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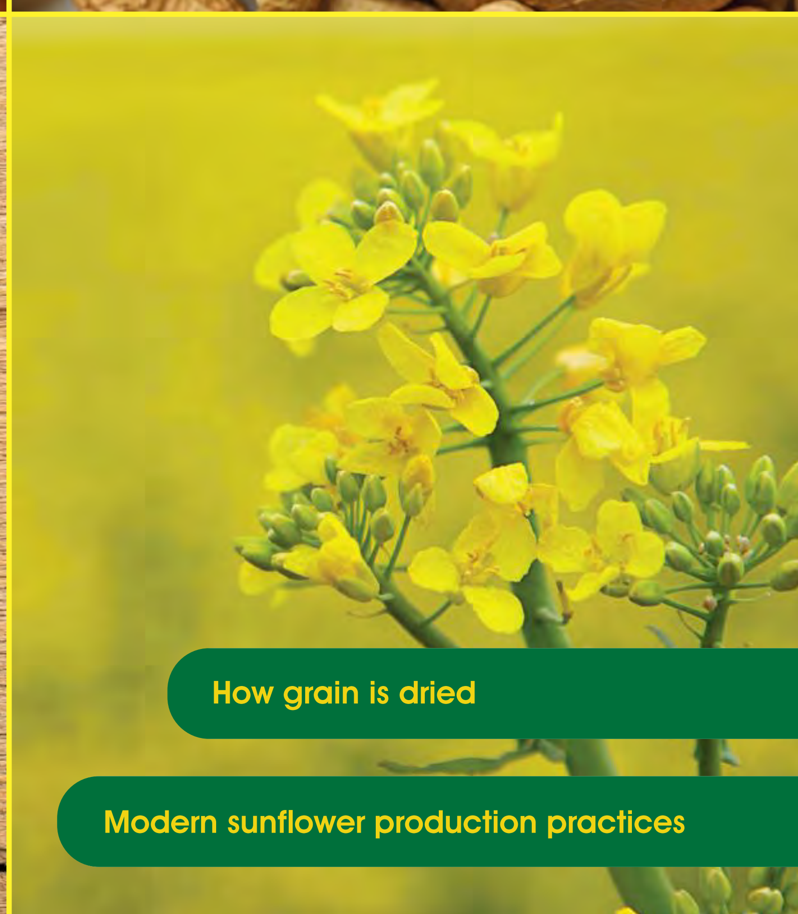
OILSEEDS focus

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



The future of glyphosate

Managing *Sclerotinia sclerotiorum* diseases

How grain is dried

Modern sunflower production practices


For the preventative
control of blackleg and
sclerotinia in canola, use
SANTANA 480 SC

Importance of reasearch in agriculture

By Dr Ilse Trautmann, deputy director-general: Agricultural Research and Regulatory Services, WCDA

South Africa is an attractive business destination due to its growing markets and welcoming business environment, and serves as an entry point to other countries in Southern Africa.

It has a market-oriented agricultural economy that is highly diversified and includes the production of all major grains, oilseeds, deciduous and subtropical fruit, sugar, citrus, table and wine grapes, and most vegetables. Livestock production includes cattle, dairy, pigs, sheep, ostriches and poultry (including eggs).

Value-added processes in the sector include slaughtering, processing and preserving meat, animal-related products (leather and feathers), processing and preserving fruit and vegetables, dairy products, grain mill products, crushing of oilseeds, prepared animal feed, sugar refining, and cocoa and sugar confectionery among others.

Compared to the rest of Africa, South Africa has by far the most modern, productive and diverse agricultural economy. This sector has overcome many challenges such as economic uncertainty due to climate change, a downgrade in credit ratings, land reform concerns, volatile exchange rates and the Russia-Ukraine war. Add to this the Covid pandemic's aftermath and the current energy crisis and we have a rather mixed bag of challenges. The agricultural sector is navigating this in a very smart way, showing leadership in uncertain times.

Role of agricultural research

Research plays a crucial role in the development and sustainability of the sector and is one of the game changers to 'weather' the sector's challenges. Research can improve crop yields (including varieties that are more resistant to pests, disease and environmental stress) and livestock (breeding, feed and management practices), and can help identify and mitigate climate associated risks.

Increased production, better food security and enhanced quality are important. New methods of food processing and preservation can help to maintain the nutritional value of food, which is critical for people with low incomes in our country.

The promotion of sustainable practices, including new methods of soil conservation, water management and pest control should be prioritised considering climate change and limited natural resources.

Agriculture has an important impact on rural areas and communities and provides livelihoods for many people. Living standards in rural communities could improve if the productivity and profitability of rural production is improved by cutting-edge research and technology transfer.

Agricultural research is a diverse field – ranging from cutting-edge work to high-precision technologies for commercial farming. There is also a need to support smallholder producers, who play a key role in rural food security, through research interventions.

Agricultural research and the 4IR

An acceleration of new technologies, referred to as the fourth industrial revolution (4IR), such as networks and connectivity, big data, the Internet of Things (IoT) and artificial intelligence (AI), are set to impact the agricultural sector by enabling farm efficiency, resource use and completeness. Precision agriculture is one example as it impacts employment through the associated increased adoption of automation and mechanisation.

The integration of digital technology into agriculture presents an opportunity for sub-Saharan Africa. Mobile phones, coupled with internet-based solutions, could boost access to financing for agricultural inputs across the value chain and provide production information emanating from research. To unlock agricultural prospects in Africa, digitalisation, as well as the effective

Dr Ilse Trautmann.

use of fertiliser and seeds, will become increasingly important.

Trending technologies include data management, machine learning, AI, automation and drone-based applications. Technology-smart research methods in agriculture such as drones, sensors, real-time data probes and camera technology, will become prominent. Skills development linked to the 4IR will attract more youth with skills fit for agriculture.

In conclusion

The demands on agricultural research, technology development and innovation will continue to increase as the world's population grows.

Agricultural research can ensure improved productivity, reduced costs and increased exports in the cornerstone sector of the country's economy. However, the lack of funding from public and private sectors remains a constraint.

Efforts should be made to 'protect and grow' our research fraternity, the new generation of researchers and support staff, and create an environment to execute research to ensure a sustainable South African agricultural sector.

Email Dr Ilse Trautmann at Ilse.Trautmann@westerncape.gov.za for more information.

The global oilseeds environment

The record soya bean crop in Brazil of an estimated 155 million tons, with a possible 157 million tons this year, has resulted in downward price pressure and robust farmer selling putting the squeeze on soya bean storage. The drop in Brazilian prices has resulted in a gain in world market share.

This bumper crop assisted the negative impact of a disastrous crop in Argentina due to drought, with some areas either not harvesting or harvesting below one ton per hectare – the crop size is estimated at 22 million tons, down from 44 million tons last season, and a bumper crop of 61,5 million tons in 2013/14.

Argentina's financial position is deteriorating, and the political situation is not conducive to improving the country's stability. Inflation is already excessively high and increasing, and the currency devaluation adds to these concerns.

Global demands for soya beans due to reduced crushing volumes have been a major reason for lower soya bean prices.

The Black Sea region still plays a critical role in the sunflower market. World production of sunflower seed is forecast at approximately 54 million tons, with reductions in Ukraine and increases in Russia in the 2022/23 forecast.

Canola plantings in Australia and Canada will play an important part in price direction, while the European Union (EU) will be increasing supply in 2023/24. Over the last year, the price of canola futures has almost halved. Strong domestic demand is experienced in Canada, and the EU is likely to reduce export volumes.

The local outlook

The record 2,8 million ton soya bean crop estimate for 2023 is certainly very encouraging and should push South Africa towards self-sufficiency. The National Agricultural Marketing Council's supply and demand estimates point to at least 350 000 tons of soya beans available for export to balance the books. Given the constraints in port capacity in the country (Durban and East London) and Maputo, exports are not easy but could be achieved, given the tenacity and appetite for the risk we have seen so far.

In terms of sunflower seed, demand still exceeds supply, and increasing sunflower production and the quality of seed produced in South Africa would be very welcome.

Despite a challenging seed supply situation, a total of 127 500ha (the highest on record) of canola have been planted in 2023 compared to the 123 510ha planted last year.

Sunflower Symposium

The Oil and Protein Seeds Development Trust/Oilseeds Advisory Committee presented a very successful Sunflower Symposium in April this year at the CSIR Convention Centre. Topics ranged from increasing production and yields in South Africa to improving quality to meet value chain requirements.

The symposium was thought-provoking and highlighted the role the OPDT/OAC plays in research and the assistance it offers in making the country's sunflower industry more sustainable.

Presentations can be viewed at *www.opot.co.za/index.php?page =sunflower-symposium-2023*.

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.
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Hong Kong sends soil bacteria to space

Hong Kong researchers have sent specimens of a soil bacteria to space on mainland China's Tianzhou 6 cargo craft. The purpose is to develop new bacteria strains through gene mutation that can improve the cultivation of soya beans.

The project, led by a research team from the Chinese University of Hong Kong (CUHK) focussing on space mutagenesis of the bacteria rhizobia, marked the city's first agricultural research project to be launched into orbit. Rhizobia is crucial for nitrogen fixing – the conversion of atmospheric nitrogen into organic forms as natural fertilisers for soya beans.

The researchers will observe changes in samples of rhizobia that are triggered by the space environment and screen for new strains that would have a higher tolerance to salt, heat or drought, as well as improved efficiency of nitrogen-fixing for soya beans, project head Prof Hon-Ming Lam said.

It is hoped that by optimising the use of rhizobia, the study could eventually reduce the use of chemical nitrogen fertilisers, improve soil conditions and contribute to a sustainable environment.

The project could also contribute to the country's food security, as soya beans accounted for about 70% of the world's plant protein and nearly 30% of vegetable oil, Lam pointed out.

"This is the first time that Hong Kong's agricultural technology has taken part in space projects. It has integrated the country's most advanced aerospace science and technology with urgent food security." – *South China Morning Post*

Greater yield from new GM soya beans

Genetically modified (GM) soya beans designed to absorb light more efficiently, produced a 25% greater yield in an advance that could significantly boost global food supplies.

The field trials are the first successful demonstration that genetic engineering can be used to directly target the photosynthesis process in food crops. The improvements are unprecedented for this kind of intervention and it would take decades to achieve this through selective breeding.

The advance comes after the most recent UN food security report found that almost 10% of the world population experienced famine last year, up from 8% in 2019, and with projections that the climate crisis will lead to harsher growing conditions for crops.

"This result is relevant right now. One out of ten people on the planet is starving. This is the biggest health crisis on the planet," said the director of the research project, Prof Stephen Long, of the University of Illinois at Urbana-Champaign.

Long started investigating how to improve photosynthesis – the process that converts sunlight into chemical energy – more than 25 years ago. The latest work targets genes involved in a process that plants use to shield themselves from bright sunlight, which can bleach leaves if plants absorb more energy than they can use for growth. To avoid this, plants have a protective mechanism called non-photochemical quenching that gets rid of excess energy through heat.

In bright sunlight, quenching kicks in almost instantaneously, like a human eye contracting. But it takes up to half an hour for the process to switch off again. This means that if a cloud passes overhead, plants are needlessly diverting energy that could be used for growth. – *The Guardian*

Record-breaking planting rates for US

Planting in the Unites States (US), according to the USDA's recent *Crop Progress* report paints a mixed picture. While the northern tier of states had barely started planting at the time of the report, eight states across the Midwest, mid-south and east were planting at a record-breaking pace.

USDA-NASS shows maize planting was on track as of 30 April and while soya bean planting was well ahead of average, it was not a record planting pace.

According to USDA-NASS, the eight states that were planting soya beans at the quickest pace included Arkansas, Illinois, Kansas, Kentucky, Missouri, Tennessee, West Virginia and Virginia. – *Agweb*

World Soya Bean Research Conference

The 11th World Soya Bean Research Conference (WSRC11) will take place from 18 to 23 June 2023 in Vienna, Austria. Vienna is a prominent meeting place, and the opportunity to host this important scientific event for the first time in Europe is a special honour and an acknowledgement of the enhanced international co-operation fostered by the European soya bean research community.

The local organising committee and the scientific committee devote their efforts towards creating a stimulating scientific, social and cultural experience for all conference attendees. This year also marks the 150th anniversary of the 1873 World Expo held in Vienna.
– *Notice, World Soybean Research Conference*

Feedback on the 2023 Soy Summit

April is observed as soya month across the globe, and it was an excellent opportunity to drive conversations about the role of soya as a source of high-quality protein and to discuss how this superfood could help address nutritional deficiencies across the world. Times of India (TOI) therefore partnered with the Right to Protein initiative in April to jointly host the 2023 Soy Summit held in New Delhi. Right To Protein is an initiative that educates people on the role of protein in our wellbeing and explores ways in which we can maximise dietary protein intake.

The summit was aimed at spreading awareness about the advantages of soya, a highly accessible plant-based protein source. The programme stressed the role soya can play in accomplishing nutritional and food security goals and its potential as an alternative to animal-based sources of protein.

The keynote speaker, former CEO of FSSAI and current CEO of Food Future Foundation, Pawan Agarwal, spoke about the role of soya in nutrition security. He emphasised that soya could be a simple solution to the very complex problem of malnutrition, owing to its affordability and accessibility. He discussed common protein deficiency health issues such as low muscle mass and insulin spikes, saying that soya consumption could minimise health issues. – *The Times of India*

German oilseed processing declines

German oil mills processed less rapeseed, sunflower seed and fewer soya beans in the first half of the running marketing year (2022/23) compared to the same period the previous year.

According to information published by the German Federal Office for Agriculture and Food (BLE), oil mills in Germany processed just under 4,5 million tons of rapeseed from July to December last year. This translated to a decline of just over 5% year-on-year. Processors received late new supplies from German production in August 2022.

According to the BLE, rapeseed processing amounted to only 536 200 tons in July 2022, but increased to 721 200 tons in September and 855 800 tons in October. The all-time peak was recorded in August 2021 at 883 000 tons.

Processing of other oilseeds slowed compared to the previous year's period, declining to just under 11% to 1,6 million tons in the half year under review.

A noticeable increase was not recorded until December 2022, with processing reaching 323 500 tons, which compared to an average of 258 000 tons in the months before. Total oilseed processing amounted to just under 6,2 million tons.

This was down 6,8% on 2021 and is comparable to the figure recorded in 2019. In general, the production of vegetable oils and meals saw a slight decrease. – *Biofuels International*

Ukraine considers grain export alternatives

Ukraine does have alternative ways of transporting grain if a deal on safe Black Sea exports is not extended. Non-extension will not be viewed as an 'apocalyptic scenario', said the country's minister of agriculture.

Ukrainian Black Sea ports were blockaded after Russia invaded Ukraine last year, but access to three ports was cleared in July through a deal, brokered by the United Nations and Turkey, made between Moscow and Kyiv. Moscow threatened to quit the agreement on 18 May unless a list of demands is met to remove obstacles to Russia's grain and fertiliser exports.

The United Nations recently said that thus far nearly 30 million metric tons of grain and foodstuffs had been exported from Ukraine under the Black Sea deal, including nearly 600 000 metric tons of grain in World Food Programme vessels for aid operations in Afghanistan, Ethiopia, Kenya, Somalia and Yemen. – *Reuters*

Taxonomy and life cycles matter when managing *Sclerotinia sclerotiorum* diseases

By Dr Lisa Rothmann, Department of Plant Sciences, Plant Pathology, University of the Free State

We all drive motor vehicles and several, for instance, come from Italy, but there is a fundamental difference between a Ferrari and a Fiat. Knowing exactly what type of organism is causing disease is equally important (Crous, 2005).

The development of an efficient plant disease management strategy is dependent on accurate disease diagnosis and pathogen identification. Knowing what the host plant is and recognising its healthy appearance is key to making comparisons to identify abnormalities in the host and patterns in the field.

Diagnosing soya bean stem rot and sunflower head rot, caused by *Sclerotinia sclerotiorum*, is relatively simple due to characteristic signs and symptoms such as wilting, water-soaked lesions (symptoms of the disease), and white fluffy fungal growth (a sign of the pathogen known as mycelia). In severe or progressive stages of the sclerotia pathogen life cycle, black survival structures can be found in and on the stems and heads of the host crops.

Pathogen identification

In contrast, pathogen identification is the process of determining the organism responsible for the disease, i.e., giving a name to our pathogenic enemy. Taxonomy provides a framework to describe, classify, name and communicate information about organisms. Traditionally, describing and naming organisms relied on observing the pathogen on the plant (*in situ*), their growth on artificial media in culture (morphology), and structures under a microscope (microscopy).

However, through molecular techniques, the untangling of an organism's DNA is possible, and we can capture robust data on the organism. Consequently, as new data about organisms is gathered, a revision may be required of the description, classification and name assigned.

Naming an organism

Assigning a name to an organism requires an understanding of how an organism's DNA aligns with the taxonomic hierarchical system, from largest to smallest, i.e., kingdom, phylum, class, order, family, genus and species. Fungi belong in their own kingdom, and their names are determined by a set of rules in the International Code of Nomenclature for algae, fungi and plants (ICNafp).

Taxonomy is critical to understanding the diversity and distribution of plant pathogens, their evolutionary relationships, mechanisms by which they cause disease, and how disease can be prevented, mitigated and managed. Most plant diseases are caused by fungi found in the phylum of *Ascomycota*, the taxonomic home of *S. sclerotiorum*.

Globally, *Sclerotinia* stem rot is considered the second most yield-limiting disease of soya beans (Savary *et al*., 2019), and the history of naming *S. sclerotiorum* is fraught with confusion.

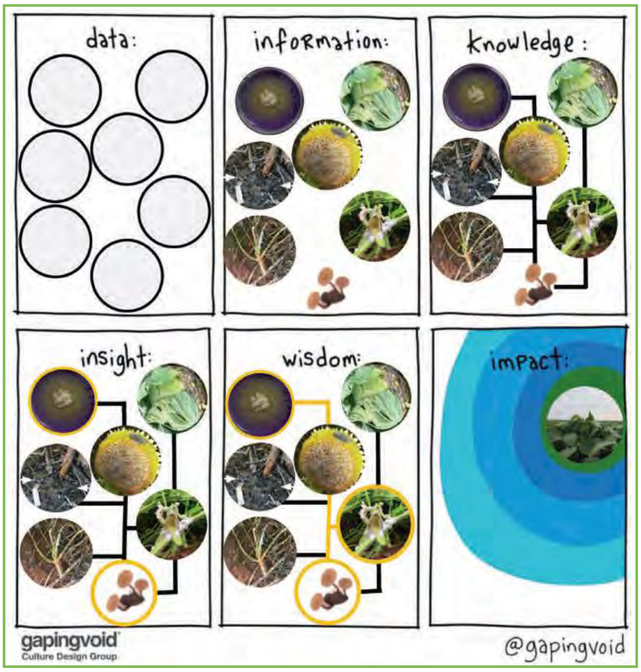
History of *S. sclerotiorum*

S. sclerotiorum (Lib) de Bary was first described by the Belgian botanist, mycologist and plant pathologist Marie-Anne Libert as *Peziza sclerotiorum* (Ekins 1999; Phillips 1979). Over the decades, the pathogens' scientific name has undergone multiple changes, with a key change leading to what we now know as the genus of *Sclerotinia*, although still honouring Libert as *S. libertiana* (Merrick Ekins 1999; Phillips 1979; Willbur *et al*. 2019).

However, *Sclerotinia libertiana* was declared inconsistent with the International Rules of Botanical Nomenclature; as a result, *S. sclerotiorum* (Lib) was proposed and retained (Buchwald and Neergaard 1976; Dennis 1974). *Sclerotiniaceae*, the family of fungi to which *S. sclerotiorum* belongs, contains 33 other recognised fungal genera. However, within the genus of *Sclerotinia* there are three universally accepted species, *S. minor*, *S. sclerotiorum* and *S. trifoliorum* (Kohn *et al*., 1988).

The pathogen, *Sclerotinia homoeocarpa*, causing dollar spots on turfgrasses is thought to be more accurately classified within the genera of *Lanzia* or

Figure 1: When data is given context, information is captured, knowledge can be created through gaining an understanding of interactions, insight guides the discovery of unapparent aspects and wisdom allows for decision making for crop protection.



The impact is achieved when we protect our yield and farm by knowing when apothecia produce ascospores, which may infect soya beans and, as a result, may produce seed-borne S. sclerotiorum under severe conditions. Seed cleaning and purchasing certified seeds is a way to reduce the risk of Sclerotinia disease events. (Inspired by www.gapingvoid.com; modified by Lisa Rothmann)

Moellerodiscus (Dernoeden, 1995 cited in Raina *et al*., 1997).

Understanding a pathogen

Naming the enemy is one component required for developing disease management programmes, although understanding a pathogen's life cycle and manner of reproduction is equally important. *S. sclerotiorum* is a monocyclic pathogen, although it can produce two different forms of inoculum. Ascospores, associated with sexual reproduction, are produced in apothecia due to carpogenic germination, whereas mycelium arises directly from sclerotia and is responsible for asexual reproduction (Kohn, 1995; Amselem *et al*., 2011).

As a monocyclic pathogen, sclerotia overwinter and germinate to produce primary inoculum, i.e., ascospores and/or mycelium, and may initiate primary infections in the growing season. No secondary inoculum types arise from lesions, i.e., points of infection. Once an infection has been initiated by either the successful germination of an ascospore or hypha/e (thread/s of mycelium), disease establishes and colonisation occurs, and no further spore forms are generated from the lesion.

However, secondary infections are possible in the same season when infectious material (tissue successfully colonised by the pathogen) comes into contact with susceptible host tissue (Link and Johnson, 2007). Once the season ends, or conditions are not favourable for further disease development, the pathogen starts to melanise the mycelium forming sclerotia.

Managing *S. sclerotiorum*

In managing diseases caused by *S. sclerotiorum*, it is critical to consider the reduction of the population of sclerotia, reducing the risk for high inoculum loads in future seasons. Monitoring for apothecia is critical in the growing season, as environmental conditions will regulate the germination of sclerotia, resulting in asynchronous events of germination, resulting in flushes of ascospores available to initiate disease.

Not all sclerotia will germinate at the same time, not all apothecia will release ascopores at the same time, and not all ascospores will successfully germinate. Staggering planting dates can reduce the risk of ascospores being present in multiple fields where susceptible host tissue is available, although one must consider the yield losses which may be incurred due to plantings outside optimum planting dates.

Positive impacts in managing *S. sclerotiorum* rely upon converting raw, unorganised facts about the pathogen to contextualised and meaningful information to gain an understanding of the host-pathogen interaction. This knowledge will guide the discovery of patterns, relationships and unapparent aspects of epidemiology, population biology and genomic data to make wise decisions on disease management, securing the development of sustainable crop protection programmes.

For more information, contact Dr Lisa Rothman on 051 401 3666.

Our world in data: Soya production

From OurWorldInData.org/agricultural-production

Soya has earned itself a bad reputation with many consumers. Its links to deforestation means that, alongside palm oil, soya has become a product to avoid. Is this reputation justified?

In this article we look at the story of soya: How production has changed over time, where it is produced, what it is used for, and whether it really has been a key driver of deforestation. Although the research suggests that the expansion of pastureland for beef production is by far the largest driver of deforestation in the Brazilian Amazon, soya is likely to have played at least some role.

More than three quarters (77%) of global soya is fed to livestock for meat and dairy production. Most of the rest is used for biofuels, industry or vegetable oils. Just 7% of soya is used directly for human food products such as tofu, soya milk, edamame beans and tempeh. The idea that foods often promoted as substitutes for meat and dairy – such as tofu and soya milk – are driving deforestation is a common misconception.

Soya has changed over time

Global soya production has exploded over the past 50 years. Global production today is more than 13 times higher than it was in the early 1960s (*Figure 1*). Since the year 2000, production has more than doubled. Back in the 1960s, we were producing 20 to 30 million tons per year. This is now 350 million tons.

Agricultural production can be increased in two ways: by improving yields (growing more on a given plot of land) or expanding the amount of land we use. Although countries have seen yield gains over time, much of the increase in production has been driven by the expansion of croplands. Unfortunately, some of this has been at the expense of forests.

Global soya producers

Global soya production has increased rapidly over the past 50 years. But to understand whether this has come at a major environmental cost, we also need to understand where this growth has come from.

Figure 1: The change in global soya bean production from 1961 (measured in tons). (Source: Food and Agriculture Organization of the United Nations)

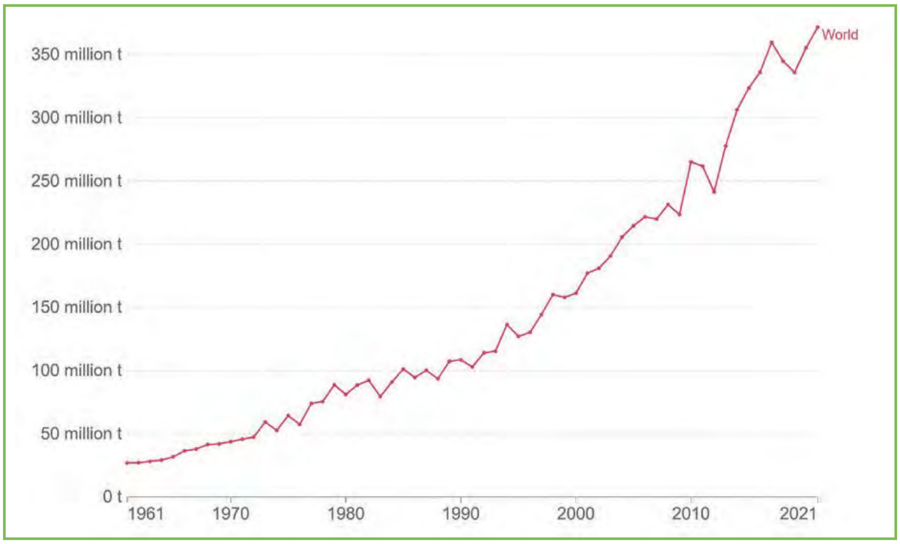
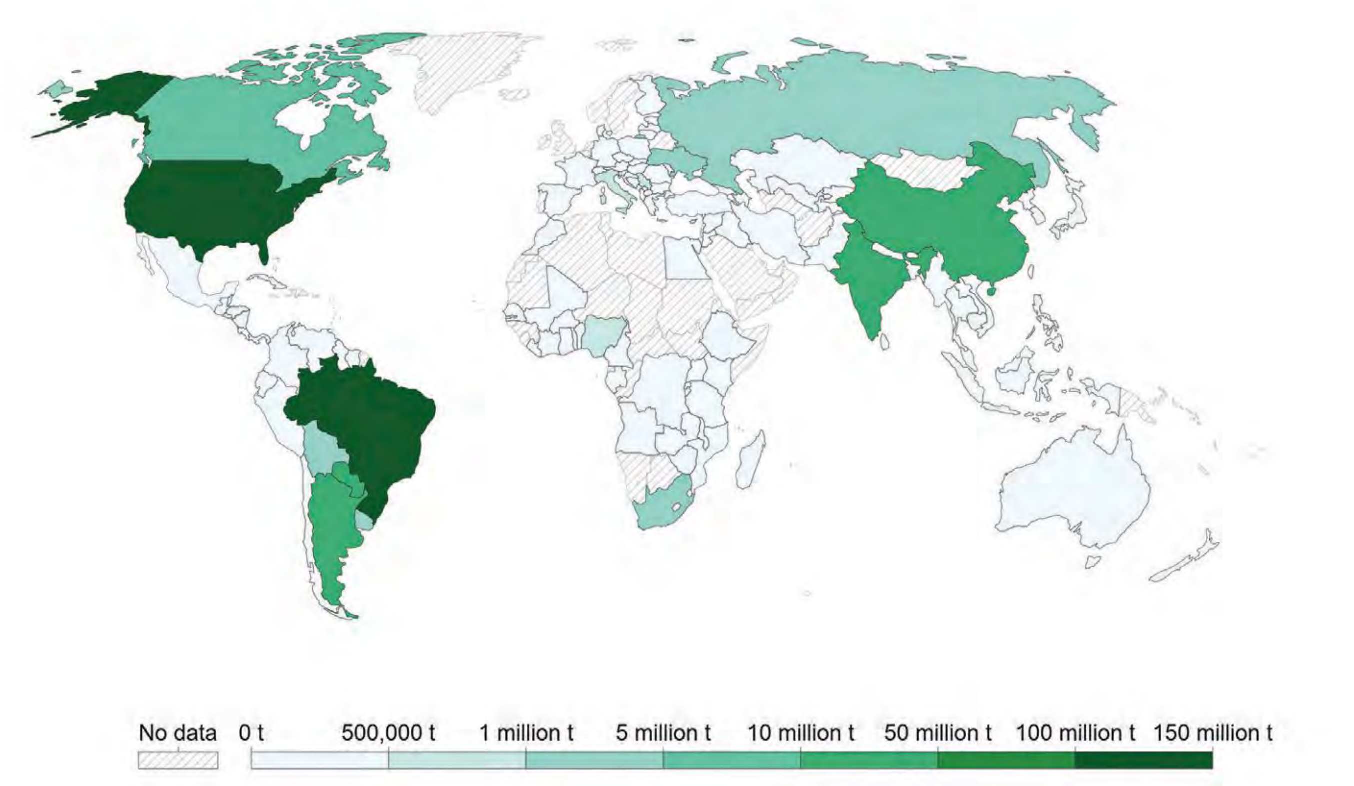


Figure 2: Distribution of soya bean production across the world (measured in tons). (Source: Food and Agriculture Organization of the United Nations)



Following the map in *Figure 2*, we see the distribution of soya bean production across the world. Most of the world's soya comes from two countries, the United States (US) and Brazil. Combined, they account for more than two thirds (69%) of global soya production. In fact, they produce almost the same amount: In 2018 the US produced 123 million tons, and Brazil 118 million tons. Individually, they each account for around one third of global production. The other major producer is Argentina, which accounts for 11% (at 40 million tons).

To understand soya as a potential driver of deforestation, it is also useful to understand how each country's production has changed over time. It is the change in production, and how this was achieved (either increased yields or cropland expansion) that is the potential driver of deforestation.

In other charts on the website, we see the change in soya production in Brazil and the US. The US was already producing a lot of soya throughout the 1960s, 70s and 80s so its growth in recent decades has been much slower than Brazil. The US was growing 20 million tons per year as early as 1960. Brazil did not reach this level of output until 1990 – three decades later. This means that its rate of growth in the last 30 years has been much faster.

Soya fed to animals

Before we look at the evidence for whether Brazilian soya is responsible for the clearing of the Amazon, we should first understand what products have been driving this growth.

When someone mentions soya, we often think about foods such as tofu, soya milk, tempeh or edamame beans. This feeds into the argument that meat and dairy substitutes – such as switching from meat to high-protein tofu, or from dairy to soya milk – is in fact worse for the environment. But only a small percentage of global soya is used for these products. More than three quarters (77%) of soya is used as livestock feed.

In *Figure 3* we see the breakdown of what the world's soya was used for in 2018. On the left we have total global soya production; in the middle, the three categories of uses (direct human food, animal feed, and industrial processes); and on the right we have the end use products. This data is sourced from an analysis published by the University of Oxford's Food Climate Research Network (FCRN), which relies on the USDA's PSD database. Over one third (37%) of global soya is fed to chickens and other poultry; one fifth to pigs; and 6% for aquaculture. Very little soya is used for beef and dairy production – only 2%.

One fifth of the world's soya is used for direct (i.e., not from meat and dairy) human consumption. Most of this is first processed into soya bean oil. Typical soya products such as tofu, soya milk, tempeh and edamame beans account for just 7% of global demand.

Soya can also be used for industrial purposes. Around 4% is used for biofuels, lubricants and other industrial processes. Biodiesel alone accounts for 2,8%.

We might therefore conclude that the increased demand for soya has been driven by a growing appetite for meat, dairy and soya bean oil. But to double-check we should look beyond this static single-year view and see how demand has changed over time. Maybe demand for these products has always been high, and instead the growth in demand has come

from the increased popularity of products such as soya milk and tofu.

In Figure 4 we see the allocation of soya beans to three categories. Processed products include all animal feed from soya bean cake (i.e., 70% of global demand), soya bean oil, and industrial products such as biofuels. Direct human food includes all non-animal-sourced foods from soya, excluding oils. Direct animal feed is soya beans fed directly to livestock (rather than being processed into soya bean cake first).

We see that most of this growth has come from the increased demand for processed soya – animal feed, biofuels and vegetable oil. This rise has been particularly steep since 1990. By 2013, it had increased from 88 million to 227 million tons. Over this period, demand for human food products such as tofu and soya milk increased by only 3 million tons (from 7,4 to 10,7 million).

This should not surprise us. Global meat production has more than tripled over the last 50 years. This increase has been most marked for poultry – the largest consumer of soya feed.

Soya production and deforestation

So far, we've established that demand for soya has increased rapidly over the past 50 years; most soya is produced in the US, Brazil (and to a lesser extent, Argentina); and most of this has been driven by increased demand for animal feed, biofuels and vegetable oils. The big question is whether this has been a key driver of deforestation.

The first step to answering this is to understand whether the amount of land we use to grow soya has increased. If improvements in crop yields were able to keep up with this rise in production, then we wouldn't need any additional land, and there would be no need to cut down forests.

In *Figure 5* we see the change in soya production, yields and area harvested. This tells us the percentage change in each of these variables relative to the first year shown. Here the starting year is 1961 but this can be changed by adjusting the time slider at the bottom of the chart on the website. This is shown for the world by default, but you can see this for any country using the 'Change country' toggle.

Figure 3: World soya allocation for food, feed and industry in 2018. (Source: Food Climate Resource Network)

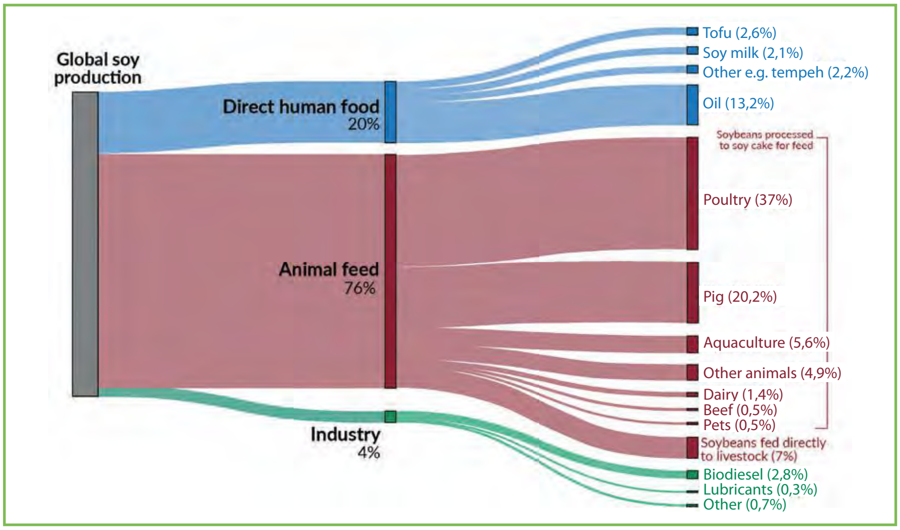
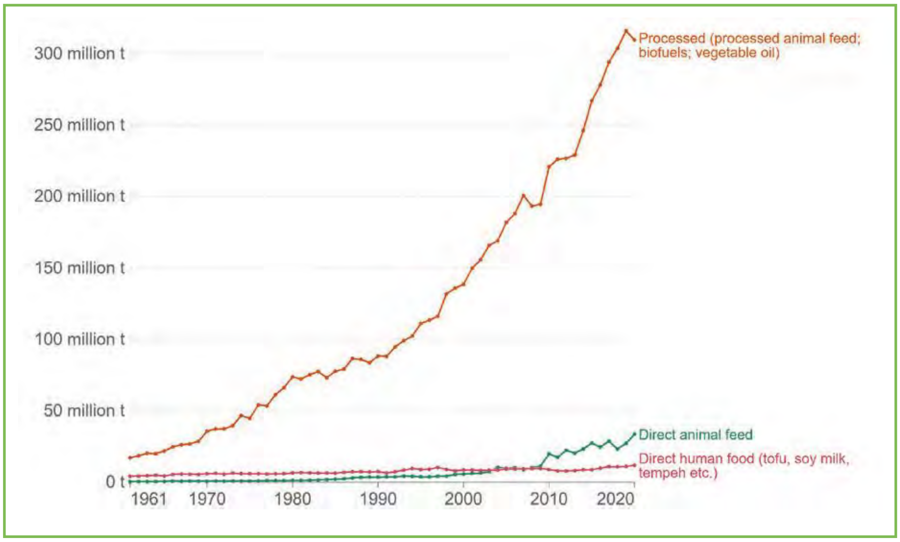


Figure 4: Three categories of soya bean uses: feed, food and fuel. (Source: Food and Agriculture Organization of the United Nations)



Note: Data at the national level is based on soya bean uses after trade (soya bean production minus exports plus imports).

Crop yields have not been able to keep up with production. Since 1961, global yields increased by 150% but production increased by 1 200%. This means the area used to grow soya has more than quadrupled.

This is also true for Brazil (see this using the 'Change country' toggle). Since Brazilian soya production was very low in 1961, it makes sense to adjust the time slider to see the change since 1980. Soya yields have doubled since 1980. This is impressive but not enough to keep up with demand: soya production increased by 680%. Instead, Brazil has had to devote more and more land to soya production: land use has tripled since 1980.

Brazil has devoted increasing amounts of land to soya production. But has this come at the expense of forests? Has the Amazon been cleared to make room for it?

This is a question many researchers have tried to answer. What makes it complex is that agricultural and land use systems are intricately linked: It is possible to assess whether soya production has a direct impact on deforestation, but much harder to understand whether it is indirectly causing harm elsewhere.

In a study published in *Science*, Alexandra Tyukavina *et al*. (2017) looks at

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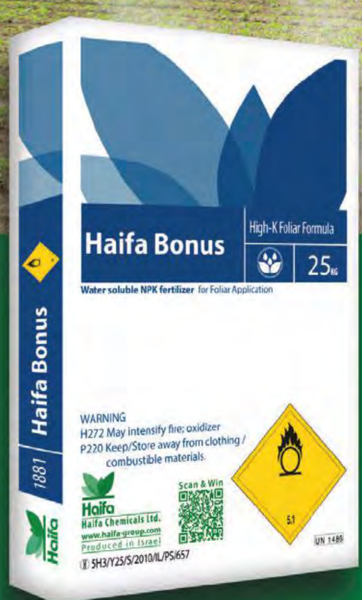

- Enables high spray concentration
- Suitable for tank mixing with diverse pesticide
- Consists of pure, fully soluble nutrients only
- Free of sodium and chloride

Growth stage	V3 - 3rd unrolled trifoliate leaf	R3 - Pods with 0.5-1.5 cm in the third superior part of the main steam
Spray conc.	3%	6%
Volume	200 l/ha	200 l/ha

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the drivers of forest loss in the Brazilian Legal Amazon. The change in these drivers from 2000 to 2013 is shown in *Figure 6*. Note that this overall trend suggests a major decline in forest loss since 2000 – unfortunately in the years since 2013, rates have increased again.

From this, we would conclude that the dominant driver of deforestation in the Brazilian Amazon was the expansion of pasture for beef production. If we look at forest loss from commercial crops – which is mainly soya beans – we see a significant decline, especially following the introduction of Brazil's soya moratorium. The moratorium was a campaign involving civil agencies and soya bean companies, which stipulated that farmers who grew soya on illegal or legal deforestation areas would not be able to sell them to suppliers. Since 2009, satellite imagery has been used to help to identify soya bean crops being grown on deforested areas.

Numerous studies have reached a very similar conclusion: It is pasture, not soya bean production, that is driving most deforestation in the Brazilian Amazon. But this only looks at the direct drivers of deforestation. In other words, the cutting down of forest today to make space for cropland for soya production.

Indirect impacts of soya production

Soya may no longer be a direct driver of deforestation in the Brazilian Amazon but we should also think about the indirect impacts of increased production. We know that the area being used to grow soya is still increasing, and that land must come from somewhere. In regions such as Mato Grosso, studies have found that instead of replacing forest, these croplands are replacing pasture. If this pastureland is simply shifting into forested areas, we could argue that soya is still a major underlying cause of deforestation.

A recent study by researchers Nikolas Kuschnig, Jesús Crespo Cuaresma and Tamás Krisztin reached this conclusion. They combined high-resolution satellite imagery from the Mato Grosso region in Brazil with socio-economic panel data to not only quantify the direct impacts of soya production, but also the spill-over effects. The results suggest that by only looking at direct impacts we are underestimating the role that soya continues to play in deforestation.

It is also the case that the Amazonas region in Brazil gets most of the attention. But most soya is now grown in other regions of the country. In 2015, only 13% came from the Amazon, while 48% came from the Cerrado region. Some researchers therefore make a strong case that interventions such as the soya moratorium need to be extended to cover regions beyond the Amazon if they are to be effective. Without wider implementation of these policies, we will continue to see deforestation simply shift elsewhere.

Figure 5: Changes in soya production, yield and area harvested. (Source: Food and Agriculture Organization of the United Nations)

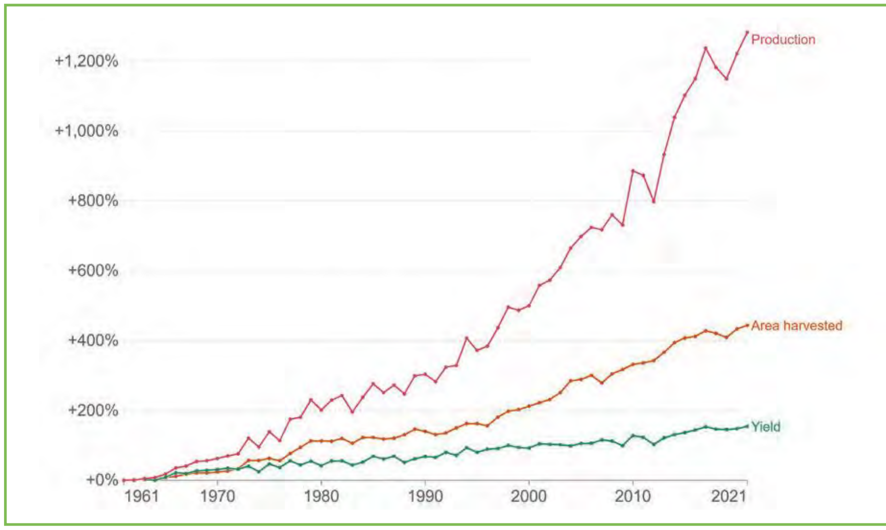
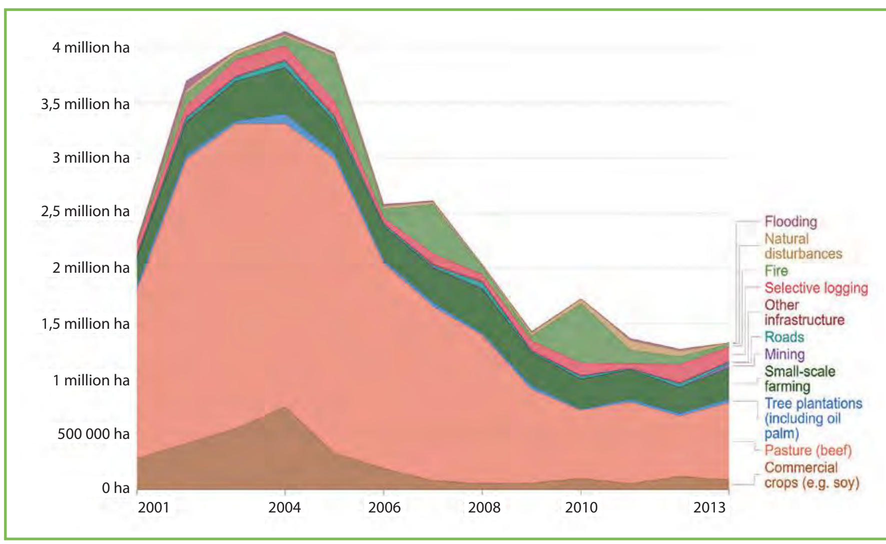


Figure 6: Drivers of forest loss in the Brazilian Amazon. (Source: Tyukavina *et al.* [2017]. Types and rates of forest disturbance in Brazilian Legal Amazon, 2000 – 2013; *Science*)



Note: Annual forest loss includes permanent conversion of forest to other land uses (deforestation) and temporary forest loss (degradation). This is measured in hectares.

Hannah Ritchie and Max Roser (2021) – "Forests and deforestation". Published online at *OurWorldInData.org*. Retrieved from *ourworldindata.org/forests-and-deforestation.*

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Aubaine® 518 SC

Are your winter rainfall wheat crops plagued by the presence of ryegrass and broadleaf weeds? We have a pre-plant, pre-emergence and early post-emergence weed control solution for you.

Aubaine® 518 SC is a suspension concentrate herbicide for the residual pre-plant, pre-emergence or early post-emergence control of weeds in wheat in winter rainfall regions.

Key advantages and attributes

- Controls *Lolium* spp. which is resistant to ALS (acetolactate synthase) enzyme inhibiting herbicides in wheat. Options are available for pre-plant, pre-emergence, and early post-emergence applications.
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Broadleaf weeds compete with crop plants for air, water and sunlight. More concerning is the fact that they also deplete the soil of nutrients which are critical to the health of lucerne, medic and clover pastures. They consequently affect the growth, quality and potential yield of crops and their removal is integral. Broadstrike® 800 WG is a post-emergence herbicide (with pre-emergence uses) for the control of certain broadleaf weeds in lucerne, medic and clover fields.

Key advantages and attributes

- Excellent crop protection for medics, clover and lucerne.
- Early application is possible to maximise crop production.
- Wheat can be planted within three months after a Broadstrike® 800 WG application.

Derby® 175 SC

In need of a herbicide that protects your crops from difficult-to-control broadleaf weeds such as Cape marigold and radish? Derby®175 SC is a selective, post-emergence herbicide for the control of broadleaf weeds in wheat and oats crops.

Key advantages and attributes

- Excellent control of non-ALS resistant weeds such as Cape marigold (*gousblom*) and wild radish (*ramenas*).
- Can be used with other herbicides to provide wider protection.
- Ensures excellent crop protection for wheat and oats crops.
- Wide application window for the crop growth stage.
- Does not leach or move laterally in the ground.

Gallant® Super

Many of our crop protection solutions are designed to have no to minimal negative impact on beneficial earthworms, soil micro-organisms and bees while addressing problematic grasses and weeds. These insects and organisms all play a vital role in our agricultural ecosystems and need to be protected.

Gallant® Super is one such product. A selective, systemic, post-emergence, emulsifiable concentrate herbicide for the control of annual and perennial grasses in broadleaf crops.

Key advantages and attributes

- Excellent control of a range of annual and perennial grasses at lower rates per hectare than competitive products – less product handled, fewer containers to dispose of.
- Very low toxicity to honeybees.
- Non-toxic to earthworms and soil micro-organisms.
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Annual winter grasses are highly competitive and deprive crops of the water and nutrients that help them thrive. Grass has intricate root systems that are highly efficient at removing water and nutrients from soils, negatively affecting the growth of fruit trees, canola, lettuce, legumes and grapes in winter rainfall areas.

Kerb™ FLO 400 SC is a suspension concentrate herbicide used for annual winter grasses in orchards and crops such as canola, grapes, lettuce and legumes in winter rainfall areas.

Key advantages and attributes

- Good residual control – it controls grasses that have not germinated during application.
- Compatible with insecticides such as dimethoate.

Lontrel™ 100 SL

Have you heard about our annual broadleaf herbicide that is safe for birds, fish, daphnia, bees, soil micro-organisms and earthworms?

Lontrel™ 100 SL is a systemic, water-soluble liquid herbicide for post-emergence control of annual broadleaf weeds that affect canola.

Key advantages and attributes

- Narrow spectrum allows control of targeted specific weed groups.
- Good crop safety profile in canola.
- Minimal transfer in soil (half-life in soil of one to four weeks).
- Safe for birds, fish, daphnia, bees, soil micro-organisms and earthworms when used according to label instructions.

Pallas® 45 OD

Are you looking for a herbicide that offers excellent control of a range of grass weeds, as well as key broadleaf weeds while reducing weed build-up?

Pallas® 45 OD is a selective, post-emergence controller of common wild oats (*Avena fatua*), ripgut brome (*Bromus diandrous*), Japanese brome (*Bromus japonicus*), spiny emex or emex dubbeltjie (*Emex australis*), small seed canary grass (*Phalaris minor*)* and ramenas (*Raphanus raphanistrum*) in wheat. (*Variable control sometimes occurs.)

Key advantages and attributes

- Excellent control of common wild oats and other weeds as listed on the label, resulting in increased yield and profit.
- Excellent control of a range of other important non-ALS resistant grass weeds as well as key broadleaf weeds, leading to a reduction in weed build-up.
- Wide application window, which allows spraying during favourable weather conditions.

Pixxaro® 266 EC

Did you know that we offer a herbicide solution for the many common broadleaf weeds that are economically damaging to wheat and barley crops?

Pixxaro® 266 EC is an emulsion concentrate herbicide for pre-plant burndown of broadleaf weeds on fallow lands and selective early post-emergence control of broadleaf weeds in wheat and barley.

Key advantages and attributes

- Effective post-emergence control of many common and economically damaging broadleaf weeds in cereals and barley.
- Low use rates result in low environmental load.
- Alternative mode of action to help manage resistant weed biotypes.
- Rapid degradation in soil and plant tissues allows flexibility during crop rotation.
- Favourable environmental and toxicology profile.
- Key broadleaf weeds (according to the label).

Quelex™ 200 WG

Western Cape and summer rainfall regions require a unique water-dispersible herbicide solution for the elimination of key broadleaf weeds that damage wheat crops.

Quelex™ 200 WG is a water-dispersible, granule herbicide for early, post-emergence broadleaf weed control in wheat in the Western Cape and summer rainfall regions.

Key advantages and attributes

- Controls key broadleaf weeds.
- Applied early post-emergence to the main flush of actively growing broadleaf weeds.
- Quelex™ 200 WG inhibits the growth of susceptible weeds.
- Visible symptoms of dying plants may occur within two to four weeks under ideal growing conditions and up to six to eight weeks under adverse conditions (prolonged periods of extreme temperature or moisture).
- Key broadleaf weeds (according to the label).

Tarzec® 320 WG

Did you know that a herbicide that has two different modes of action reduces the likelihood of resistance, offers cross-spectrum control of key broadleaf and grass weeds in a single spray operation while inhibiting the growth of weeds and some annual grasses in wheat grown – is available to you!

Tarzec® 320 WG is a water-dispersible granule herbicide for selective, early post-emergence control of broadleaf weeds and some annual grasses in wheat in the Western Cape and irrigated areas in summer rainfall regions.

Key advantages and attributes

- Since Tarzec®320 WG has two different modes of action, resistance is less likely to develop.
- Applied early post-emergence to the main flush of actively growing broadleaf weeds.
- Tarzec®320 WG inhibits the growth of susceptible weeds.
- Visible symptoms of dying plants may occur within two to four weeks under ideal growing conditions and up to six to eight weeks under adverse conditions (prolonged periods of extremes in temperature or moisture).
- Cross-spectrum control of key broadleaf and grass weeds in a single spray operation.
- Safe to crops if used as directed.
- Key broadleaf weeds (according to the label).

For more information about any of these crop protection innovations from Corteva, visit *www.corteva.co.za*.

Small changes, big rewards in modern sunflower production

By Kobus van Zyl, senior agronomist, Omnia Nutriology

Sunflower is one of the major row crops cultivated in South Africa. The history of commercial sunflower production dates back as far as the 1930s when it was planted for the first time. Sunflower was seen at the time as a potential replacement for traditional oilseed crops such as groundnuts and cottonseed. Today sunflower and soya bean are the main oilseed crops.

The focus of this article is to emphasise how small changes in general production practices can lead to big rewards. Modern sunflower production requires a good balance of risk and reward.

Maize and soya bean are normally planted from October to December; sunflower is planted at the end of the maize and soya bean planting season. Producers who plant sunflower at an earlier date and treat it the same way they do maize are often surprised the crop's good yield and oil content.

Sunflower competes well with maize and soya bean if the following production basics are adhered to:

- Soil should be thoroughly tilled and there must be no compacted layers.
- The seedbed should be firm but not compacted.
- Plant when soil moisture is sufficient.
- Planting depth should be 3 to 5cm; however, it must be deeper (5cm) in sandy soils.
- Plant population of 25 000 to 50 000 plants per hectare is the norm, depending on soil potential.
- If a later planting date is preferred, soil temperature should be considered. High soil temperatures will negatively impact germination.
- Use nematicides on sandy soils or if nematode pressure is high.
- Fertilise according to yield potential and soil analyses.
- Placement of fertiliser should be 5cm away and 5cm beneath the seed.
- Use a rotary hoe three days after planting to break the crust, if needed.
- Use a good quality foliar micronutrient spray to increase production potential.
- Prevention of diseases and insect damage is easier than controlling the disease when it becomes visible.
- Scout fields regularly and be on the lookout for foliar diseases and insects.

1


Sunflower planting depth.

The planting depth of sunflower is one of the basics that can make a big difference in the final plant population as shown in *Photo 1*. The plant on the left (5cm) was planted 1cm shallower than the plant on the right (6cm). The plant population was much better for the 5cm planting depth than for the 6cm planting depth.

Importance of fertiliser

Sunflowers, like any other crop, need proper stimulation at an early growth stage to establish the foundation for a high-yielding crop. The correct application rate, type and placement of fertiliser are essential building blocks to create this foundation. *Photo 2* shows the difference between fertiliser applied at planting

2


Sunflowers planted with and without fertiliser. The six rows in the centre were planted without any fertiliser. (Photograph: J Peyper)

compared to no fertiliser applied at planting.

The placement of fertiliser is an important aspect of the cultivation process. Incorrect placement, in this instance too close to the seed, can cause fertiliser burn, as shown in *Photo 3*. If fertiliser is placed too far from the seed, the seedling will be starved of essential nutrients in the early growth stages with a negative impact on yield potential.

Early growth stimulation of sunflower roots (*Photo 4*) results in yield increases with a return on investment (ROI) of more than 300%. In this trial, a root stimulant was applied to the seed at planting. The plants on the left served as the control and received no root stimulant treatment; the plants on the right did receive the treatment.

The application of quality foliar sprays that complement the fertiliser programme has a positive impact on the yield of

3


Fertiliser burn. (Photograph: L Ehlers)

A root stimulant applied at planting. (Photograph: K Coetzee)

the crop. Moreover, it increases the resilience of plants to withstand stresses such as drought or excessive heat. *Figure 1* shows the effect of foliar application – the result indicates that the correct foliar spray applied at the right time will have a positive impact on yield (ROI of more than 200%).

Fertiliser trials are often conducted to establish the maximum economical return on a single element such as nitrogen (N). The question remains if this is the correct way to look at plant stimulation? The synergetic effect that nutrients have on each other when used in combination is often neglected. A trial was recently conducted to better understand the effect of additional phosphate and potassium fertilisation on sunflower.

Figure 1: Effect of foliar treatments, using different products, on sunflower yield.

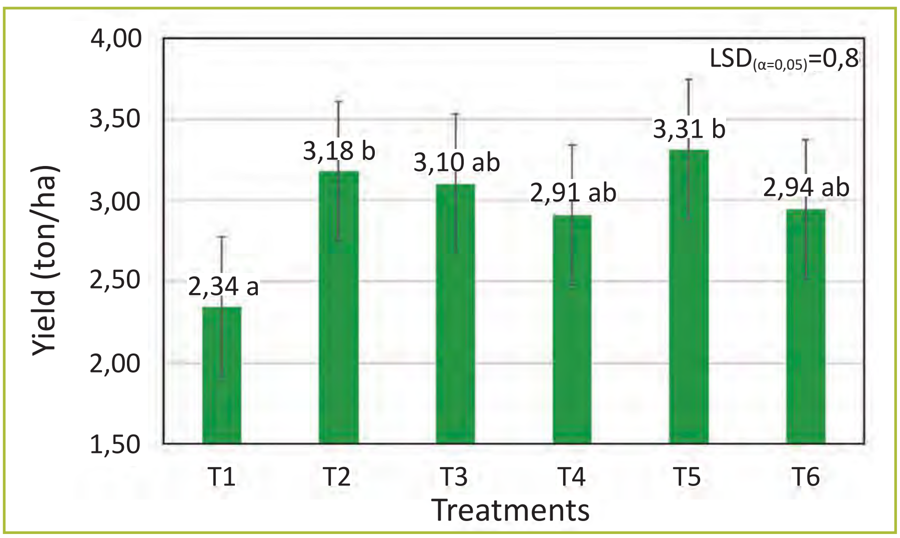
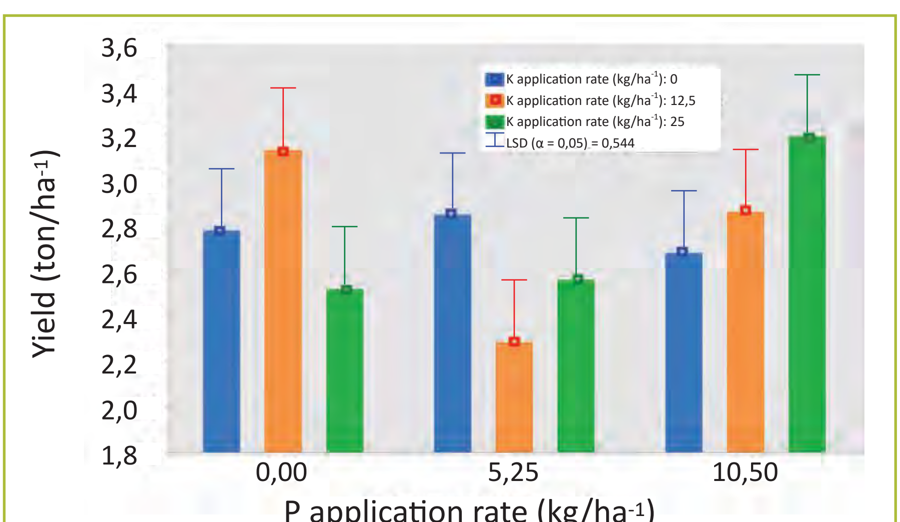


Figure 2: Sunflower yield response to additional phosphate and potassium fertiliser.



The average soil phosphate and potassium levels were between 10 to 15mg/kg and 60 to 80mg/kg, respectively. Phosphate and potassium fertiliser were applied at 16kg P/ha and 8kg K/ha. Phosphate and potassium applied in isolation do not have a significant effect on yield (*Figure 2*). The trial results showed that additional applications of phosphate (5,25 and 10kg P/ha) and potassium (12,5 and 25kg K/ha) in combination, had a significant effect on yield.

Sunflower is heavily dependent on boron to produce optimally. *Photo 5* shows the visual symptoms of a boron deficiency. The occurrence of a boron deficiency will be more prominent in sandy soils that are normally low in organic matter. Boron deficiency could also occur in acidic soils in high-rainfall areas.

Visual symptoms of boron deficiency.

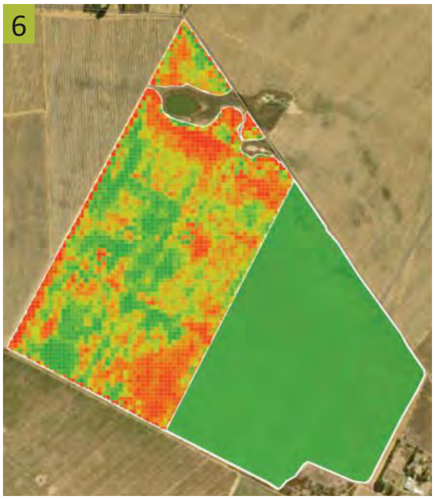
The response of sunflowers to different N sources (*Figure 3*) indicates that nitrate-containing products used as a top dress improved yield. The ANO top-dressed treatment received 51kg/ha N and the rest of the treatments received 60kg N/ha as a pre-plant or top-dress application. The N-Gas™ treatment showed the best pre-plant result. Products rich in nitrate N also showed a significant increase in water use efficiency.

These results indicate that well-fertilised sunflowers will deliver a good return on investment (ROI).

Crop monitoring

The continuous monitoring of any crop during the growing season is essential. Plant sap (OmniSap® analysis) or tissue analyses could indicate if the plant needs additional nutrients to achieve optimal yield. Satellite imagery is also a very good tool to detect plant growth problems.

6

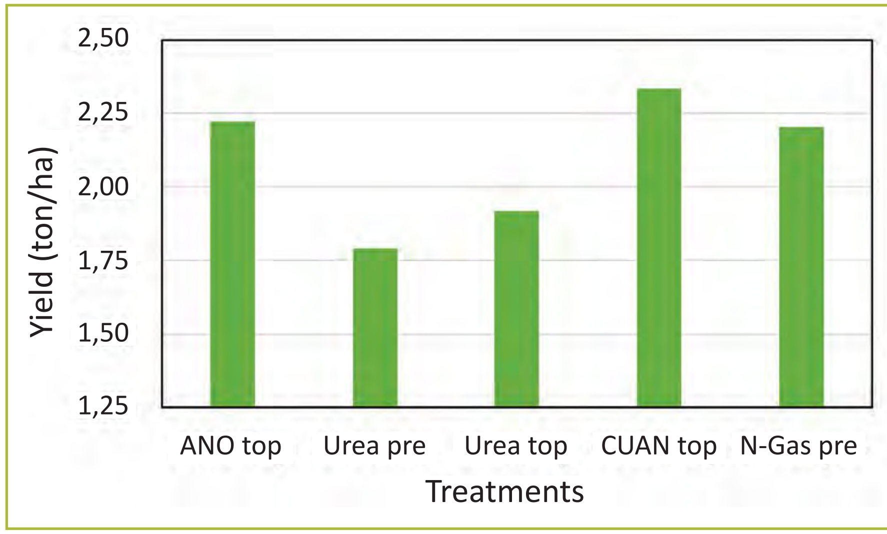


Satellite image to monitor plant growth.

Photo 6 is an example of a satellite image used for crop monitoring.

Poor plant growth, as shown by the satellite image, should be investigated in the field to determine the cause. Poor plant growth might be the result of disease, nutrient deficiency, drought or too much water. This technology enables the grower to proactively intervene and minimise potential income losses.

Figure 3: Sunflower yield response to different nitrogen sources applied as a pre-plant or top dress.



The inclusion of sunflowers in a crop rotation strategy with maize, especially in the North West and Free State, has many advantages. If sunflower is treated as a main crop and well looked after, success will follow. The opposite is also true – if sunflower is treated as the third choice after maize and soya beans, it will very seldom exceed the income per hectare of maize or soya bean.

For more information, contact the author at email Kobus.VanZyl@omnia.co.za.

New breeding technology: Nature, opportunities and regulation

By Izak Hofmeyr (Article with courtesy of Agbiz Grain Quarterly)

New breeding technologies have opened the door to mind-boggling opportunities in both plant and animal breeding. With this explosion of possibilities, however, it is becoming increasingly important to adapt the regulatory framework for these technologies to ensure sustainable innovation, as well as mitigate the possible risks.

It all started with the search for answers to specific problems in agricultural production. One of the first commercial breakthroughs came in the early 1990s when molecular biologists succeeded in transplanting a gene from a bacterium into maize. The result was a genetically modified maize cultivar that was resistant to stalk borer.

However, in addition to the tremendous excitement about the possibilities this technology offered, concerns were also raised as to the possible negative effects of genetic modification (GM). A new term was born – genetically modified organism (GMO), which refers to an organism whose genetic material has been altered by introducing one or more genes from a different species. Different countries formulated different sets of regulations to manage this new technology and in a few countries, it was even rejected altogether.

A shortcut to advanced breeding

Genome editing was eventually developed, where the genome of a specific organism is altered without introducing the genetic material from a different species.

This technology opened the door for scientists to better understand the genes of various species, which meant they could pinpoint the exact location of the genes that regulated specific traits and alter those genes to achieve a specific outcome. (It is important to highlight that there is a fundamental difference between merging genes from different species and altering existing genes within a species.)

"Genetic variation," explains Dr Hennie Groenewald, executive manager of Biosafety South Africa, "forms the basis of any structured breeding programme. Ever since mankind realised that it was possible to select for certain traits, male and female lines have been selected and put together to achieve specific trait combinations. This is a very long process, requiring multiple generations.

"With these new technologies, a quick and effective shortcut was created to achieve the desired results. These potential benefits will, however, be lost should the strict regulations, and associated long timelines and high development costs that apply to GMOs also be applied to gene-edited products, which have a fundamentally different risk profile."

The point of departure should be to define exactly what a GMO is, why and how it should be regulated, and how this relates to the new techniques and products associated with induced genetic variation through genome editing (*Figure 1*).

Genome editing in practice

There are three components to the genome-editing process, Dr Groenewald explains. The first is the ability to identify a very specific target sequence in the complete genome. This is probably the main difference between genetic manipulation and genome editing. In the latter, a very specific gene is targeted for editing, while in GM a completely new gene is added.

The second step is to 'cut' the DNA at the exact site on the genome that has been identified. Thereafter the endogenous mechanism of the cell takes over to repair the cut DNA. It is during this third and final repair step that a mutation may be introduced – just like mutations occur naturally and give rise to biodiversity.

An apt metaphor for this process is the editing of an article. It is possible to zoom in on a specific letter and change it. For example, you can change the meaning of an expression by replacing the letter 'r' with 't' in the sentence 'the car is white' – as opposed to 'the cat is white'. Hence the term 'genome editing'. Scientists use a specific template to induce a specific mutation at a very specific site on the genome, which is a shortcut to selecting for the same mutation over many generations of breeding.

An example of a genome edited product, says Dr Groenewald, is the non-browning mushrooms commercialised in the United States. By using genome editing technology, the polyphenol oxidase gene, which causes the browning effect in mushrooms and fruit, was disabled. Less browning means easier production, a higher quality product, longer shelf life, and less waste.

A few other examples include:

- High-oleic soya beans. These soya beans have a fatty acid profile that contains 80% heart-healthy oleic acid.
- Low gluten and coeliac-safe wheat. Some specific digestion-stable fragments of wheat gluten are recognised by immune cells, ultimately resulting in a variety of symptoms ranging in severity. Genome editing enables the production of wheat lines that have a strongly reduced coeliac immunogenicity.
- Biofortified tomatoes to address vitamin D deficiency. Most food contains little vitamin D and plants are very poor sources. Genome editing enabled the modification of a duplicated section

Figure 1: Genetic variation as the basis for phenotypic variation.

of plants' endogenous phytosterol biosynthesis, to provide biofortified food.

- Polled cattle. Horn growth is determined by a specific gene mutation and through genome editing, it is now possible for any cattle breed to be polled.

Less money, more benefits

Genome editing is already being used worldwide in a wide range of applications, such as improved food/feed quality, increased plant yield and growth, biotic stress tolerance, industrial utilisation, herbicide tolerance, abiotic stress tolerance, product colour/flavour and storage performance.

Because it is so accurate and relatively easy to apply compared to GMOs, genome editing has created a huge surge in bio-innovation productivity. Furthermore, due to it being cheaper and more effective, it is within reach of small companies, entrepreneurs, and public research and development institutions.

"To produce a single GMO line could cost more than R1 billion and could take 16 years. Genome editing is much cheaper and faster, which means relatively small players are now able to enter the market. Even developing countries can now develop context-relevant products for their own benefit, contributing at the same time to global food security, productivity and diversity. Finally, and most importantly, it enables us to react more effectively and faster to climate change challenges," says Dr Groenewald.

A need for regulation

With all the potential benefits this technology offers, the issue of regulation becomes increasingly important. "The key concept here is 'sustainable bio-innovation'. A central aspect of sustainable innovation is the proactive integration of all biosafety and viability requirements, ensuring a balance is drawn between innovation and safety."

The first issue to understand, he adds, is that the basic assumptions regarding GMO risk and regulation are not necessarily applicable to all possible products of genome editing and other new breeding technologies. "Genome editing is starkly different from the original definition of GMO, which is the transfer of genes from one species to another. This is exactly why such strict regulations are necessary for the application of GMO technology."

The aim of some genome editing processes, on the other hand, is to induce mutations that could potentially occur naturally in the genome of that organism.

"In this context, the risk is no more and no less than what could potentially have occurred naturally. This does not imply that there is no risk, because there is. But we conventionally manage that risk via conventional legislation. The risk, however, is not the same as that which can occur in GMOs. It therefore follows logically that the regulatory framework for genome editing should be different from that of GMOs."

Another reason why a distinction should be drawn between genome-edited and GMO products, is to separate genome-edited products that are equivalent to naturally occurring ones from the inaccurate, negative perceptions still associated with GMOs – these products are fundamentally different.

"Our view is that an oversight system should be introduced, according to which products should be assessed on a case-by-case basis to determine whether they should be regarded as GMO or not," says Dr Groenewald. "This will ensure that broad oversight remains in place without an undue impact on bio-innovation or unnecessarily attaching the GMO connotation to products when this is not warranted."

Unfortunately, South Africa and New Zealand are at present the only countries in the world that have decided genome editing should be regulated in the same way as GMOs, he points out. In the European Union, where gene-edited products are currently regarded as GMOs under a court ruling, the regulatory framework is under review, and the rest of the world has adopted a much more nuanced approach to the issue.

For more information, contact Dr Hennie Groenewald on 083 288 1271.

Soya bean cultivar selection

By Nico Barnard, agronomist, Pannar Seed, Central Highveld

South Africa is divided into three primary production areas, namely cool, temperate and warm. The cool production areas are found in the higher-lying eastern Free State, Mpumalanga and KwaZulu-Natal, which are characterised by a shorter production season with moderate summer days and relatively higher rainfall.

Table 1: Seven-year average for different maturity groups expressed as a percentage of average yield. (Source: Agricultural Research Council)

Maturity group (MG)	Cool eastern production regions	Temperate eastern production regions	Western production regions
MG 4,5 to 5,4	101	90	94
MG 5,5 to 6,4	100	103	102
MG 6,5 to 7,5	93	104	102

The temperate production areas include the central parts of the Highveld as well as the North West and western Free State, and generally has a longer production season with warmer days and average rainfall.

The warm production areas have a long growing season with hot days and less rainfall. Here, soya beans are mostly grown under irrigation.

Cultivar choice is determined by the production area and the production potential of the field. The next step is to select between the different growth classes. *Table 1*, which provides a summary of seven years' performance, indicates the different maturity groups and the production areas they are suited for.

In years where rain is absent at the end of February and in March, maturity groups 4,5 to 5,5 will perform much better than maturity groups 5,5 to 7,5. The reverse is true if the second half of the season receives good rain. Over the long term, it was found that maturity groups 5 and 6 produce the most stable yield and the largest part of the package should comprise these maturity groups. *Table 2* gives an indication of the performance of Pannar's cultivars over two years.

Table 3 shows the recommended cultivars. By selecting the best cultivars from each maturity group, risk can be optimally managed.

Table 2: Two-year data (2019/20 and 2021/22) expressed as percentage of average yield.

Cool eastern production regions @ 2,89t/ha				
PAN 1521R	PAN 1644R	PAN 1532R	PAN 1555R	PAN 1588R
105,12	102,22	100,00	99,99	99,85
Temperate eastern production regions @ 2,84t/ha				
PAN 1521R	PAN 1555R	PAN 1644R	PAN 1588R	PAN 1532R
104,05	102,75	102,51	98,89	97,01
Western production regions @ 3,047t/ha				
PAN 1521R	PAN 1644R	PAN 1555R	PAN 1588R	PAN 1532R
104,78	103,39	100,43	97,47	95,13
Irrigation @ 4,04t/ha				
PAN 1521R	PAN 1588R	PAN 1644R	PAN 1555R	PAN 1532R
106,25	105,67	103,25	95,99	92,54

Table 3: Cultivar recommendations.

	Quick/early	Medium	Late
Maturity group (MG)	4,5-5,4	5,5-6,4	6,5-7,5
	PAN 1502R	PAN 1507R	PAN 1644R
	PAN 1532R	PAN 1555R	
		PAN 1521R	
		PAN 1586R	
		PAN 1588R	
Area recommendation: MG as a percentage of the cultivar package			
Cool	50	40	10
Temperate east	10	50	40
Temperate west	-	50	50
Warm irrigation	10	50	40

New soya bean cultivars

PAN 1502R (MG 5,2) is a consistent performer and a great support variety to PAN 1532R (MG 5,3) in this early maturity category.

PAN 1507R (MG 5,5) is an excellent choice in the cooler production regions. PAN 1507 complements PAN 1532R (MG 5,3) in this early maturity class and PAN 1521 (MG 5,7) and PAN 1555R (MG 5,7) in the medium maturity class.

PAN 1586R (MG 5,9) is an excellent choice for the eastern production area. Together with PAN 1521R (MG 5,7), PAN 1555R (MG 5,7) and PAN 1588R (MG 5,9), it is recommended as part of the main planting in all the temperate dryland production areas, which also includes the western Highveld.

Contact your nearest Pannar representative to help you choose the best cultivar package for your fields or visit *www.pannar.com*.

The future of glyphosate

By Prof Charlie Reinhardt, North-West University

The veritable war that has been waged against glyphosate for a considerable time has already reached the stage where socio-political pressure on this herbicide is denting its reputation, curtailing its current use, and casting a shadow over its future use.

However, such is its popularity and utility that most crop producers the world over will probably be loath to even reduce its use. Despite being under intense scrutiny from human health and environmental impact points of view, glyphosate remains the world's most popular herbicide (Duke 2020). In this case 'popularity' converts seamlessly to 'most used'.

From glyphosate's release on the market in 1974 until the first glyphosate-tolerant crop (soya bean) was introduced in 1996, glyphosate use was curtailed by its non-selective nature which prevented spraying it with impunity over the tops of crops. This use restriction to a large extent fell away for at least maize, soya bean and cotton when glyphosate-tolerant (Roundup Ready™) cultivars of these crops became available in the space of five years (1996 to 2000).

During the following decade or so the herbicide industry basically marked time with regard to the development of novel herbicides, because no one could be certain what would become of the rapidly acquired almost total dominance by glyphosate of the herbicide market for maize, soya bean and cotton. Glyphosate use about doubled thanks to glyphosate-tolerant crops, and this profitable association was further boosted by conservation agriculture, specifically zero-tillage practice (Duke 2020).

Popularity can have consequences

After about 20 years (1974 to 1995) of use, glyphosate had gained the reputation of being highly effective and safe compared to its rival, paraquat, for non-selective (broad-spectrum) weed control. But then, as is the case with many popular, widely used herbicides, glyphosate inevitably ran into weed resistance, especially those with a single mechanism of action such as inhibition of a specific enzyme.

Whereas glyphosate has to date accrued resistance in 53 weed species globally, the ALS-inhibiting herbicides as a group (e.g., chlorimuron, imazethapyr, etc.) are burdened with 175 resistant weed species (Heap, 2023. The *International Herbicide-Resistant Weed Database*, *www.weedscience/org*).

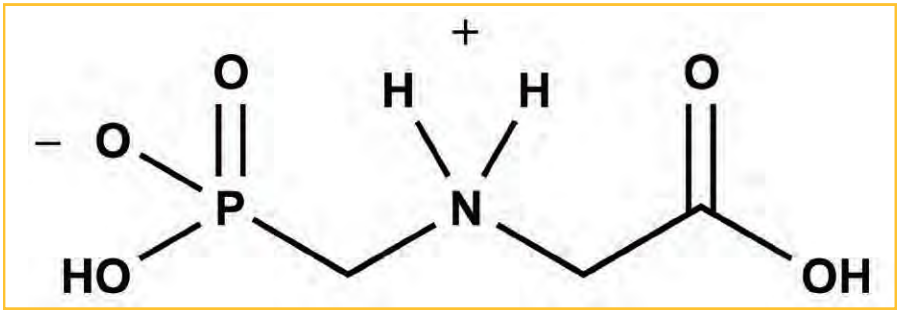
However, herbicide-resistant weeds can be managed effectively, provided the well-proven, well-documented strategies and tactics for weed resistance management are adhered to both proactively and on a long-term basis.

Unique mode of action

Glyphosate has a unique mechanism of action in that it is the only herbicide that inhibits the EPSPS enzyme which occurs in all plants and in certain micro-organisms. Except for glyphosate-tolerant crops, which through transgene (GM) technology possess an additional EPSPS enzyme that

The impact on Sri Lanka's tea industry was devastating following the banning of glyphosate. Yield losses, a huge increase in manual labour and reduced exports were some of the results.

Figure 1: Glyphosate (chemical formula: $C_3H_8NO_5P$) is a simple organophosphorus molecule consisting of a phosphate group (HPO_3) attached to glycine, one of the most widely used amino acids in plant nutrition.



is resistant to glyphosate, all other plants and certain microbes can theoretically be affected by glyphosate because they have only the original (natural) glyphosate-sensitive EPSPS enzyme.

Some fungal plant pathogens can be suppressed by glyphosate, giving the herbicide this added advantage in glyphosate-tolerant crops (Duke 2020). In fact, this property of glyphosate has been patented.

> Glyphosate has a unique mechanism of action in that it is the only herbicide that inhibits the EPSPS enzyme which occurs in all plants and in certain micro-organisms.

In laboratory studies, adverse effects of glyphosate on certain beneficial microbes, such as the N-fixating *Bradyrhizobium* species in root nodules on legume crops, have been reported but an overwhelming volume of field-focussed research points to this effect having only minor, transient impacts on crop growth and yield (Duke 2020). Furthermore, glyphosate has been found to have minor and transient effects on microbes in agricultural soils, whereas many agricultural practices and the climate have much greater and longer-lasting impacts on soil microbes.

Overwhelming scientific evidence indicates rapid microbial degradation of glyphosate in soil, coupled with strong adsorption (fixation) on clay minerals, which cause glyphosate to be relatively inactive in the soil environment. Another claim from the anti-glyphosate lobby, which has also been discredited through rigorous research, is the notion that glyphosate present in crop plants can reduce the levels of cation nutrients (Ca^{+2}, Mg^{+2}, etc.) to the extent that crop yield losses are incurred in glyphosate-tolerant crops (Duke 2020).

Glyphosate has been reported to accumulate in the seed of crops that are directly exposed to it. Glyphosate residues reported in seed of glyphosate-tolerant soya bean in the United States (US) is well below the maximum residue level (MRL) applicable in the US, namely 20ppm or mg/kg (USDA AMS Survey, 2020). Up to 10mg/kg of glyphosate was detected in glyphosate-tolerant soya bean seed in a countrywide survey in the US (USDA AMS Survey, 2020). However, in the same survey, no glyphosate residues were detected in seed of glyphosate-tolerant maize.

Consequences of a ban

About a decade ago, the government of Sri Lanka (GoSL) embarked on the national goal of rapidly switching crop production practices to organic farming only. This unique drive by the government commenced in 2014 with a total ban on paraquat use, and glyphosate use being regionally restricted (Marambe and Herath 2020). The motivation behind the adoption of organic farming by GoSL was the high costs of importing government-subsidised crop production inputs such as fertilisers and pesticides.

Glyphosate had to shoulder an extra burden in the form of socio-political pressure because of a theory, which subsequently could not be substantiated on either scientific or medical grounds, that a rare kidney disease in certain regions of Sri Lanka was linked to glyphosate use. GoSL officials gave in to public pressure that was based on perceptions and not on scientific or medical facts. Therefore, this is a clear case of socio-political forces suppressing scientific reason.

Impacts on Sri Lanka's tea industry (Ceylon tea) alone was devastating within the brief space of two years (2016/17) following the banning of glyphosate. Yield loss suffered was 5 to 10%. Where previously four people per hectare were required for hand-weeding to supplement glyphosate use, 40 people per hectare were now needed for manual weeding. Tea exports were expected to take six to ten years to recover.

Such was the economic impact of just the glyphosate ban on the wider economy of the country, that in 2018 the decision was rescinded for 36 months; the herbicide's use was limited to tea and rubber plantations. Other concessions on glyphosate use followed and in 2021 the ban was lifted in its entirety, and with it GoSL abandoned attempts to make the country 100% organic farming compliant.

Can we do without it?

We can reflect on this quote from the review article by Dr Stephen Duke: "Glyphosate has been a valuable tool in economically managing weeds in many settings for the past 45 years". The question we need to ask is whether crop production in South Africa can remain both profitable and sustainable if glyphosate use would be seriously restricted, or even 100% banned.

Undoubtedly, the South African crop production industry and producers would literally be the poorer without this valuable chemical tool.

The author wishes to thank Dr Stephen Duke of the Mississippi State University, US for his advice about the interpretation of certain aspects of his review article (Duke 2020).

Prof Charlie Reinhardt is a professor in agronomy at North-West University, and research leader in the South African Herbicide Resistance Initiative (SAHRI) at the University of Pretoria. For more information and references, call 083 442 3427 or send an email to dr.charlie.reinhardt@gmail.com.

The difference sulphur makes in soya beans

Article courtesy of the United Soybean Board

Sulphur plays many important roles in soya bean plants, from helping with nitrogen uptake to formation of essential amino acids. It is important that we understand how to manage sulphur for high soya bean yields.

Sulphur deficiencies, which are showing up more often in fields, are caused by several factors, including:

- Reduced industrial emissions, with current rates around 2,2kg per 0,4ha.
- Higher crop yields, which remove more sulphur from the fields. It is estimated that approximately 1,9 tons of soya beans remove around 5,9kg of sulphur.
- Increased use of fertilisers without sulphur instead of manure containing sulphur.
- Sulphur leaching out of the root zone at higher rates due to excessive rainfall or irrigation.

The importance of managing sulphur is a priority for many producers as it not only impacts soya bean production but also affects feed quality. We understand that sulphur is incorporated into soya bean protein in amino acids cysteine and methionine. Animals cannot synthesise either of these, so they must get them from dietary sources. In fact, sulphur-containing amino acids (SAAs) are often the limiting factor when using soya bean meal as animal feed.

Understanding sulphur mobility

Sulphur is full of contradictions. It is one of the most mobile and variable nutrients when in the soil – which makes soil testing for sulphur problematic – but has low mobility once incorporated into plants. In addition, sulphur can interact with other nutrients that are applied at the same time, such as nitrogen, phosphorus, potassium and manganese.

Depending on temperature and moisture levels, approximately 95% of the sulphur in soil is in the form of organic matter, which is broken down (mineralised) to sulphate-sulphur (SO_4-S) over many years. It is the SO_4-S that is absorbed by plant roots. Once in the plant, sulphur is not easily transported.

Most sulphur is transported through the plant as a hitchhiker. When plants suffer from a lack of nitrogen, they deconstruct older leaves and tissues, and transport the nitrogen-containing compounds to new growth areas or for use in seed production. Since some of these compounds also contain sulphur, the sulphur is transported to seeds as well. However, if plants have sufficient nitrogen, they do not transport the nitrogen-containing compounds, so the seeds may end up deficient in sulphur and thus deficient in sulphur-containing amino acids.

So, what does the research say? While recent research has started untangling some of the other dependencies of sulphur needs, the results have not been consistent.

Higher yields

In Maryland in the United States (US), foliar spray on flowering soya beans resulted in improved protein quality (double the percentage of methionine and cysteine), as well as a 5 to 10% increase in yield, when treated with gypsum (calcium sulphate) or Epsom salts (magnesium sulphate). They are also experimenting with different methods of application, such as dry powder or a spray rig.

In Indiana, ammonium sulphate and pelletised gypsum both significantly increased yields, regardless of the growth stage at which they were applied. Their conclusion was that reference strips of soluble sulphur should be applied as close to planting as possible.

Higher protein levels

In 2018, trials in Tennessee with different levels, methods and timing of sulphur application showed that only sulphur applied late in the growing season resulted in higher protein levels.

So, what do researchers do when there are many studies, but the results disagree? They look at the big picture and conduct a meta-analysis of the results of all the relevant studies. Two such analyses have recently been completed by researchers.

The big picture

Led by Dr Ignacio Ciampitti of Kansas State University, the first study group looked at a total of 44 unique site years over eight states and three growing seasons.

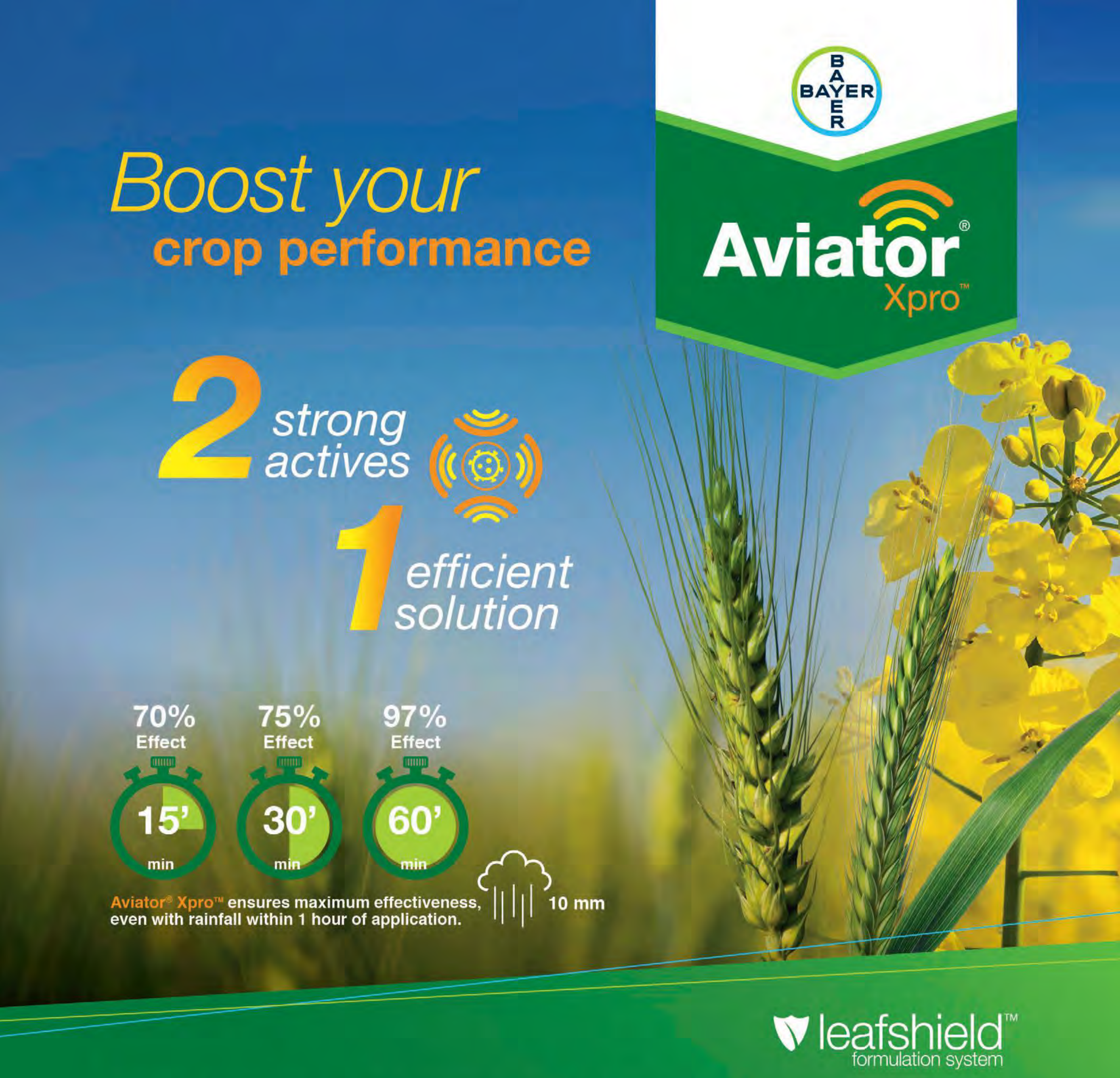
Their analysis found that applying sulphur at planting increases seed protein concentration; and application at any time can increase SAA concentration, but only if the field already had intermediate levels of sulphur and organic matter. However, the gains were all highly variable and site specific, indicating there may be other variables at work.

In the second study, Dr Anna M Locke and her team at the USDA office at North Carolina State University used data from 76 peer-reviewed journal articles to examine the effects of irrigation, nitrogen application, plant density, row spacing, sulphur application and tillage on soya bean yield, protein and oil concentration and protein yield.

Locke found "the largest increase in seed protein resulted from sulphur application". In fact, applying sulphur fertiliser increased protein and oil concentrations as well as yield. However, rainfall was high in many of the studies, which possibly washed away existing sulphur, making the added sulphur more valuable.

Sulphur applications show promise, but there is more we need to understand to produce more higher-quality soya beans. We are dedicated to continued research to make sure we thoroughly understand the positives and negatives of different sulphur fertiliser applications.

For more information, visit *www.unitedsoybean.org*.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By Dr FG Adriaanse, for Kimleigh Chemicals SA (Pty) Ltd

Copper (Cu) and molybdenum (Mo) are among those elements which have been well recognised as essential plant nutrients for soya production. However, up to now nickel (Ni) and cobalt (Co) have mostly not formed part of fertilisation programmes, even though Ni was documented to be an essential element in 1987 and Co in 1983.

Yet both these elements play vital roles in soya bean production. Ni is key for nitrogen metabolism of urea-like compounds and can benefit symbiosis of Rhizobia bacteria. Deficiency symptoms show as browning of leaf tips because of toxic levels of the urea-like compounds accumulating. Co facilitates nodule formation and N_2 fixation processes. It also increases growth yield, oil and protein contents in seeds.

Materials and methods

A field was identified close to the Vaal River, approximately 30km from Potchefstroom, which, according to soil and leaf analyses, indicated Cu and Mo deficiencies despite compost applications of 4,9t/ha. Ni and Co were not analysed in the soil and leaves since norms for these elements have not been well documented. Band-placed fertiliser applications at planting were 13,6kg N/ha, 13,5kg P/ha, 7,8kg S/ha, 192g Zn/ha, 105g Cu/ha, 96g B/ha and 38g Mo/ha.

The micronutrients in the plant mixture were Kimleigh Mentrix formulations which were coated onto fertiliser granules. Zn and Cu were supplied as nano formulations. Deficiencies of Cu and Mo still showed up in the leaves despite significant applications at planting.

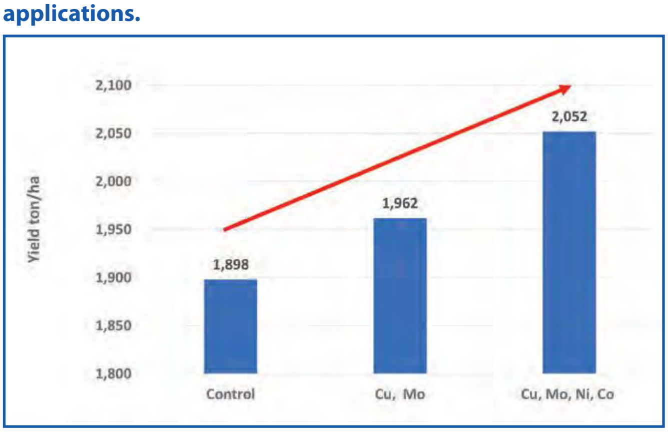
Eight foliar spray treatments and four replications were arranged in a randomised block design. Apart from a control treatment, one treatment consisted of Cu and Mo and another of Cu, Mo, Ni, and Co (*Figure 1*). Only Cu was supplied in nano-formulation in both products.

The trial was planted on 9 December 2021 and treatments sprayed on 24 February 2022 (R3 growth stage). Harvesting took place on 5 May 2022. Yields were corrected to 12,5% moisture.

Results and discussion

Treatment effects on soya yield are illustrated in *Figure 1*. Treatment 1 increased yield by 0,064t/ha (3,4%) above the control, which was statistically not significant. The increase in income at R8 000/ton is R512/ha and the cost R276,80 resulting in an increase in profit of R235,20/ha. Treatment 2 increased yield by 0,154 ton/ha (8,1%) above the control which was statistically significant at P = 0,15. The increase in income at the same soya price is R1 232/ha and the cost R266,34/ha resulting in an increase in profit of R778,34/ha.

Figure 1: Kimleigh Metalin and Fertilin combinations of foliar applications.



Treatment 1: 101g Cu/ha + 38g Mo/ha. Treatment 2: 87g Cu/ha + 147g Mo/ha + 20g Ni/ha + 7g Co/ha. LSD (P = 0,15) = 0,138 ton/ha. CV = 6,9%.

All micro-nutrients except Ni and Co were applied to all treatments in significant quantities as a fertiliser coating at planting. Since the topsoil pH (KCl) was 5, Mo would not have been readily available for uptake. Mo is the only micronutrient which becomes less available under acidic conditions. Mo applied at planting could also have leached to some extent. Cu in the fertiliser plant mixture was probably also fixed by the application of organic material.

Organic matter binds Cu more than any other micronutrient which also reduces availability to crops. For these reasons, at least some response to Cu and Mo foliar applications as shown in *Figure 1* was expected. A far better yield response to Treatment 2 compared to Treatment 1 can be ascribed to the addition of Ni and Co and/or a higher Mo rate in Treatment 2.

Conclusions

A specific combination of Cu, Mo, Ni and Co resulted in an increase in soya yield which was 85% statistically reliable and economically justifiable, increasing profit by R778/ha. Cu applications at planting may be ineffective due to fixation by organic material.

Foliar applications of Mo are inevitable under acidic conditions and when leaching is expected. The synergistic effect of Ni and Co with other elements and the clearly defined roles of these elements in soya production should be realised and further investigated.

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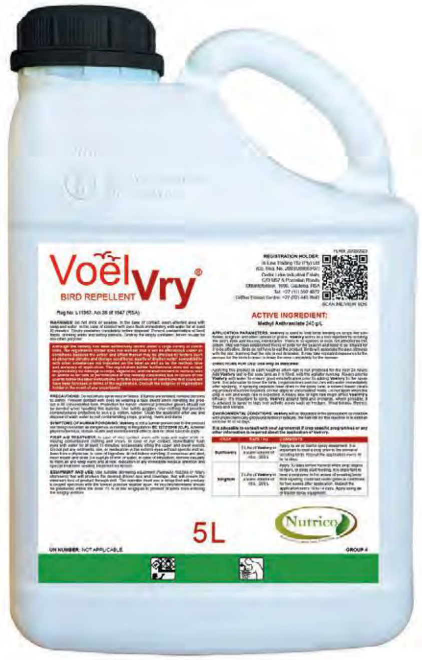

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Eco-friendly bird repellent now available

Bird damage is one of the major constraints affecting sunflower production in South Africa. The physical damage caused by birds may become infection sites for *Sclerotinia sclerotiorum* (head rot) with the possibility of infecting an entire field. Not only does bird damage lead to significant yield losses, but it also poses a food safety issue.

Voëlvry® (L11367, *Act 36* of *1947*) is a new eco-friendly and non-toxic bird repellent, registered for use on sunflowers and various other crops. It is suitable for aerial applications and effective on all bird species.

Methyl anthranilate

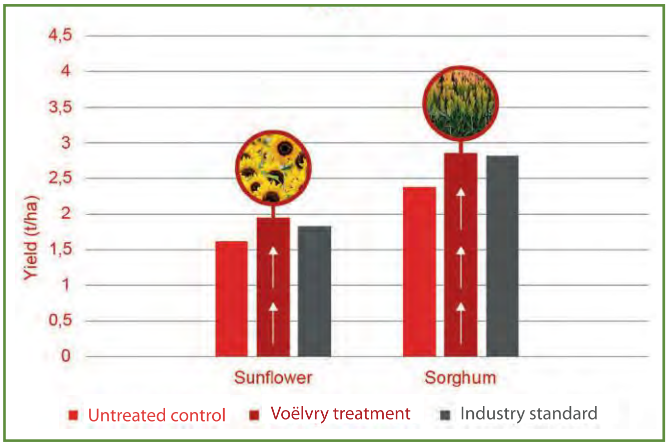
Voëlvry® contains the active ingredient methyl anthranilate (MA). MA is naturally present in fruits and plants and, due to its unique scent and taste, is frequently used as flavouring in food and beverages. It functions as a bird repellent by irritating the pain receptor connected to birds' senses of taste and smell.

Non-toxic repellent mechanism

Birds have the remarkable ability to adapt to new habits in response to physical stress and environmental changes. Voëlvry® temporarily irritates the bird's eyes and mucus membranes, causing the birds to feel uncomfortable and stressed. This will repel established birds for the season without permanent damage to the birds.

Birds must inhale Voëlvry® to be effective. They will associate the pain stimulus with the site and not return for the rest of the season. All pain effects dissipate when the bird leaves the treated area. Furthermore, MA degrades in the atmosphere after ten to 14 days by reacting with photochemically-produced hydroxyl radicals and is therefore environmentally safe.

Figure 1: An illustration of how Voëlvry® can have a positive influence on crop yields.



Banish all birds with Voëlvry®

The formulation of Voëlvry® effectively deters all bird species. Not only is the product eco-friendly and non-toxic, but no phytotoxicity is applicable when used according to label recommendations. The active ingredient, MA, does not require restrictive pre-harvest or re-entry intervals and is also exempted from compliance with maximum residue levels.

Voëlvry® is easily applied via aerial applications and effective at a low dosage of 2ℓ/ha. For the best results, apply this product in calm weather when rain is not predicted for the next 24 hours, and repeat every ten to 14 days.

Various field trials carried out on sunflowers and sorghum over different seasons and bioclimatic zones show average yield increases of up to 20% compared to untreated controls when following the application recommendations as set out on the product label.

Nutrico is the proud supplier of various specialised biopesticides including Voëlvry®. We have a team of technical experts available to help you find the best science-backed solution for your pest management application.

For more information, visit *www.nutrico.co.za* or phone 011 392 4072 or 021 807 5922.

Why and how do we dry grain?

Article courtesy of ABC Hansen, ABC Africa Group

When grain is harvested it is in the best condition it will ever be. From harvesting onwards, it can only go into worse condition. Drying is the solution to increased storage life of harvested grain.

Moisture content should be reduced by about one percentage point for grain that has low quality at time of storage. The longer we wish to store grain, the more important it is to get the grain to a moisture level that will prevent spoilage.

Drying involves driving out the moisture trapped inside the 'seed coat' or skin. Moisture can migrate in both directions. Over-drying or drying grain too quickly will cause stress cracks in the seed coat. These cracks can lead to broken kernels. Cracks can also lead to easier access for moulds and insects to the seed interior.

There are four different types of drying:

- **Aeration:** While not a form of drying, it is essential to the drying process. It simply entails forcing air through the grain mass to maintain condition.
- **Natural air drying:** This entails the use of outside ambient air without the addition of heat.
- **Mechanical dryers:** These include the screen type, tower dryers, etc.
- **In-bin or in-silo drying.**

Importance of airflow

Airflow is the amount of air passing through the grain mass. It is a volume of air crossing a volume of grain at a given time. Airflow is usually measured in cubic feet per minute per bushel or cubic metres per minute of air per cubic meter of grain.

Airflow requirements will depend on silo usage. Aeration can run from 0,10cfm/bu (0,08cu m/cu m/min) in large commercial silos to 4cfm/bu (3,2 cu m/cu m/min) in natural air drying.

Airflow is dependent on the 'static pressure' of the grain. Air travelling in the voids between kernels of grain will lose energy due to friction and turbulence. This energy drop or pressure drop is regarded as static pressure. In general, the taller the silo and the smaller the grain kernel, the greater the static pressure.

Role of fans

Fans are important because they force air through the grain mass. There are two basic types of fans namely axial flow fans and centrifugal fans (*Figure 1*).

Axial fans produce more air flow at lower static pressures than centrifugal fans. Centrifugal fans work better at higher static pressures and are much quieter than axial fans. Fans can work with either forced air or suction. We only recommend forced air systems in silos as suction systems can cause damage.

Natural air drying

Natural air drying is a process used to dry grain by forcing unheated air through the grain mass until the grain reaches

Figure 1: On the left is a centrifugal fan and on the right, an axial flow fan.

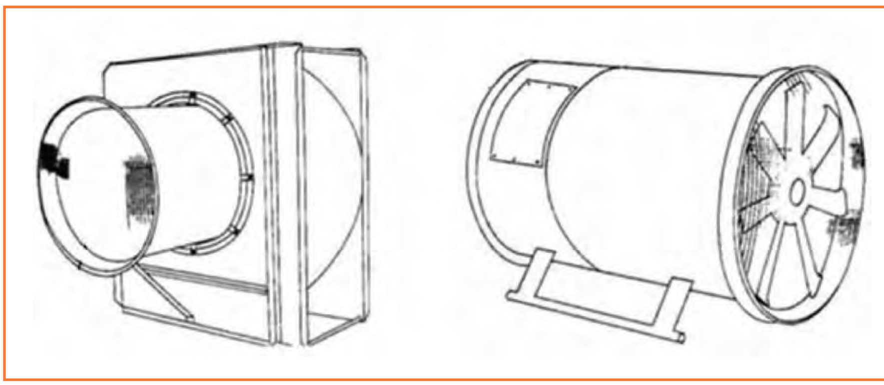
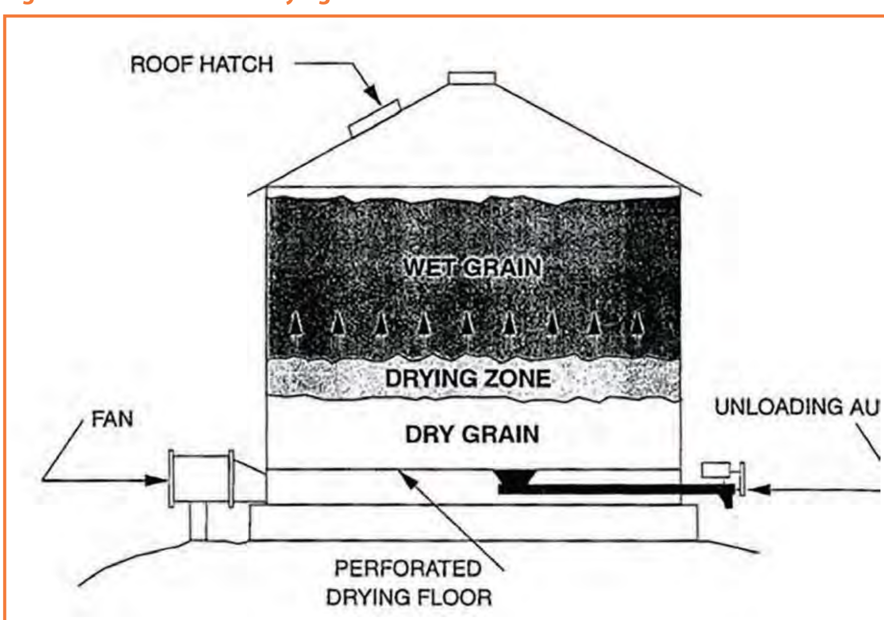


Figure 2: Movement of a drying front illustrated.



equilibrium moisture with the outside air. Drying with natural air can only be accomplished if the air temperature and relative humidity conditions allow a net moisture transfer from the grain to the air.

Generally, natural air drying requires large volumes of air and long periods of time. Natural air drying is not a process that will work in commercial silos or situations. It is restricted to farm silos of 15m and smaller.

Relative humidity (RH) is one of the major factors in drying. Air at 100% RH will not hold more water. The warmer the air, the more water it will carry. If the air temperature is raised about 10°F (6°C) the RH is halved or the warmer air will carry twice as much water.

As air passes the grain and absorbs moisture, it will become saturated (100% RH). The drying air will take this moisture from a narrow band in a silo called the drying front (*Figure 2*).

Cooling and warming grain

In temperate climates with cool to cold winters grain needs to be cooled along with the decreasing temperatures of winter. As the average outside temperature cools by 10°F (6°C) the temperature of grain needs to be dropped by starting the fans and cooling the grain inside.

The length of time (in hours) fans need to run can be calculated by the equation 15/(cfm/bu) (produced by the fan(s)) [12/(m^3/minute*m^3)].

Fans need to be run continuously to drive the 'cooling front' all the way through the grain. Using a thermometer on a stick that can be driven into the grain pile, the actual temperatures can be checked at different levels to determine if the front has moved all the way through. This process must be repeated each time the outside air temperature drops 10 to 15°F (6 to 8°C) until the grain mass reaches 32 to 35°F (0 to 3°C). Insect activity and mould growth will slow or stop below 40°F (5°C). Freezing of grain is not recommended.

The entire process needs to be run in reverse in the spring as outside temperatures start to increase. The grain in the silo should be no more than 15°F (8°C) different than ambient temperature.

Cooling grain is probably not an option in tropical climates; there, other measures must be taken. Moisture control is the only choice to keep your grain in condition. Grain must be dried to a lower moisture content in tropical conditions than in temperate climates.

If ambient air conditions will not allow for the removal of moisture, it may be necessary to add heat. In cases where a 'hot spot' cannot be eliminated by aeration it will be necessary to recirculate the grain. Moving the grain from one silo to another will break up the spot and allow for the introduction of pesticides or fungicides during the moving process.

Mechanical dryers

There are many different styles of mechanical dryers. Some, such as the screen (tower or stack) are a cross-flow design. Some dryers are counter-flow where the material is moving in one direction and the air in the opposite direction.

Most times we can dry to within two points moisture and draw the rest with the cooling process or aeration.

In-bin or in-silo drying

In-bin or in-silo drying can be done with just a fan for natural air drying. Add a heater to the fan and dry. The results are best if done with low heat and/or layered drying.

Mechanical systems added to a silo include a stirring machine, recirculator or a continuous flow unloading system.

Stirring provides increased airflow and less energy is consumed by the fan to get the same results. It also prevents over-drying of the grain by mixing the fines in the grain mass to help promote even air flow. Note that prolonged use can push fines to the bottom. A benefit of stirring is that the moisture content of the grain is consistent throughout the entire silo.

Wall loads

Drying leads to two major changes in the grain during the drying process. The first is shrinkage, which causes vertical forces on walls. A 5% removal equals 10% shrink and 10% removal equals 16% shrink.

Lower angle of repose and internal friction: It creates more wall tension and less vertical load. In some cases, part of the silo is filled and dried and there is a break before any more grain is added. This dried grain has shrunk and the grain is putting the wall into tension. The new grain needs to be dried and has a higher internal friction angle. This creates a point of discrepancy where these two layers meet. This location may be where some re-corrugations take place.

This article was edited and shortened for use in *Oilseeds Focus*. For more information and the original article, visit *www.abchansenafrica.co.za.*

Oilseed prices under pressure

By Christiaan Vercueil, agricultural economist, Grain SA

Oilseed prices recently came under increasingly greater pressure in the international market. The global oilseed market is highly dependent on the entire oilseed complex, because of the very strong substitution competition between the different sources of vegetable oils. The main commodities contributing to vegetable oil production includes soya beans, sunflowers, canola and especially palm kernels.

As is illustrated in *Figure 1*, oilseed production has seen a 3,2% increase from the 2021/22 to the 2022/23 season with production also increasing by 4,8% compared to the four-year average. Of the aforementioned commodities, the only one to show a decrease in production is sunflower with a decrease of 12% from the previous season.

This drop in production is, however, more than offset by the increases in production shown by the other oilseed commodities. Soya bean production is by far the greatest contributor to world oilseed production, with an expected 369,64 million tons to be produced in the current marketing season (2,7% higher than the previous season).

Figure 2 illustrates how, in the 2019/20 season, closing stocks for the four main oilseeds fell by 26% and remained at low levels. In 2021/22, closing stocks recovered. In the current season expectations regarding the closing stocks of these commodities are 2,2% lower than the previous season, but still 15,6% higher than the four-year average. The higher closing stocks could be putting pressure on international oilseed prices in the longer term.

Local market outlook

In the local market, the situation is similar to that of international trends. Increased soya bean production in South Africa is also boosting the availability of oilseeds. This, in turn, is putting pressure on the entire oilseed complex in South Africa.

In the monthly supply and demand estimate (*Table 1*) major production is reflected in the large figure for exportable surplus of soya bean. At the end of the current season, Grain SA estimates that

Figure 1: Global oilseed production. (Source: PSD online)

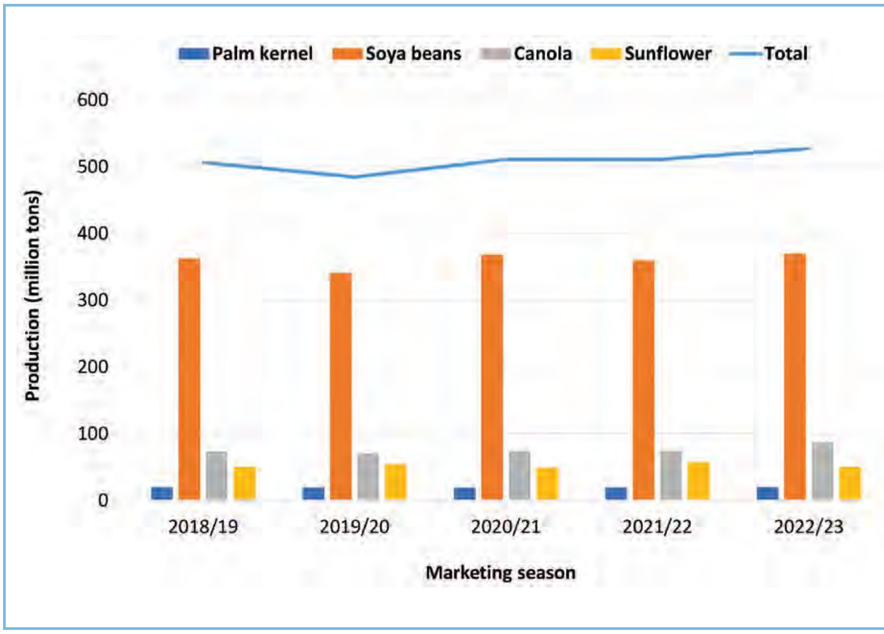


Figure 2: Global oilseed closing stocks. (Source: PSD online)

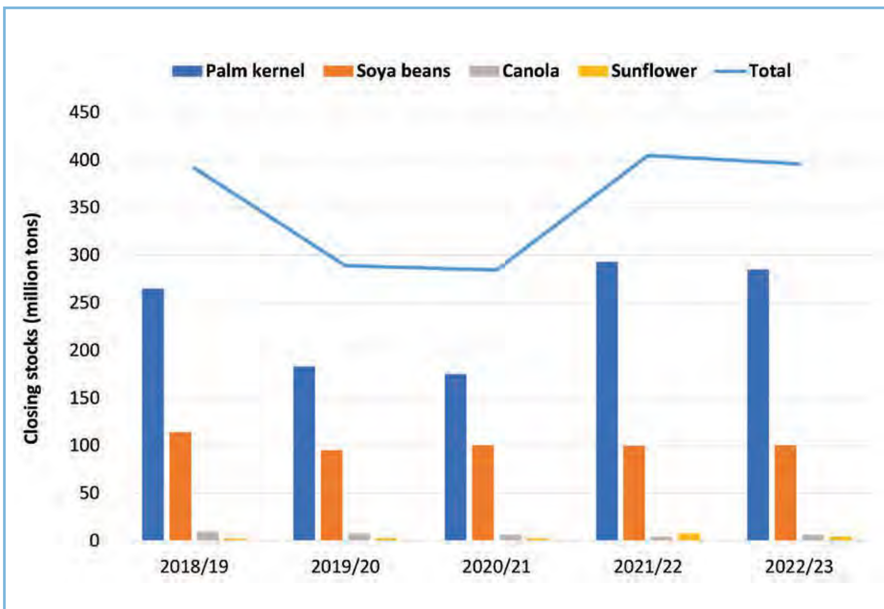


Table 1: Supply and demand estimate of soya beans in South Africa, April 2023. (Source: Grain SA)

	Third production forecast (26 April 2023)
Marketing year	**2023/24***
Area planted (x1 000ha)	1 148
Yield (ton/ha)	2,40
CEC crop estimate ('000 tons)	2 755
Available for commercial deliveries	2 725
Commercial supply	**Grain SA ('000 tons)**
Opening stocks (1 March)	171,9
Commercial deliveries	2 725,3
Total commercial supply	**2 897,2**
Commercial demand	
Commercial consumption	
Food	22,1
Feed (full-fat soya)	192,5
Crushed for oil and oilcake	1 800
Total	**2 014,6**
Total SA soya bean demand	**2 026,1**
Exports	619,0
Total commercial demand	**2 645,1**
Carry-out (28 February)	**252,1**
Pipeline requirements	251,8
Surplus above pipeline	**0**

there will be an exportable surplus of about 600 000 tons of soya beans, even with a large local consumption figure of more than two million tons. Local consumption might be hindered by the lack of processing power due to load shedding; hence the consumption figure might be susceptible to moderate changes.

In conclusion

With current major oilseed production figures in South Africa, especially that of soya beans, prices are more likely to remain closer to export parity. If prices were to dip below export parity, exports will be responsible for supporting prices back to export parity levels. Sunflower oil production will be subject to local prices and with lower sunflower production, sunflower imports will likely occur towards the end of the season as crushing will no longer be economically viable.

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Global oilseeds markets and trade: Soya bean trade remains strong

Issued by the United States Department of Agriculture's Foreign Agricultural Service

Soya bean trade in 2022/23 is forecast well-above last year, owing mostly to record production in Brazil and strong global demand. While import demand has plummeted in markets such as Bangladesh, Pakistan and Egypt, this is mostly offset by growth in markets including Argentina and China. Argentina is forecast to have the largest growth in 2022/23 as crushers look to supplement waning domestic production with imports from other South American producers, especially Brazil and Paraguay.

Soya bean meal and oil

Conversely, global trade of soya bean meal and oil is forecast lower. The drought in Argentina is the primary driver, constricting crush and production of soya bean meal and oil in the world's largest exporting country of both. For soya bean meal, global 2022/23 imports are forecast 4,2 million tons lower than the previous marketing year – the lowest level in six years. Soya bean meal imports are down in most countries, but the biggest drops are in the Middle East, Southeast Asia and the European Union (EU).

Meal exports are forecast up from Brazil and the United States (US); however, supplies will be insufficient to entirely offset the losses in Argentina. Importers are expected to increase purchases of soya beans and other substitutable protein meals such as rapeseed and sunflower seed meal.

For soya bean oil, imports are forecast to be the lowest in five years driven by lower Argentina exportable supplies and strong US renewable diesel production, which has rendered US soya bean oil export prices uncompetitive on the global market. Soya bean oil trade is further dampened by the announcement that the Brazil biodiesel blend mandate has been raised to 12%, putting further pressure on exportable supplies. As a result of tighter global exportable supplies and higher industrial consumption, soya bean oil as a percentage of global vegetable oil consumption is forecast to fall below 30% in 2022/23 for the first time in nearly a decade. Despite lower soya bean oil food use, global vegetable oil food consumption is forecast up in 2022/23 on gains in palm, rapeseed and sunflower seed oil consumption.

EU rapeseed trade, consumption

The EU is projected to import, crush and consume record volumes of rapeseed this year. Imports are forecast at 6,7 million tons, 30% higher than the previous five-year average. Demand for rapeseed in the EU has long outpaced domestic production following several years of drought and the 2018 ban on neonicotinoid pesticides, with harvested area decreasing almost 10% since the policy was enacted.

While EU domestic rapeseed production is expected to rebound in 2022/23, global exportable supplies are also up, with total production nearly 20% higher than last year. A record crop in Australia (the EU's main rapeseed supplier) and increased rapeseed exports from Ukraine suggest that the EU will capture more than a third of global rapeseed trade in 2022/23.

Demand for protein meal has recently driven more of the rapeseed crush value in the EU given the reduction of exportable soya bean meal supplies in Argentina. Prices for rapeseed meal have continued to trade at a discount

Figure 1: Soya bean export prices in 2022/2023

Figure 2: Soya bean meal export prices in 2022/23.

Table 1: Global supply and distribution of soya bean oil (in thousand metric tons).

	2018/19	2019/20	2020/21	2021/22	Mar 2022/23	Apr 2022/23
Production						
China	15,232	16,397	16,666	15,680	16,486	16,307
United States	10,976	11,299	11,350	11,864	11,882	11,882
Brazil	8,180	8,998	8,951	9,762	10,160	10,256
Argentina	8,044	7,700	7,930	7,664	6,965	6,323
European Union	2,850	2,964	3,002	2,926	2,784	2,785
India	1,728	1,550	1,800	1,530	1,750	1,750
Mexico	1,135	1,110	1,145	1,171	1,199	1,199
Other	7,928	8,483	8,430	8,547	8,983	8,770
Total	**56,073**	**58,501**	**59,274**	**59,144**	**60,209**	**59,272**
Imports						
India	3,000	3,626	3,251vv	4,231	3,150	3,150
China	783	1,000	1,231	291	1,000	800
Bangladesh	1,036	696	676	689	600	600
Peru	539	521	594	471	570	550
Morocco	536	573	507	529	550	525
Algeria	899	693	632	571	575	450
European Union	419	483	493	459	450	450
Korea, South	328	402	407	392	370	370
Colombia	343	387	285	317	335	300
Egypt	270	375	428	215	350	300
Other	2,873	2,779	3,275	3,345	2,993	2,792
Total	**11,026**	**11,535**	**11,779**	**11,510**	**10,943**	**10,287**
Exports						
Argentina	5,268	5,404	6,137	4,873	4,750	4,100
Brazil	1,085	1,156	1,262	2,409	2,350	2,400
European Union	977	909	1,065	971	1,075	1,075
Russia	572	641	561	480	650	650
Paraguay	652	631	562	371	585	585
Bolivia	393	408	525	510	390	390
Turkey	132	176	264	289	270	280
Other	2,401	3,049	2,241	2,337	1,754	1,718
Total	**11,480**	**12,374**	**12,617**	**12,240**	**11,824**	**11,198**
Domestic consumption						
China	15,850	17,000	17,600	16,650	17,100	16,700
United States	10,376	10,122	10,575	11,262	11,816	11,816
Brazil	7,165	7,750	7,950	7,450	7,900	7,925
India	4,750	5,125	4,950	5,825	4,940	4,940
Argentina	2,624	2,175	2,042	2,660	2,340	2,340
European Union	2,255	2,380	2,430	2,405	2,280	2,280
Mexico	1,240	1,285	1,300	1,300	1,320	1,320
Bangladesh	1,254	1,264	1,205	1,100	1,100	1,000
Egypt	895	915	1,075	980	1,025	960
Algeria	755	785	825	850	890	875
Iran	615	650	725	800	850	850
Korea, South	505	535	580	590	560	570
Peru	525	535	540	555	570	550
Morocco	510	520	510	525	530	525
Japan	488	482	458	533	475	516
Other	5,396	5,520	5,685	5,753	5,655	5,528
Total	**55,203**	**57,043**	**58,450**	**59,238**	**59,351**	**58,695**
Ending stocks						
United States	805	840	967	903	878	878
China	536	778	1,033	240	536	557
Brazil	324	482	470	405	335	411
Argentina	427	548	299	523	398	406
European Union	282	440	440	449	334	329
Other	2,382	2,287	2,152	2,017	1,921	1,622
Total	**4,756**	**5,375**	**5,361**	**4,537**	**4,402**	**4,203**

Most countries are on an October/September marketing year (MY). Mexico is on a September/August MY. Paraguay and Peru are on a January/December MY and Bolivia is on a March/February MY.

compared to soya bean meal since last spring, with the discount increasing since the beginning of the calendar year.

EU rapeseed oil prices also dropped below palm oil prices for the first time in two decades in March, encouraging an increased share of rapeseed oil feedstock in biofuel production and providing an alternative option for food consumption.

PSD database additions

Soya bean meal country additions

As of this publication, the USDA's Production Supply and Distribution (PSD) database has been expanded to include soya bean meal balance sheets for Azerbaijan, Cambodia, and Cote d'Ivoire starting in marketing year 2013/14. The three countries are forecast to import a combined 485 000 tons of soya beans in 2022/23 (October to September). These additions account for much of the change in the soya bean meal trade balance in April this year.

Overview of 2022/23

Global oilseed production is lowered 4,5 million tons to 625 million on reduced Argentina and Uruguay soya bean crops due to continued deterioration from drought conditions, with some mitigation coming from Brazil soya beans.

Oilseed trade is little changed from March this year with Uruguay soya bean export reductions mostly offset by increases from Canada and Ukraine. However, meal exports are down two million tons on lowered Argentina exports. Global production of meal is down three million tons on lower Argentina and Bangladesh soya bean meal.

Production of oil is little changed with reductions in soya bean oil from Argentina offset by higher rapeseed oil from Bangladesh. Oil exports are little changed. The projected US season-average farm price is unchanged at US$14,30 per bushel.

Export prices

Average soya bean prices were lower in March for all major exporters in anticipation of the impending record Brazil harvest. Brazil prices fell the most, increasing the discount versus other exporters. Following a several-month trend, global soya bean export prices were also pressured downward by soya bean oil prices amid ample supplies of other vegetable oils as crush margins were less attractive for processors.

As of the beginning of April this year, South America soya bean oil is trading at a premium to palm oil. Soya bean meal prices were also lower on average in April for the first time since December last year.

This article has been shortened for publication in *Oilseeds Focus*. To read the full article, visit *www.apps.fas.usda.gov/psdonline/circulars/oilseeds.pdf.*

Ukrainian grain exports explained

Since the beginning of Russia's invasion of Ukraine in February 2022, Ukrainian exports of grain have been severely disrupted. For over four months, Russian military vessels have been blocking Ukrainian ports in the Black Sea.

On 22 July 2022, an agreement was brokered by the United Nations and Türkiye to open a safe maritime corridor in the Black Sea (the Black Sea Grain Initiative). Since then, over 900 ships full of grain and other foodstuffs have left three Ukrainian ports: Chornomorsk, Odesa and Yuzhny/Pivdennyi.

While unblocking the sea export route has helped to address the global food security crisis and lower grain prices, the export backlogs remain significant.

What has been exported so far?

As of March 2023, over 23 million tons of grain and other foodstuffs have been exported via the Black Sea Grain Initiative.

Figure 1: Black Sea exports. (Source: Black Sea Grain Initiative Joint Steering Committee)

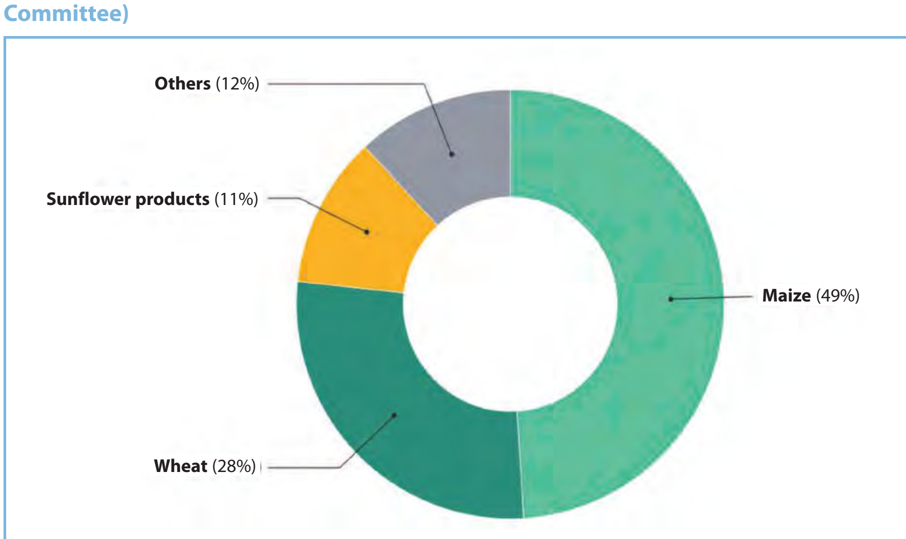


Figure 2: Share of grain export by country wealth. (Source: Black Sea Grain Initiative Joint Steering Committee)

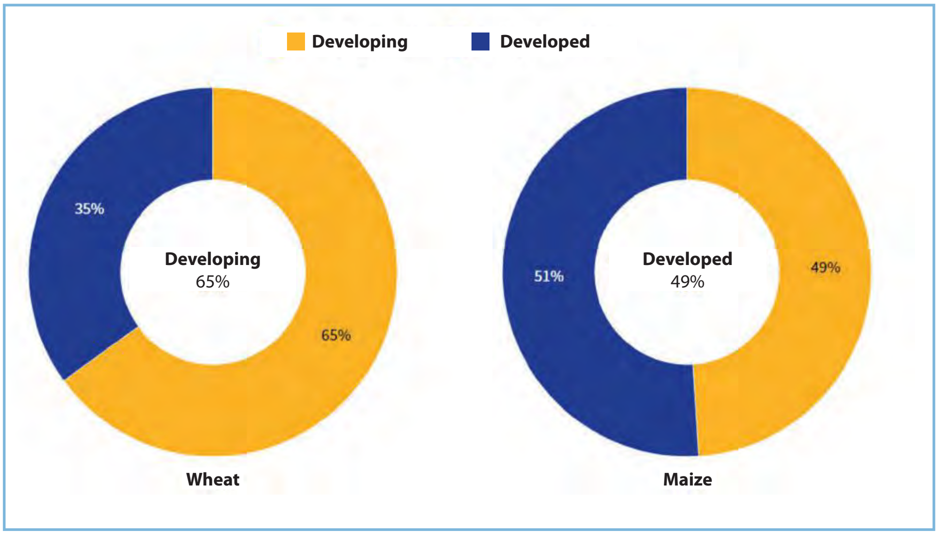
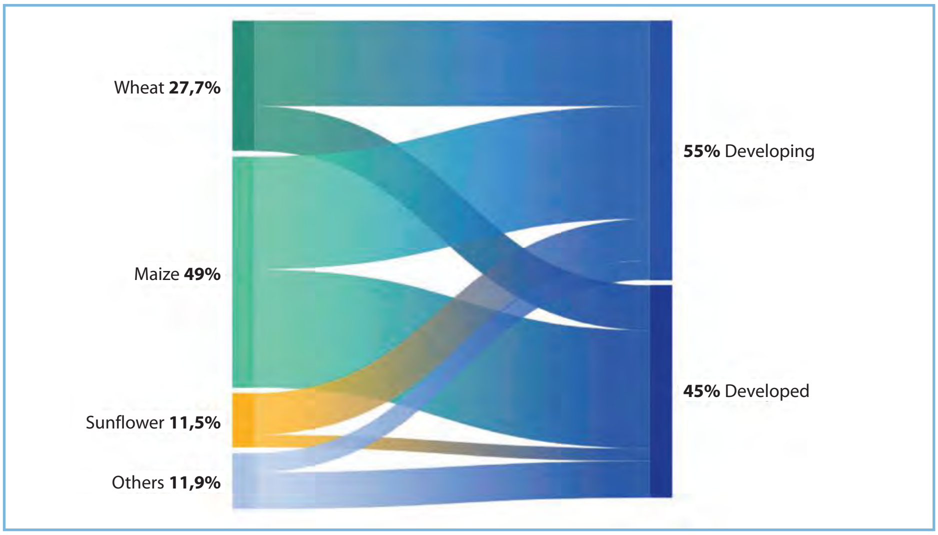
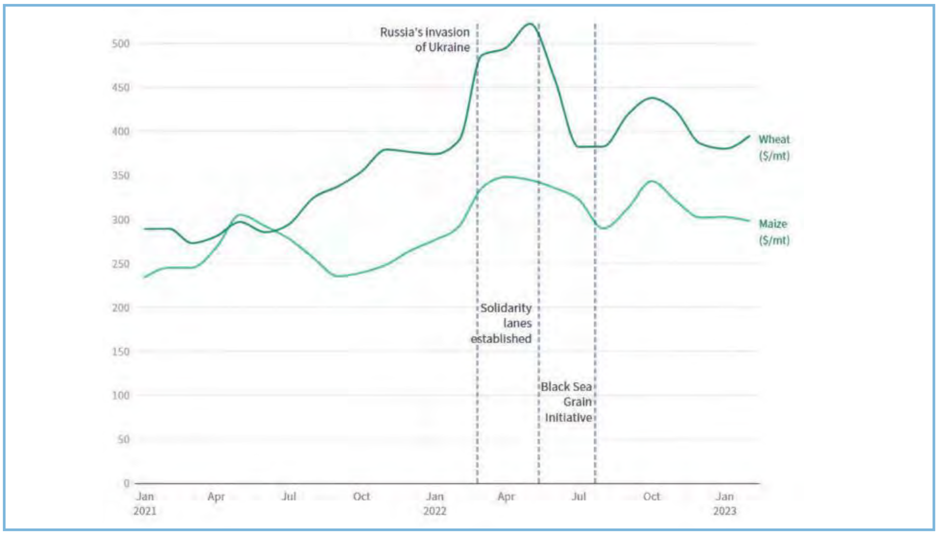


Figure 3: Share of export by commodity and destination. (Source: Black Sea Grain Initiative Joint Coordination Centre)



Percentages stand for share of total grain exported via the Black Sea route.

Figure 4: Food price changes due to the war. (Source: World Bank)



Almost 49% of the cargo was maize, the grain most affected by blockages in Ukrainian granaries at the beginning of the war (75% of the 20 million tons of grain stored). It had to be moved quickly to make space for wheat from the summer harvest.

Where is grain shipped to?

Over 65% of wheat exported through the Black Sea Grain Initiative reached developing countries. Maize is exported almost equally to developed and developing countries.

The United Nations World Food Programme (WFP – the largest humanitarian organisation in the world) has restarted shipping wheat from Black Sea ports. Before the war, the WFP bought half of its grain stock from Ukraine. So far over 456 000 tons of wheat have left Ukrainian ports *en route* to Ethiopia, Yemen, Djibouti, Somalia and Afghanistan.

The European Union (EU) is a major global producer and exporter of wheat. In 2022, according to estimates, the EU exported around 36 million tons of soft wheat. Destination countries include Algeria, Morocco, Egypt, Pakistan and Nigeria.

Food prices influenced by war

Russia's invasion of Ukraine has caused a significant increase in food prices on global markets. The prices of grains have risen particularly sharply. Both solidarity lanes (routes created by the EU to help Ukraine export its agricultural products, among others) and the Black Sea Grain Initiative have notably contributed to lowering prices.

Maintaining Ukrainian grain flow remains crucial for ensuring global food security.

Article originally published by the European Council of the European Union. Follow this link to view the original article: *www.consilium.europa.eu/en/infographics/ukrainian-grain-exports-explained.*

Update: Effect of fertiliser prices on the grain industry

By Christiaan Vercueil, agricultural economist, Grain SA

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

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

Import volume and price changes

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

As of 2009, fertiliser imports for these four products have increased by 103% in total. During 2021, South Africa imported a total of 1 803 348 tons of just these four fertiliser products from various countries. Besides the increase in import volume, the exchange rate of the Rand to other major currencies also weakened sharply from 2009 onwards, which further intensified the effect of price increases. In 2022, almost 1,6 million tons of these four products had been imported, showing a 12% decrease from 2021.

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

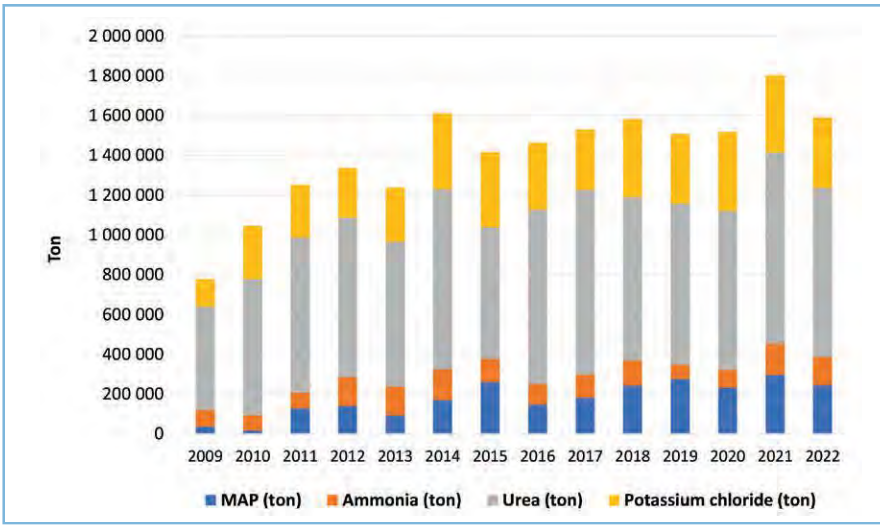


Table 1: Price comparison of nitrogen, phosphate and potassium for April 2022 and April 2023.

	Nitrogen	Phosphate	Potassium
Average price: April 2022 (R/kg)	R47,20	R95,70	R47,70
Average price: April 2023 (R/kg)	R28,90	R68,60	R28,70
Change (year-on-year)	-39%	-28%	-40%

Table 1 contains the average price changes for nitrogen (N), phosphate (P) and potassium (K) during April last year, compared to April 2023. It is a welcome relief to see a slight decline in prices compared to the previous year.

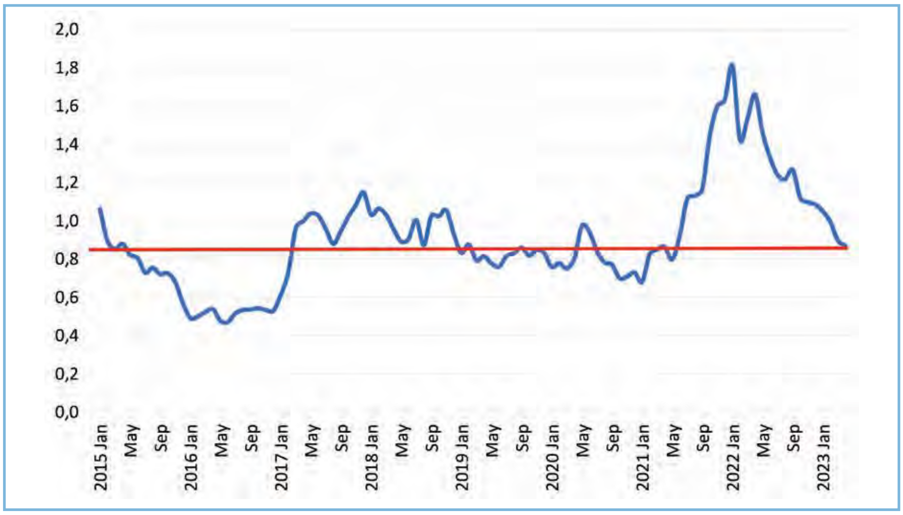
Looking at the fertiliser requirements of different regions of the country, the western Free State uses and average of 72 units of N, 16 units of P and 14 units of K per hectare; the eastern Free State uses 100 units of N, 19 units of P and 27 units of K per hectare. Irrigated areas use 286 units of N, 52 units of P and 80 units of K per hectare.

Table 2 provides a comparison of the average fertilisation requirements for these three regions for April 2022 and April 2023.

Table 2: Change in fertiliser cost per hectare for April 2022 compared to April 2023.

	Nitrogen	Phosphate	Potassium	Price: January 2022	Price: January 2023	Change
Eastern Free State: Average units (kg/ha)	100	19	27	R7 826	R4 968	-37%
Western Free State: Average units (kg/ha)	72	16	14	R5 597	R3 580	-36%
Irrigation: Average units (kg/ha)	286	52	80	R22 292	R14 129	-37%

Figure 2: The affordability of fertiliser.



On average, the cost of fertiliser declined by 36%.

Fertiliser affordability

Figure 2 indicates the affordability of fertilisers compared to the Safex price of maize. Fertilisers, which account for between 30 and 50% of input costs, have become less and less affordable, which means that the producer's margin for trade has weakened excessively. This puts pressure on the producer's profitability and can result in fewer hectares being planted, especially maize. Recently, fertiliser prices have declined due to the market becoming more accustomed to the Russian-Ukraine war and declining energy prices.

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

Although fertiliser prices are following a downward trend and, according to the affordability index, are becoming more affordable, inputs for the current season were purchased when prices were higher.

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

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

Study of market reactions to China-US friction

By Ping Li, Tian Wen, Lei Chen and Yunbi An

Former president of the United States, Donald Trump, announced in March 2018 that the US would impose tariffs of 25 and 10% on Chinese steel and aluminium, respectively, for an extended period, marking the beginning of trade friction between China and the US.

Over the following year, each country issued three rounds of measures to impose tariffs on the other, involving hundreds of billions of dollars in Sino-US trade. China's tariff countermeasures focussed mainly on agricultural product trade, including soya beans which, as the largest single commodity in Sino-US trade, have become the focus of trade friction between China and the US.

China and the US are interdependent partners in the soya bean trade. Thus, this trade friction situation comprises a major risk event for the soya bean futures markets of China and the US. In 2018, the US provoked Sino-US trade friction on the grounds that China had an immense trade surplus with the US. It is undeniable that while China has made great achievements in the development of foreign trade, it has encountered an increasing number of trade barriers around the world.

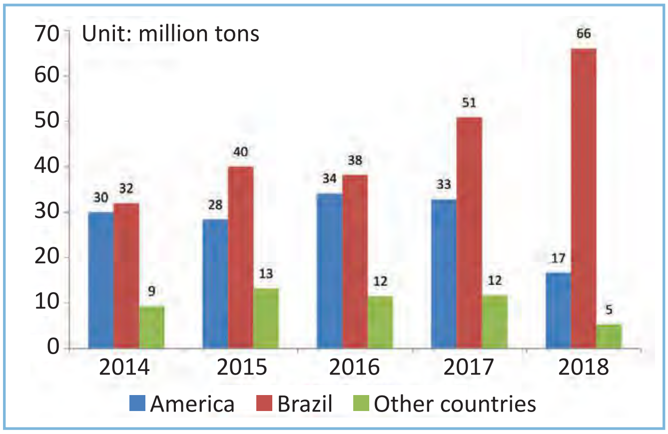
The impact of trade tariff barriers on the volatility and return of the soya bean futures market was investigated by using the major risk event of Sino-US trade friction.

Before and after trade friction

Trade friction weakened the return spillover effect between soya bean futures markets in the two countries. A leverage effect was evident in the fluctuations of both markets before and after trade friction. After trade friction, the Chinese soya bean futures market became less sensitive to the positive shock of tariff measures, whereas no significant change was observed in the US soya bean futures market.

The sample of trade friction was divided into periods of three rounds of tariff increases to further analyse the dynamic changes in the impact of tariff increases on soya bean futures markets in both countries. The empirical results indicated that although the scale of the three rounds of tariff increases was amplified, the impact on the return spillover effect between the soya bean futures of China and the US was weakened.

Figure 1: Source of China's soya bean imports.



Further, the sensitivity of China's soya bean futures market volatility to the positive shock of tariff increases gradually decreased, as did the continuity of the volatility. Conversely, the sensitivity of the US soya bean futures market to the negative shock of tariff increases gradually escalated, while the volatility persistence gradually decreased.

Market reaction

From the perspective of market volatility, trade friction significantly increased the volatility of the two markets but had a greater impact on the US soya bean futures market. In contrast, the effect of the shock of the three rounds of tariff increases on the volatility of China's soya bean futures market gradually weakened.

At the same time, the three rounds of tariff increases and the expansion of soya bean imports from Brazil and other countries helped ease the volatility of China's soya bean futures market, whereas the decline in US soya bean exports to China aggravated the volatility of the US soya bean futures market.

From the perspective of the short-term shock of the announcement of tariff increases to the returns of soya bean futures markets in China and the US, China's soya bean futures market showed significant positive, cumulative, abnormal returns after three rounds of tariff increases. However, the cumulative abnormal return gradually decreased and the overreaction gradually weakened.

Although the soya bean futures markets of China and the US were impacted by the Sino-US trade friction, the reaction of the futures market is becoming increasingly moderate. This is evident in soya bean futures prices, which have already partly reflected the expectation that trade friction will worsen. Furthermore, the results of this study indicate that exporters are more affected by trade friction than importers.

As global integration continues to face increasing challenges, this study provides a reference for futures market investors and regulators to contend with the market risks induced by trade friction.

This article was condensed for publication in *Oilseeds Focus*. For more information, email Ping Li at lip@uestc.edu.cn. To view the full article, visit *www.doi.org/10.1016/j.jmse.2022.12.002.*

Is soya sufficient in the NSNP?

By Dr Carmen Muller, Dr Beulah Pretorius and Prof Hettie Schönfeldt, University of Pretoria

The South African National School Nutrition Programme (NSNP) was introduced in 1994 by the government as part of the Reconstruction and Development Programme to feed primary school children.

In 2006 a survey conducted by the Fiscal and Finance Committee confirmed that a need existed to extend the programme to secondary schools. Subsequently, in 2008, the minister of finance announced a budget for the inclusion of secondary schools in the programme. Currently, the NSNP reaches more than nine million pupils in around 20 000 schools all over South Africa. Soya plays a cardinal role in this programme as it features at least once a week on the menu across all nine provinces.

A research study funded by the Oil and Protein Seeds Development Trust (OPDT) in 2018 titled 'The role of soya in the South African National School Nutrition Programme' delivered some concerning results regarding soya consumption in the NSNP. A follow-up study titled 'Building an evidence base for soya served in the National School Nutrition Programme' was conducted to further investigate the causes of a dislike of soya within the NSNP.

Results from these studies found that prepacked bags of soya delivered by suppliers contain large amounts of additives that were assumed to be maize meal and flavouring. Results showed that up to 60% of a bag of soya, as supplied by registered accredited vendors to schools, was powder and not soya chunks.

This raises the question whether the supplied soya mince is compliant with the specifications stipulated by the Department of Basic Education (DBE). (This product of lower quality leads to the final cooked product being an unappealing mush that pupils are not willing to consume and which does not comply with the guidelines as set out by the DBE.)

Involvement of the DBE

Research studies led to various consultations with the DBE. During these consultations, numerous concerns were raised by the DBE on how to either improve soya meals within the NSNP or remove soya from the menu. The valuable data presented by the researchers motivated the DBE to keep soya in the NSNP and rather investigate options on how to improve the product offering and decrease the likelihood of lower quality soya products being supplied.

As a point of departure, the guidelines set out for soya in the NSNP need to be revised. It is recommended that the guidelines to soya suppliers within the NSNP be more specific, stringent and better implemented.

Soya guidelines

Current DBE guidelines state the following regarding soya mince in terms of composition per 100g dry product:

- Moisture content shall not exceed 9g.
- Protein content shall be at least 24g from soya protein.*
- Energy content should not be less than 1 365kJ.
- Sodium content shall not exceed 1 500mg.
- Calcium content shall be 150mg.
- Iron content shall be 13,3mg.
- Zinc content shall be 3,7mg.
- Dietary fibre should be 4g.
- Product should not contain more than 10% fat from other sources than soya protein product (SPP) or polyunsaturated vegetable oil.

**Protein content is currently under review and is recommended to be increased to 30g per 100g dry product.*

The guidelines also state that the SPP shall remain the main ingredient of the final product. This statement is open for interpretation as to what percentage can be referred to. More specific and enforceable guidelines are required that state exactly what the ratio of soya chunks to powder and additives can be. This should be accompanied by anonymous audits conducted in respect of suppliers and submitted to the NSNP.

Practical solutions

This research presented to the DBE caught the attention of the nutrition fraternity and the researchers presented on the topic at the biennial Nutrition Congress, co-hosted in April 2023 by the Association for Dietetics in South Africa and the Nutrition Society of South Africa. This congress brings together nutrition and dietetic collaborators from South Africa, Africa and further afar to deliberate the nutrition-related challenges that impact heavily on the health and quality of life of so many, as well as to consider potential relevant and practical solutions.

A presentation titled 'Investigating soya as a crucial food in the South African National School Nutrition Programme' proved to be a thought-provoking presentation during the session on nutrition interventions. Valuable feedback was gained from conversations held during the session regarding the important role of soya as a source of protein in these children's diets, and the interventions required to ensure that high quality soya is served.

Overall, researchers as well as the DBE agree that soya plays a valuable role in the NSNP. Industry and other relevant role-players should work together to ensure that soya of the highest quality is served to pupils to ensure that children develop a taste for soya from a young age.

For more information, visit *www.education.gov.za/Programmes/NationalSchoolNutritionProgramme.aspx* or send an email to hettie.schönfeldt@up.ac.za.

Plant-based proteins from soya bean: Health benefits and soya product development

By Pingxu Qin, Taoran Wang and Yangchao Luo, Department of Nutritional Sciences, University of Connecticut, US

Proteins are essential to human nutrition and health, and it is crucial for the development of the human body. While animal proteins have been the primary dietary protein source for decades, there has been a paradigm shift in recent years in the dietary consumption patterns among the general population towards plant-based food proteins.

As a result, plant protein production in the food industry has skyrocketed. Research has led to a closer look at diverse plant sources and their capacity to replace conventional animal-based proteins for health and environmental reasons. Soya protein is a high-quality protein with a protein digestibility-corrected amino acid score (PDCAAS) of one (1) which is close to some of the proteins from animal sources such as meat and dairy.

Soya proteins contain well-balanced essential amino acids except for sulphur-containing ones such as methionine. They also have desirable textures with endless possibilities to formulate various sophisticated soya-based food products. Due to their high protein content and versatility in developing food products, soya proteins are the primary supply of plant-based proteins and are widely consumed by diverse populations worldwide.

This review briefly compared plant-based proteins with animal proteins regarding their health and environmental benefits, amino acid composition and protein digestibility. The relationship between soya protein consumption and chronic diseases such as cardiovascular diseases, women's menopausal symptoms, osteoporosis, cancer and abdominal body fat is analysed.

Animal vs plant-based proteins

Protein quality generally relates to its composition of essential amino acids and its digestibility in the human body after consumption. Animal proteins such as meat, eggs and milk are widely considered to have complete amino acids, known as 'complete protein packages'. In other

Table 1: Soya consumption per day.

Population	Soya and soya foods	Soya protein
Vegetarians	NA	8,42g – 9,25g
United States (US)	NA	NA
Korea	21,7g	7,4g – 8,5g
Japan	50,7g – 102,1g	6g – 11,3g
China	23,5g – 135,4g	2,5g – 10,3g

Adapted from reference Rizzo and Baroni (2018). NA, not available.

Table 2: Influence of food processing on soya bean protein digestibility.

Food processing	Protein evaluation method	Results
Cooking (100°C, 30 min)	IVPD (%)	89,8
Autoclaving (123°C, 20 min)	IVPD (%)	81,3
Fermentation (Bacillus Natto, 25°C, 48h)	IVPD (%)	90
Unfermented	IVPD (%)	83
Protein isolate	IVPD (%) PDCAAS 100	93 100
Protein concentrate	IVPD (%)	100

IVPD: In vitro protein digestibility. Adapted from Sá, Moreno and Carciofi. (2020).

words, animal proteins contain all nine essential amino acids.

Protein digestibility indicates the proportion of ingested amino acids that can be made available for utilisation by the body after digestion and absorption. In general, animal proteins have a high digestibility (> 95%), meaning that most animal proteins can be utilised after digestion. Plant-based proteins, on the other hand, are often lacking one or two of the essential amino acids, which therefore have been regarded as 'incomplete protein packages'. Soya protein is, however, considered to have a high protein quality.

Soya bean protein

Soya beans, a species of legumes, have a long cultivation history in Asia. In the early 90s, soya beans were already known for their protein-rich composition and other nutritional benefits. Unlike most legumes, soya beans have a high protein quality, making soya beans and their food products excellent plant-based protein sources. Soya beans contain ~35 to 40% protein, ~20% lipids, ~9% dietary fibre and ~8,5% moisture based on the dry weight of mature raw seeds.

Different cultivation environments, such as wild and cultivation conditions, make soya beans differ in their protein compositions. Stimuli such as genetic modification can also change soya protein expression.

Two out of four protein groups are found in soya protein: albumins (water-soluble) and globulins (salt soluble). The primary protein type in soya beans is globulin. When treated by ultracentrifugation, two major storage proteins – glycinin (11S) and β-conglycinin (βCG, 7S), accounting for 30 and 40% of soya protein, respectively – can be separated.

Table 1 shows a summary of the daily (g/d) consumption of the population in different countries, along with vegetarians (worldwide) as a separate group. There is no current data available for European countries as they do not consume a significant amount of soya products. The Asian population consumes a significant amount of soya and its by-products like tofu, soya milk and soya sauce. Vegetarians have a high intake of soya protein daily.

Applications in the food industry

Soya milk is a typical soya protein product and is one of the most popular non-dairy milk substitutes. Other products such as soya oil, meals, soya sauce and tofu are manufactured through diverse processing technologies. Moreover, with well-developed techniques, the quality of soya protein can be improved through food processing: cooking, soaking, germination, extrusion, fermentation, protein concentration and isolation.

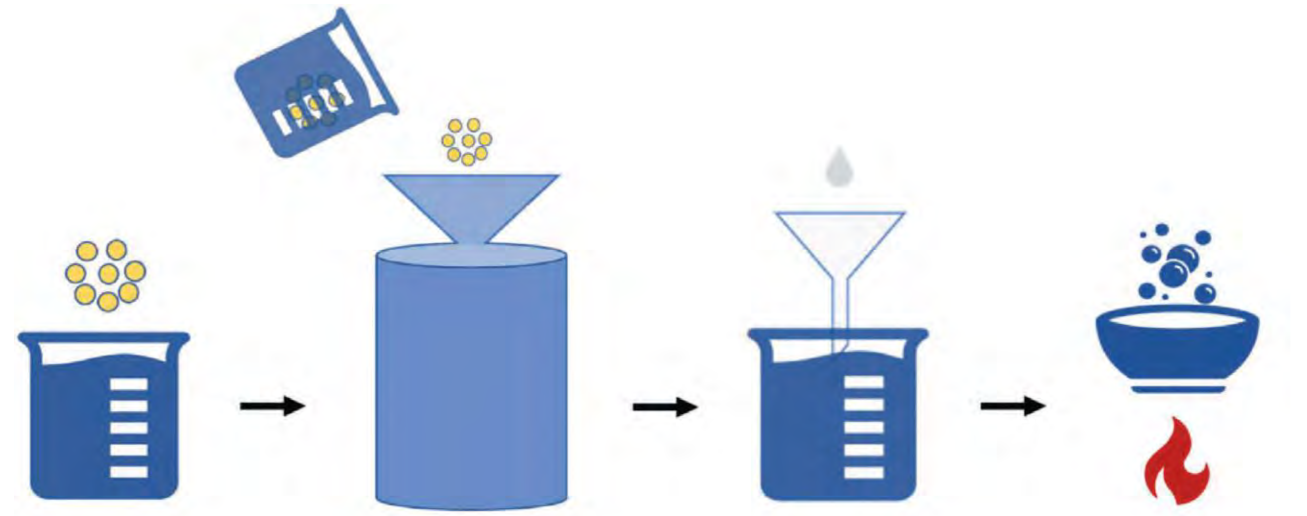
Table 2 summarises different food processing methods of soya bean protein and their influence on digestibility. Heating treatments (cooking, irradiation and autoclaving) are commonly involved in plant-based protein processing. It has shown a significant reduction of toxic compounds and anti-nutritional factors in soya protein. Non-thermal processing methods, such as fermentation and protein isolation/concentration, are used in soya protein product development to avoid overheating that causes protein denaturation.

Heating process

Thermal processing is commonly involved in plant-based protein manufacturing, and heat can significantly impact protein quality. The most suitable soya protein cooking temperature is 100°C for no more than one hour. The heating process contributes to the degradation of large protein molecules to small peptides and amino acids for better absorption.

However, overheating can cause protein aggregation, thus reducing the number of amino acids released in the intestinal tract and lowering the bioavailability and protein nutritional values. Autoclaving is

Figure 1: Flow chart of the soya milk manufacturing process.



a cooking technique under high pressure, and it is often used to reduce food micro-organisms and undesirable compounds to level up protein digestibility.

Protein isolation/concentration

Soya protein is isolated from soya beans through a series of treatments, including dehulling, flaking and defatting. It can be processed into three high-protein commercial products: soya flour, concentrates and isolates.

Among them, soya protein isolate (SPI) is the most refined form, with a protein content > 90% and improved digestibility. The production process of the SPI can remove rigid cell walls and anti-nutritional factors, having a huge impact on protein digestibility in the gastrointestinal phase.

Fermentation

Fermentation is commonly used for low-cost processing with improved bioavailability. *Aspergillus* and *N. subtitles* are two primary strains of micro-organisms used in the enzymatic fermentation process. Soya proteins and other larger molecules can be broken down into small peptides and amino acids through enzymatic fermentation, thus increasing protein bioavailability. Fermented soya products have an increased protein content.

The fermentation of soya beans is also a widespread practice in Asia because this is considered as the main processing technique to create products unique to the Eastern culture. Many traditional technologies to ferment soya beans have then been developed, including the pasting process to manufacture fermented soya beans. This has helped to promote a general preference for plant proteins in Asian countries over animal proteins.

Soya sauce is perhaps one of the most common fermented soya products used in Asian culture for food seasoning. The sauce is dark brown and usually prepared through fermentation of soya bean paste and roasted grain in brine with the presence of certain fungi.

Unfermented products

Soya milk is a ubiquitous unfermented soya-based protein product that can be found everywhere in the grocery store. The technology used to produce soya milk from plant substitutes is straightforward. Seeds are soaked, ground in water and boiled after filtration (*Figure 1*).

Tofu, also known as soya bean curd, is a soft and smooth soya product made from hot soya milk. Tofu is another common soya-based protein product made from soya beans created by grinding soaked seeds in water to make soya milk. The filtered milk is boiled, and coagulants promote the formation of curds that are collected and compressed.

Health benefits

Plant protein whole foods, introduced by Ahnen, Jonnalagadda and Slavin (2019), refer to the plant protein in entire meals and often comes with additional health benefits. Similar to meat consumption, plant-based proteins are often consumed as a 'mixed diet'.

Many other nutrients from the entire plant are also ingested. Most of these extra components have a significant positive impact on human health, such as isoflavones, bioavailable iron, calcium, magnesium, dietary fibre and polyunsaturated fatty acids. The beneficial effects of soya protein on human life are coming from the interactions with other components.

Research on soya-based protein products have shown that they contain antioxidants (phytate, isoflavonoid), function as tyrosine kinase protein inhibitors, control cell life and death, reduce lipid and bile acid absorption from the gastrointestinal system, and improve anti-neoplastic enzyme activity.

The information demonstrates health benefits such as lowering cholesterol, decreasing symptoms of menopause, avoiding malignancies and boosting bone health.

Cardiovascular disease

Cardiovascular diseases (CVDs), such as heart disease, are the primary cause

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of mortality across the world. High cholesterol, hypertriglyceridemia, increased low-density lipoprotein cholesterol (LDL-C), reduced high-density lipoprotein cholesterol (HDL-C), high blood pressure, obesity and diabetes are preventable risk factors for CVDs.

Considerable research is suggesting that eating plant-based protein instead of animal protein products decreases cholesterol levels and may have other health advantages, especially in reducing the risk factors of CVDs. Early research suggested that soya protein consumption was highly beneficial to lower cholesterol, LDL and triglycerides. In contrast, some studies found that the intake of soya protein rich in isoflavones did not affect LDL reduction.

Menopausal symptoms

Decreased oestrogen levels in menopause can cause hot flashes, genital epithelial atrophy and osteoarthritis. Oestrogen treatment is considered to relieve or eliminate menopausal symptoms. Isoflavones, naturally present in soya beans, have a similar chemical structure compared to oestrogen. Many researchers have been focussing on how isoflavones in soya can be used to manage menopausal symptoms as a safer alternative to hormone treatment.

An observational study showed a beneficial effect on managing hot flashes of menopausal women using soya supplements. Numerous initial meta-analyses of randomised placebo-controlled studies have been conducted to examine the effects of isoflavones on menopausal symptoms. Ten studies showed a significant reduction of hot flashes reported in the treatment group (soya beans rich in isoflavones) compared to the placebo group.

Osteoporosis

During women's menopause, endogenous oestrogen decline leads to abrupt bone density loss. Hormone therapy was among the most used treatments for menopausal osteoporosis till the last decade. Soya products not only have high-quality proteins but are rich in isoflavones and calcium. Thus, soya-based protein products could contribute to bone health and prevent the risk of osteoporosis. According to several randomised controlled trials, treatment with soya proteins rich in isoflavones showed a reduction of the bone resorption turnover rate.

In addition, a study showed that intake of soya protein results in an increased bone calcium retention in females during the post-menopausal period, reflecting a positive bone balance, thus maintaining bone volume and increasing bone strength. Moreover, as an excellent dietary source of calcium, a higher intake of soya protein and its by-products can help meet daily calcium recommendations.

Cancer risks

Many studies indicate that cancer prevention can be achieved through healthy dietary intake. Soya products are rich in various nutrients that can suppress abnormal cell division and spread and can act as an anti-cancer inhibitor in different types of cancer. Soya-based products are well-studied plant protein food for cancer prevention.

Considerable research is suggesting that eating plant-based protein instead of animal protein products decreases cholesterol levels and may have other health advantages, especially in reducing the risk factors of CVDs.

One early study from Hirota *et al*. (2000) focussed on the DPPH free radical scavenging activity of molecular compounds from miso, a fermented soya bean product, indicating eight compounds in miso with high activity in cancer cell lines. Moreover, a compound called 8-hydroxy daidzein showed the highest DPPH free radical scavenging activity on human promyelocytic leukaemia cells.

Abdominal body fat

The efficacy of consuming soya protein on fat loss and preventing obesity has been demonstrated in animal and human research. Daily consumption of soya protein has been studied for its nutritive value and potent antioxidant benefits for many years. Several hypotheses for the anti-obesity impact of soya proteins include restriction of hepatic lipogenic enzymes and FA production, simulation of muscular FA oxidation, enhancement of plasma adiponectin levels and enhanced faecal matter excretion.

Dietary intake high in soya protein could have the potential to prevent hyperlipidaemia and obesity. The impact of soya intake on weight and other obesity-related characteristics has been investigated to unravel the underlying mechanisms by which soya products exert such health benefits.

An early study showed that soya isoflavones activate the peroxisome proliferator-activated receptor, thus improving lipid metabolism and generating anti-diabetic benefits. Furthermore, research proved that soya protein products rich in isoflavones have an anti-diabetic effect by suppressing insulin resistance. Kim *et al*. (2008) found that the fermented soya product, chungkukjang, can regulate blood glucose and increase plasma insulin levels in mice, thus ameliorating the symptoms of diabetes.

Conclusion

With increased popularity, plant-based protein products and plant-based whole food intakes are growing rapidly worldwide in the marketplace, and such a trend is expected to continue with more research reporting their beneficial effects on both human health and environmental sustainability compared to animal protein food products.

Soya, one of the well-studied plant protein sources, have been cultivated and consumed for centuries as an animal protein substitute for diverse populations. Although soya protein lacks some of the SAA, they have the highest protein quality among plant proteins and the quality is comparable to some animal proteins.

Even though many studies show evidence of the positive health effects of soya protein, there is still more space to be explored.

This article was shortened for publication in *Oilseeds Focus*. For the full article, visit *www.sciencedirect.com/science/article/pii/S2666154321001678.*

Efficiency of soya bean meal replacement by rapeseed meal and/or canola seeds in commercial layer diets

By Georgeta Ciurescu, National Research Development Institute for Animal Biology and Nutrition, Balotesti, Romania

Researchers have been invested in finding solutions for poultry feeding which support high layer performance at lower feeding costs.

Poultry feeding uses two main types of ingredients: cereal grains and vegetal industrial by-products. Maize is the most important feed ingredient due to its high nutrient levels, which provide high energy input. Maize protein has a low biological value, however, because two of the amino acids essential to non-ruminant feeding, lysine and tryptophan, are at very low levels. Hence, the need arose to supplement compound feed formulations with ingredients of high biological value.

Soya bean meal is the main source of vegetal protein used in poultry feeding because of its high protein level (44% non-dehulled and 46 to 50% dehulled), balanced composition of essential amino acids and because it has the highest lysine digestibility (91%) of all the available protein sources.

The compound feed industry uses partially defatted and full-fat soya bean meal. Although regarded as a strategic feed ingredient in many countries in Europe and Asia, soya bean meal is imported, hence the need to find alternative vegetal protein sources.

Rapeseed meal and/or canola seeds are potential alternative vegetal sources for poultry feeding, allowing cutting the feeding cost, provided the compound feed was formulated adequately.

The rapeseed meal made from whole seeds contains approximately 40% crude protein (on a dry matter or DM basis). Rapeseed meal protein is less digestible than that of soya bean meal (72 versus 88%), but the amino acids balance is similar or even better than in soya bean meal (for the sulphur amino acids) (Summers *et al*., cited by Koreleski, 1993). Considering the high level of insoluble polyosides and tannins from the teguments, the metabolisable energy is quite low and is one of the problems of this meal, in addition to the presence of glucosinolates.

Many studies conducted during the previous decades (Cowan *et al*., 1994; Khattak *et al*., 1996; Miles, 2002) have shown that the addition of enzymatic preparations has improved the efficiency of rapeseed meal nutrient utilisation. However, rapeseed meal has a higher vitamin content (choline, biotin and folic acid) than soya bean meal (Bell, 1984 cited by Koreleski, 1993).

Experiments conducted on broilers in the National Research Development Institute for Animal Biology and Nutrition (IBNA) have shown that rapeseed can be used in compound feed formulations for broilers, replacing up to 25% of soya bean meal without affecting broiler performance. Compound feed supplemented with the enzyme complex Kemzyme VP Dry (beta-glucanase, endo-beta-glucanase, alpha-amylase, bacillolysine and endo beta-xylanase) did not significantly influence broiler performance (Vasile *et al.,* 2005).

Canola is a rapeseed variety with superior nutrition, containing 20 to 22% crude protein and 40 to 42% fat, low levels of glucosinolates and erucic acid (Swick and Tan, 1997). Compared to soya bean meal, canola has a higher level of calcium and phosphorus, but around 65% of the phosphorus is phytates and thus unavailable. The sulphur content also is higher than in the soya bean meal (1,1 versus 0,4%), which may cause leg defects (Larbier and Leclercq, 1994; Charlton, 1997).

Material and methods

The trials for rapeseed meal (experiment 1) and canola seeds (experiment 2) utilisation were conducted on 432 Roso SL 2000 commercial layers supplied by SC Avicola Bucureti SA. The layers, between the ages of 40 to 47 and 51 to 58 weeks, were assigned to three groups for each experiment as follows: a control (C) group and two experimental (E) variants with 24 replicates each (one replicate in a cage with three layers).

Each experiment used three compound feed formulations: a maize and soya bean meal-based control diet, and two experimental diets in which 52,38 and 72,86% of the soya bean meal was replaced by rapeseed meal. This replaced 34,32 and 45,74% of the dietary crude protein, respectively, in experiment 1; 18,31 and 30,32% of the soya bean meal was replaced by canola seeds, which replaced 17,40 and 22,45% of the dietary crude protein, respectively, in experiment 2.

All diets were isocaloric and isoprotein, and had similar levels of sulphur amino acids, calcium and available phosphorus, and agreed with the feeding requirements recommended for the intensive rearing of commercial layers.

The rapeseed meal had the following chemical composition: 90% DM; 34,45% crude protein; 2,60% ether extractives; 11% crude fibre; 7% ash; and 1 790 kcal/kg metabolisable energy. The canola seeds had the following chemical composition: 93,18% DM; 17,42% crude protein; 40,58% ether extractives; 9,17% crude fibre; 9,02% ash; and 3 900 kcal/kg metabolisable energy. All analyses were performed within IBNA specifications.

The layers were kept in a two-tier battery, with free access to feed and water. Throughout the experimental period, light was provided by light bulbs using a 16-hour regimen (between 04:30 and 20:30).

Production parameters that were monitored included laying percentage (monitored daily); average egg weight

(determined by weighing all eggs for four consecutive days, at the end of each four week period); proportion of egg components including yolk, white and eggshell (determined by weighing all eggs produced daily, for one week at the end of the experiment); feed intake (recorded daily for each replicate separately, calculated per layer per day); and live layer weight (determined by individual weighing of the layers at the beginning and end of the experiment).

At the end of the experiment, we calculated:

- Egg mass production (grams of egg/layer/day).
- Feed conversion into eggs (grams of feed/grams of egg).
- Feeding cost (economic efficiency, %).

The eggs with abnormal morphology or shell defaults (broken or cracked shells, shell-less eggs, deformed eggs) and mortalities were monitored daily. The experimental data were processed statistically by variance analysis using the Fisher test. The Student's t-test was used to evaluate the significance of differences between experimental groups. Differences were considered statistically significant for P < 0,05.

Table 1: Effects of the level of soya bean meal replacement by rapeseeds meal on the laying percentage and egg quality of 40 to 47 weeks old layers.

Performance parameters	Control: Soya bean meal	Experiment 1: Rapeseed meal	Experiment 2: Rapeseed meal
Egg production:			
Laying percentage (%)	88,97[a]	88,39[a]	87,11[b]
Egg mass (g/layer/day)	53,31[a]	52,43[a]	50,38[b]
Egg weight (g):			
Initial	56,80[a]	57,20[a]	56,92[a]
Final	59,92[a]	59,32[a]	57,83[b]
Daily feed intake (g)	121,73[a]	118,92[a]	116,26[b]
Feed conversion (g feed/g egg)	2,28[a]	2,27[a]	2,31[b]
Live bodyweight (g)	2 143,24[a]	2 186,90[a]	2 161,54[a]
Yolk weight (g)	17,98	17,73	17,00
Egg white weight (g)	36,35	36,14	35,36
Eggshell weight (g)	5,59	5,52	5,47

a, b – different superscripts show significant differences (P < 0,05).

Table 2: Effects of the level of soya bean meal replacement by canola seeds on the laying percentage and egg quality of 51 to 58 weeks old layers.

Performance parameters	Control: Soya bean meal	Experiment 1: Rapeseed meal	Experiment 2: Rapeseed meal
Egg production:			
Laying percentage (%)[1]	79,79	79,68	78,69
Egg mass (g/layer/day)[1]	51,65	51,26	50,93
Egg weight (g):			
Initial[1]	62,87	62,12	62,56
Final[1]	64,63	64,33	64,72
Daily feed intake (g)	121,73	119,92	119,26
Feed conversion (g feed/g egg)	2,35	2,33	2,34
Live bodyweight (g)[1]	2 276,48	2 230,43	2 224
Yolk weight (g)	18,98	18,75	18,97
Egg white weight (g)	38,85	38,83	38,86
Eggshell weight (g)	6,90	6,75	6,89

1 – no significant differences (P > 0,05).

Results and discussion

Experiment 1

The statistical calculation of the data on the laying percentage, egg weight, production of egg mass, feed conversion into eggs and egg component indices (*Table 1*) have shown no significant differences between the groups up to 52,38% soya bean meal replacement by rapeseed meal. The resulting average values are similar to those of the control group (P > 0,05). Exceeding this level of replacement significantly depressed layer performance (P < 0,05).

Experiment 2

Table 2 contains the experimental data which shows no significant differences from the group where 30,32% of the soya bean meal was replaced by canola seeds, the average values being similar to those of the control group (P > 0,05). These results agree with the data of Elwinger and Saeterby, 1986; Leeson *et al*., 1987; Rachwal *et al*., 1989; Smulikowska and Buraczewski, 1991; Zglobica and Wezyk, 1991 cited by Koreleski 1993, reporting that a 25% replacement of soya bean meal by canola seeds in protein and energy-balanced diets did not affect layer performance, nutrient deposition and bone mineralisation.

The experimental results show that rapeseed meal and/or canola seeds can be used as a potential alternative to sources of vegetal protein for commercial layer diets. Rapeseed meal can be used up to a level of 15% in the compound feed. The formulation for commercial layers replaces up to 50% of soya bean meal. Canola seeds can be used up to a level of 20% in the compound feed formulation replacing 25 to 30% of the dietary soya bean meal, without significantly affecting laying performance and egg quality.

This article was condensed for publication in *Oilseeds Focus* from Archiva Zootechnica 12:1 (2009). For more information and references, email the author at ciurescugeorgeta@yahoo.com.

Health benefits of canola oil

By the Food Advisory Consumer Service (FoodFacts)

The canola plant was developed from the rapeseed plant by means of traditional breeding techniques. The name 'canola' is derived from 'Canadian oil' and the new oilseed was selected mainly for its low erucic acid and low glucosinolate composition.

Canola and its products were thoroughly investigated before it was released for commercial use and today canola is produced in many countries (*www.canola-council.org*). The USFDA (United States Food and Drug Administration) has accredited canola oil GRASS (generally accepted as safe) status. It is suitable for human consumption and is included as one of the edible oils by the American Oil Chemists Society (*Food Fats and Oils, AOCS Resource Directory, 9th edition, 2006*). Canola oil and oilcake have been used in Canada since the late 1970s and is now a household name in Europe, the United States and Australia.

Canola oil has seen the biggest increase in production over other vegetable oils over the past number of years and is now ranked number three in world production with around 67 million metric tons per annum.

At present, canola oil is of lesser importance than other household oils to the South African consumer. However, the situation is changing – local production increased to 100 000 tons per annum in 2014.

The following trends are predicted:

- Increased local production of canola to significant levels.
- Greater consumer demand for vegetable oil due to rising living standards.
- Consumer demands for healthier oils.

The myths about canola oil

Canola oil, like many other food products, is exposed to myths and misinformation. Unfortunately, this discreditation of canola oil is to the detriment of a very good food product. The purpose of this information article is to put canola oil into perspective.

Rebuttal of myths

There is strong scientific evidence that omega-3 fatty acids (alpha linolenic acid) can assist in preventing certain cancers. Canola oil is one of a few vegetable oils which is a good source of omega-3 fatty acids.

Dr Carl Albrecht, retired head of research of the South African Cancer Association (CANSA), was one of the internationally renowned scientists concerned about the negativity surrounding canola oil. He therefore did an extensive and detailed literature survey to determine whether the negativity was justified (*Canola oil – good or bad, C Albrecht, CANSA Report, 2002*).

He referred to several creditable information sources and the following is a summary of his survey and rebuttals:

- Canola oil is from a special variety of rape which is not chemically identical to the common rape plant.
- Rapeseed is not a poisonous weed.
- Canola oil is not an industrial oil but does have industrial applications as a lubricant.
- Canola oil does not form latex-like substances that agglutinate red blood corpuscles. Actually, the opposite could be true.
- Canola oil does not have any adverse effect on vision or the peripheral nervous system.
- Canola oil is not a source of mustard gas (the confusion with rapeseed is because it belongs to the mustard family, *Brassicaceae*).
- There is no evidence that canola glycosides depress the immune system.
- There are no free alcohols in canola oil.

The Canola Council of Canada also responded to each of the negative claims by means of scientific reports and facts.

A further example of the international recognition of canola is the contents of the book *Canola and Rapeseed – Production, Chemistry, Nutrition and Processing Technology*, edited by Fereidoon Shahidi, and with 28 international contributors.

Nutritional value of canola oil

The theory on the nutritional value of polyunsaturated fatty acids changed dramatically during the past decade. In

2011 the Global Omega-3 Summit: A Koyoto-type approach was held in Bruges and participants discussed the role of long-chain omega-3 fatty acids in health and mental health.

AP Simopoulos discussed the importance of the correct omega-6 to omega-3 fatty acid ratio in cardiovascular disease and other chronic diseases (*Experimental Biology and Medicine, 2008, 233, 674-688*). Prof B Lands provided a review on the latest information on the metabolism of unsaturated fatty acids, and the formation of highly unsaturated C20 and C22 fatty acids and their hormonal effect on the body (*INFORM, July 2010*). As early as 1996 the American Heart Association warned that consumption of high intakes of omega-6 fatty acids increase the risk of gallstones and may promote cancer (*Circulation, 1996, 94, 1795-1800*).

The Nutrition Society of South Africa arranged a debate on the nutritional value and future trends in vegetable oils. The omega-6 to omega-3 ratio of canola and sunflower oils were discussed and shown that canola oil with its ratio of 2,1 has the ideal combination of polyunsaturated and mono-unsaturated fatty acids. It was stressed that the omega-3 fatty acid in canola is linolenic acid, a carbon 18 fatty acid, with different physiological properties than fish oil with its carbon 20 and 22 polyunsaturated fatty acids.

Prof M Smuts elaborated on the intake of the different polyunsaturated plant oils and showed that the intake of oleic acid can be seen as neutral since it does not affect the omega-6 to 3 ratio (*SA Graan, April 2011, 13-15*). The fact that canola oil contains 60% oleic acid is also a nutritional advantage. It can claim to provide a healthy omega-6 to 3 and high oleic acid composition, which is the reason why the SA Cancer Association supports canola oil.

Canola oil is also a source of plant sterols, brassicasterol, campesterol and beta-sitosterol, as well as alpha- and gamma-tocopherol.

Canola versus palm

During the past few years, palm olein (the softer fraction of palm oil) has been promoted by certain scientists. This was primarily based on oil stability, the absence of trans fatty acids and the nutritional properties of tocotrienols (minor components).

In South Africa there has been a dramatic increase in the use of palm olein for industrial purposes. The promotion of palm olein created more confusion than education. It was therefore decided to compare the properties of canola versus palm (*Table 1*). The figures are averages. Fatty acid composition can vary and can be influenced by cultivar, location and weather patterns.

Table 1 indicates that canola is a richer source of the essential fatty acids, linoleic and alpha linolenic acid. Palm olein, on the other hand, contains around ten times more palmitic acid than canola oil. This is important because palmitic acid is one of the saturated fatty acids that increase LDL cholesterol (bad cholesterol) (*Food Fats and Oils, AOCS Resource Directory 2006*). Canola oil is clearly the more unsaturated of the two oils and therefore healthier.

Table 1: Canola oil versus palm olein (oil).

	Palm olein	Canola oil
Major components		
Ambient temperature	Semi-solid	Liquid
Palmitic (C16:0)	39	4
Oleic (C18:1)	43	60
Stearic (C18:0)	4	1,5
Linoleic (C18:2)	11	20
Alpha-linolenic	0,2	11
Trans fatty acids	<1,5	<1,5
Saturated fatty acids	high (45 to 50)	low (<6)
Minor components		
Tocopherols	240 ppm	692 ppm
Tocotrienols	560 ppm	
Sterols	2 250 ppm	B050 ppm
Cholesterol	16 ppm	53 ppm

Regarding the minor components it is clear that the tocopherol content of canola oil is higher than that of palm olein. The tocopherols have vitamin E activity, and it suggests that canola will be a better source of vitamin E. *Table 1* shows that palm olein is a valuable source of tocotrienols.

Canola is generally considered the only vegetable oil, when evaluated against recognised nutritional standards, that is nutritionally well balanced.

From *Table 1* it is clear that, nutritionally speaking, canola is the better oil. It will also be the choice of the consumer because it is a liquid at ambient temperatures whereas palm olein is not. Canola oil can be mechanically expelled without solvent extraction and possible chemical residues in the oil and oilcake. Palm oil is also isolated without solvent extraction.

Canola oil is recommended for household and industrial use while palm olein can find application in industrial frying operations because of superior stability at frying temperatures. It is not pourable (it has to be spooned out of its container) which makes it a cumbersome operation in the kitchen.

Plant breeders have, and are continuously developing, canola oil with a higher oleic acid composition which will make it more stable and suitable for industrial operations.

Nutritional properties of oil

- Low in saturated fat (less than 6%).
- High in linoleic acid (omega-6), an essential fatty acid.
- High in alpha-linolenic acid (omega-3).
- Can be a good defence against coronary heart disease (high sterol content).

Canola oil will have a beneficial nutritional and health advantage when incorporated into the daily diet. Its major advantage is its high alpha-linolenic acid (omega-3) content which can supplement the generally low consumption of omega-3.

For more information, visit *www.foodfacts.org.za.*

SA's oilseed structures: Committed to transformation

By Gerhard Keun, chief executive officer, Oilseeds Advisory Committee

The various structures in South Africa's oilseeds industry are committed to supporting agricultural transformation in South Africa, as it is imperative for the future and growth of the oilseeds industry and the agricultural industry as a whole.

Several transformation initiatives are executed by associations, foundations, organisations, companies and government departments in South Africa. Unfortunately, these initiatives are not always well co-ordinated and while oilseeds are included in some of these projects, there is no specific emphasis on the major oilseeds – sunflower, soya bean, groundnut and canola.

For several years, structures in the oilseeds industry played a significant role in agricultural transformation via the provisions of their respective constitutions and trust deeds. The Sunflower, Soybean and Soyfood Forum, the SA Groundnut Forum, the Oilseeds Advisory Committee (OAC) and the Oil and Protein Seeds Development Trust (OPDT), since its inception in 1997, have all acknowledged the importance of transformation and therefore supported several projects.

A focussed approach

The challenge of co-ordinating initiatives together with the challenges experienced at the Grain Farmer Development Association (GFADA) created the perfect opportunity for the OAC to develop a transformation programme focussed on sunflowers, soya beans, groundnut and canola. To assist with the scope, focus and envisaged outcomes of the programme, Optimal Agricultural Business Systems (OABS) was contracted to conduct a study titled 'Analysis to determine the scope of transformation projects funded in South Africa concerning the production and processing of oilseeds'.

This programme, now in its second year, allows for better co-ordination between existing projects, the implementation of new projects, collaboration with other industry role-players and projects, and improving the effectiveness and efficiency of agricultural transformation efforts in South Africa.

The programme focusses on training, information supply, technology transfer, insurance funding, soil correction, seed, mentorship, upliftment and socio-economic development, job creation and enterprise development. The five pillars of the *Transformation Guidelines of the National Agricultural Marketing Council* (NAMC) are addressed in the programme.

Developing projects

Currently, a lot of emphasis is being placed on the commercialisation of producers. Yet the transformation programme of the OPDT/OAC has a much wider focus, namely to also address upliftment, poverty, nutrition and food security.

The following projects are funded by the OPDT/OAC and executed by service providers in the agricultural industry:

Eden Social Development Foundation

The aim of the foundation if to create job opportunities in soya bean planting and micro or macro soya agro-processing to warrant food sustainability. This project grew from a KwaZulu-Natal-based soya awareness project to one that is now assisting universities, government departments, and other relevant organisations to establish soya bean production in Limpopo, Mpumalanga, the Eastern Cape and the northern areas.

During the 2021/22 season, a 'Soya in Food Awareness' programme was conducted in KwaZulu-Natal, Mpumalanga, and Limpopo (327 women and 257 men were trained). Soya bean planting and training workshops were attended by 100 men and women in KwaZulu-Natal, Mpumalanga, Limpopo and the Eastern Cape.

During the same season, developing producers were assisted with soya bean production in different areas totalling 956ha. Of this area, 875ha were harvested and yielded an average of 1,7 ton/ha , the highest being 3,77 tons/ha in the Newcastle area.

Grain SA: Pula, training and trials

This was the first producer-based transformation project funded by the OPDT/OAC. It started with the training of developing producers to plant sunflowers in North West. Currently, the production of oilseeds is managed under a different project.

As part of the aforementioned project the following results were achieved:

- **Farm visits and support to individual producers (mentorship):** Dundee, Kokstad, Free State, Lichtenburg and Louwsburg regional development offices recorded 397 farm visits.
- **Training:** A total of 12 courses were presented with 193 trainees in attendance. The training was conducted by the Dundee, Ladybrand, Lichtenburg, Louwsburg and Nelspruit offices. Training courses covered the topics 'Introduction to soya bean production' and 'Introduction to groundnut production'.
- **Trials and demonstration days:** A total of four trials were planted. Demonstration plots are an effective model for enhancing improved technology adoption.
- ***Pula/Imvula*:** The magazine is a reliable source of steady information that is provided to developing grain producers. It is free of charge and information is supplied in five languages: English (2 243), Sesotho (1 960), Tswana (1 075), Zulu (4 815) and Xhosa (5 675).

Producer development by Grain SA

Funding for Grain SA's advanced producers' input support is specifically aimed at soil correction, insurance and mentorship. Together with co-funders, planning entailed the planting of 1 905ha of soya beans and 770ha of sunflowers.

Direct producer input support: Farmsol

Sunflower and groundnut producers in the Free State and North West are supported through this project and thus far a total of 842ha of sunflowers and 80ha of groundnuts have been planted.

Free State University snack project

This project is aimed at the development of nutritious soya-based snacks to address under- and overnutrition and to promote small-, medium- and micro-sized enterprises (SMMEs) in low-income communities. Ten products have been developed and tested. In addition to the soya snacks, plant-based meat products will also be developed.

As part of the project, a so-called SoyCow was installed at the Best Is Good Academy in De Deur, Gauteng. The SoyCow is an electric food processing system designed to produce soya milk and its derivatives. It assists with healthy nutrition for scholars and the community.

Support is essential

The transformation space is challenging and through the aforementioned projects, the OPDT/OAC is relying on co-funding from institutions such as the Technology Innovation Agency and SACTA. The Department of Agriculture supports the provision of equipment in the different provinces.

Although challenging, these efforts are very rewarding and the OPDT/OAC remain committed to making a difference in the lives of developing producers and the upliftment of communities.

For more information, email Gerhard Keun at oliesade@opot.co.za.

New Holland's TH7.32 telehandler makes headlines at NAMPO

New Holland Agriculture's impressive display of machinery at the 2023 Nampo Harvest Day featured several exciting new offerings, including this year's headline act: The launch of the TH7.32 telehandler, a new addition to the company's extensive range of agricultural equipment.

According to Jaco du Preez, New Holland Agriculture's marketing manager, New Holland telehandlers have continued to deliver an unrivalled blend of performance, dependability and affordability for over 20 years.

"Designed for applications like materials handling, yard work and stacking large bales, the new TH7.32 is the ideal choice for arable, mixed farm and contract applications. It is the default choice for demanding farm and contract operators, with its high power to weight ratio enabling the delivery of exceptional performance in the most demanding applications," he said.

Productivity improving features

The TH7.32 benefits from an all new 4x3 PowerShift™ transmission, providing smoother shifting and shuttling performance resulting in a better driving experience. Compliant to Tier 3 emissions standards, enhanced performance and economy is matched to improved comfort and reduced operating costs. The very latest cab sets a benchmark for low noise and comfort.

The best in class 600-hour service intervals ensure the machine is kept busy working for longer. A large one-piece hood gives full access to the engine bay and lower side panels can be opened to give even more access to the engine. Engine oil, water coolant, air filter, radiators and all daily checks are easy to check and service. Radiators fold out for excellent cleaning access.

High comfort and ergonomics

The new TH model features an advanced cab design that offers improved comfort, noise suppression and visibility for maximum productivity at any time. The new LED light option can produce up to 25 000 lumen of combined lighting power to turn night into day and increase safety and productivity.

New Holland has taken its established expertise in tractor cab design and applied it to the 360° vision cab. Offering class-leading space and comfort, the cab affords excellent all-round visibility with an unparalleled (Continued on page 61)

Now is the time for sunflowers to shine

By Elmarie Helberg, Plaas Media

The Oil and Protein Seeds Development Trust and Oilseeds Advisory Committee (OPDT/OAC) hosted a sunflower symposium on 25 April at the Council for Scientific and Industrial Research (CSIR) Convention Centre in Pretoria. The event among others explored the possible sweet spot between high-oil content and high yields in sunflowers in South Africa.

Sunflower production in SA

According to Corné Louw of Grain SA, sunflower production in South Africa has decreased during the past few years, mainly due to the prevalence of *Sclerotinia* during the wetter cycle as well as increased plantings of other competition crops. A shortage of seed was also a problem for the current season. According to Prof Ferdi Meyer of the Bureau for Food and Agricultural Policy (BFAP), this situation should recover during the upcoming dryer weather cycle.

Sunflower is the most significant oilseed crop in South Africa, with almost the entire local crop being processed into sunflower oil. Oil-type sunflower seeds contain 38 to 50% oil and approximately 20% protein.

According to the BFAP, South Africa's sunflower oil consumption has increased by 28% over the last decade, with a further 28% increase predicted by 2030. Although slower than the previous decade, this growth remains significant. Since domestic consumption is projected to remain higher than production, South Africa will continue to be a net importer of crude sunflower oil.

Meyer noted that while global sunflower production has doubled from 25 to 50 million tons over the past 20 years, South Africa's sunflower crop has remained flat. He suggested that if producers are able to achieve good yields, sunflowers can be more viable than maize.

However, the cost of producing a ton of sunflowers in South Africa is higher than the global average. In addition, the oil content of sunflowers has decreased over time, making it less economically viable for the crushing industry. The challenge is balancing the crushing industry's need for higher oil content with the producer's need for higher yields.

Focus on high-oil content

According to Charles Basson, a sunflower breeder at Syngenta, some 99,1% of sunflowers processed in South Africa is destined for oil and oilcake, while the remainder is used in feed. While the country's sunflower yield remained stable from 2016 to 2020, oil content decreased as producers continued to select for yield rather than oil content. This highlights the potential for high-oil seeds in South Africa.

Unlike countries such as the United States, where a premium is paid for each percentage point of oil content above 40%, South Africa does not currently have a standard regarding premiums for higher oil yields. However, good-quality sunflower hybrids can help increase sunflower production in South Africa.

Meyer suggested that the industry considers high-oil sunflower cultivars and the feasibility of offering a 1,5% premium for each 1% of oil content above 38%.

During the symposium, other factors influencing sunflower production in South Africa were also addressed by various role-players, including Dr Safiah Ma'ali of the ARC-Grain Crops

Prof Ferdi Meyer of BFAP addressed the audience on South African sunflower production and global competitors. He said producers need to shift their focus to high-oil content sunflower varieties.

Potchefstroom. According to Ma'ali, planting dates of sunflower has a significant effect on the quality and yield of sunflowers. Environmental factors playing a role here include the amount and distribution of rainfall as well as soil temperature.

> Sunflower is the largest source of vegetable oil in South Africa, with almost the entire local crop being processed into sunflower oil.

Her studies have shown that the probability of obtaining higher yield, higher oil content and higher oil yield under a specific threshold decreased when the crop was planted after December. However, a number of factors need to be considered when deciding to plant, such as the possibility of frost damage, drought during grain filling, bird damage and the possibility of a high soil temperature during emergence.

"A farmer planning to plant sunflower as the main crop should consider planting during November and no later than the end of December if he/she is to achieve the target yield. Sunflower planted later in the season, especially during January, will have a lower yield potential," she says.

"The lower seed yield, oil content and oil yield associated with late sowing might be attributed to the higher temperatures experienced during the early growth period, which leads to excessive early stem growth and reduced flowering time followed by cooler temperatures and reduced incident radiation during post-anthesis. For rapid and uniform emergence, sunflower should only be planted after sufficient rain. Keep in mind that the drought-sensitive pre-flowering and flowering stages should preferably coincide with a period of high rainfall probability."

Increasing sunflower production

During a panel discussion led by Dr Erhard Briedenhann, chairperson of the OAC, factors influencing sunflower production and yields were discussed by experts.

According to Peter Lovelace, director at CEOCO, other countries that grow sunflower seed such as Russia and China are all growing a far higher quality than South Africa is doing. "Higher quality sunflower is possible in South Africa, but we have concentrated too much on yield per hectare rather than quality."

Lovelace said the quality of sunflower has dropped dramatically over the last eight to ten years in South Africa, making oil and crushing operations more expensive. "Let's go back to planting the correct sunflower cultivar at the right time. The crushing industry is prepared to pay the producer a handsome premium."

Louw agreed that we need to start looking at sunflower differently. "Most of our farmers used to plant sunflower as a catch crop, not a cash crop, and we need to change that dynamic."

To download speaker presentations as well as watch videos of the various presentations, go to *www.opot.co.za/index.php?page=sunflower-symposium-2023.*

(Continued from page 59)

view of the front of the carriage and forks when fully lowered. During work, this extra visibility significantly boosts productivity.

A seat mounted joystick is available for ergonomic excellence and fatigue free operation and the cab boasts a clear and visible instrument cluster. Comfortable driving makes all the difference on long working days with an air-suspended and heated seat.

Enhanced quality and strength

The TH7.32 telehandler features a twin U shaped robot welded boom that is extremely rigid and durable. The H shaped ladder chassis has massive torsional strength and is engineered to operate in the most demanding applications. New Holland employs state-of-the-art manufacturing techniques in the production line for TH models. Robot welding is a key manufacturing process and ensures consistent quality during chassis and boom construction.

Hydraulic dampers ensure smooth boom retraction and extension. The dampers also protect the boom and operator from regular shock loads. The TH7.32 is designed with 40/60 weight distribution, eliminating the need for bolt-on counterweights, ensuring maximum stability and traction is achieved when loaded.

Superior lifting geometry

With the TH7.32 the boom compensation cylinder faces rearward near the hinge point and both cylinders extend in opposite directions as the boom is raised. This "opposite working" design greatly improves boom control and overall stability.

The lower centre of gravity and longer 3m "corner to corner" wheelbase concept, along with the rear-mounted boom acts as a built-in counterbalance making this telehandler hard to beat. It can lift objects as high as 7m and has a 3,2t capacity.

Outstanding engine power

The TH7.32's turbocharged 4,5 litre 4 cylinder engine is Tier 3 compliant, with outstanding power output of 98kW and 549Nm of torque at 1 500 r/min, allowing it to handle any task comfortably.

Powerful hydraulics ensure that a high performance variable displacement piston pump delivers a maximum of 140 litre/min, providing versatility in all conditions with two optional front auxiliary hydraulic outlets and additional rear auxiliary lines.

"The New Holland TH7.32 telehandler is a great choice for lifting and material handling on the farm thanks to greater lift capacity, better reach, faster cycle time and the highest manoeuvrability and stability working with loads. With all the power and torque a farmer needs to perform the most intensive tasks on all terrains, together with exceptional fuel efficiency, this new model will get the job done quickly and efficiently," Du Preez added.

For more information contact Jaco du Preez at email jacobus.du-preez@cnhind.com.

Termination of farm dwellers' right of tenure

By Clarissa Pienaar, Moolman & Pienaar Incorporated

Section 10(1)(c) of the *Extension of Security of Tenure Act, 1997 (Act 62 of 1997)*, which applies to a person who was already a farm dweller on 4 February 1997, and Section 11(3)(d), which applies to a person who became a farm dweller after 4 February 1997, stipulates that the court can grant an eviction order if the farm dweller has caused such a serious breach in the relationship between him/her and the owner or person in charge, that it is not practically possible to restore the relationship, whether in its entirety or in a manner that allows for it to be restored to a reasonable level.

This raises the question as to whether the termination of a group of farm dwellers' right of tenure, as a collective, will be fair and equitable if the farm owner or person in charge is unable to identify individual farm dwellers who engaged in misconduct. The Court of Appeal considered this question in the case of *Isedor Skog NO and Others vs Koos Agullus and Others (797/2021) [2023] ZASCA 15* (20 February 2023).

Background of the case

When the new owner (the trust) took over the farm from the previous owner in 2010, the farm dwellers already resided on the farm, with the majority employed by the trust. Their previous employment contracts included accommodation for employed workers and their dependents. However, when the trust took over the farm, new agreements were concluded with the employed workers – under these new agreements they and their dependents could continue to live on the farm for as long as they were employed by the trust.

However, misconduct led to the ending of this relationship between the trust and employed workers on 24 June 2011. The farm dwellers did not contest the termination of employment at the Commission for Conciliation, Mediation and Arbitration or any other forum. The trust eventually re-employed two of these workers but, given the dilapidated condition of their cottages, accommodation was provided elsewhere.

The trust launched an application for the eviction of respondents one to 26, based on a substantial breach in the relationship between the trust and farm dwellers. The farm dwellers opposed the application for eviction and denied that this relationship had been breached. The trust was also unable to identify the individuals who disobeyed the farm rules and committed the acts.

What does the court say?

The Land Claims Court found that Section 10(1)(c) comes into effect if an occupier has breached the relationship between him/her and the owner or person in charge. The court also found that there was no evidence of the deplorable acts and/or violations by the farm dwellers and stated that the trust failed to identify an individual farm dweller as the person responsible for contravening the farm's rules.

The Land Claims Court finally found that the trust, given the fact that the rules were broken by unknown individuals whom the trust was unable to identify, was wrong to treat all the respondents as a collective. The court ruled that it was never fair and equitable to order the eviction of families, parents and children from a farm based on unfounded allegations of a relationship breach between the farm dwellers and trust.

The finding of the Land Claims Court was, however, set aside. The Court of Appeal found that many of the serious allegations of unacceptable and inappropriate behaviour attributed to the farm dwellers, which they denied, were testament to the farm dwellers' apathetic attitude towards the restoration of a social relationship with the trust.

The Court of Appeal, referring to a judgment in *Ovenstone Farms (Pty) Ltd vs Persent and Another [2002] ZALCC 31*, upheld that a material breach in the relationship between an owner and occupier, as referred to in Section 10(1)(c), relates to a social rather than legal relationship and that this requirement would be met if "it is impossible for the relationship to continue due to a lack of mutual trust".

The complaints pertaining to the inappropriate behaviour were of a serious nature and damage to the trust's property could not be allowed to continue simply because individual offenders could not be identified on CCTV cameras.

The Court of Appeal ultimately ruled that terminating the tenure of these farm dwellers was procedurally and substantively fair and equitable. The complaints pertaining to the inappropriate behaviour were of a serious nature and damage to the trust's property could not be allowed to continue simply because individual offenders could not be identified on CCTV cameras.

Do it right from the start

Despite this ruling, landowners are encouraged to take all possible steps to correctly identify wrongdoers and ensure that innocent farm dwellers' right to tenure on farms is not terminated.

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

Insubordination: Types and steps to follow

By Tiaan Botes, legal advisor, LWO Employers Organisation

The relationship between the employer and the employee is based on mutual benefits and respect. Clear rules and guidelines ensure that friction and misunderstandings are kept to a minimum, which in turn promotes productivity and a positive working environment. Often it is only one employee who acts as a troublemaker, negatively influencing and inciting other employees. Reasons for such a poor attitude can include personal circumstances, personality clashes, a misplaced sense of entitlement, and the like.

Insubordination refers to the defiance of, or resistance to authority and the refusal or failure to obey clear, reasonable and lawful instructions. Many employers have had to deal with insubordination in the workplace and it is important to know how to deal with it correctly and in line with labour legislation.

Types of subordination

Insubordination is generally a serious offence, although it is important to differentiate between offences due to negligence and offences with intent, as it has a definite impact on the seriousness of the offence. The seriousness of the offence is also influenced by the employee's type of work and responsibilities, the (possible) consequences of the offence and the impact of the offence on the employee-employer trust relationship.

Insubordination can be related to a wide variety of offences and is mainly linked to disrespectful behaviour. Common offences include:

- Non-compliance with established rules and procedures.
- Playing games – this offence is more serious when such action endangers the safety or health of others, or the good spirit in the workplace and smooth running of work.
- Insolence – any disrespectful attitude towards the supervisor, a more senior person or a client.
- Refusing to obey a reasonable and legal instruction.
- Abusive language – this offence is more serious when it is aimed at race, gender, religion or any other arbitrary ground.
- Distributing unauthorised propaganda – information, especially of a biased or misleading nature, used to promote or publicise a particular political cause or point of view.

Each case must be assessed according to its own merits and the sancation should be in line with the seriousness of the offence.

Steps to follow

Employers are advised to follow these steps to identify misconduct referring to insubordination:

- **Investigate:** During the investigation the employer must establish whether the employee acted in an insubordinate manner. The employer should also gather evidence in this regard and determine the seriousness of the offence, including (possible) consequences.
- **Consult with the employee:** When consulting with the employee, the employer should determine if the offence was due to the employee's negligence or with intent. It is important to give the employee the opportunity to present more information and explain the situation from his/her point of view.
- **Determine the sanction:** The sanction is determined by the seriousness of the offence. To establish if the sanction is fair, the employer must consider the facts of the case as every case has its own merits. It is important to note that the employer must prove on a balance of probability that the employee is guilty before imposing any sanction.

> Insubordination refers to the defiance of, or resistance to authority and the refusal or failure to obey clear, reasonable and lawful instructions.

- **Take disciplinary action:** A disciplinary code is vital to ensure there are clear rules in the workplace, with appropriate sanctions, for employees to follow. When these rules are broken, the employer can apply progressive discipline (warnings), or in cases of severe misconduct proceed directly to a disciplinary hearing. The employer must take note to keep detailed records of employees' misconduct and sanctions applied.

Every employee must have a detailed job description to clarify duties and the employer's expectations.