous, Protein Research Foundation

South Australia has a Mediterranean climate similar to that of the Western Cape, so it is no surprise that the three most important crops grown there – wheat, barley and canola – are also the most popular in the Western Cape. Climate change in South Australia has caused several important changes that have consequences when growing these crops, and we could learn much from the research that is currently being done there.

Producers in Australia have noticed a considerable decrease in autumn rainfall, when sowing traditionally takes place, and an increase in spring temperatures, both of which have influenced the timing of crop events such as flowering (crop phenology), leading to an increased risk of frost damage.

One of the many interventions introduced to overcome these problems has been to make use of faster-growing varieties that are generally planted later in the season. However, these have been shown to reduce yield potential. Dr John Kirkegaard, farming systems agronomist at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Canberra, has innovative ideas for overcoming the problem in the short and medium term.

Dr Kirkegaard and his colleagues believe that the negative impact climate change has on canola production can be mitigated to a large extent through several management interventions. Three of these – storing summer rainfall more effectively, sowing earlier with slower-maturing varieties, and using variable nitrogen (N) fertilisation management – are discussed here.

Storing summer rainfall

Under increasingly warm and variable climates, the efficient use of soil water carried

over from the previous crop, and of rainfall accumulated during fallow periods, is an important element of the farming system.

In 2008, the Australian grains industry established the five-year Water Use Efficiency (WUE) Initiative, which challenged growers and researchers to increase WUE of grain-based production systems by 10%. In the years that followed it was demonstrated experimentally that water productivity could be improved by levels well above the 10% target through better summer weed control (37 to 140%), inclusion of break crops (16 to 83%), earlier sowing of appropriate varieties (21 to 33%) and matching N supply to soil type (91% on deep sands).

Fallow efficiency, the proportion of fallow rain that is stored and hence available for the subsequent crop, is a key concept that is worth studying in more detail. It is influenced by the management of weeds, crop residues, and soil tilth during the fallow period. The capacity of soil to capture, store, and supply water to crops depends on its long-term management. Interventions such as minimising excessive cultivation, avoiding compaction by heavy machinery or livestock, and maintaining adequate inputs of soil organic matter are all principles of conservation agriculture that maintain soil structure, and are well known to Western Cape producers.

Retaining surface residues

Perhaps most important is retaining surface residues to protect the soil from raindrop impact and erosion. Residues slow the flow of water on the soil surface, thereby allowing more time for infiltration, and reduce soil evaporation following rainfall events. However, if conditions remain dry for an extended period, residues will not affect total evaporation.

Weeds are not considered appropriate residues, as they transpire water that could otherwise be used by subsequent crops. Weed control has the biggest impact on grain yield when pre-crop rainfall is high and subsequent in-crop rainfall low.

Integrated pre- and in-crop weed management that will maintain weeds below damaging thresholds include pasture leys, crop sequences, rotating herbicide groups, hay-cutting, chaff collection, and strategic tillage and burning. Strict control of weeds is necessary if summer rainfall is to be stored efficiently.

In most southern Australian dryland farming systems, a fallow period of four to six months follows the harvest in early summer and precedes planting of the subsequent crop in late autumn. This 'short' fallow period occurs when mean monthly rainfall is low (20 to 50mm) and evaporation rates high (250 to 300mm), but a significant portion of rain falls during large, infrequent events.

Rainfall above 20 to 30mm can infiltrate below the evaporative zone at the soil surface and be stored for subsequent crop growth. Fallow rainfall stored in the soil can contribute between 6 and 58% of average crop yield depending on soil type and both pre- and in-crop rainfall patterns.

Sow slower-maturing varieties

In Australia, attempts were made to overcome the effects of water limitations on yield by adapting crop phenology with the use of faster-growing varieties. Crops sown following autumn rains flowered after the period of significant frost risk but matured before the onset of summer heat and drought.

A better understanding of cultivar phenology and improved agronomic management has prompted a re-evaluation of sowing date recommendations in canola,



with
sowing
windows
shifting three weeks
earlier than previously

recommended. This ensures that crop establishment occurs following autumn rains (April and May), and flowering occurs in an optimal period in spring after frost risk, but before heat stress and terminal drought.

In Australia, canola yield declines by 5 to 12% per week of delay in establishment after mid-April, resulting in decreases of 44 and 85% for crops established in June and July, respectively. Early crop establishment and longer growth duration means that greater efficiency is achieved in converting rainfall into grain. This occurs primarily through deeper root growth and access to water, reduced evaporative losses from the soil, and increased transpiration efficiency. In South Australia, the sowing window closes in the second week of May.

Early sowing of crops

The concept of fallow efficiency is important for storing rainfall prior to sowing a canola crop. Another important concept is that of crop establishment opportunity, which relates to the likelihood that pre- and post-sowing conditions will result in the establishment of 40 or more plants per square metre.

The management of and yield from a canola crop depend heavily on whether the opportunity exists for the crop to become established. This in turn depends on the rainfall predicted for the period after sowing, the soil type, and whether more than 25% of fallow rainfall has been stored. The rule for sowing early in

sandy soil is that 10mm of rain must fall over seven days soon after sowing, while loam requires 15mm of rain over seven days. As the chances for genuine crop establishment opportunity diminish, the predicted yield from the crop will decrease and the use of N-fertilisation will change.

Field selection and pre-crop management are critical for the successful implementation of early sowing. Early sowing increases the reliance on in-season weed management as options for knockdown weed control are limited. Therefore, choosing fields with low weed pressure is key to success. This can be achieved through various strategies including crop rotation, which minimises the weed seed bank, and harvest weed seed control in the preceding crop, including the use of chaff carts, windrow burning, crop topping and seed destruction.

Other key factors to consider when choosing which fields to sow early or dry, include topography and soil type. Sowing should start in the higher areas of the farm, followed by sowing in the low-lying fields that are more prone to frost. In water-repellent sandy soils, disturbance of dry soil can adversely affect the germination and emergence of dry sown crops. Therefore, these soils are not recommended for dry sowing. Lighter sandy soils with lower water-holding capacity require less rainfall to germinate dry sown crops and are more suitable for large dry sowing programmes.

N-fertilisation management

N-fertiliser inputs should be adjusted in response to soil type and yield potential as determined by seasonal conditions. The amount supplied should relate to the crop establishment opportunity: If this is low, then the amount of N should be low and vice versa. The response to N is always greater on sandy soils, and the highest response is during a wet season, although there is an advantage in delaying the application of N in such a season. Split application of N allows management decisions to be delayed until seasonal conditions and forecasts provide more knowledge of crop yield prospects.

There is always a yield gain when canola follows a legume crop because of the N remaining in the soil, irrespective of the amount of N added later. In sandy soil, canola responds to additional N application with no interaction with the previous crop or rainfall during the season, whereas in loamy soils and high rainfall there is less advantage in applying additional N if canola has followed a legume crop. Soil-specific management of N leads to increased profit and reduced risk.

Important considerations

For a season of average rainfall, the Australian experience is that if sowing took place on land preceded by a legume crop, according to the crop establishment opportunity and using variable N management, the gain in profit over a base of AU\$100 was a further AU\$200/ha. With this in mind, Western Cape canola producers who are not currently using these interventions should seriously consider taking advantage of the research that has been conducted in Australia.

However, a couple of important provisos need to be mentioned:

- High-yielding, early-sown crops can leave a legacy of dry, N-depleted subsoil, which may require changes to crop sequence and management to avoid yield penalties. If the subsequent rainfall during the summer fallow period is low and fails to refill the soil profile, it may be necessary to reconsider the crop sequence plan or the intended sowing date of subsequent crops in order to avoid high-risk scenarios.
- The success of agriculture in the southern Australian cropping zone has not come without the emergence of environmental problems such as soil acidification, dryland salinity, compaction, and herbicide resistance in weeds. Addressing these issues, while maintaining crop yields, is crucial for the future. 🌱

For more information or references,
send an email to the author
at gous@ukza.ac.za.

Policy brief:

Expropriation Bill 2020

By Theo Boshoff and Wandile Sihlobo, Agbiz

The *Expropriation Bill, 2020* (the Bill), along with an explanatory memorandum, was published in the *Government Gazette* by the Department of Public Works and Infrastructure on 9 October this year. This policy brief is aimed at highlighting the context, process, and impact of the proposed legislation.

The rationale for the Bill

The Bill is required to lay down a uniform process and means to calculate just and equitable compensation for all expropriations. These functions are currently performed by the existing *Expropriation Act, 1975 (Act 63 of 1975)* but, because it predates the *Constitution*, the prescribed process would likely no longer be considered administratively fair.

Likewise, *Act 63 of 1975* provides for compensation to be market based, whereas section 25 of the *Constitution* makes provision for “just and equitable” compensation that balances the rights and interests of the individual versus that of the public good.

In this sense, the Bill is what is known as framework legislation since it regulates how multiple state entities must exercise their existing powers of expropriation. The ability to expropriate for a specific purpose must still exist in other dedicated legislation.

There is a common misconception that the Bill will afford the state the powers required to expropriate land for land reform purposes. This is not true. The minister has had the power to expropriate for land reform since the mid-1990s but has seldom used these powers. This is partly

because framework legislation to guide the correct procedure and method to calculate compensation, was not in place.

Understandably, media reports have linked the Bill to land reform since the nil compensation provisions are directed at land reform only. However, it is important to remember that the Bill vests with the Department of Public Works and Infrastructure (not Land Reform) and must regulate the procedures and compensation where property of any kind is expropriated for other purposes, such as building infrastructure.

The current process

The latest publication signals the minister's intention to introduce the Bill in Parliament. Once in Parliament, the Portfolio Committee on Public Works and Infrastructure will host public consultations. Once adopted by the National Assembly, the Bill will go to the National Council of Provinces, which may call for public hearings in the provinces before it is finally voted on and assented to and signed by the president. This is a lengthy process and is unlikely to be finalised in 2020.

The Bill has appeared in various versions since 2013, the latest looking substantively the same as the version deliberated on at the National Economic Development and Labour Council (Nedlac) earlier this year.

Analysis of the latest version

The latest version of the Bill still contains the controversial section 12(3) which states that a court ‘may’ find it just and equitable to award nil compensation for land expropriated under certain circumstances.

It should be emphasised that the following checks and balances are in place:

- The Bill does not state that nil compensation *will* be awarded in the listed instances; it simply states that it *may* be just and equitable to do so after considering all relevant factors. In other words, properties falling under the listed instances are not automatically eligible for nil compensation; it simply states that factors such as abandoned land or labour tenant claims should be a consideration when determining if it will be just and equitable to award nil compensation.
- Notably, the state does not take this decision – the courts do. If the state and the owner/rights holder cannot agree on compensation, mediation must be arranged, after which the courts must decide what is just and equitable. The state must take the matter to court if requested by the owner/rights holder.
- Expropriation is always the last resort:
 - o There is a procedural guarantee contained in the Bill which prevents expropriation as the first option. The state can only legally initiate expropriation after negotiations to buy the property on reasonable terms has failed.
 - o Expropriation is not a shortcut for the state. The procedural requirements contained in the Bill make expropriation such a cumbersome process for the state, that it will always be quicker, easier, and arguably cheaper for the state to buy property. Expropriation will likely only take place if the owner refuses to sell at reasonable terms.

- o Expropriation is but one of many options to obtain land for reform. Both the Presidential Advisory Panel on Land Reform and Agriculture, as well as the minister have emphasised that expropriation is merely one option in the broader land reform toolkit. The bulk of land reform acquisitions are likely to be based on purchase and sale.

Recent developments to finalise the Blended Finance Scheme for land redistribution indicates that government prefers to follow the route of voluntary sales. Moreover, the Land Donations Policy, which is still being drafted, also indicates that government is exploring numerous instruments to drive land reform in South Africa, and is not solely focusing on expropriation.

What is the most significant risk?

The biggest risk is that a landowner/ bondholder may have to rely on litigation to receive compensation. It has already been stated that the courts will be the final arbiter of compensation and they have traditionally been reluctant to deviate substantially from market value. Although the Bill makes it possible for a court to award nil compensation, they are likely to only do so under extreme circumstances.

If the legitimate dangers posed by the nil compensation provisions are sensationalised, it can affect sentiment and the dangers it poses to investor confidence and investment, may become a self-fulfilling prophecy.

To date, the courts have only sanctioned nil compensation where there is no impact on the owner (i.e. where an owner was not compensated for the space used by a farmworker to bury his relatives on the farm where he/she resides) or where the proceeds of crime are forfeited to the state (i.e. the asset forfeiture unit of the SAPS).

The biggest risk is that the state officials implementing the Bill may offer nil compensation if an owner's circumstances resort under section 12(3) and leave it to the owner or bondholder to approach the courts for a determination. This may be costly and cumbersome. Moreover, it may dampen business confidence at a time when investments are desperately needed to rebuild South Africa's economy.

Amending the Constitution

The provisions of the Bill are intended to apply to the *Constitution* as currently drafted and may not be substantially affected, whether the *Constitution* is amended or not. The Bill makes provision for just and equitable compensation to be paid as per section 25(3) of the *Constitution*. The nil compensation clause does not replace just and equitable compensation; it merely states that a court can determine that it is just and equitable to award nil compensation.

Broader land reform strategy

Agbiz has always emphasised that the concept of expropriation without compensation is not the desired path for agricultural development and as an organisation, we do not support it. This Bill, however, goes beyond the nil compensation provisions – it is framework legislation aimed at regulating how multiple state entities must exercise their (existing) powers of expropriation, be it for agricultural purposes, human settlements, or industrial development.

Again, the Bill does not state that nil compensation *will* be awarded in the listed instances; it states that it *may* be just and equitable to do so after having considered all relevant factors. Against this backdrop, we do not think too much emphasis regarding driving land reform should be placed on this Bill, but rather on the various options highlighted by the Presidential Advisory Panel on Land Reform and Agriculture's report, as well as various models from agribusinesses and other agricultural stakeholders.

Managing expectations

While the provisions of the Bill do not pose a great deal of danger from a legal point of view, the political left may

unduly raise expectations that the Bill will usher in widespread expropriation at nil compensation. This may pose challenges if the expectations of the landless and political left are not aligned to either the actual provisions or the frequency with which it is likely to be used.

Investor confidence will likely also be affected by sentiment, so there is a duty on agribusinesses and associations to moderate communication relating to the Bill. If the legitimate dangers posed by the nil compensation provisions are sensationalised, it can affect sentiment and the dangers it poses to investor confidence and investment, may become a self-fulfilling prophecy.

In conclusion

The *Expropriation Bill* is a necessary addition to the statute book as *Act 63 of 1975* is outdated and potentially unconstitutional. If the Bill is delayed any further, it could hinder infrastructure projects if the state does not have a constitutionally sound mechanism to acquire property for public purpose/ interest where the owner refuses to sell. Practically all governments around the world have legislation that enables expropriation for this reason.

From a legal point of view, the Bill seems to provide for a sound process and contains several checks and balances in favour of landowners and bondholders. The controversy surrounding the Bill, and hence its potential negative effect on investor confidence, stems from the nil compensation provision for land reform. The actual impact of this provision will largely depend on the extent to which the state invokes it and the willingness of the courts to award compensation that deviates markedly from market value.

Expropriation will always remain the last option, so the extent to which it is used will depend on the success or failure of other land reform programmes based on public-private partnerships, which is government's preferred route at present. 🌱

For more information, send an email to Theo Boshoff at theo@agbiz.co.za or Wandile Sihlobo at wandile@agbiz.co.za.



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Overview of current water supply in the Eastern Cape

By Carin Venter

Since 2015, the Eastern Cape has been in the grips of one of the worst droughts in history. While several coastal areas received good rainfall during October this year, many catchment areas saw hardly any improvement.

According to the Department of Water and Sanitation (DWS), provincial water storage levels reached a low of 48,6% on 26 October, compared to 52,6% during the same period in 2019. This meant that water restrictions remained in place in many residential areas, while agricultural endeavours had to continue with limited access to water.

District dam levels

Amathole district: By the end of October, the Amathole district was still under severe strain to continue supplying water to Buffalo City (East London) and surrounding areas. Xilinxha Dam, which supplies water to Ngqamakhwe and Butterworth, was

almost empty, while Bridle Drift Dam, which serves as the main drinking water supply dam for Buffalo City, measured 38,9%. Sandile Dam, used mainly for irrigation purposes, stood at 43,3%, while Nahoon Dam (domestic and industrial supply) was at 40%.

Nelson Mandela Bay Municipality: During October, dams in the Algoa Water Supply System, which supply Nelson Mandela Bay Municipality, increased slightly from 18,5 to 20,1%. At the same time last year, levels stood at 37,2%.

Chris Hani District Municipality: By mid-October, the Klipplaat Water Supply System supplying Queenstown (Komani) dropped to 34,2%, while Macubeni Dam and Xonxa Dam dropped to 79,1 and 93,7%, respectively. Tsojana Dam remained at 92,2%.

Agricultural water supply

Gamtoos Irrigation Board

According to Rienette Colesky, CEO of the Gamtoos Irrigation Board, the major

rainfall periods for the Gamtoos Valley are March/April and October/November. Most producers rely on drip irrigation, while some also make use of pivots for their cash crops. The Kouga Dam is vital for water supply and it has a canal system to distribute bulk water.

According to Colesky, the most critical time of the year for producers in their area is November to February. By the end of October water restrictions were still in place, which meant that producers only received 20% of their allocation. This severely affected all agricultural activities and made it particularly difficult to keep citrus trees alive during the latter part of the year. "There is no guarantee of a harvest and minimal cash crops have been planted. Dairy farming in the Mondplaas area is also becoming increasingly challenging."

Lower Sundays River Water User Association

According to the CEO of the Lower Sundays River Water User Association, Mike Primmer, they primarily operate in the Sundays River Valley, Nelson Mandela Bay Metro (bulk raw water) and the local towns of Kirkwood, Patterson and Addo.

They mainly cultivate citrus, with approximately 75% of the crop destined for the export market. Irrigation is performed by means of drip systems, whereas a few growers still use spray techniques. A very small percentage of producers produce cash crops and some grow lucerne for the purpose of restoring nitrogen levels in soil and as animal fodder.

"The Sundays River Valley has no appreciable catchment area of its own and with the vagaries of the rainfall pattern, it is very difficult for growers to rely solely on natural rainfall for irrigation," says Primmer.



By the end of October the Kouga Dam was 11,59% full. The dam supplies irrigation water to the Kouga and Gamtoos Valleys, as well as drinking water to the Nelson Mandela Bay Metro.

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"The agricultural sector of the Sundays River Valley is totally dependent on a canal system for its water supply demands."

Water for the Sundays River Valley originates from the Gariep Dam and is conveyed via a system of weirs, tunnels, and natural watercourses to Darlington Dam. Water is then released through a strictly controlled and measured system into the Sundays River and diverted approximately 46km downstream into the canal system operated by the Lower Sundays River Water User Association. The water is then delivered to dams and canals.

According to Primmer, the water supply was stable at the end of October. There were no restrictive measures in place, dam levels were stable, and the main supply dams were constantly being monitored by the DWS and the association.

Great Fish River Water Users' Association

The Great Fish River Water Users' Association receives its water via the Orange-Fish River transfer scheme, starting at the Teebus tunnel outlet near Steynsburg, which gets its water from the Gariep Dam.

From the Teebus tunnel, the water runs past Cradock into the Elandsdrift Dam. From there a huge volume of water is transferred into the next transfer scheme by means of a concrete canal system, running past Somerset East and into the Small Fish River. From there it runs into De Mistkraal Dam, where the water is divided into a third transfer scheme (Sundays River System).

According to Christo Kotzé, CEO of the Great Fish River Water Users' Association,



Canals and measuring devices in the Grassridge area within the Great Fish River scheme.

the number of hectares listed on the transfer scheme totals 32 600ha, with a total allocation of 413 832 280m³ per year. Agriculture in the area consists mostly of dairy production and the cultivation of maize, wheat, lucerne and pecan nuts. There is also a growing interest in citrus in Cookhouse and Somerset East.

"The Tarka River sub-area is also part of the scheme, but it does not receive any water from the Orange-Fish River scheme, which makes it completely dependent on rainfall in the north-eastern parts of the Karoo," he says. "Kommandodrif Dam, being the scheme's main storage dam, was empty for most of 2019 and measured just 13,24% by the end of October this year. The second storage dam in this catchment

area, Lake Arthur, has been empty since September 2019. It reached a mere 3,9% in October this year."

Water supply is critical between March and May when producers must see the summer crop through, as well as from November to February when rainfall can be patchy.

Although there were no water restrictions in place for the Orange-Fish River scheme at the time of writing, a 75% restriction did apply to the Tarka River System. According to Kotzé, this has had a huge impact on producers, who received only 45% of their allocation during the previous season.

"From September 2019 to February 2020 the dam measured below 3%, which meant that there could not be any releases for irrigation during that time. Complicating matters even more was the fact that the applicable irrigation area did not receive any remarkable rainfall." 🌧️



The main canal off the Great Fish River in the Klipfontein area.

For more information, contact the Gamtoos Irrigation Board on 042 007 0382 or info@gamtooswater.co.za, the Lower Sundays River Water User Association on 042 234 0038 or info@sundaysriverwater.co.za, the Great Fish River Water Users' Association on 048 881 2408 or admin@grootvis.co.za, or visit www.dwa.gov.za.

Smallholder farmers can make it big



By Lindie von Maltitz and Dr Yonas Bahta, University of the Free State

Smallholder farmers are usually defined as farmers who own or have access to a small plot of land on which they produce food for their own use and the market. Commercial farmers are typically those who own or have access to large pieces of land on which they produce crops and livestock for the market – in other words, for commercial purposes. The difference between smallholder and commercial farmers tend to be linked to available land size and annual turnover.

Skills and characteristics

The skills required by commercial farmers are similar to those required by smallholder farmers and include:

- **Knowledge and expertise:** Commercial farmers must be knowledgeable about and stay informed of all the processes involved in producing their produce. For example, if they produce maize, they must be knowledgeable about soil health and preparation, cultivar choice, seed quality, fertiliser application, planting techniques, harvesting, storage, and marketing.
- **Planning and execution:** Multiple activities must be planned and executed at the right time. Timing is crucial in farming. For example, planting too late can result in crop failure. If treatment for ticks on cattle is not done at the right time, the disease can cause losses.
- **People management:** Commercial farmers must manage their employees and promote a good working relationship. They must also know the applicable labour laws and keep a record of necessary labour documentation.
- **Risk management:** To be sustainable, producers must be able to manage risks and decide their own risk profile.

For example, a risk-averse producer should avoid high-risk enterprises. They must incorporate risk in their planning process through typical 'what if' scenarios.

- **Financial management:** Financial management is an integral part of any farming enterprise. Short-, medium- and long-term financial planning, as well as cash flow management, are essential.
- **Multi-tasking:** Many of the tasks must be completed simultaneously. As such, the ability to multi-task is crucial.

Challenges of commercial farming

Statistics made available by the government in 2019 paint a clear picture of the challenges faced by commercial farmers.

Producer prices of field crops have been especially volatile, with an average decrease of 25,7% from the 2016/17 to the 2017/18 season (*Figure 1*).

Farming becomes particularly challenging under these circumstances because the prices of farm inputs keep

increasing, irrespective of fluctuating producer prices (*Figure 2*).

The result of these challenges is that farmers' debt increases annually in order for them to survive. The changing climate has had a significant impact on both commercial and smallholder farming. While commercial farmers are more resilient due to better access to finance, this situation is changing, and many commercial farmers are at the end of their rope.

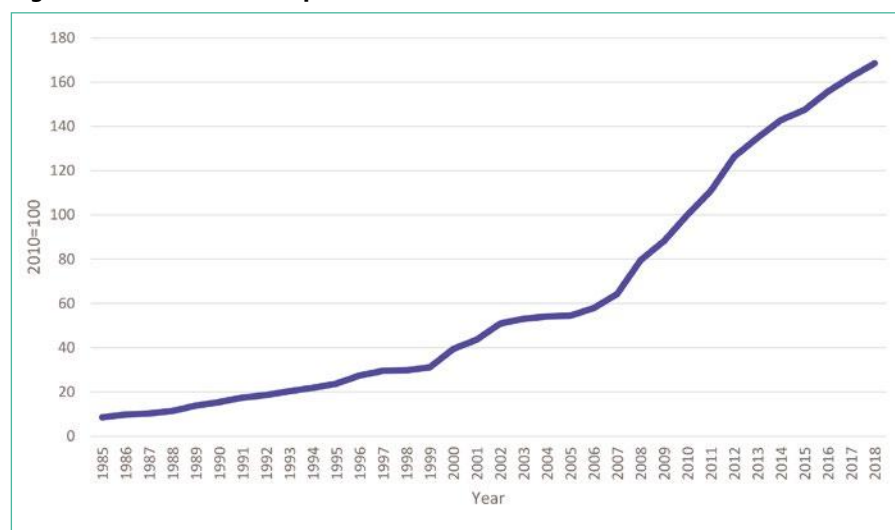
Advantages of smallholder farming

A smallholder farming enterprise has several benefits. Smallholder farmers can carefully manage production because they are physically involved in every step of the process.

In addition, precision farming can be a workable solution for smallholder farmers as the intensive management it requires is possible on a smaller piece of land. Cultivation practices such as composting, using cover crops, organic farming and mulching are all possible on a small scale. Smallholder farmers could potentially

Figure 1: Producer price indices for various commodities between 2013 and 2018.



Figure 2: Price indices for input costs from 1985 to 2018.

produce top-quality produce due to the operation's small scale; large-scale operations often compromise quality for quantity.

Challenges of smallholder farming

The challenges faced by smallholder farmers and how they relate to the process of becoming a commercial farmer include:

- **Lack of access to more land:** A smallholder farmer must consider products that can be produced on a small piece of land. Beekeeping, tunnel farming, and producing garlic, herbs and eggs can all be successful on small pieces of land. However, obtaining financing is a challenge because land is often used as collateral. The smaller the piece of land owned, the smaller the loan. Smallholder-friendly financing and investment should be a priority in the existing supporting structures.
- **Inadequate infrastructure:** Smallholder farmers are limited in their access to facilities such as storage sheds, cold rooms, and cattle holding pens. This should be incorporated when policies are developed for rural and municipal areas.
- **Poor institutional infrastructure:** Many institutions offer support to smallholder farmers. The Department of Agriculture, Land Reform and Rural Development (DALRRD) and organisations such as the African Farmers' Association of South Africa (AFASA) provide support to smallholder farmers. These farmers should persistently communicate their needs to these organisations so that problem-specific solutions can be developed.
- **Limited access to information:** Information is available from smartphone applications and agricultural institutions. Another way to procure information is by contacting successful commercial farmers in the area.
- **High transaction costs:** Economy of scale plays a role in agriculture. For example, producers who want to take their cattle to auction must often hire transport. Transporting five or ten cows often costs the same as transporting 20. Collaborating with neighbours and sharing costs (as in a co-operative) can be a solution. Collective bargaining can also result in better prices and contracts with buyers that would otherwise have been impossible.
- **Lack of skills:** Producers must be multi-skilled. They must have marketing, financial recordkeeping and production knowledge. Once again, institutional support from organisations such as AFASA and the government plays a vital role in developing these skills. Government and business alliances should develop and promote pro-smallholder marketing chains.
- **Poor quality equals poor prices:** It is often said that the market discriminates against produce from smallholder

farmers. The reality is that inferior quality equals lower prices, while top-quality produce fetches the best price. The focus should be on becoming the best chicken, cattle or vegetable producer in the district through hard work and dedication. This will result in quality products that can compete on the open market.

The way forward

Smallholder farmers who want to become commercial farmers should evaluate their situation by performing a SWOT (strengths, weaknesses, opportunities and threats) analysis. Once producers have completed this analysis, they will have a clearer picture on where their business is headed.

In terms of strengths, they should determine which aspects of the farming enterprise can be used to their advantage. For example, is the farm next to a busy road where produce can be sold?

Weaknesses point to aspects of the farming enterprise that indicate room for improvement. Lack of access to a suitable market is an example of a weakness. Producers should find ways to turn their weaknesses into opportunities. They also need to learn how to identify opportunities and exploit them. An example of this can be making an appointment with a new shop owner to discuss becoming a produce supplier.

Producers should also consider threats to their farming enterprise. Diseases, adverse weather conditions, and competition from other producers could threaten their profitability.

A final word

Smallholder farmers play a significant role in providing fresh, locally produced food to their immediate community, especially the poor who cannot always travel to commercial centres for food. The role of smallholder farmers in ensuring food security and the South African rural economy should not be underestimated and must be fully supported. 🌱

For more information or references, send an email to Dr Yonas Bahta at BahtaY@ufs.ac.za.

Eviction proceedings during a labour dispute

By Clarissa Pienaar, Moolman & Pienaar Incorporated

Can a farm owner launch eviction proceedings before a labour dispute is settled? The short answer is no.

A court may grant an eviction order in terms of the *Extension of Security of Tenure Act, 1997 (Act 62 of 1997)*, or the *ESTA*, if:

- A farm dweller's right of tenure has been legally terminated.
- The farm dweller refuses or fails to vacate the farm after his/her right of tenure has been terminated.
- The conditions of an eviction order have been met.
- The landowner or person in charge has given the occupier, local municipality and provincial office of the Department of Rural Development and Land Reform two calendar months' notice of his/her intention to obtain an eviction order.

The process of eviction

The termination of a farm dweller's rights on the farm is therefore the first step in the prescribed process that follows. This article deals only with the case where a farm dweller's right of tenure arises from a service agreement and where a landowner launches eviction proceedings against such a dismissed farm dweller.

In this regard, it is important to analyse the provisions of section 8(2) and (3) of the *ESTA*:

- Section 8(2): "The right of residence of an occupier who is an employee and whose right of residence arises solely from an employment agreement may be terminated if the occupier resigns from employment or is dismissed in accordance with the provisions of the *Labour Relations Act*."
- Section 8(3): "Any dispute over whether an occupier's employment has been

terminated as contemplated in subsection (2) shall be dealt with in accordance with the provisions of the *Labour Relations Act*, and the termination shall take effect when any dispute over the termination has been determined in accordance with that Act."

Section 191(1)(b)(i) of the *Labour Relations Act, 1995 (Act 66 of 1995)*, or the *LRA*, stipulates that an aggrieved employee can refer a dispute regarding unfair dismissal to the Commission for Conciliation, Mediation and Arbitration (CCMA), or a bargaining council with the required jurisdiction, within 30 days of termination of employment.

Section 190(1) of the *LRA* describes the date of dismissal as the date on which the employment contract was terminated or the date on which the employee left the service of the employer, whichever comes first.

Termination of tenure

If a farm dweller has been dismissed and wants to dispute the fairness of the dismissal, it is, according to the provisions of section 8(2), crucial to remember that a labour dispute must be settled before the farm dweller's right of tenure on the farm in terms of the *ESTA* can be terminated.

In other words, if the occupier whose right of tenure arises by virtue of a service agreement disputes his or her dismissal, the dispute regarding the fairness of dismissal must first be settled before the landowner or person in charge may terminate the occupier's right of tenure.

The result is that the owner or person in charge will be obliged to provide accommodation to the dismissed employee, until such time as the dispute regarding the validity of the dismissal in question has been settled.

Consequently, the *ESTA* does not provide for the termination of a farm

dweller's right of tenure while the labour dispute is unresolved. Should an owner attempt to terminate rights before the dispute is resolved, he or she will run the risk that all steps in the eviction proceedings may be undone.

Disputing a dismissal

With regard to section 8(3), the Land Claims Court does not have the legal jurisdiction to decide whether the termination of the farm dweller's employment relationship was performed in accordance with the *LRA*. If a farm dweller wishes to challenge the lawfulness of his/her dismissal, he/she will have to challenge the termination of service in accordance with the procedures as prescribed by the *LRA*.

However, it is important to remember that if a farm dweller fails to take the necessary steps in time to challenge his/her dismissal, the court will accept the dismissal as fair.

Consequently, when an occupier has been dismissed (or has resigned), an owner or person in charge will have to wait until the period in terms of section 191(1)(b)(i) of the *LRA* has expired, before the occupier's right of tenure can be terminated in terms of the *ESTA*, so that there is no dispute pending when eviction proceedings are launched.

Once the 30 days (after the date of dismissal) have lapsed, and assuming that the dismissed employee does not refer the dispute and asks for condonation for non-compliance with the prescribed time frame, the termination of the right of tenure as well as further steps in terms of the *ESTA* may continue. 🟡

For more information, contact Clarissa Pienaar on 018 297 8799 or send an email to clarissap@mmlaw.co.za or hj@mmlaw.co.za.

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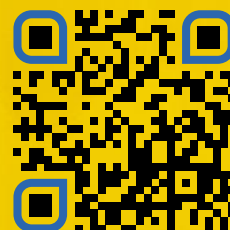
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