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OILSEEDS focus

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

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Promising soya bean cultivars

The changing nature of university-industry collaboration

By Prof Danie Brink, dean of the Faculty of AgriSciences, Stellenbosch University

Investments in global food and agricultural research and development (R&D) are decreasing relative to total R&D, dropping from around 7,4% (US$41 billion) in 1980 to 4,3% (US$101 billion) in 2020. Over this period, the share of high-income countries in global agri-food R&D spending increased from 69 to 84%, while the Asia-Pacific region's share rose from 23 to 48%, compared to the net contribution from Africa at a mere 4% in 2020.

Risks of underinvestment

The risks associated with underinvestment in agri-food R&D include:

- A slowdown in the growth of agricultural productivity.
- Negative impacts on food security and accessibility.
- Resolving regulatory restrictions.
- Undercutting international competitiveness and responsiveness to changing markets.
- Persistence of unmanaged risks such as a changing climate, and pest and disease pressure.
- Lowering the footprint of agriculture on the environment.

It is also important to highlight the difficulty of Africa being globally competitive based on a 4% comparative expenditure on agri-food R&D. It is essential for local (African-based) industries and institutions to collaborate in establishing effective global networks and partnerships to access new knowledge and technologies.

Public versus private sector

A significant trend in global agri-food R&D spending is the corresponding decrease in the public sector contribution from 66 to 49% between 1980 and 2020. Meanwhile, the private sector has emerged as the major contributor, accounting for 51% (US$53 billion) of total spending.

These trends have stimulated the development of university-industry collaboration, enhanced by the pressures exerted on both the industry by rapid technological change and intense global competition, and on universities through the growth in new knowledge, the challenges of rising costs and resource burdens, and societal pressure to contribute to economic growth.

While the collective aim of such collaboration is to enhance innovation and economic competitiveness at country, sectoral and institutional/company level, universities also gain through access to complementary expertise, equipment and facilities, funding for research, opportunities to discover and test the application of new knowledge, and exposing students and staff to practical problems and applied technologies.

Industry, on the other hand, gains from access to expertise, technologies, research networks, multidisciplinary and complementary know-how, cost savings and co-funding, and human capital development.

Key constraints

In spite of significant progress in terms of university-industry collaboration, key constraints have emerged concerning adequate capacity and resources (funding, human and facilities), legal issues and contractual mechanisms (inflexible university policies, intellectual property rights, confidential and proprietary information), and outcomes and benefits (tacit or explicit, academic rigour or industrial relevance).

Tensions can also develop between the more results-orientated, short-term and applied approach of industry compared to the longer-term and basic research outlook of universities.

South African context

Higher education in South Africa, *per se*, is experiencing a steady decline in the government's ability to fund core activities of human capacity development and knowledge generation through research. At Stellenbosch University, government subsidies as a contribution to income (excluding research funding) have declined from 66% in 2000 to 51% in 2024.

This affects agriculture faculties and related programmes, due to the higher operating and infrastructure costs associated with applied training and research. Hence, these faculties have been merged into science faculties at many research-intensive universities, causing a shift from applied research to basic research.

Agriculture education and research

These trends and outcomes underscore the importance of collaboration between universities and industry in agricultural education and research in South Africa. However, this collaboration should maintain the government's role and responsibility, focussing instead on a value proposition that meets the short-term operational needs and long-term strategic goals of both parties.

Effective and ongoing communication between universities and industry is essential for articulating their needs, priorities and objectives. This collaboration should extend beyond short-term research proposals to understanding each other's long-term values, objectives and vision.

Universities need the assurance of partnerships to guide long-term investments in human capital and infrastructure. Conversely, industry partnerships require universities to become more agile and responsive to the short-term needs and priorities of industry.

Working together

The longstanding engagement of the oilseeds industry via the Oil and Protein Seeds Development Trust, the Oilseeds Advisory Committee, and the Protein Research Foundation in university-industry collaboration deserves special recognition and encouragement. It presents the only sustainable model to ensure the delivery of relevant agriculture education and research at South African universities.

For more information, send an email to the author at db@sun.ac.za.

Biodiesel's impact on the oilseeds market

Biodiesel is produced through a process called transesterification where triglycerides (fats and oils) react with an alcohol (usually methanol) to create fatty acid methyl esters. Various feedstocks, including vegetable oils, animal fats, and recycled cooking oils, can be used. Biodiesel is an environmentally friendly alternative to fossil fuels.

The industry has grown substantially; however, challenges remain, such as competition from other feedstocks, fluctuating oil prices, and the need for consistent regulatory support.

Canola oil in Canada

The canola-oil-to-biodiesel industry has grown significantly over the past few decades, driven by increasing demand for renewable energy sources and sustainable fuel options. Growth in demand is influenced by governments and industries focussing on reducing greenhouse gas emissions. Biodiesel has gained popularity as a cleaner alternative to fossil fuels.

Incentives and mandates, such as the Renewable Fuel Standard in the United States (US) and several policies in the European Union, have incentivised biodiesel production. Improvements in biodiesel production processes have increased yields and reduced costs. The establishment of biodiesel production facilities has increased in regions where canola is grown, particularly in Canada and the northern US.

Overall, the canola-oil-to-biodiesel industry is poised for continued growth as technological innovations and market dynamics evolve, aligning with global sustainability goals.

Soya bean oil in the US

Soya bean oil is increasing in importance in the US for biodiesel production, accounting for nearly half of the biodiesel produced in the country. Policies and demand for lower-carbon fuels are key drivers. The US Department of Agriculture projected a 21% increase in soya bean oil allocation for biofuel in 2024, with significant expansion in biodiesel production expected. Policies promoting renewable fuels have intensified, creating incentives for biodiesel producers to focus on soya bean oil alongside other renewable feedstocks.

However, soya bean oil's role in biodiesel faces challenges from imports of other biodiesel feedstocks such as used cooking oil (UCO) and animal fats, which have a lower carbon intensity. Used cooking oil imports, particularly from Asia, have increased substantially, based on the demand for the US sustainable biodiesel sources.

Palm oil in Indonesia

Indonesia's biodiesel programme, primarily driven by palm oil, has seen notable growth in 2024, with the government increasing domestic allocations by nearly 2% last year. This reflects Indonesia's strong commitment to its B35 mandate (35% palm biodiesel blend) implemented in August last year. The government aims to escalate its programme to a B40 blend by 2025, further strengthening its position in biodiesel production and its role in reducing fossil fuel reliance.

More mandates for biodiesel blends influence the demand for oils such as soya bean and palm, which is likely to put upward pressure on prices. Spikes in biodiesel demand pull vegetable oils away from food markets, causing a tighter supply for food consumption and consequently, prices could increase.

With more countries adopting biodiesel mandates, the competition for low-carbon feedstocks (such as UCO, animal fats, and vegetable oils) is on the rise, contributing to higher prices for preferred oils such as soya bean and palm.

In final thought

The interplay between biodiesel demand and vegetable oil markets is complex, influenced by policy, global supply, and alternative fuel developments, all of which affect the prices of these critical commodities. Biodiesel policies can cause significant fluctuations in vegetable oil prices.

Send us your contributions and suggestions to make *Oilseeds Focus* an enjoyable and valuable publication for the oilseeds industry.
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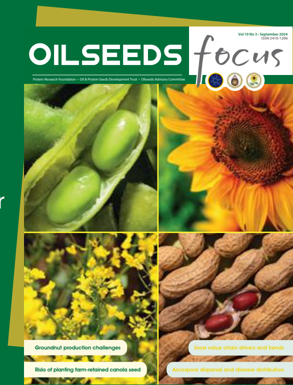

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US soya bean futures climb

Chicago soya bean futures gained more ground recently, with a recovery in demand for United States (US) shipments and delays in Brazilian planting supporting prices. Wheat prices edged up amid higher prices in Russia, the world's number one exporter, while maize dipped. Brazil's soya bean planting for the 2024/25 season had reached 18% of the total expected area in October, agribusiness consultancy AgRural said, up from 8% but still below last year's 30%.

The US soya bean harvest was 81% complete in mid-October, the fastest pace seen since 2010, according to the United States Department of Agriculture's weekly crop progress report. – *livemint.com*

China probes canola imports

China announced a probe of Canadian canola imports, escalating a trade fight between the two countries. The move, which could lead to tariffs on a key Canadian export, came a week after Canada said it would impose new border taxes on Chinese-made electric vehicles (EV), steel, and aluminium. Beijing also said it would file a complaint with the World Trade Organization over the EV tariffs, which it criticised as "discriminatory" and "unilateral".

Beijing blocked exports from two major Canadian grain companies for three years citing pest concerns, following the 2018 arrest in Vancouver of Chinese businesswoman Meng Wanzhou, chief financial officer of the tech firm Huawei. Canada's agriculture minister, Lawrence MacAulay, said Canadian producers "depend on, and play by, a rules-based global trading order that provides reliable market access".

Calling Beijing's announcement "deeply concerning", he said Ottawa is monitoring developments closely. "We will continue to defend and support the sector every step of the way," he said. – *BBC*

Local grain and oilseed harvest update

South Africa's summer grains and oilseed harvest has reached completion for most crops. The crop size estimates at hand are unlikely to change much and possibly represent an actual picture of the harvest. For example, the Crop Estimates Committee lifted the 2023/24 summer grains and oilseed harvest by 0,6% to 16 million tonnes. Still, this is down 20% year-on-year.

The monthly slight upward adjustment of the summer grains and oilseed harvest size is mainly because of the notable uptick in the yellow maize production estimate, while other crops remained roughly unchanged. This data illustrates the scale of damage caused by the midsummer drought to the South African summer grains and oilseed harvest. Still, from a consumer perspective, South Africa is not in a crisis regarding supplies of grains and oilseed. – *businesslive.co.za*

Canadian canola exports take off

Mercantile Consulting Venture recently bumped up its export estimate on its 2024/25 supply/demand balance sheet. It is now forecasting nine million tonnes of exports, which is well above Agriculture Canada's estimate of 7,5 million tonnes.

Global vegetable oils remain fired up and look poised to bring in fresh buying interest, which will be the driving force behind a likely new record global crush.

Canada has shipped out 2,9 million tonnes of canola through week 12 of the 2024 to 2025 marketing campaign, more than double the 1,31 million tonnes exported during the same period one year ago. China was the big buyer through the first two months of the campaign, accounting for 78% of sales.

However, other markets are heating up as well. Mercantile reports that 22 000 tonnes of canola was recently loaded in Thunder Bay, which it expects will be heading to the European Union (EU). That could be because the EU's top supplier is running low on stocks. – *The Western Producer*

Ukraine sunflower price rally

Indicative export prices for Ukrainian sunflower seeds continued to rise, adding another US$15 to US$30 per metric tonne and reaching US$505 to US$535 on a Carriage Paid To (CPT) basis. Lower sunflower seed harvest combined with strong demand from exporters and sunflower oil refineries were the main reasons for the rise in prices.

Ukrainian sunflower seed cost US$480 to US$490/t CPT as of 23 October and US$445 to US$455 as of 9 October.

APK-Inform said Ukraine was likely to harvest 13,8 million tonnes of sunflower seed in 2024 versus 15,1 million tonnes in 2023. It noted that 13,4 million tonnes of sunflower seed could be processed in 2024/25 compared to 15,1 million a season earlier.

Ukraine is a global major sunflower oil producer and exporter, and the local sunflower oil producers' union forecast that sunflower oil exports could fall to 5,2 million tonnes in 2024/25 compared to 6,2 million tonnes in 2023/24.

Ukrainian grain traders' union, UGA, said the country exported 458 000 tonnes of sunflower oil in October 2024 versus 374 000 tonnes a year ago. – *Reuters*

Canadian canola harvest declines

The Canadian canola harvest for 2024 is expected to fall just short of the previous year's level. With rising consumption and strong export demand, ending stocks are likely to decrease notably. This translates to a 1% decline from 2023.

In September, the United States Department of Agriculture anticipated a harvest of 20 million tonnes. The revised estimate is likely based on a slightly smaller production area and lower yields. Favourable weather conditions in late September and early October expedited the progress of harvest operations. Most of the crop has already been collected.

Canada and the EU-27 are the world's leading producers of canola and rapeseed, each producing approximately 20 million tonnes per year. In the current season, the EU relies more on imports to supply its oil mills, including from Canada, due to a smaller harvest.

With Canadian domestic consumption slightly rising to 11,9 million tonnes, the country will have a surplus of 7,1 million tonnes. Nevertheless, stocks are projected to drop to 1,7 tonnes, well below the three million tonnes recorded the previous year. – *Biofuels International*

UAE-Australia tariff cuts

A tariff of 5% on Australian canola, pulses and other grains entering the United Arab Emirates (UAE) will be eliminated under the *Australia-United Arab Emirates Comprehensive Economic Partnership Agreement* (CEPA). Alongside oilseeds and grains, the agreement will cut tariffs on nearly all Australian exports to the UAE, including meat, dairy, nuts, horticultural produce, and honey.

It is estimated that Australian producers will benefit from an estimated AU$50 million annually in tariff savings alone. Australia's largest agricultural export to the UAE in 2023 was canola, topping AU$741 million, while pulses hit AU$248 million, and other grain and oilseed exports were valued at UA$215 million. The UAE was Australia's largest market in the Middle East, with the "two-way trade valued at AU$9,9 billion in 2023," said minister of trade and tourism Don Farrell. "This is a great deal for Australian producers – over 99% of Australian products will enter the UAE tariff-free."

Minister for agriculture, fisheries and forestry, Julie Collins, said the deal also contained Australia's first standalone chapter on sustainable agriculture and food systems. The trade and investment package includes agreements co-operation in investment in areas such as food and agriculture and green and renewable energy. The agreement has an emphasis on technology pathways to produce advanced biofuels and synthetic fuels, with a focus on sustainable aviation fuels, renewable diesel, biodiesel, bioethanol and e-fuels, as well as energy-efficient and low-emission technologies. – *Grain Central*

Argentina's soya crop outlook

Argentina is expected to produce more soya beans in 2024/25 but the crop faces "several complex challenges and opportunities shaped by weather, economic pressures, and production practices," according to a report from the Foreign Agricultural Service (FAS) of the United States Department of Agriculture. Soya bean production is estimated at 52 million tonnes, up from 49,5 million tonnes last harvest.

Economic factors will also tip producer's decisions toward soya, with production costs for soya beans significantly lower than for other crops. Due to a recent shortage of high-grade seed stock on the market, producers are lowering planting densities to allow each seed more room to germinate, but this will likely lower total yields, the FAS said.

"Overall, the combination of environmental, economic, and technical challenges paints a complex picture for Argentina's soya bean sector in 2024-25," the FAS said. "While increased acreage and technological advancements may support production, the adverse weather and compromised seed quality may prevent yields from reaching their full potential, and the financial strain on producers remains significant."

Crush is expected to increase slightly from 41,5 million to 42 million tonnes. "Argentina's soya bean crush industry has seen a resurgence in activity this year due to increased domestic soya bean production and a steady flow of imports, primarily from Paraguay," the FAS commented. – *World-Grain.com*


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Spray application in canola

By Philip Rebel and Dr Gideon van Zyl, ProCrop

Canola is one of the world's most versatile and valuable crops, playing a vital role in the agricultural economy. However, like any crop, canola is vulnerable to pests and diseases that can significantly reduce yields if not properly managed.

Effective control starts with getting the basics of sprayer setup and calibration right. The relationship between factors such as water volume per hectare, droplet size, and forward speed is crucial, as each of these variables influences the others. Understanding spray application methodology is essential to maximise the effectiveness of every spray pass to ensure pest and disease control.

A key aspect of spray application that is often overlooked is the maintenance of spraying equipment. When spray equipment is not maintained unexpected breakdowns happen more often, which can be detrimental to the timing of critical sprays (for example 30% flowering stage fungicide spray application for *Sclerotinia* stem-end rot).

Height of the boom

When setting up a spray boom, attention must be given to the boom height above the target crop area and the nozzle fan angle. An industry standard recommendation is to run a spray boom between 35 and 50cm above the target crop canopy. A boom height of 50cm will ensure 100% overlapping between neighbouring nozzles from 80- to 110-degree nozzles.

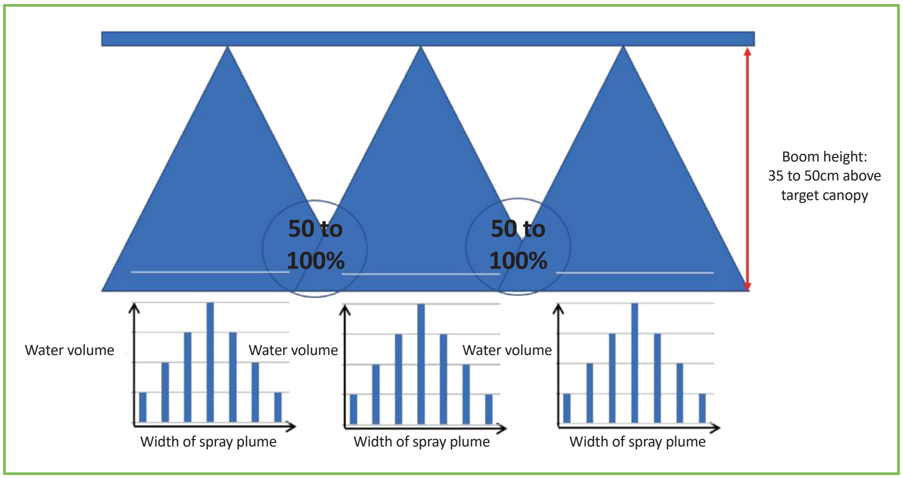
Overlapping is important as the volume and droplet size produced in the spray plume of a flat fan nozzle are not uniform from the middle to the side of the plume (*Figure 1*). Overlapping must be sufficient to ensure an even distribution of spray volume over the width of a spray boom. Boom height above the canopy thus needs to be increased throughout the growing season as canola canopies become higher and more complex, to stay within the 35 to 50cm above the top of the canopies.

Time and speed factors

Spraying speed is a determining factor for spraying logistics, effectiveness, and safety. The ideal is to use a spray speed that will allow the operator to do the spray application under the most ideal environmental conditions during the day/or night, achieve optimal deposition parameters, reduce drift, and do so as efficiently as the equipment and driving surface will allow.

We want to do the right application at the right time. An example of this is herbicide application that should be done at the weed's sensitive growth stage or a preventative fungicide application to susceptible plant material before a potential infection period. If the application is not done in the optimal time slot, poorer effectiveness of the application can be expected.

Figure 1: Water volume distribution across the width of the spray plume produced by normal flat fan nozzles, thus indicating the need for spray plume overlap.



It is important to choose the optimal spraying speed according to a farming unit's specific circumstances. As the spray boom moves through the air, the air movement caused by the wake of the moving sprayer affects the formation of the spray plume and the ability of the droplets to reach the target area. If the spraying speed increases, the wake of the sprayer can intercept droplets before they reach the target area. These intercepted droplets are prone to spray drift out of the target sprayed area.

Spray factor trials

Spray deposition trials were conducted by ProCrop in 2020/21 in collaboration with the Western Cape Department of Agriculture (WCDA) to investigate the effects of water volume, spraying speed and droplet size on spray deposition in winter wheat. Data generated indicated that spraying speed has a direct decreasing effect on spray deposition as indicated in *Figure 2*. This should be considered when spraying later in the canola growing season (for example the 30% flowering spray application for *Sclerotinia* stem rot management).

Increasing spraying speed can lead to lower canopy penetration in this critical spray period. Thus, when selecting a forward speed for these applications, data suggests a more conservative spraying speed will still have you finish the spray application at the right time while ensuring optimal spray deposition. ProCrop and the WCDA is currently busy with a similar spray deposition project in canola to investigate how spraying speed and water volume affect spray deposition in canola plants at the four- to six-leaf growth stage and the 30% flowering stage.

Optimal water volumes

The selection of water volume per hectare plays a critical role in ensuring optimal spray deposition. It is important to consult plant protection product labels for recommendations regarding specific water volume rates per hectare. Spray deposition trials were conducted in 2023 by ProCrop and the WCDA on the influence of water volume rates on deposition quantity at the four- to six-leaf stage and 30% flowering stage of canola plants.

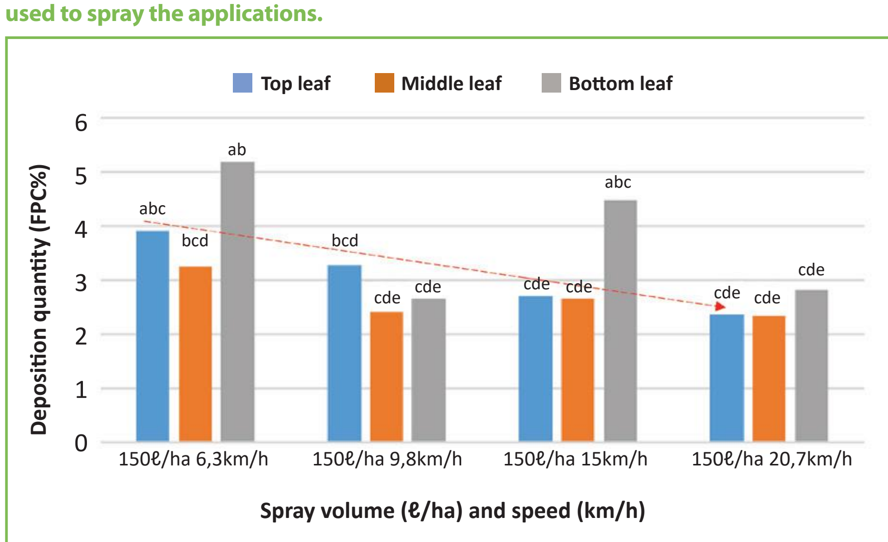
Data suggests an advantage in using lower water volume ranges within a given water volume recommended by fungicide labels as illustrated by *Figure 3*. For example, Aviator® Xpro from Bayer recommends that spray applications be made in at least 250 to 350ℓ/ha when doing ground-based boom spray applications. From these trails using the 250ℓ/ha water volume rate will be the preferred selection within this given volume range.

The effect of higher spray deposition at a lower water volume rate is due to a higher active ingredient concentration per droplet when using lower water volume rates compared to a higher water volume rate. This effect results in a higher deposition quantity per droplet impact on a target surface. This effect has been observed across a wide range of crops sprayed at low-volume concentrate spays. However, this advantage only holds when the number of droplets released towards the target is sufficient.

This lower limit for droplets or water volume rate needs to be determined for each crop type and growth phase. Recent studies in winter wheat indicated a rapid decline in deposition quantity when water volume rates below 100ℓ/ha were used compared to 100 and 150ℓ/ha, while using a constant product dose per hectare between water volume rates (unpublished data, ProCrop).

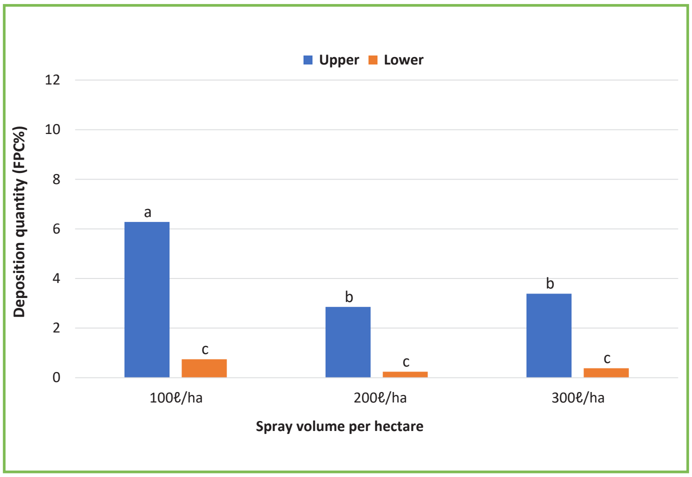
Trails to determine the lower limit for water volume rate on canola plants at the four- to six-leaf stage and 30% flowering stage were conducted in 2024 by ProCrop

Figure 2: Spray deposition on wheat leaves as a result of different forward speeds used to spray the applications.



Bars with the same letters do not differ significantly according to Tukey's HSD test.

Figure 3: Spray deposition quantity resulting on the upper and lower leaf surface of canola plants at the 30% flowering growth stage when sprayed at 100ℓ/ha, 200ℓ/ha and 300ℓ/ha water volume rates. The active ingredient dosage per hectare was constant between the three spray volumes tested.



Bars with the same letters do not differ significantly according to Tukey's HSD test.

and the WCDA in collaboration with the Plant Pathology Department of Stellenbosch University. Data will be published in due course.

Strategy leads to success

When selecting nozzles for a given water volume rate for a spray application at a given sprayer speed or speed range, the droplet size produced by the nozzle needs to be considered. Spray deposition trials done in wheat, onions and potatoes indicated that using medium (volume median diameter [VMD] range 236 to 340 micron) to coarse (VMD range 341 to 403 micron) droplets strikes a balance between coverage area and drift reduction. Medium to coarse droplets provide sufficient coverage while reducing the risk of drift, especially when using lower water volumes.

Be mindful of self-calibrating systems when selecting a nozzle with a given droplet size at a given pressure. As the sprayer speed increases, the self-calibration system will increase the liquid pressure through the nozzles to ensure constant water volume rates per hectare. However, with an increase in pressure the droplet spectrum of a nozzle changes towards finer droplets. Thus, when selecting a nozzle make sure the droplet spectrum over the pressure range to be used is within the desired droplet range. Consult the nozzle catalogue of the brand of nozzles that you are interested in buying to help aid this decision.

Consider your spraying strategy before setting out to do a spray application. The principles in this article are a reminder of some of the most important influencing factors that can help ensure that the right plant protection product selected reaches the target successfully. Consider these before investing in new technologies to aid the spray application process. Further optimisation for spray application in canola production is an ongoing process towards a well-oiled process.

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Promising soya bean cultivars based on the national soya bean cultivar trials

By Annelie de Beer, Nicolene Cochrane and Lizette Bronkhorst, Agricultural Research Council

The production of soya beans (*Glycine max*) in South Africa accelerated during the mid-2000s to such an extent that it is currently the second-largest grain crop produced. Favourable soya bean prices, higher yields, increased input costs, and improved soil health contribute to the rapid expansion of soya bean production. However, the severe drought during the 2023/24 season resulted in an average yield of 1,57t/ha, much lower than the previous season's 2,4t/ha, with total production of 1 810 790t on 1 150 500ha.

Notable events impacting production include the registration of the first Roundup Ready® cultivar (A5409RG) in 2001 and the approval of the first Intacta Roundup Ready 2 Pro® (a new genetically modified soya bean trait) by the South African regulatory authority in 2021.

Soya bean yield varies by locality due to locality-specific genotype x environment interactions, as soya beans

Table 1: Average number of days to 50% flowering and harvesting of cultivars during the 2023/24 growing season for warm, moderate, and cool production areas (*Table 1* continues on page 11).

Cultivar		Days to 50% flowering			Days to harvest			
	Maturity group	Warm[1]	Moderate[2]	Cool[3]	Warm[4]	Moderate[5]	Cool[6]	Supplier
RA4918RR	4,9	39	50	61	127	136	151	Agri Seed & Technology
NS 5258 R	4,9	39	50	63	127	129	152	Limagrain
DM 5351 RSF	5	40	51	62	130	134	153	GDM Seeds/Agricol
RA5022BR	5	42	50	63	127	134	153	Agri Seed & Technology
PAN 1515R	5	43	53	68	128	133	153	Pannar
DM 53154 RSF IPRO	5,1	41	51	62	127	134	154	GDM Seeds/Agricol
P52T52R	5,2	51	59	74	134	144	170	Pioneer
LG60353R	5,3	45	54	68	130	136	165	Limagrain
Y540	5,4	47	58	71	134	141	166	Southern Hemisphere
RA 565 R	5,5	49	61	75	134	143	166	Agri Seed & Technology
LAKE 253 RR	5,5	50	66	81	146	149	172	Lake Agriculture
LS6851R	5,6	49	60	74	146	146	173	Limagrain
US56-26R	5,6	53	59	72	141	145	166	United Seeds
PAN 1521R	5,7	51	63	76	141	144	170	Pannar
PAN 1555R	5,7	53	64	82	145	149	176	Pannar
RA5821R	5,8	51	62	75	130	141	172	Agri Seed & Technology

LAKE 250 RR	5,8	52	65	78	146	154	178	Lake Agriculture
PAN 1588R	5,9	52	65	81	138	148	172	Pannar
RA660 R	6	49	61	74	137	145	166	Agri Seed & Technology
DM 59R03 RSF	6	49	59	73	142	145	175	GDM Seeds/Agricol
DM 59160 RSF IPRO	6	50	65	75	145	148	176	GDM Seeds/Agricol
LG60260IPR	6	55	66	81	145	149	176	Limagrain
LG60259R	6	51	62	79	142	148	172	Limagrain
LG6026IPR	6,1	53	66	82	145	150	179	Limagrain
P62T16R	6,2	53	64	80	146	154	179	Pioneer
US63-22 IPRO	6,3	52	66	77	148	157	183	United Seeds
RA6422BR	6,4	57	67	82	147	158	178	Agri Seed & Technology
P64T39 R	6,4	52	67	83	147	153	178	Pioneer
Y657	6,5	53	65	78	148	151	172	Southern Hemisphere
Y651IPRO	6,5	57	66	85	144	153	181	Southern Hemisphere
DM 68R09 RSF	6,6	58	66	82	146	154	179	GDM Seeds/Agricol
DM 61I63 RSF IPRO	6,6	58	68	84	147	156	182	GDM Seeds/Agricol
PAN 1644R	6,7	57	64	78	147	151	173	Pannar
US68-12 IPRO	6,8	62	73	91	155	161	185	United Seeds
P71T74 R	7,1	60	66	84	156	160	182	Pioneer

**Cultivars not on the variety list, contact the relevant seed companies.*
1: Average of five localities; 2: Average of six localities; 3: Average of nine localities; 4: Average of four localities; 5: Average of seven localities; 6: Average of six localities.
Days to flowering – average of 50% of plants with one flower.
Days to harvest – average of pods is mature, brittle and dry.

are daylight-sensitive. This and the prevailing temperatures drive the division of soya bean production into cool, moderate, and warm regions. Cultivar evaluation trials are an indispensable source of information for producers, given the yield benefits that producers can exploit by being able to adequately identify cultivars with reasonable adaptability that fit their localities, thereby ensuring optimum yield and profitability.

It is important when selecting cultivars to identify localities with similar climatic conditions and use tables representing the same region (*Table 2*). Important characteristics to consider during cultivar selection include days to 50% flowering,

Figure 1: The average yield for the cultivars evaluated during 2023/24 for the cooler production area.

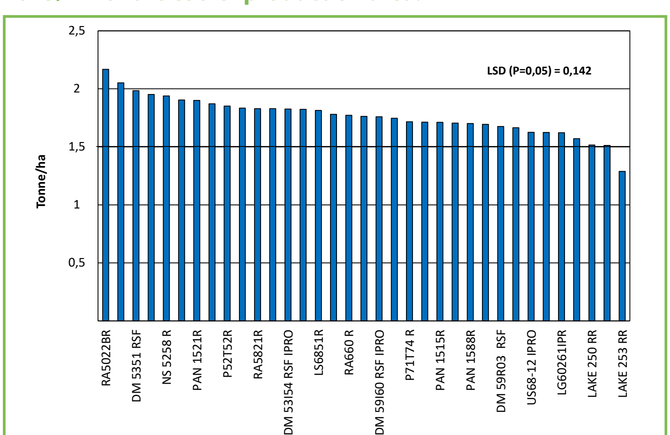
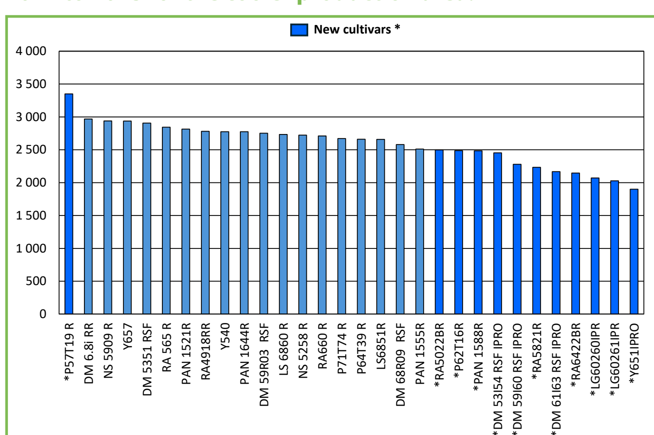


Figure 2: The average yield for the cultivars evaluated from 2021 to 2023 for the cooler production area.

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days to harvest (*Table 1*), and pod height. This article, however, focusses on yield, cultivar stability, yield probability, and the performance of new-generation cultivars.

Key aspects of the trial

Yield: Indicates the genetic adaptation and suitability of a cultivar that is to be planted in a specific area. It is recommended to use yield results along with yield probability and stability values for a more accurate cultivar choice (*Tables 3*, *4* and *5*). Determine the yield potential for which recommendations must be made, then consult the yield probability table at the determined yield potential. Select cultivars from the table that have above-average probability values and yield stability. This will improve the chance for a stable, successful yield.

Cultivar stability: The stability of a cultivar is determined by how close the R^2 value is to one; the smaller the Fprob value (preferably <0,1), the more stable the cultivar.

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

During the 2023/24 season, 30 trials were conducted at 27 localities, and 35 cultivars were included in the national soya bean cultivar trials.

Figures 2, *4* and *6* illustrate the performance of the new cultivars. Only cultivars included in the trials for at least two planting seasons were considered. For both the cool and moderate cultivars, P57T19R is among the top five, while DM59I60 RSF, DM61I63 RSF and LG60261 IPRO are among the top five performers for the warm area.

Table 2: Grouping of localities according to warm, moderate, and cool production areas during the 2023/24 growing season.

Warm	Moderate	Cool
Brits Agri Seeds (B/I) NW	Barberspan (D) NW	Alice Fort Hare university EC, Stellenbosch (D) WC
Hoopstad (D) FS	Cedara Dept (D) KZN	Bapsfontein PD1 (B/I) MP
Lichtenburg Agricol (D) NW	Greytown (D) KZN	Bapsfontein PD2 (B/I) MP
Schweizer-Reneke PD1 (D) NW	Greytown Kranskop Lake Agri (D) KZN	Belfast (D) MP
Schweizer-Reneke PD2 (D) NW	Heilbron Agri Seeds (D) FS	Bethlehem PD1 (B/I) FS
Warrenton Limagrain (B/I) NC	Kroonstad (D) FS	Bethlehem PD2 (B/I) FS
	Kroonstad Agricol (D) FS	Clarens (D) FS
	Leeudoringstad (D) NW	Delmas 1 (D) FS
	Umtata (D) EC	Kinross (D) MP
	Potchefstroom Limagrain (B/I) NW	Kokstad (D) KZN
	Umtata (D) EC	Marquard United Seeds (D) FS
	Winterton (D) KZN	Standerton (D) MP
		Zanyokwe EC, Stellenbosch University (B/I) WC

B/I: Supplementary irrigation; D: Dryland; NW: North West; FS: Free State; L: Limpopo; MP: Mpumalanga; KZN: KwaZulu-Natal; G: Gauteng; EC: Eastern Cape; NC: Northern Cape.

Table 3: Yield probability (%) of cultivars evaluated during 2021/22, 2022/23 and 2023/24 for the cooler production areas at different yield potentials (*Table 3* continues on page 15).

	Yield potential (t/ha)							Regression line	
Cultivar	1,5	2	2,5	3	3,5	4	4,5	Fprob	R^2
RA4918RR	61	59	56	55	52	51	48	<0,001	0,85
NS 5258 R	62	57	51	46	41	36	31	<0,001	0,78
DM 5351 RSF	62	60	57	54	52	49	47	<0,001	0,78
Y540	53	51	49	48	46	45	43	<0,001	0,73
RA 565 R	51	53	53	55	55	56	58	0,0008	0,66
LS6851R	51	49	45	41	38	35	32	0,0006	0,67

PAN 1521R	56	56	55	55	55	54	53	<0,001	0,97
PAN 1555R	35	36	37	39	41	42	43	<0,001	0,91
RA660 R	43	45	46	49	50	51	53	<0,001	0,95
DM 59R03 RSF	49	51	54	56	58	60	62	<0,001	0,93
*P62T16R	39	37	35	32	31	29	28	<0,001	0,74
P64T39 R	46	48	50	53	55	57	59	<0,001	0,91
Y657	46	51	55	60	64	68	72	<0,001	0,93
PAN 1644R	45	48	51	53	56	59	61	<0,001	0,93
P71T74 R	43	47	51	55	59	63	67	<0,001	0,93

Figure 3: The average yield for the cultivars evaluated during 2023/24 for the moderate production area.

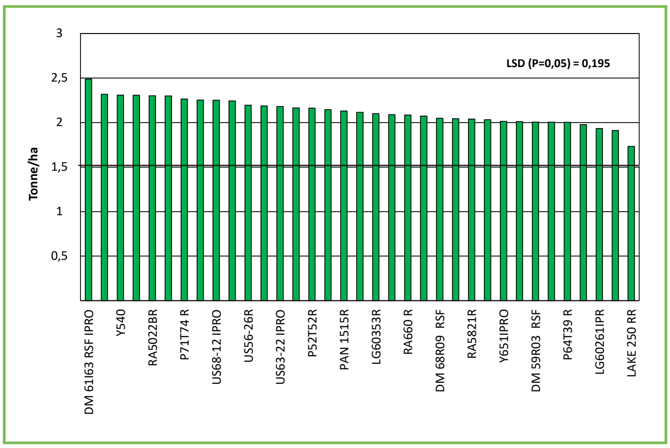


Figure 4: The average yield for the cultivars evaluated during 2021 to 2023 for the moderate production area.

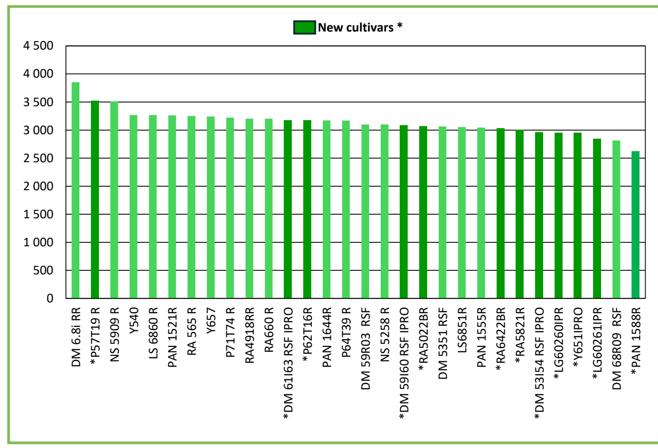


Table 4: Yield probability (%) of cultivars during 2021/22, 2022/23 and 2023/24 for the moderate production areas at different yield potentials.

	Yield potential (t/ha)							Regression line	
Cultivar	1,5	2	2,5	3	3,5	4	4,5	Fprob	R^2
RA4918RR	54	54	55	55	55	55	56	<0,001	0,93
NS5258R	45	46	48	49	50	51	52	<0,001	0,90
DM5351RSF	36	39	42	45	49	52	56	<0,001	0,86
Y540	52	54	56	58	60	61	63	<0,001	0,91
RA565R	61	59	59	57	56	55	54	<0,001	0,95
LS6851R	43	43	43	42	42	41	41	<0,001	0,93
PAN1521R	62	60	58	55	53	51	48	<0,001	0,88
PAN1555R	50	47	45	42	39	36	34	<0,001	0,95
RA660R	46	48	50	52	54	56	58	<0,001	0,94
DM59R03RSF	52	49	46	44	41	38	35	<0,001	0,94
*P62T16R	53	53	53	52	52	52	52	<0,001	0,87
P64T39R	49	48	48	48	48	47	47	<0,001	0,88
Y657	56	56	56	55	55	54	54	<0,001	0,87
PAN1644R	51	50	50	49	49	49	49	<0,001	0,92
P71T74R	50	51	52	53	54	56	57	<0,001	0,87

Table 5: Yield probability (%) of cultivars in 2021/22, 2022/23 and 2023/24 for the warm production areas at different yield potentials.

	Yield potential (t/ha)								Regression line	
Cultivar	2	2,5	3	3,5	4	4,5	5	5,5	Fprob	R^2
RA4918RR	65	63	61	59	56	54	51	49	<0,001	0,83
NS5258R	47	46	44	43	42	41	40	39	<0,001	0,74
DM5351RSF	62	58	54	49	45	41	37	33	<0,001	0,79
Y540	42	43	45	47	48	50	51	53	<0,001	0,94
RA565R	41	43	46	48	51	53	55	58	<0,001	0,92
LS6851R	40	41	42	44	45	46	47	49	<0,001	0,81
PAN1521R	56	56	55	54	53	52	51	51	<0,001	0,88
PAN1555R	51	47	43	38	34	31	27	24	<0,001	0,79
RA660R	68	66	64	61	59	57	55	52	<0,001	0,86
DM59R03RSF	49	49	50	51	51	52	52	53	<0,001	0,89
*P62T16R	40	40	40	41	41	41	41	42	<0,001	0,85
P64T39R	54	55	57	58	60	61	62	63	<0,001	0,96
Y657	52	56	59	63	66	69	72	74	<0,001	0,90
PAN1644R	39	44	49	54	59	63	68	72	<0,001	0,93
P71T74R	46	48	50	52	54	55	57	59	<0,001	0,91

** Cultivars coloured in Tables 3, 4 and 5 can be regarded as 'all-rounders' and have the potential to perform above average at all yield potential scenarios.*

Figure 5: The average yield for the cultivars evaluated during 2023/24 for the warm production area.

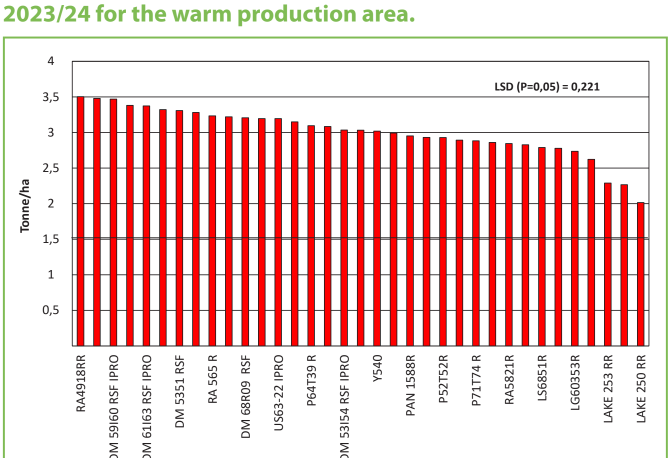
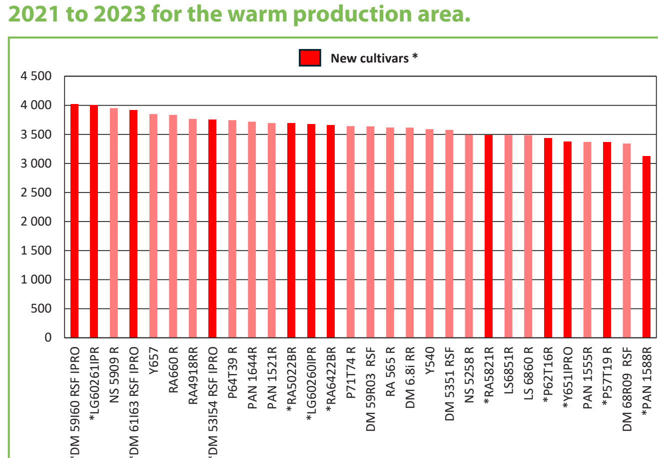


Figure 6: The average yield for the cultivars evaluated during 2021 to 2023 for the warm production area.



The execution of these trials was made possible through the financial support of the Agricultural Research Council, the Oil and Protein Seeds Development Trust, seed companies, UPL (inoculant), and numerous collaborators who conducted trials. We would like to thank Heila Vermeulen for her technical assistance. For more information, *visit www.arc.agric.za*.

Source: www.freepik.com.

Ninth World Congress on Conservation Agriculture

By Prof Johann Strauss, sustainable cropping systems research, Directorate Plant Sciences, Western Cape Department of Agriculture

The ninth World Congress on Conservation Agriculture (WCCA) was a tremendous success, attracting 490 delegates from 41 countries across six continents. Held at the Cape Town International Convention Centre, it was hosted by the Western Cape Department of Agriculture, *Landbouweekblad*, Conservation Agriculture Western Cape, and the African Tillage Network, with solid support from local and international sponsors.

The congress featured numerous keynotes, panel discussions, 93 oral presentations, and 43 posters. Special sessions covered sustainable mechanisation for smallholders, scaling conservation agriculture (CA) in Africa, gender equity, youth and social inclusion in CA, and the intersection of CA and agro-ecology. *Landbouweekblad* hosted sessions on legumes in the Western Cape, conservation farming technology, food safety, human nutrition, climate change, and insights from pioneer CA producers.

From humble beginnings

Conservation agriculture has experienced remarkable growth since the Food and Agriculture Organization of the United Nations (FAO) introduced it. Starting with the first WCCA in Madrid in 2001, the movement has expanded to cover an estimated 250 to 270 million ha of cropland, accounting for nearly 20% of global cropland. Despite this progress, CA remains relatively unknown to the public. The aim is to increase CA to cover 700 million ha by 2050.

The initial adoption of CA was driven by key factors such as erosion control, drought resilience, and economic benefits. Policy support is essential for widespread CA adoption to mitigate issues including soil degradation, biodiversity loss, and climate change. Development policies can integrate CA into education and vocational training systems, creating knowledgeable and skilled staff within national extension systems to aid producers in the transition. Additionally, research programmes should focus on CA systems rather than tillage research.

Supportive policies are crucial, such as providing financial assistance through credit schemes for new CA equipment and technologies and adjusting subsidy schemes to cover crop seeds or environmental services facilitated by CA. These measures can also stimulate a market for CA technologies, encouraging the machinery industry to participate.

Proof in implementation

Some interesting results have surfaced in the five decades of experience with CA systems worldwide and the three decades of intensive scientific research on these systems. Conservation agriculture was found to build and conserve the soil and regenerate many ecosystem functions and resources, such as soil organic matter, soil structure and health, biodiversity below and above the soil surface, and clean freshwater resources.

More recently, it was discovered that crops grown under CA would be richer in some vitamins, trace elements, and secondary ingredients. Complemented with other modern technologies for crop production, CA can be highly productive, helping to fight global hunger while regenerating natural resources and ecosystems.

Despite this, numerous efforts have been made to find alternatives and sustainable farming systems, as seen in terms such as 'eco-agriculture', 'agro-ecology', and more recently, 'regenerative agriculture'. Often, these 'ecological' farming systems are essentially organic farming, which still harms the environment through tillage. If they represent sustainable farming systems, it is because they incorporate CA. This is true for regenerative agriculture.

In some of Robert Rodale's literature, the creator of regenerative agriculture, there are references to CA principles, as regenerative organic agriculture differs from organic farming using no-tillage. Rodale adds two more principles: permanent living roots and crop-livestock integration with mob grazing. Regenerative agriculture is not an alternative to CA, but a complementary system optimised for agro-ecological zones where the climate supports permanent living roots and livestock integration.

The three principles of CA remain the universally valid concept for sustainable land management, while other elements and concepts complement and enhance the production system's performance and intensity. Additionally, the social components, a crucial aspect of the agro-ecology movement, are not alternatives to CA but intrinsic elements, according to Dr Theodore Friedrich, retired FAO official and CA researcher.

Highlights from the congress

One of the immediate challenges facing CA is herbicide-resistant weeds. According to Prof Ken Flower of the Australian Herbicide Resistance Initiative, the primary benefit of using more diverse crop rotations is the ability to employ different herbicide modes of action rather than simply reducing herbicide use. A relatively recent innovation in non-chemical weed control is harvest weed seed control. Harvest weed seed control allows the chaff fraction to be managed in various ways: it can be directed into a mill on the harvester to crush and kill weed seeds, dropped in the wheel tracks to confine the seeds, or collected in a cart pulled behind the harvester and used for livestock feed.

The heavy reliance on herbicides for cropping in Australia makes the system vulnerable to significant threats, such as the loss of social license to use certain essential herbicides and the evolution of herbicide-resistant weeds or weeds adapting their life cycles to evade constant herbicide use. However, the paradigm is shifting with rapid advances in digital technology and data science/machine learning. We should leverage these new technologies to inform our cropping and weed management strategies rather than relying solely on herbicides for weed control.

In a recent study led by Prof Karin Jacobs and her team at Stellenbosch University, the impact of CA practices on the soil microbiome and its function in maize was examined. The study compared farms employing cover crop and crop rotation practices with conventional farming methods in a maize-growing region. The findings revealed that CA practices with reduced nitrogen input significantly influenced soil bacterial diversity, community structure, and function.

The microbiomes from CA farms exhibited higher diversity and more distinct microbial communities than those from conventional farms. Additionally, it was observed that farms from different areas had unique microbial communities associated with the maize rhizosphere. There was a notable increase in microbial groups involved in biological nitrogen cycling in samples from CA farms, whereas these groups were suppressed in conventional farming practices.

Dr Martin Harries, a research scientist from Australia, underlined the importance of crop and pasture rotation, including break crops and pastures, as a foundation of conservation agriculture. These rotations are critical to ensuring high water use efficiency in a dryland farming environment. It is concerning that the need to manage herbicide-resistant weeds has caused a move away from biological nitrogen fixation. This is at odds with a critical principle of sustainable intensification: to rely less on external inputs while engaging ecological processes to supply nutrients.

Solutions for challenges

A significant concern in the Southern African context is the incomplete adoption of CA due to the unresolved issue of maintaining sufficient ground cover in smallholder farmers' fields and the prevailing belief that herbicides are the only solution for weed control once inversion tillage is abandoned, according to Dr Christian Thierfelder, principal cropping systems agronomist at the International Maize and Wheat Improvement Centre. He noted that various management strategies are available to address insufficient ground cover that is accessible to smallholder farmers.

Community grazing arrangements and improved rangeland management can help farmers maintain adequate ground cover for livestock. Various mechanical, biological, and cultural practices are also available to manage weeds in farming systems. However, achieving lasting change and fully adopting CA systems requires more than technological innovations; it necessitates a concerted effort on multiple fronts. This may include private incentives, changes in norms, institutional innovations, and supportive governmental policies.

Conservation agriculture is not a cure-all for humanity's challenges, but it is a powerful tool that addresses multiple issues simultaneously. Of the 17 *United Nations Sustainable Development Goals*, CA directly and indirectly contributes to 11 of these goals. This alone should motivate us to focus on promoting and accelerating the adoption of CA globally. Rather than creating new buzzwords, we should recognise that CA offers a practical, operational, and universally applicable solution for sustainable land management that can help feed the world.

For more information, send an email to Prof Johann Strauss at Johann.strauss@westerncape.gov.za.

Source: www.freepik.com.

Profitability and risk profile: A South African perspective

By Hendrik Smith, Mary Maluleke, James Blignaut, Jaap Knot, Anika de Beer, and Nic van Schalkwyk

Crop producers are increasingly walking the financial tightrope because of rising input costs, reduced soil productivity due to soil degradation, climate variations, and being selling price-takers. The producer's ability to hedge him-/herself against financial distress is increasingly limited.

From a food security perspective and for the survival of the rural agrarian economy of South Africa, it is of the utmost importance to use the most productive, profitable and sustainable crop production system. More so since debt, and thus financial risk, in the agricultural sector is spiralling out of control (*Figure 1a*). Intermediary expenditure, or the production cost of running a farm, as a percentage of total farm debt, increased by 134% from 37% in 1985 to 86% in 2020.

Agriculture, with its ambition to produce food and make a profit, is doing that on debt – and that is debt serious. This is largely because of the discrepancy between the retail and producer prices and the cost of production. This price differential spans the entire value chain, as indicated in *Figure 1b* for beef production.

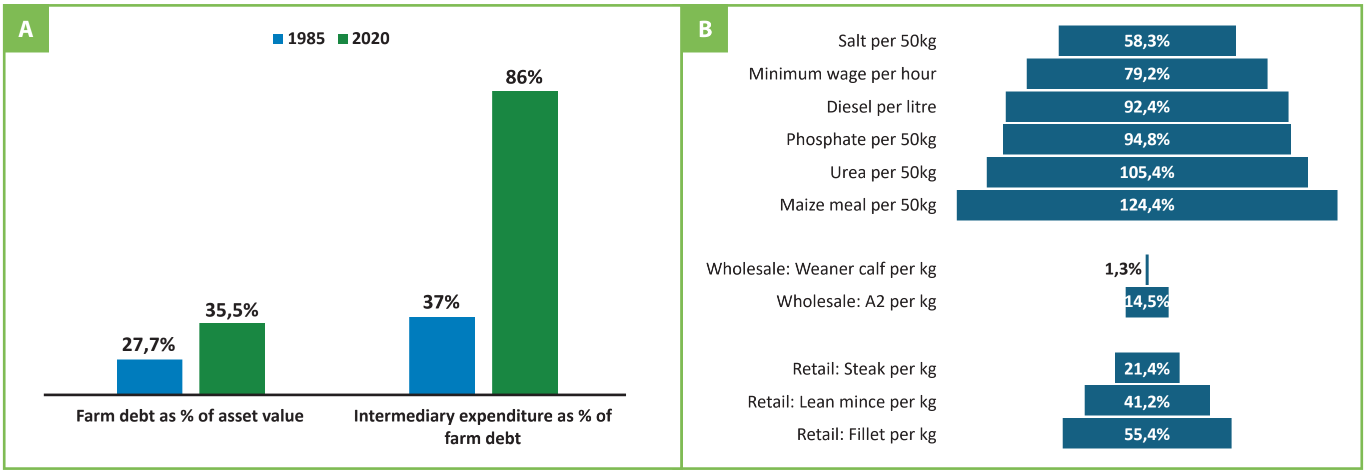
Due to debt and narrowing profit margins, farms are being consolidated, i.e., they are getting bigger. As noted in *Figure 2*, the area under maize production has remained relatively stable since 2010, but the number of farms in 2024 has decreased to only 45% of the number in 2010. Meanwhile, the average farm size has increased by 215%. This is a staggering structural change and has introduced even more risk.

With economies of scale, each farm can operate more efficiently with expensive technology and equipment, but they are less efficient when it comes to the need for an introduction of management and knowledge-intensive production systems. Additionally, the agricultural system is at greater risk due to the reduced number of participants, placing an increasing burden on their shoulders not to fail.

Grain production system analysis

The *South African Journal of Science* recently published a paper comparing the cumulative free cash flow (CFCF) of three different grain production systems in three summer rainfall regions across South Africa (Maluleke *et al*. 2024). The regions are the Mpumalanga Highveld, North West province, and the Maluti region in the Eastern Free State. The production systems analysed are an integrated crop-livestock conservation and regenerative agricultural system (CA/RA), conventional tillage (CT), and a no-tillage (NT) system.

Figure 1: Farm debt in South Africa (A, on the left) and the percentage change in unit prices between 2017 and 2024 (B, on the right). (Source: Abstract of agricultural statistics 2021 and various primary sources)



These systems include three key grain and oilseed crops that currently drive the farming economy in these regions: maize, soya beans, and sunflower.

The authors modelled and compared the CFCF (financial benefits) of these different production systems over twenty years based on in-field research and data from six research trial sites covering these regions. This cost-benefit model assumed a farm size of 1 000ha, with 600ha as cropland and 400ha as rangeland (veld).

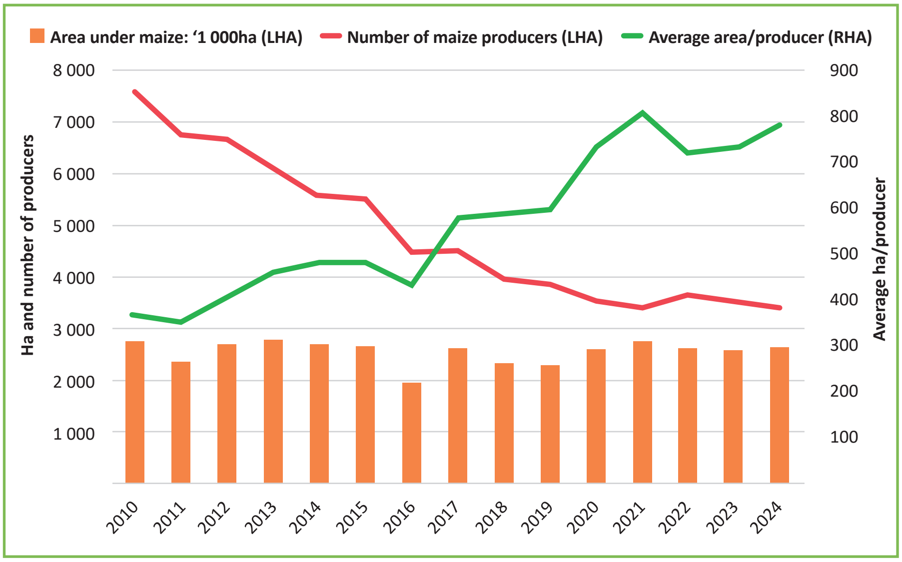
The CT system in the model has been defined as a system that employs primary tillage practices before planting, and after planting using chemical weed control (post-emergence herbicides), with simple crop rotations (maize and soya in Mpumalanga and Maluti, with maize and sunflower in North West) and livestock grazing only on the veld. It assumes an increased use of agrochemicals over time (10% higher by year 20), which includes herbicides, pesticides, fungicides, and fertilisers. The NT system is defined as a system that employs no-tillage planters with the same crop rotation system as that of the CT system, and livestock grazing only on the veld. This system assumes constant high rates of agrochemicals over the 20 years.

The CA/RA system employs no-tillage practices with a more complex crop rotation system integrating maize, soya bean and sunflower cash crop rotations with cover crops. Livestock is used intensively in both the veld area and on cover crops. This model assumes the decreasing application of agro-chemicals due to improved ecosystem functions and services, such as soil health, and increasing use of bio-stimulants. Fertiliser use decreases to up to 50% of the original. To allow for a longer period of learning and adaptation, a CA/RA conservative scenario was developed. This scenario is based on the same parameters as the one mentioned but allowing for a slower reduction (ten years) in the use of external inputs.

Macro data for the model, such as input and selling prices, have been kept uniform based on the actual market data from the 2020/21 and 2021/22 seasons. A cost inflation rate of 6% and a revenue inflation rate of 5% are assumed, while using a social discount rate of 7%. It is further assumed that the cash crop yields remained unchanged, but that such constant yields were achieved by the change in the use of fertiliser as mentioned. Maize yields varied between 7t/ha (Mpumalanga), 5t/ha (Maluti), and 5,85t/ha (North West). It was assumed that the yields for soya would be 2t/ha (Mpumalanga) and 1,8t/ha (Maluti), and that the sunflower yield would be 1,83t/ha (North West). Biomass utilisation rates varied across the production areas based on the research trial data.

While the capital costs started on levels unique to each production system, the model allows for different replacement periods over 20 years. For the CT system, equipment is replaced every five years, while for CA/RA and NT, it is replaced every eight years (seven years for the

Figure 2: Area (in '1 000ha) under maize production, the number of maize producers, and the average size of maize farms. (Source: Crop Estimates Committee)



Note: LHA = left-hand side axis; RHA = right-hand side axis.

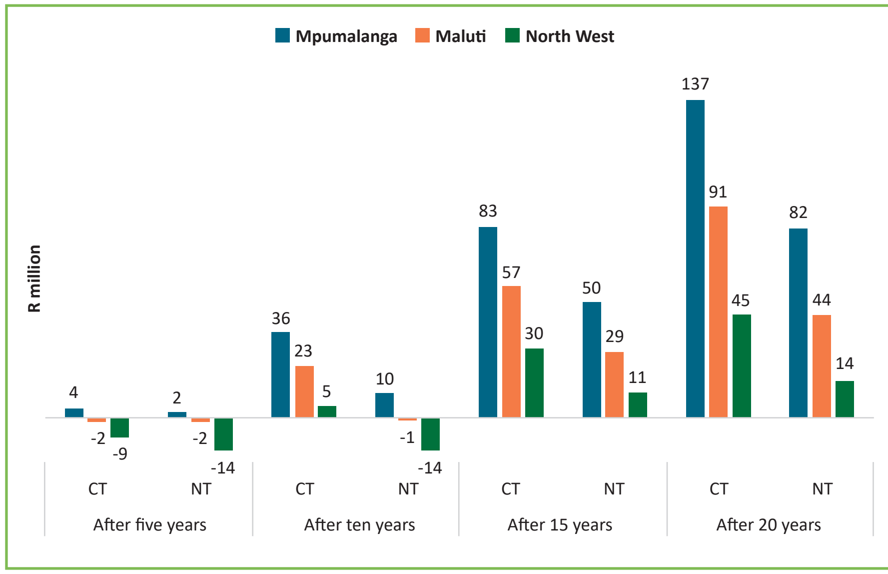
conservative CA/RA scenario). The CA/RA system involves a significant investment in livestock by buying cattle for higher grazing intensities on cover crops and veld.

CFCF margin analysis

The margin (difference) in CFCF between the average of the two CA/RA scenarios and that of CT and NT at four time intervals is provided in *Figure 3*. A positive margin indicates that the difference in CFCF is in favour of CA/RA. While the net difference in the CFCFs at year five is slightly negative in the Maluti and North West regions, significant positive margins are observed in all the production areas by year 20.

In Mpumalanga, the CFCF for the CA/RA at year 20 is estimated to be R86 million, compared to -R51 million for CT and roughly R4 million for NT. That is a net difference of between R137 million (compared to CT) and R82 million (compared to NT). In the Maluti area, the CFCF for the CA/RA production system is estimated at R26 million compared to -R66 million for CT and -R19 million for NT. In the North West production area, the CFCF for the CA/RA production system is estimated at R35 million, compared to -R9 million for CT and approximately R21 million for NT. The differences in the CFCF of the CA/RA system and other systems represent the financial opportunity cost of not converting to CA/RA systems.

Figure 3: Cumulative difference between the CFCF of CA/RA and that of CA and NT respectively at different intervals for three production regions. (Adapted from Maluleke *et al*. 2024)



Note: The bigger the margin, the bigger the difference between CA/RA and the alternative system. A positive figure indicates that the CFCF of CA/RA is higher.

CA/RA transition costs

The requirement to invest in livestock to diversify and restore soil health (by grazing on cover crops) reduces the initial free cashflows of CA/RA, as modelled in this study, compared to both CT and NT. This gives rise to what is known as a J-curve, or an investment curve, during the first few years of transitioning to CA/RA (visible in *Figure 3* in the first five years).

The costs associated with the J-curve may exceed the financial ability of many producers, and financial and technical strategies and incentives are required to assist them in successfully transitioning through this period. After this transition period, given the reduction in exposure to input and equipment costs and the continuous improvement in soil health, the long-term benefits of CA/RA outweigh the initial investment cost by a significant margin and help producers avoid the deadly cost squeeze.

In conclusion

The challenge to feed a growing population while producing maize, soya bean and sunflower profitably will continue to increase, and that must take place against the backdrop of variable climatic conditions, rising external production costs, and limited land. This, in addition to rising farm debt uptake, growing area under production, and declining number of farms and producers in South Africa.

It is thus imperative, from both a food as well as national security perspective, to adapt and implement grain production systems that are both financially and environmentally sustainable. That is possible and there are options, including for smallholders, but it will require context-specific technical and financial support systems and approaches.

This study showed that this system allows maize and oilseed producers to produce a yield surplus and generate a positive return on investment over the medium to long term, but it seems as if this is based on a condition. The condition is the sustainable reduction of input and equipment costs, which will reduce vulnerability and exposure to external shocks, improve soil health to improve resilience, and the change in production methods.

From a practical point of view, the following tips can be considered by maize and oilseed producers to ensure success:

- Start learning the new CA/RA practices on small test plots on the farm.
- Alleviate any soil problems, such as compaction and soil acidity, before you start with CA/RA.
- Design the rotation system and include cover crops during summer and winter.
- A double cover crop system (summer and winter) could be established on a field every four to six years, or roughly 15 to 25% of the farm, depending on the number of livestock.
- For soya beans, a double cover crop system before, and winter cover crops after harvest increase its resilience.
- For sunflower and maize, intercropping boosts total production and resilience.
- Perennial, green, fallow ley crop systems and livestock work best to rehabilitate degraded soil.
- Consider using biostimulants, such as seed coating inoculant, pop-up in row support and foliar applications, and work towards the reduction of synthetic inputs.

For more information, email the author at smith.hendrik@gmail.com.

Sulphur nutrition for oilseed crops

By William Gibson

Tessenderlo Kerley's crop nutrition product portfolio of potassium sulphate and clear liquid thiosulphate fertilisers all contain sulphur and a macronutrient. These products are ideally suited for fertilising many crops, including high-sulphur-demand oilseed crops.

Importance of sulphur

Sulphur plays an important role in determining final oilseed quality and yield. It is an essential nutrient that must be considered for profitable oilseed production.

Sulphur is a key component for forming plant proteins, amino acids, vitamins, and enzymes.

Sulphur is essential for chlorophyll production. It is also required for optimum nitrogen metabolism and assimilation.

Sulphur is immobile in the plant, so should be continually available during peak sulphur-demand growth stages. It is important to choose the right sulphur-containing fertiliser for the specific crop and growth stage. Sulphur can be applied to the soil or topped up with foliar spray application, when the plant sulphur requirement may exceed what the soil can supply.

Thiosulphate fertilisers

Thiosulphate fertilisers are very effective, high-concentration liquid products. They have unique properties and allow for cost-effective and uniform fertiliser application. These fertilisers contain sulphur in the highly effective thiosulphate form. Thiosulphate typically becomes available to plants over a longer period than sulphate.

Topdress soil application

KTS® (potassium thiosulphate) contains a high concentration of chloride-free potassium (20,7% w/w) and 17% w/w sulphur.

Thio-Sul® (ammonium thiosulphate) contains nitrogen (11,8% w/w) and a very high concentration of sulphur (26% w/w). Thio-Sul® is a popular sulphur-containing product in the liquid nitrogen fertiliser industry. It can be applied as a straight product and is compatible with most liquid nitrogen fertilisers.

Foliar application of K-Leaf®

K-leaf® is a unique product, developed specifically for foliar application. It contains fast-dissolving, soluble potassium (42,8%) and sulphur (18%). K-leaf® provides a boost of potassium and sulphur when it is needed most.

These products can be a valuable addition to your crop nutrition programme. Confirm final recommendations with your local agronomist.

Visit *www.tessenderlokerley.com* for more information.

Oilseed producers go for gold

By Elmarie Smit, Plaas Media

Grain SA's Grow for Gold Awards recently celebrated its fifth birthday at the Thaba Eco Hotel in Johannesburg. The Grow for Gold National Yield Competition provides a platform for grain producers to compete for the best yield per category, aiming to reach the genetic potential of different grain crops and learn from one another.

According to Corné Louw of Grain SA, this year saw the best yields per millimetre of rain, despite the drought experienced in most parts of the summer rainfall area. Soya bean yields were between 130 and 210% higher than the national average. This year a wheat competition was introduced, and a new sunflower grain yield p/ha record was set.

The winners in the Grow for Gold oilseeds categories were (place, producer, company or own entry, cultivar, yield):

Soya beans

KwaZulu-Natal region:

- *First*: Bertie Pretorius from Newcastle, Pioneer, P64T39R, 4,402 t/ha.
- *Second*: Hein Smit from Normandien, Agricol, DM 68R09, 4,401 t/ha.
- *Third*: Tommie Scholtz from Bergville, Pioneer, P64T39R, 4,189 t/ha.

Eastern Highveld region:

- *First*: Danie Bester from Balfour, direct entry, DM 5351 RSF, 5,470 t/ha.
- *Second*: Rouxgrow from Witbank, AST, RA565 RR, 4,660 t/ha.
- *Third*: Jannie Schoeman from Middelburg, Pioneer, P48T48R, 4,374 t/ha.

Eastern Free State region:

- *First*: Daniel Slabbert from Bethlehem, Agricol, DM 5953 RSF, 3,710 t/ha.

Central region

- *First*: Viljee Crous from Kroonpark (Kroonstad), direct entry, DM 6.8iRR, 5,030 t/ha.
- *Second*: Boetina Boerdery from Endikot, Agricol, DM 5953 RSF, 4,948 t/ha.
- *Third*: Mike van Niekerk from Derby, Pioneer, P71T74R, 4,144 t/ha.

North West region

- *First*: PG van Zyl from Schweizer-Reneke, Pioneer, P64T39R, 4,720 t/ha.
- *Second*: Jozeph du Plessis from Schweizer-Reneke, direct entry, Agriocare EC24, 3,804 t/ha.
- *Third*: Hennie and Henro Pieterse from Sannieshof, Agricol, DM 6.8iRR, 2,370 t/ha.

Water Table region

- *First*: Kobus Grobbelaar from Bothaville, Agricol, DM 6.8iRR, 6,124 t/ha.
- *Second*: Chris Marx from Bultfontein, AST, RA565 RR, 5,609 t/ha.
- *Third*: Burrie Naudé from Hoopstad, Agricol, DM 61i63 RSF iPRO, 4,725 t/ha.

Some of the winners in the soya bean categories. At the back from the left are Bertie Pretorius from KwaZulu-Natal, Daniel Slabbert from the Eastern Free State, Danie Bester from the Eastern Highveld, Corné Louw of Grain SA, and Johan Bibbey of Bayer. In front are PG van Zyl from North West, Derek Mathews, chairperson of Grain SA, Kobus Grobbelaar from the Water Table region, and Japie Breedt, irrigation category.

Irrigation

- *First*: Japie Breedt from Bapsfontein, AST, RA660 RR, 6,197 t/ha.
- *Second*: Tok van der Walt from Delareyville, Agricol, DM 5953 RSF, 6,170 t/ha.
- *Third*: Jan van Heerden from Hartswater, Agricol, DM 5953 RSF, 5,732 t/ha.

Sunflower

Grain yield/ha:

- *First*: Stompie Olivier from Potchefstroom, Pannar, PAN 7180CLP, 4,472 t/ha (competition record).
- *Second*: Dalton Viljoen from Koster, Pioneer, P65LP65, 4,173 t/ha.
- *Third*: Danus van Zyl from Leeudoringstad, Agricol, AGSUN 5270, 4,147 t/ha.

Oil yield/ha:

- *First*: Danus van Zyl from Leeudoringstad, Agricol, AGSUN 5270, 4,147 t/ha, 46,6% oil, 1,93 oil yield/ha.
- *Second*: Eddie van Heerden from Wesselsbron, Agricol, AGSUN 8251, 3,650 t/ha, 44,1% oil, 1,61 oil yield/ha.
- *Third*: Pieter van den Berg from Hertzogville, Agricol, AGSUN 8251, 3,27 t/ha, 43,7% oil, 1,43 oilyield/ha.

Stompie Olivier from the Potchefstroom area and winner of the sunflower category for grain yield/ha, spoke to *Oilseeds Focus* following the awards function. He said that contrary to popular belief, sunflowers do not thrive under harsh conditions. He emphasised the importance of proper fertilisation and planting the crop at the right time. In his experience sunflowers that are planted earlier perform better. Foliar sprays are also very important for sunflowers.

For more information, visit *www.groeivirgoud.co.za* or send an email to luzelle@grainsa.co.za.

Effective seed treatments and coatings

By Jonathan Etherington, CEO, MBFi

Seed treatments and coatings play a significant role in the global agriculture industry. The return on investment is significant for growers who make use of these high-quality technologies in the farming business.

When selecting a seed treatment, it is important to start by identifying the target or goal that needs to be achieved. Growers have a variety of registered products to choose from including, but not limited to, nitrogen-fixing and phosphate-solubilising bacteria, green chemistry biocontrol and chemical fungicides, insecticides, nematicides, and bio-stimulants or nutrient treatments. The abundance of options can sometimes be overwhelming.

Once the grower, local consultant, and agent in a specific area have identified the target or goal of the treatment, several practical requirements must be considered:

- The application method: Dry/wet sequential or slurry mixtures, depending on the available seed treatment machine.
- Compatibility of the various treatments.
- The viability period of the product on the seed.
- Practical situations for flow and dusting rate caused by the seed treatment.
- Globally harmonised system (GHS) compliance for the health and safety of workers applying seed treatments.

Methods of application

Seed treatments can be applied using three different methods: dry sequential, wet sequential, or a slurry mixture. These methods significantly impact the viability and compatibility of the products used, especially biological products, but chemical compounds can be impacted as well.

Most pesticide formulations contain biocides to kill bacteria and increase the shelf life of products in containers; however, on the seed, compatibility between different products can be negatively impacted. Therefore, it is important to consider formulations with the same active ingredients for compatibility.

Best practice

Dry sequential: Three products are used to treat the seed. The first product is typically a chemical seed treatment. This layer needs to dry completely before adding the second layer, which is generally biological. Again, proper drying is required before applying the third and final product, normally a finishing or drying powder. This method creates physical layers, which is the most effective way to treat seeds, although it is generally uneconomical.

Wet sequential: Three products are used to treat the seed. The first is typically

Figure 1: The no-clearance zone observed on the plate (A); a clearance zone is observed, indicating incompatibility (B).

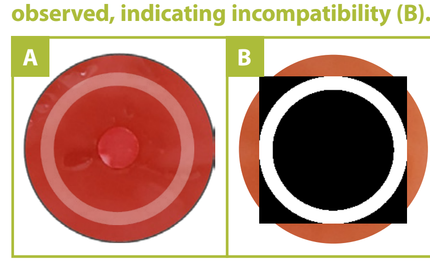


Figure 2: Variations in the viability of treatments can be observed over four hours (T0), seven days (T7) and 14 days (T14).

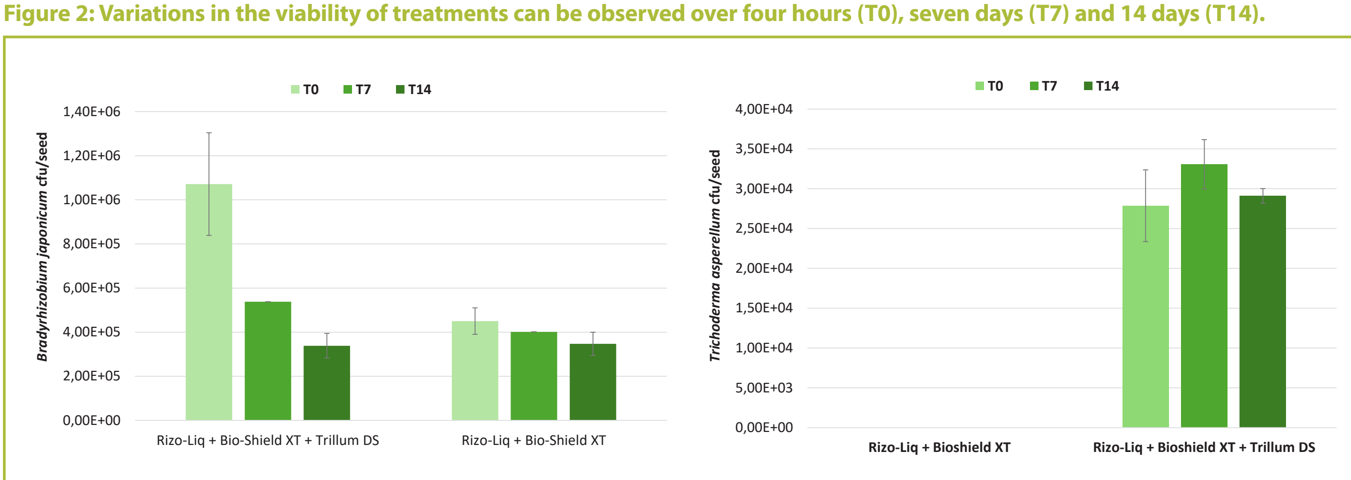
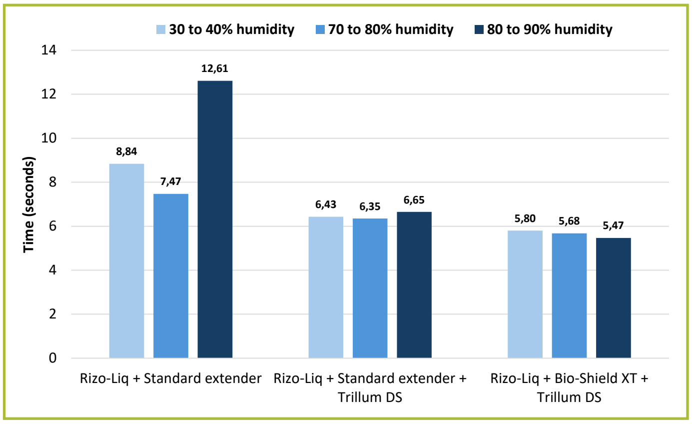


Figure 3: The reaction of seed treatments at various humidity levels.



a chemical seed treatment. Following thorough mixing while still wet, the second layer is added. This is generally a biological product. Once completely mixed, the final product, a finishing or drying powder, is applied. This method also creates physical layers but is executed in one treatment, taking only a few milliseconds between applications, making it more economical and practical for seed treatment.

Slurry mixture: Three products are used to treat the seed. All three products, including both chemical and biological products, are mixed in a clean, empty container. The slurry is mixed thoroughly before application to the seed. No layers are formed with this method, resulting in the least compatibility among the products used.

Compatibility, viability, flow rate

Figure 1a indicates no clearance zone observed on the plate, compared to *Figure 1b* where a clearance zone is observed, indicating incompatibility of the products.

Figure 2 indicates clear variations in the viability of the treatments over four hours, seven days, and 14 days. We can see that these products are viable for up to 14 days in this trial specifically.

At various humidity levels, the seed treatments react and flow differently. A seed treatment product will always affect the seed surface, but it is essential to have a good quality treatment which needs to be practical and ensure good singulation for the grower to plant practically (*Figure 3*).

GHS compliance

New legislation is now in force to ensure worker safety and guidance on personal protective equipment and clothing to be used with various treatments. Always read the full label and if unsure refer to the material safety data sheets or safety data sheets of the product.

Seed treatment products, when applied correctly, are effective and will increase the yields of your crop, but then you also need to choose the best registered products which are compatible and tested in your area. You will have consistently higher yielding crops and better stand. Plants will also be more resilient, improving tolerance to weather and environmental challenges faced throughout the planting period and in the early growing cycle of the plant.

For more information, contact Jonathan Etherington on 082 921 8428 or at jonathan@mbfi.co.za.

syngenta®

Choosing the right variety: A challenge indeed

Cropwise Seed Selector

With various commercially available wheat varieties to choose from on the market, one of the most daunting challenges South African growers face is choosing the best one for their needs. Syngenta® can help you meet this challenge head-on with our unique and differentiated variety of seed recommendations. With our digital solutions, you will have access to this innovative technology for your farm.

What sets us apart?

Cropwise® Seed Selector is all about allowing growers to make more confident decisions by providing high-quality recommendations. From our trials around South Africa, we can give the best advice and solutions to growers for each individual field.

Cropwise® Seed Selector does this by categorising each of our trial locations according to their environment, climate, soils, and yield potential, so it can best meet the requirements for your own fields and farms.

A convenient online solution

Cropwise® Seed Selector is all about providing added convenience and flexibility for producers who lead busy lives. The release of this 'self-service' platform is an important milestone for Syngenta® as it offers the same experience and data-driven, personalised recommendations for each grower, which is used by Syngenta's technical sales representatives daily.

Cropwise® Seed Selector provides ultimate flexibility and enables growers across South Africa to benefit from our field-specific recommendations. Cropwise® Seed Selector is designed to work for everyone on any device and can be easily accessed by growers whatever they are.

Trust and experience

Our recommendations come tried and tested. Cropwise® Seed Selector's application, along with Syngenta's on-farm technical sales reps, have already collected plenty of valuable data over the last few seasons, creating a variety of recommendations for more than 5,2M ha globally for many growers just like you!

As wheat is planted just once a year, producers have a limited number of opportunities in their lifetime to find the right variety for their fields. We understand that each of these decisions is vital. Luckily Cropwise® Seeds Selector is here to help you make the best planting decisions, using Syngenta's experience and technical resources. This is why Cropwise® Seed Selector's recommendations are built on data matching your local conditions and your fields.

Looking after all growers

Digital solutions such as Cropwise® Seed Selector allow us to bring the best agronomic advice and the best growing experience to all farms in South Africa.

Choosing the right variety to plant on each field effectively reduces risks and variables, which can make the difference between a successful or unsuccessful season. Cropwise® Seed Selector ensures sustainable seed recommendations for all outcomes, with recommendations developed for remarkable stability and consistency in variety performance, to cope with variable environmental extremes and climates.

Cropwise® Seed Selector gives you the tools and knowledge to take on the season, no matter what the challenge is. Make the best start with Cropwise® Seed Selector with years of experience and innovative technology, helping growers plant the right varieties and optimising their yields. Let's grow together.

Scan the QR code to watch a video on how the Cropwise® Seed Selector can be used, visit *www.syngenta.co.za/seed-selector* or contact Magda du Toit at magda.du.toit@outlook.com or on 066 204 9285.

New groundnut cultivars registered

By Dr Wikus Snijman, project manager: groundnut breeder seed, ARC-Grain Crops, Potchefstroom

The Agricultural Research Council's (ARC) national groundnut cultivar trial results were announced earlier this year. Registered and breeding line varieties were once more investigated, and new accessions developed by the ARC's breeding division were introduced to the 2022/23 trials.

The ARC is constantly developing new cultivars to meet industry requirements. Thus, two new cultivars were registered with the Registrar of Plant Improvement in accordance with Section 20 of the *Plant Improvement Act, 1976 (Act 53 of 1976)*, and the listing of varieties ARC 474 (PC 474-K9) and ARC K6 (PC 435-K6) in the national varietal list were approved. Seed of these two cultivars are being multiplied.

During the 2022/23 season, cultivar and plant population trials were planted under dryland and irrigation conditions and 24 genotypes (cultivars and breeding lines) were investigated – 22 from the ARC and two from SA Peanut. The trials aimed to identify the best breeder seed so that the multiplication of the best cultivars could commence. To accommodate uniformity, all trials were harvested 150 days after planting.

PC 474-K9, one of the new cultivars registered as ARC 474.

Data were analysed using the GenStat® statistical program, and all trials were planted according to a randomised block design. The 24 genotypes were planted in three repetitions and four rows of 4m/genotype. Nine different localities with different climatic conditions were included, covering all South African groundnut production areas. The localities were Bultfontein, Hartswater (Vaalharts), Vaalwater, Hoopstad, Bothaville, Setlagole, Groblersdal, Potchefstroom, and Jan Kempdorp.

Trial results

This article presents the results of the top five varieties that produced a pod mass higher than the benchmark. The pod mass was determined by measuring the mass of pods (producer's stock) harvested from two of the four rows per genotype per repetition. The kernel mass was determined by shelling 500g of pods per genotype.

The screen (sieve) sizes used during the grading of groundnuts were 9, 8,25, 7,5, 6,75, 6 and 7,2. Values 9 to 6,75 represent the choice grade fraction of the seed, and 6 and 7,2 represent the diverse/sundries and splits fraction, respectively.

Bultfontein (irrigated trial that yielded more than 3,5kg pod mass): In repetition one, Sellie Plus performed the best with 5,04kg from 2 x 4m rows as harvested and collected from the field, although the kernel mass obtained from a 500g pod sample was lower (368,78g) compared to ARC 474-K9 (3,66kg pod yield) with a kernel mass of 374,05g from a 500g pod sample. The ideal choice grade fraction from the kernel mass on sieves 9 and 8,25 was almost not obtained throughout the repetitions, but from sieves 7,5 and 6,75 which are less preferable. This phenomenon was also prevalent across most of the genotypes.

Vaalwater (irrigated trial that yielded more than 3,5kg pod mass): The climatic conditions played along very well as can be seen in the high yields. The best pod yield was obtained from ARC Opal (6,84kg) from 2 x 4m rows, as was harvested and collected from the field. PC 474-K9 is one of the new cultivars registered. The best kernel yield obtained from a 500g pod sample was produced by Anel (391,18g). The bigger percentage of the choice grade fraction was obtained from the 7,5 and 6,75 sieves.

Hoopstad (dryland trial that yielded more than 5kg pod mass): The yields were very good and compared well to the yields at Vaalwater, which was an irrigated trial. The best pod yield was produced by PC 480-K14 (6,68kg) in repetition two. The best kernel yield was obtained from PC 494-K2 (404,55g), but the better choice grade fraction was not obtained from sieves 9 and 8,25.

Setlagole (dryland trial that yielded more than 2,5kg pod mass): At the dryland trial at Setlagole, the yields followed the same pattern as was indicated by the values in the trials mentioned.

Bothaville (dryland trial that yielded more than 2,5kg pod mass): In repetition two there were only four genotypes with a yield that was higher than the benchmark of 2,5kg pods. In relation to the same set of genotypes/accessions that were cultivated at localities, another genotype (PC 435-K4, 4,8kg), different from Hoopstad, outperformed the rest regarding pod mass. ARC Oleic (404,2g) yielded the highest number of kernels. The best choice grade was obtained from Akwa in repetition two, although the biggest fraction came from the smaller kernels on sieves 7,5 and 6,75. Only PC 435-K4 (repetition two), ARC Oleic (repetition three), and PC 474-K9 (repetition three) produced choice-grade groundnuts from the bigger kernel fractions (sieves 9 and 8,25).

Groblersdal (dryland/plant population trial): Although the pod mass of the highest population should supposedly be the highest, the data showed that population and pod mass are not necessarily the determining factors. The most important variable is the choice grade fraction because that determines the income the producer will receive. In repetition one, Kwarts (with a population of 350 000 plants/ha) produced 2,32kg pods from 2 x 4m rows. However, Schubert (with a population of 300 000 plants/ha) yielded the highest number of choice-grade kernels (166g) from a 500g pod sample.

In repetition two, Schubert (with a population count of 300 000 plants/ha) yielded 2,28kg of pods, but the choice grade of PC 474-K9 (2,08kg pods) produced the highest number of choice grade kernels (159,6g) per 500g pod sample. This phenomenon is visible throughout the trials. At this stage, the only explanation is that groundnuts are triploid and have a complex genetic profile which causes the variety in growth patterns and yields.

PC 435-K6, a new cultivar registered as ARC K6.

Hoopstad (dryland/plant population trial): The Hoopstad trial was the best across the genotypes and localities. In repetition one, the cultivars ARC-K6 (250 000 plants/ha) and Schubert (350 000 plants/ha) showed the ideal production pattern where the yield on sieves 9 and 8,25 were higher compared to the yields on sieves 7,5 and 6,75. This pattern is ideal because the 6/7 and 7/8 kernel sizes mostly determine the quality of the choice grade fraction and have a direct effect on the price of the groundnuts. Across repetitions one to three it is again visible that the higher pod yields do not determine the choice grade yields.

Jan Kempdorp (dryland/plant population trial): At Jan Kempdorp the yields were much lower compared to Hoopstad. The different climatic conditions are the reason for the differences across locations, which are different from the variances caused by the genotypes' genetic profiles. It is also shown that the lower quality of choice grade kernels is produced by sieves 7,5 and 6,75. For example, in repetition three the kernel yield of Sellie Plus (300 000 plants/ha) on sieves 7,5 and 6,75 was 119,5g and on sieves 9 and 8,25 it was 92,5g.

Vaalharts (irrigated/plant population trial) and Potchefstroom (dryland/plant population trial): In these trials the values were very close to each other. The erratic rainfall patterns affected the yields in regard to distinguishing between dryland and irrigated trials. However, the same pattern was followed as was seen in the results from the trials described.

Due to the variations, it is viable to compare results per location among the repetitions and genotypes and not across localities. Cultivars on the national seed list still produced well. The two new registered cultivars, ARC K6 and ARC 474, performed well. The diverse/sundries and crush component (sieves 6 and 7,2) are high and could be reduced through more careful picking and shelling during the harvesting process.

The full set of results and tables can be obtained from the author at snijmanw@arc.agric.za.

The economic and environmental cost of delayed GM crop adoption: The case of Australia's GM canola moratorium

By Scott Biden, Stuart Smyth, and David Hudson

The commercialisation and adoption of genetically modified (GM) crops in numerous early adopting countries reached their 20th anniversary in 2017. Despite a rapidly growing body of literature on the economic, environmental and health benefits arising from the adoption of GM crops, environmental non-governmental organisations (eNGOs) are still campaigning for barriers to further adoption, if not outright bans, on GM crops and the technologies used to create them.

The eNGO community's strategy is to rigorously apply the Cartagena Protocol on Biosafety (CPB) as part of developing countries' biosafety regulations and regulatory framework. Using socio-economic considerations (SECs), the opponents of biotechnology and GM crops can establish barriers to the adoption of agricultural innovations. Often this debate to restrict the release of biotechnology and GM crops is so fixated on perceived risks and impacts to biodiversity that evidence of environmental, food security, and producer benefits are often overlooked or undervalued.

GM crop legislation and impact

Negotiated in 2000 and coming into effect in 2003, the CPB initially showed some potential as an international environmental agreement that could serve a valued role. However, it has evolved into an agreement that is no longer based strictly on scientific risk assessments but allows for the implementation of spiritual, ethical and cultural issues that, in most instances, have no data and no methodology capable of assessing the issue, let alone providing informed insights into the substance of the matter.

This politicisation of risk has resulted in socio-economic issues such as gender rights and land tenure becoming part of the assessment process for GM crops in some countries that are party to the CPB. The inclusion of SECs within the CPB framework allows countries to develop biosafety legislation in which no negative socio-economic impact from the commercialisation of a GM crop is allowable. This use of the precautionary principle, with ambiguous interpretations of how to evaluate SECs, may allow SECs to act as a trade barrier to protect the vested interest and stands in contrast to 20 years of evidence which shows that GM crops continue to be welfare-enhancing with no negative effects on human health.

With eNGO organisations lobbying for the outright rejection of biotechnology, instead of following scientific, evidence-based policy, it is critical to be able to quantify the environmental and economic cost of rejecting the technology. To enable such evidence to be compiled, GM canola adoption data from Canada has been modelled into an adoption S-curve that has been applied to Australia. Australia approved GM canola for production in 2003, which was followed by moratoriums imposed by state governments, lasting up to six years in the three main canola-growing states and ongoing in other states.

Using the Canadian GM canola adoption curve, it becomes possible to estimate what the environmental and economic benefits of GM canola could have been for Australia in 2014, had the moratoria not been implemented. Quantifying the opportunity cost of a GM crop delay will serve to inform policymakers in developing countries regarding the option of not including GM crops as part of the solution to improving domestic food security and producer incomes. While there are several studies, primarily in Europe, but also in Australia, that estimate the ex-ante costs and benefits of adopting GM crops, this analysis is one of the first studies that evaluate post-adoption evidence to assess the opportunity costs of a moratorium on a GM crop.

Data and results

The resulting environmental opportunity costs from delaying the adoption of GM canola in Australia are sizable with continued impacts today. The foregone hectares of GM canola production resulted in an additional 6,5 million kg of herbicide-active ingredients applied. The application of these herbicides had a negative environmental impact of 14,3% as measured through the environmental impact quotient.

In addition to the herbicidal impact from the continuation of non-GM conventional canola varieties, there is also a foregone benefit of changes in machinery use associated with fewer spraying applications in GM canola. These changes in machinery use resulted in

Table 1: Australian economic moratoria opportunity costs, 2004 to 2014.

Economic category	Actual	Scenario	Difference	Percentage change
Yield (mt)	25mt	26mt	1,1mt	4,2% increase
Contribution margin (AU$)	AU$10,7 billion	AU$11,1 billion	AU$485,6 million	4,5% increase

over seven million extra hectare passes in Australia, burning an additional 8,7 million litres of diesel fuel. The environmental impact associated with the burning of this diesel fuel released 24,2 million kg of greenhouse gas (GHG) and compound emissions, equivalent to approximately 5 000 cars being driven for one year.

GM crop benefits

These environmental impacts come in strong contrast to much of the hypothetical controversy against GM crops. The aggregate impacts in this case study have illustrated that GM canola has a lower environmental impact compared to the non-GM canola basket established through the application of lower amounts of less toxic herbicides and a reduction in GHG emissions.

The aggregate economic impacts follow a similar storyline to the environmental impacts. The economic factors of changes in variable costs of weed control, yield, and the contribution margin indicate that GM canola possesses economic benefits compared to the non-GM canola basket. The yield impact from the moratoria resulted in an opportunity cost of 1,1 million tonnes of foregone canola production. Pricing this foregone canola production based on the Australian delivered price for canola per metric tonne from 2004 to 2014, the foregone yield benefit is approximately AU$ 551 million (~US$495 million) of revenue to the Australian economy.

The contribution margin, an evaluation of revenue minus the variable costs of production, calculated the per-hectare trade-off of GM canola production versus a non-GM canola basket. This margin includes the average revenue, calculated using yield and the average canola price between 2004 and 2014, and the variable cost of production, consisting of the variable cost of weed control, seed, and segregation costs.

GM canola carries the additional variable costs of a technology access fee, for the use of the patented trait and a cost for the on-farm segregation of GM seed. The impact of the contribution margin indicates an AU$486 million (~US$431 million) opportunity cost of foregone producer benefits associated with the moratoria.

Conclusions

The policy discussion on GM crops tends to involve the environmental benefit of protecting biodiversity from the risk a new crop trait may hold, possibly through cross-pollination of wild relatives. This discussion does not usually incorporate the risks that are innate to the conventional varieties already in production and cultivation, such as the toxicity of active ingredients applied in the form of pesticides and herbicides.

> As is evident from the assessment of Australia's moratorium, the costs to a developed nation are substantial, but they may be more impactful in the developing world to food insecure and poorer producers.

If the goal is to minimise agriculture's impact on the environment, then the adoption of the more environmentally friendly and sustainable GM crop is likely the best solution, as negative environmental impacts are higher through the continuation of non-GM, conventional crops. Similarly, delays in approving GM crops may be denying producers potential economic benefits that have been shown to accrue in jurisdictions in which producers have had the choice of GM and non-GM crop varieties. Although benefits vary based on crop, trait, and on a country-by-country basis, evidence suggests most adopters do gain.

The CPB advocates that countries have the right to implement the precautionary principle to the fullest extent should the approval of a GM crop variety fail to guarantee with 100% certainty that biodiversity would not be impacted following commercial approval. Such a rigorous application of the precautionary principle has developing countries following the lead of European nations, banning the commercialisation of GM crops, or implementing moratoriums on the assessment, regulation and commercialisation of GM crops, similar to that of Australia.

As is evident from the assessment of Australia's moratorium, the costs to a developed nation are substantial, but they may be more impactful in the developing world to food insecure and poorer producers.

Impact in Africa

The impacts of these results offer some insight to other countries delaying the adoption of GM technology, especially in the developing world. In Africa, the influence of European policy and the CPB in delaying the adoption and cultivation of GM crops is best illustrated through the impact to income.

Klümper and Qaim's meta-analysis report of 147 studies on GMO crops found declines in chemical use of 37%, yield increases of 22%, and producer profit increases of 68%. Poor weed control is arguably the single biggest contributor to low maize yields for African smallholder farmers, which can be benefitted by GM herbicide tolerant traits that allow for more efficient use of a post-emergent broad-spectrum herbicide, which has a positive impact on weed control, therefore yield.

Long-term effects

GM crops have been shown to decrease yield losses, which can increase income; reduce inputs such as herbicides and pesticides, which have negative health effects and financial costs; and reduce input applications, which frees up time and is associated with higher farm incomes, with the larger impacts being observed in developing opposed to developed countries. Thus, the policy of preventing the adoption of GM crops may harm the environment and effectively limit producers' abilities to choose what is best for them and their land.

This article was condensed for *Oilseeds Focus*. For the full article or references, email Stuart Smyth at stuart.smyth@usask.ca.

INTRODUCING

LIVIN

SOYBEAN - LIQUID

SBP1

A liquid *Rhizobium* bacterial inoculant for enhanced nitrogen fixation in Soybeans

THE UNIQUE FORMULATION OF LIVIN-SBP1 OFFERS:

- A high concentration of *Bradyrhizobium japonicum* WB74 (2 x 10^9 CFU/g)
- Protective layer allows seeds to be treated up to 2 days before planting
- Natural sticking properties
- Superior plant health and yield
- Compatible with standard seed treatment equipment

LIVIN SBP1 at work

LIVIN SBP1 has been put to the test during many field trials, across various bioclimatic zones. While the number of nodules is important, the colour inside of the nodule is also of significance. **Nodules that are cut open and are red, pink, or orange inside are actively fixing N and are beneficial to the plant as shown here for Soybeans treated with SBP1. LIVIN SBP 1** outperformed the industry standard and untreated control on all parameters tested:

29 %	40	8 %
YIELD	NODULE COUNT	NODULE SIZE
increase compared to untreated control.	extra per plant, when planting 2 days after treatment.	increase compared to industry standard.

ALWAYS READ LABEL BEFORE USE / NOT CLASSIFIED IN TERMS OF GHS / HAZARD STATEMENT: None. / **ACTIVE INGREDIENT:** *Bradyrhizobium japonicum* 2.0 x 10^9 cfu/ml / Reg. No. L11643, Act 36 of 1947. **REGISTRATION HOLDER:** In Line Trading 112 (Pty) Ltd. (Co. Reg. No. 2003/008663/07) Cedar Lake Industrial Estate, C/O M57 & Porcelain Roads, Olifantsfontein, 1666, Gauteng, RSA

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Livin SBP1: A strategic investment for soya bean growers

The demand for sustainable and high-yielding crops such as soya beans is paramount in today's rapidly evolving agricultural landscape. To meet the growing demand while addressing environmental concerns, innovative agricultural practices and inputs are essential.

Livin SBP1 is a new Nutrico seed treatment solutions product offering a reliable and effective solution for soya bean growers seeking to optimise yields, reduce costs, and promote sustainable farming practices. By incorporating this innovative inoculant into their production systems, producers can enhance the profitability and resilience of their soya bean operations.

Key features of Livin SBP1

Livin SBP1 carries a high concentration (2 x 10^9 cfu/g) of the beneficial soil bacterium *Bradyrhizobium japonicum*, which forms a symbiotic relationship with soya bean roots. By facilitating nitrogen (N) fixation, this inoculant reduces the need for excessive N fertiliser applications, leading to cost savings and environmental benefits.

When the legumes utilise fixed N, they form green leaves (rich in chlorophyll). This improves the plant's photosynthetic capability making the plant grow faster and healthier, directly affecting the potential yield. Healthy soya beans are also in a better position to withstand environmental stresses, such as drought and nutrient deficiencies.

The efficacy of bacterial inoculants can be affected by certain environmental conditions such as temperature, radiation, pH, presence of the nutrients phosphorus, sulphur, molybdenum, cobalt, iron, as well as water availability.

The advanced formulation of Livin SBP1 features the high-performing *B. japonicum* strain WB74, known for its adaptability to diverse African soil conditions, and includes a protective layer which not only boasts natural sticking properties but allows seeds to be treated up to two days before planting. The liquid format promotes rapid and efficient colonisation of soya bean roots and is compatible with standard seed treatment equipment, maximising its convenience and effectiveness.

Independent trials

Independent trials are crucial to ensure the effectiveness of any agricultural input. These trials evaluate product performance under various field conditions, providing valuable insights for producers. By analysing key parameters such as yield increases, N fixation rates, nodule number and overall crop health, producers can make informed decisions regarding the use of soya inoculants. While the number of nodules is important, the colour inside of the nodule is also of significance. Nodules that are red, pink, or orange inside are actively fixing N and are beneficial to the plant.

Livin SBP1 has been put to the test during many independent field trials, across various bioclimatic zones. To show the efficacy of SBP1 when applied as indicated on the product label, the average number of nodules per plant, the soya bean yield, and the average nodule size of Livin SBP1 were compared to an untreated control and various registered standards (competitor products).

Livin SBP1 outperformed the industry standard and untreated control on all parameters tested (*Figures 1* and *2*) for trials carried out in South Africa and Zimbabwe. For the trials in South Africa, an average yield increase at plant maturity of 29% was seen compared to untreated control, and the average yield increase compared to the *B. japonicum* standard in Zimbabwe was measured at 26%.

It is also important to note that up to 40 additional nodules per plant were determined, even when planting two days after treatment, as well as an 8% increase in nodule size compared to the industry standard.

Figure 1: Effect of different inoculants on soya bean average grain yield at crop maturity (kg/ha) in South Africa.

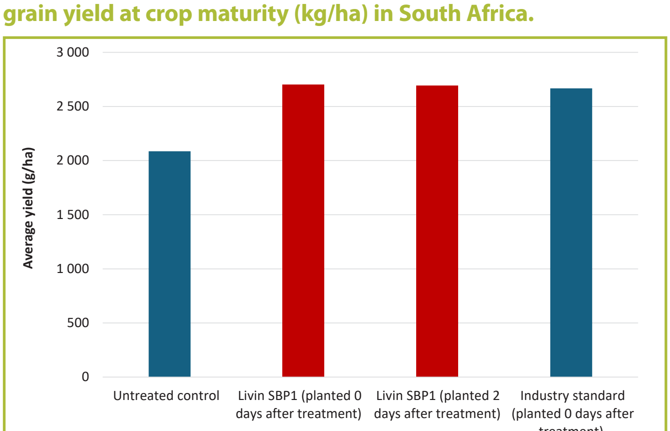
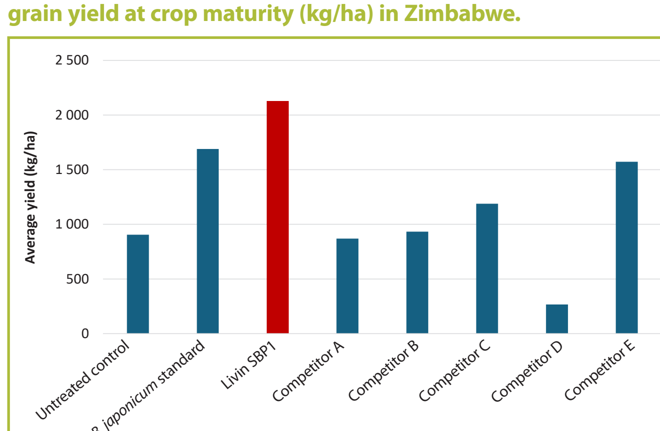


Figure 2: Effect of different inoculants on soya bean average grain yield at crop maturity (kg/ha) in Zimbabwe.



For more information on Livin SBP1, visit *www.nutrico.co.za* or phone 011 392 4072 or 021 807 5922.

Soya bean genetics, genomics, and breeding for improving nutritional value and reducing antinutritional traits in food and feed

By William Singer, Yi-Chen Lee, Zachary Shea, Caio Canella Vieira, Dongho Lee, Xiaoying Li, Mia Cunicelli, Shaila S Kadam, Mohammad Aamir Waseem Khan, Grover Shannon, MA Rouf Mian, Henry Nguyen, and Bo Zhang

CRISPR/Cas9 has been used to edit a variety of traits in soya bean including biotic and abiotic stressors tolerance, agronomic traits, and improved seed composition and nutritional profile (Xu *et al*., 2020). For instance, CRISPR/Cas9 has been used to create early flowering soya bean genotypes, drought-tolerant soya bean, and *Phytophthora sojae*-resistant soya bean (Han *et al*., 2019; Liu *et al*., 2023; Zhong *et al*., 2022).

This technology has been used to increase the content of nutrients as well as decrease the content of antinutritional factors (ANFs). It has been used to increase oleic acid content while simultaneously decreasing linolenic acid (Chen *et al*., 2011; Demorest *et al*., 2016; Wu *et al*.,2020), as well as combining these traits with a decrease in linoleic acid (Do *et al*., 2019). CRISPR/Cas9 has also been utilised to improve protein content through the editing of the *AIP2* gene (Shen *et al*., 2022).

There have been cases of developing soya bean varieties combining both improved protein and oil content, which were previously demonstrated to have a strong pleiotropy and negative correlation. In this case, researchers were able to develop soya bean progenies with increased oleic acid and protein contents while significantly decreasing linolenic acid content by knocking out the *GmFAD2-1A* and Gm*FAD2-2A* genes (Wu *et al*., 2020).

This multiplexing of traits has also been used to improve the isoflavone content of soya bean and decrease the content of the raffinose family oligosaccharide (Cao *et al*., 2022; Zhang *et al*., 2020). Lastly, CRISPR/Cas9 has been used to significantly decrease the content of ANFs, Kunitz trypsin inhibitor (KTI), P28, and P34 in soya bean seeds (Sugano *et al*., 2020; Wang *et al*., 2022).

Source: www.freepik.com.

Improved methods

While high-throughput phenotyping is already an extremely useful tool for soya bean breeders, improved methods are constantly being developed and adopted by the soya bean breeding community. Near-infrared reflectance spectroscopy (NIRS) has substantially contributed to the improvements of protein and oil in soya bean. The development and calibration of superior models have allowed NIRS to estimate additional seed composition traits, such as amino acids, fatty acids, sucrose, and even total isoflavone content (Choung, 2010; Pazdernik *et al*.,1997; Sato *et al*., 2008).

The advancements in robotics, artificial intelligence, and NIRS capacities are allowing the development of real-time, non-destructive, single-seed characterisation for physical and chemical properties. An example is the QSorter Explorer, which accurately sorts and groups seeds on an individual basis based on a variety of traits, including protein and oil as well as specific fatty acids (QSorter Technology, n.d.). This allows breeders to easily identify seeds with desirable composition, as well as facilitating the process of purifying seeds for field trials and commercialisation.

Genomic prediction and selection

Genomic selection has been used in breeding schemes to enhance different traits in soya bean, including stress resilience, seed composition, agronomic traits, and ultimately seed yield. For protein and oil content, genomic selection has been found to have moderate to high efficacy and accuracy, ranging from 40 to 80% (Duhnen *et al*., 2017; Jarquin *et al*., 2016; Smallwood *et al*., 2019; Stewart-Brown *et al*., 2019).

While protein and oil content are two of the primary traits studied in soya bean breeding, genomic prediction and selection provide limited benefits given the availability of methods that can effectively quantify seed protein and oil quickly, and cost-effectively. Instead, genomic prediction and selection have focussed on traits that are labour-intensive and/or costly to measure, such as amino acids and carbohydrate profiles.

Additionally, multivariate genomic prediction models can be deployed to improve multiple traits simultaneously (Jia and Jannink, 2012). Multivariate models have been used to predict traits of interest, such as chlorophyll content in conjunction with soya bean cyst nematode (*Heterodera glycines*) resistance, and have been found to improve prediction accuracies compared to univariate models (Okeke *et al*., 2017; Ravelombola *et al*., 2019). In seed composition, multivariate models have the potential of improving a variety of seed composition traits simultaneously, including selection for higher protein and oil content, as well as amino acid, carbohydrate, and AND content.

Future directions

Although there have been many successes in soya bean seed composition improvement, further advancements have been hindered by technological obstacles. The two primary obstacles are obtaining stable soya bean mutants after transformation and finding suitable genotypes of soya bean that can be transformed (Xu *et al*., 2022). As of now, nonelite cultivars, such as Jack and Williams 82, are primarily used in transformation (Paz *et al*., 2004). While these lines are highly suitable for transformation, they lack the high-yielding genetic background of modern cultivars.

Currently, few elite lines have been transformed (Jing *et al*., 2016; Zhang *et al*., 2014). Ideally, breeders would be able to transform a wide variety of soya bean varieties to develop elite lines with improved nutrient traits. To fully utilise CRISPR/Cas9 to accelerate breeding, more work is needed to overcome these obstacles. Doing this will enable breeders to transform elite lines that are adapted to their respective areas of interest. This will increase the breeding speed by allowing breeders to eliminate the step of crossing the transformed cultivars with adapted, elite lines.

Additionally, CRISPR/Cas9 has been successfully used to multiplex traits. As gene editing technology continues to improve, there is no doubt that breeders will use it to multiplex a variety of improved seed composition traits into one variety. This will likely expand to multiple composition traits, such as a variety having allergens, TI, and other ANDs knocked out.

Similarly, the high-throughput phenotyping methods will continue to advance. Even though NIRS has been heavily used to quickly measure a variety of seed composition traits, there are still some traits that it cannot precisely measure. These traits include ANFs, such as KTI and Bowman-Birk trypsin inhibitor (BBTI), vitamin and mineral content, carbohydrates, and individual isoflavones. As this technology continues to improve, breeders will be able to select desirable traits in a high-throughput manner with minimal labour requirements, costs, and inputs.

Genomic prediction and selection have revolutionised plant breeding by predicting unobserved traits that are labour-intensive and costly to measure. Although minimal applications have been deployed in seed composition-related traits, genomic prediction and selection can substantially help improve seed composition traits such as ANFs, isoflavones, vitamins, minerals, and carbohydrates. For instance, genomic prediction and selection can be used for KTI and BBTI as opposed to just overall TI content.

Lastly, due to the increased efficacy of multivariate models compared to univariate models, genomic selection can be used to help breeders improve multiple traits simultaneously. This could be particularly useful for breeding for allergens and isoflavones since it is necessary to have soya bean varieties with augmented concentrations of many allergens and isoflavones simultaneously.

Conclusion

Diverse and innovative processing methods have also expanded the functionality of a single seed by unlocking each unique seed component. This utility provides measurable, added value that can be obtained by targeting specific market demands through traditional, molecular, and novel breeding approaches. More specifically, breeders can continue to use genetic and phenotyping technologies to emphasise seed composition alongside agronomic traits.

With the advent of marker-assisted selection (MAS), plant breeders could now successfully use genetic information to accelerate their breeding programmes through known genes or genetic linkage that were strong enough between a marker and an unknown causal variant. As markers improved alongside next-generation sequencing, high-density molecular markers, and whole-genome resequencing, the return on investment for MAS also improved.

These advancements have also bolstered the progress of genomic prediction and genomic selection models. Application of genomic prediction and genomic selection to many quantitative seed composition traits could discover genetic gain previously limited by MAS.

Genetic engineering, phenotyping

Similar progress has occurred in technologies for genetic engineering and high-throughput phenotyping, which could further enhance a plant breeder's ability to develop new varieties. From genetically modified organisms (GMOs) to gene editing, breeding schemes have the potential to shift paradigms from selecting the best to designing the best.

In soya bean, genetic engineering shows enormous potential for translating genetic mechanisms to field realisation, with GMO varieties finding significant herbicide tolerance success and gene editing methodologies evolving rapidly. However, neither has shown an immediate proclivity for nutritional improvement. A combination of seed compositions being broad, quantitative traits and the soya bean plant itself being difficult to transform will require substantial efforts to overcome.

At the other end of the spectrum, high-throughput phenotyping technologies could allow breeders to surmount the phenotyping bottleneck by quantifying phenotypes with greater breadth, depth, and speed. Specifically, sensors and calibration models that could quantify seed components would make nutritional breeding targets more accurate and dependable, and partitioning out variations over time or in combination with environmental conditions will be able to investigate complex inheritance and genetics by environmental mechanisms.

Soya bean breeders have aptly adopted technologies to match the producer, environmental, and market needs of soya bean to develop consistent and competitive varieties. Continually maximising value and utility through seed composition will require the same tactical application of emerging technologies to the diversity of soya bean germplasm and the complexities of environmental interactions.

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Heat and drought:
Just as damaging as certain herbicides

By Prof Charlie Reinhardt

Photosynthesis is a key life process in all green plants, including single-celled algae and certain bacteria. Without photosynthesis the production of the world's foodstuffs and oxygen would be impossible; life on Earth cannot exist without it. The productivity of all crops is intricately linked to photosynthesis, and optimising photosynthesis in crop plants is therefore fundamental to achieving crop yield potentials.

Basically, photosynthesis involves the absorption of light energy originating from the sun, which is then used to bind carbon dioxide (CO_2) into stable, energy-rich carbohydrates such as sugars and starches. During this process, oxygen (O_2) is generated and released into the atmosphere.

> The simplified chemical formula for photosynthesis is 6 CO_2 + 6 H_2O (water) $\longrightarrow$ $C_6H_{12}O_6$ (sugars) + 6 O_2.

Sunlight energy splits water molecules into hydrogen and oxygen; the released, highly energised electrons' energy is utilised in the 'light reaction' of photosynthesis. This energy is then stored in carbohydrates through the incorporation of CO_2 in the 'dark reaction' of photosynthesis.

Heat, drought, and herbicides

Heat and drought as plant-damaging stressors go together because water is required for the cooling down of plants to temperature levels where physiological processes, such as enzymatic reactions, can occur optimally.

Heat is normally produced in plants through the formation of energised electrons during the light reaction phase of photosynthesis. This heat needs to be quenched through the transpiration process in plant leaves, where water transitions from a liquid to a vapour state, expending heat energy.

When the water supply to plant roots is interrupted, either short term (several hours) or long term (several days or weeks), the plant system overheats because of the stress-induced closure of stomata – openings on leaf surfaces that allow O_2 and water vapour to escape into the atmosphere and CO_2 to enter leaves for producing carbohydrates. This is similar to what would happen to humans if we were unable to sweat to cool down our bodies.

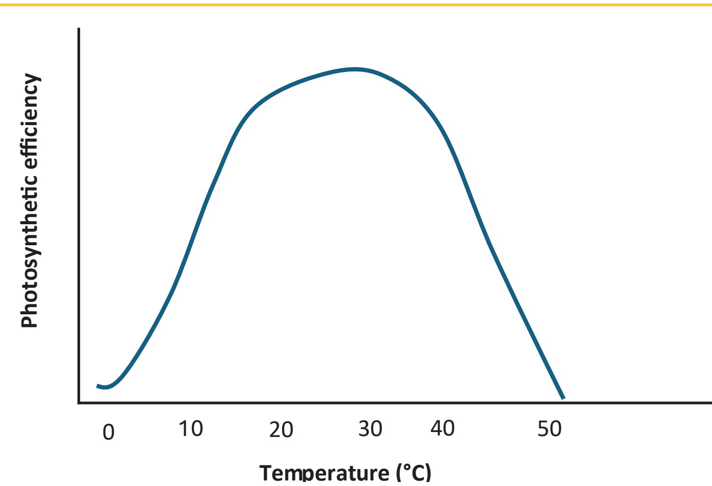
Within the temperature range of 5 to 30°C, photosynthetic efficiency, as measured in the amount of CO_2 captured, is generally high. Plant species vary in their temperature tolerance. Some organisms can be photosynthetically effective at extreme temperatures, such as certain conifer trees at -20°C and algae in hot springs at temperatures above 50°C. Photosynthesis in most plants ceases or declines beyond these extremes, i.e., below 5°C and above 30°C.

Internal heat generation is not the only effect that sunlight-energised electrons have on plants. If the photosynthesis process is impaired, such as during heat and drought stress or due to photosynthesis-inhibiting herbicides (e.g., atrazine, terbuthylazine, paraquat, etc.), the energised electrons fail to have their energy tapped. Consequently, they react with oxygen molecules to form harmful, oxidative (membrane-degrading) molecules known as active oxygen species (AOS).

Hydrogen peroxide (H_2O_2) is an example of AOS whose first target for destruction is the membranes in cell organelles (chloroplasts) where the light reaction of photosynthesis takes place. When chloroplast membranes are destroyed, the chlorophyll (green pigment) rapidly follows, leading to symptoms characterised by yellowing (chlorosis) of leaf tissue, typically following initial wilting of leaves in response to water and heat stress.

Soon after the destruction of chloroplast membranes, the membranes of the cells containing the chloroplasts also deteriorate, resulting in cells and tissues losing their contents and collapsing. The symptoms include wilting and yellowing of leaves, followed by browning (necrosis or death) of the affected plant parts.

Figure 1: Generalised relationship between rates of photosynthesis in the leaves of crop plants and air temperature.



Other herbicides (e.g., acetanilides, imidazolinones, sulfonylureas, triketones) are known to ultimately, i.e., as secondary or tertiary effects, cause chlorosis and necrosis on leaves due to the impairment of chloroplast structure and function.

The detoxification process

Glutathione is a natural, potent antioxidant in plants that reduces or neutralises AOS and serves as a substrate for glutathione-S-transferases (GSTs). These enzymes degrade a range of xenobiotics (pesticides), including certain herbicides, thus reducing the risk they pose to crop plants. Vitamin E is another effective antioxidant found in plants.

Herbicides such as triazines (e.g., atrazine, terbuthylazine) and acetanilides (e.g., alachlor, metolachlor) rely on the GST enzyme system for their selectivity (safety) towards the crops in which they are registered for use. Without the optimal functioning of GSTs in crop plants, these herbicides could pose a real risk of crop damage. For example, in cool or cold conditions, crops in which acetanilide herbicides (e.g., metolachlor, acetochlor) are registered for use might be damaged because the functioning of GSTs, like other enzymes, is impaired by low temperatures.

Typically, crops are not resistant to any herbicide (plant killer) but are only tolerant within certain concentration limits. When herbicide concentrations in crop plants exceed safe threshold values, crop plants are likely to be damaged or killed. Safeners, which are necessary for the safe use of grass-killer herbicides such as metolachlor and acetochlor in grass crops such as maize due to the high risk of plant damage, act by boosting the activity of GSTs. This ensures that these herbicides are rapidly degraded to safe levels within maize plants.

The same activation of GSTs does not occur within weed plants, or GSTs are present at lower levels in susceptible weeds, allowing the weeds to be killed without harming crop plants, provided all goes according to plan.

Heat or drought interaction

Under heat and soil moisture stress conditions, crop plants not only have to contend with overheating and AOS but also struggle with the inactivation of herbicides, making it difficult to avoid reaching damaging threshold levels. These internal defence mechanisms place additional burdens on plants' antioxidant arsenal, including the GSTs, which detoxify herbicides but require energy to do so. This sapping of plants' energy hinders crop productivity.

Applying herbicides at rates higher than the registered (label recommended) dosages, or using unregistered mixtures comprising several herbicides, poses a serious risk to crop productivity. Such risks are exacerbated by heat and water stress because these stressors, combined with herbicides acting on photosynthesis, lead to excessive amounts of AOS. This can overwhelm a plant's antioxidant defences, causing physiological and physical damage that culminates in yield loss.

Charlie Reinhardt is a professor in agronomy at North-West University and research lead in the South African Herbicide Resistance Initiative (SAHRI) at the University of Pretoria (*www.up.ac.za/za/sahri*). He can be reached at 083 442 3427 or dr.charlie.reinhardt@gmail.com.

MBFi
Leaders in Science. Partners in Growth.

Ensuring increased yields and healthy plants

By Nadine Loubser and Dr Chantal Scholtz, MBFi

Micro PHOS Grains
Phosphorus Solubilising Bacteria

XPRESS TECHNICAL
Soluble liquid fertilizer

MicroPhos® Grains is a biological product that enhances phosphate availability in agricultural soils. It contains the active ingredient *Pseudomonas fluorescens*, a naturally occurring beneficial bacterium. This product leverages the unique capabilities of *Pseudomonas fluorescens* to solubilise phosphates in the soil, making them more accessible to plants. By increasing the bioavailability of this essential nutrient, MicroPhos® Grains promotes healthier plant growth, leading to increased yields in various agricultural settings.

Phosphorus is a critical nutrient for plant growth, playing a key role in various physiological and metabolic processes, including energy transfer, photosynthesis, and nutrient transport. Despite its importance, phosphorus is often present in soils in forms that are not easily accessible to plants. This is particularly true in soils with either very acidic or very alkaline pH levels, as phosphates tend to become insoluble and unavailable to plants when the soil pH deviates significantly from the optimal range of 6 to 7.

From insoluble to soluble

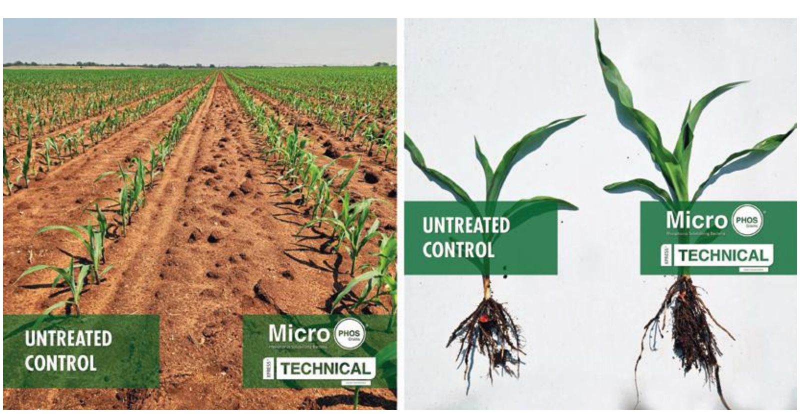
MicroPhos® Grains addresses this issue by utilising the phosphate-solubilising capabilities of *Pseudomonas fluorescens*. This bacterium works by releasing organic acids and protons, which lower the pH in the immediate environment surrounding the plant roots. As a result, insoluble phosphates are converted into soluble forms that plants can easily absorb.

One of the key ways in which *Pseudomonas fluorescens* enhances phosphate solubility is by releasing protons (H^+) into the surrounding soil. These protons help to release phosphate compounds, particularly in soils with high pH, where phosphates tend to bind tightly to metal ions such as calcium, aluminium and iron in soils with low pH. The bacterium also produces various organic acids, such as citric acid and gluconic acid. These organic acids chelate (bind) with metal ions, preventing them from interacting with phosphate molecules. This further enhances the bioavailability of phosphorus in the soil.

Trials were done with MicroPhos® and it was found that root development on maize was better than compared to the control. The overall plant biomass was also more when MicroPhos® was applied (*Figure 1*).

MicroPhos® Grains provides a sustainable solution to phosphorus deficiency by utilising naturally occurring bacteria to solubilise phosphates already present in the soil.

Figure 1: Field trials conducted with MicroPhos® in Combination with X-Press® Technical on maize in Thabazimbi.



Reg no B 4766 *Act 36 of 1947*. Composition: calcium 66,7g/ℓ. Contains a high concentration of *Ecklonia maxima* extract.

The root promoter

Establishing strong roots and strong cell walls leads to strong plants. X-Press® Technical is a bio-stimulant formulation containing a seaweed extract, 6,7% calcium (amino acid chelated) and genetic expression technology (GET). Calcium (Ca^{2+}) is an essential macronutrient that serves a pivotal role in plants, contributing to cell wall development, cell division, and enzyme activity, all of which promote plant health. It is required for structural roles in the cell wall and membranes, as a counter-cation for inorganic and organic anions in the vacuole, and as an intracellular messenger in the cytosol.

The presence of calcium in the extracellular solution ensures the maintenance of membrane integrity and works with potassium in the process of stomatal regulation. Calcium (Ca^{2+}) is known to be immobile in plants, however, the chelation of calcium in this specialised formulation facilitates the transport and distribution of calcium within the plant, improving the mobility and bioavailability of the calcium.

GET and seaweed extract provides a well-balanced combination of plant growth regulators and bio-inducers which provide a wide range of beneficial effects such as early seed germination and establishment, improved crop performance and yield, elevated resistance to biotic and abiotic stress, and the generation of vigorous vegetative growth. X-Press® Technical stimulates vigorous root growth, drives root cap formation naturally and increases cell structure and strength, resulting in stronger, healthier plants and improved yield.

Reg No L 9405 *Act 36 of 1947*. Active ingredient: live *Pseudomonas fluorescens* bacteria (minimum 1×10^9cfu/mℓ).

For more information, email the authors at chantal@mbfi.co.za or nadine@mbfi.co.za or visit *www.mbfi.co.za*.

Overview of the soya bean process in the crushing industry

By Anibal Demarco and Véronique Gibon

The edible oil industry goes back a long way, but recent decades have witnessed changes mainly due to stricter environmental and economic criteria. Today, the operation must comply with stringent environmental rules and, simultaneously, wants to improve process efficiency for both operational costs and product quality.

In general, current trends come with fewer chemicals and solvent use, less energy consumption, reduced environmental impact, safer processes, milder operating conditions, and optimised nutritional properties for the refined oil.

The crushing process

The complete chain from the seed to the finished products (meal and crude oil) consists of three stages: seed preparation, solvent extraction, and meal treatment. The seed preparation stage is a succession of operations that allows the proper shaping of the seed for optimal performance in the extraction process and to ensure precious final products. It generally includes a dehulling section enabling the increase of the protein content and reduction in the final fibre content in the meal.

Solvent extraction consists of oil extraction from the seeds (or press cakes) using a solvent. The solvent extraction step may or may not be preceded by pressing. Hexane has maintained the dominant position as a solvent for major plants which extract oil from seeds; the existing technology has sufficient virtues to maintain credibility while it continues to be developed in a competitive market.

There is also the advantage of well-understood industry expectations for performance, the availability of trained personnel, and established standards for safe use. It should be noted that other solvents may be required to produce different and specific products; for example, an alcohol-water mixture is used in an additional extraction step (after hexane extraction) to produce soya protein concentrate (SPC) by removing the sugars from standard soya bean meal (Wang *et al.*, 2004).

The meal treatment is a necessary process to treat the meal before final dispatch. This process is usually located in the same building as seed preparation and is thus considered part of the seed preparation process. Meal treatment and seed preparation both involve the exclusive treating of solid material.

Hull purification

Hull purification involves reclaiming the small particles of soya bean meats and fines from the soya bean hulls removed during conditioning and cracking or dehulling. This process is economically important since the soya bean meats and fines contain both soya bean oil and meal, each having a considerably higher value than the soya bean hulls. The effectiveness of hull purification is typically measured by the fat content of the hull stream.

Soya bean hulls have a very low bulk density; they are fibrous and are not free-flowing. The purpose of hull grinding is to increase their bulk density and flow ability in order to prepare them for pelletising. Hull pelletising uses elevated temperature, elevated moisture and high pressure to bind ground hulls into a pellet shape that has a lower dust content to ease handling, and is higher in bulk density to reduce storage and shipping volume.

Soya bean meal from the solvent extraction plant is a mix of particle sizes. It is, therefore, necessary to undergo several additional process steps (meal sizing) to produce a finished product that meets trading rule size specifications.

The flakes that have been shaped in the preparation plant enter the solvent extraction plant. After oil extraction, the miscella is sent to the distillation unit, the crude oil is recovered, and the hexane is recycled. A mineral oil system allows the purification of the air leaving the solvent recovery section. The meal is conveyed in the desolventiser whose purpose is to remove the solvent, toast the meal to control antinutritional factors, and reduce the moisture and temperature to appropriate levels. Then the meal is led to the meal treatment plant for sizing.

Preparation process

The protein and fibre content in meal and the residual oil content in hulls must comply with the quality objectives targeted in the preparation and meal treatment plant. Proper removal of the hulls increases the meal protein content, and reduces the meal fibre content. A basic mass balance applied to soya bean recognises three main parts on the seed stream: meat (92 to 93%), hulls (6 to 7%), and foreign material (balance).

Flaking technology

Good flaking is essential for the best solvent extraction efficiency. The main goal of flaking is to expose the oil as much as possible to the solvent (or miscella) in the solvent extractor. Flaking involves mechanically squeezing the warm, pliable cracked and dehulled soya bean shape, approximately 3mm across, into a flake shape, 0,3 to 0,4mm in thickness and 10 to 15mm in diameter.

The cellular structure of the cracked soya bean is severely distorted during flaking which tears open many of the cell walls, enabling the oil to be extracted more readily during the solvent extraction process.

Solvent extraction process

The residual oil and hexane content in meal and oil and the oil and meal moisture are the main quality parameters targeted after solvent extraction and meal treatment. In the solvent extraction section, utilities like steam consumption and electricity are typically ≤150kg/t and ≤5kwh/t, respectively, with hexane consumption of 0,46kg/t. This process can be divided into four sections: extraction, desolventising, distillation or solvent recovery, and mineral oil system.

Extraction

Extraction washes the prepared material with commercial hexane, in a counter-current multistage process to enable a reasonable quantity of solvent to extract a maximal amount of oil. It is not a pure hexane but a mix of isomers with very similar properties. After washing, the solvent-laden meal drains by gravity and then discharges to the meal desolventising section; meanwhile, the oil or solvent mixture, commonly called miscella, discharges to the distillation section.

Although there are many mechanically different extractor designs all over the world, the main parameters that rule the good efficiency of a solvent extractor are all identical. First is the contact time between the prepared material and the solvent (or miscella); this parameter is of critical importance for a good yield.

Second is the extraction temperature – the higher the temperature, the lower the oil viscosity and the higher the hexane diffusion inside the flakes. The extraction performance can be improved by increasing the temperature of the material and the solvent. The ideal temperature for the material incoming from the preparation section is ~65°C; however, the solvent recommendable temperature is ~61°C (~2°C below the first drop solvent distillation).

Third is the flake thickness and cracks. These are important parameters (optimal flake thickness, minimal milling defect and no cracks) concerning solvent extraction efficiency. It is critical to avoid the presence of cracks to get reasonable residual oil content in the meal. In a modern and efficient extraction plant, a residual oil content of ≤0,5% for soya bean meal is expected. A number lower than this value is quite common in good-sized extraction plants and makes the difference in a competitive market.

Desolventising

The solvent-laden meal exiting the extractor contains 26 to 30% solvent by weight. The desolventising process removes the solvent from the solvent-laden meal, toasts the meal to control the anti-nutritional factors, and reduces moisture and temperature to levels appropriate for storage and transport; this operation is usually performed by a single integrated unit often called desolventiser/toaster/dryer/cooler (DTDC).

Most of the heat supplied for evaporating the solvent from the meal comes from the latent heat of condensing live steam, which increases the meal moisture to facilitate toasting. The drying and cooling of the meal are accomplished by passing air through a fluidised bed of the meal. The solvent and water vapours exiting the desolventising process pass through a scrubber to remove potential meal particles existing in that stream before entering distillation for heat recovery. The most critical aspects of the meal desolventising process are the residence time and the steam distribution.

Distillation and solvent recovery

The oil or solvent mixture (miscella) leaves the extract or contains 70 to 80% of the solvent by weight. The purpose of distillation is to thermally separate the miscella into a liquid oil and solvent vapour fraction. The energy efficiency of the distillation is maximised through the optimum use of the available heat at the discharge vapour stream of the DTDC, of the available heat from the condensate flash tank, and of heat recovery within the distillation itself.

Mineral oil system

The effluent air leaving solvent recovery contains an equilibrium concentration of solvent in the range of 50 to 70% by weight, dependent upon vapour temperature. The purpose of the mineral oil system is to absorb the residual solvent out of this effluent air stream to less than 1% by weight of solvent before it is safely discharged into the atmosphere.

The solvent absorption takes place in cool mineral oil. After absorbing the solvent, the cool mineral oil is heated and then the solvent is steam-stripped out of the mineral oil under a vacuum. The hot, stripped mineral oil is then cooled and circulated back for absorption, forming a closed-loop mineral oil system.

Water degumming

The crude oil from the solvent extraction process contains water-soluble components, primarily comprised of phospholipids, which need to be removed from the oil to enable minimum precipitation and settling during oil transport and long-term storage. It is generally convenient not to exceed 0,1% moisture content in the crude oil to minimise gums (lecithin) settlement.

Conclusion

The complete chain from the seed to the finished product consists of three stages: seed preparation, solvent extraction, and meal treatment. As far as solvent extraction is concerned, the advances made in recent decades have been mainly based on production capacity increases in plants. This change in production volume means that the greatest design efforts are focussed on maximum yields and operational safety, with an emphasis on quality and environmental standards.

This article was shortened for *Oilseeds Focus*. For the complete article, visit *www.ocl-journal.org* or email vgibon@desmetballestra.com.

The 2024/25 oilseed outlook: Trends, challenges, and market movers

By Marguerite Pienaar, junior agricultural economist, Grain SA

The 2024/25 oilseed outlook offers an insight into the drivers shaping one of the agricultural sector's most critical commodities. With global demand for vegetable oils and oilseed-derived products continually rising, producers and stakeholders are navigating an increasingly complex environment influenced by shifting weather patterns, trade policies, and evolving consumer preferences.

This year's outlook delves into these dynamics, examining expected production volumes, pricing trends, and market disruptions. It focusses on how innovations in farming and sustainable practices are helping to meet growing demand. With supply chains affected by recent global shocks, the article takes a closer look at the next year for the oilseed sector.

Oilseed complex explained

The oilseed complex refers to a tightly interlinked network of various oilseed crops, including soya beans, sunflower seeds, canola, rapeseed, and palm kernels. These crops produce oil and protein-rich meal as valuable by-products. They interact dynamically within the complex due to their roles as both substitutes and complements in global markets.

For example, fluctuations in soya bean production can impact the availability and pricing of soya bean oil, which, in turn, influences demand for alternative oils such as sunflower or palm. Similarly, oilseed meals are critical protein sources for animal feed, meaning changes in one crop's output can shift demand across others.

This interdependence is influenced by factors such as climate conditions, global trade policies, and consumer preferences, making the oilseed complex both competitive and collaborative as different regions adjust to maximise yield, address shortages, and meet rising demand.

Soya beans: Supply and demand

The global outlook for soya beans, canola, and sunflower in 2024/25 shows contrasting trends. World soya bean production is expected to increase by 7% year-over-year, driven by expanded acreage and improved yields in leading producing nations. This rise in output will support record-high utilisation, primarily due to increased demand from the feed, food, and industrial sectors. Significant stock accumulation is anticipated, with major exporters expected to see a 51% boost in reserves.

Global import demand for soya beans is also forecast to inch up by 1%. The 2024/25 global soya bean output is forecast to reach a record high; rising demand from feed, food, and industrial sectors is expected to drive processing growth, with global utilisation projected to increase by 5% and total inventories reaching new highs. Trade is also anticipated to rise slightly to a peak of 179 million tonnes (+1%), supported by another season of above-average shipments to China. Among exporters, both the United States (US) and Brazil are expected to increase their shipments.

Canola: Supply and demand

In contrast, canola output is projected to decrease by 4% year-over-year. Although consumption will decline, it is predicted to stay well above the recent average, balancing somewhat against the reduced supply. A drawdown in canola stocks is expected, primarily due to declining reserves among major exporters. Trade in canola is forecast to dip as weaker demand in Asia outweighs record imports in the European Union (EU).

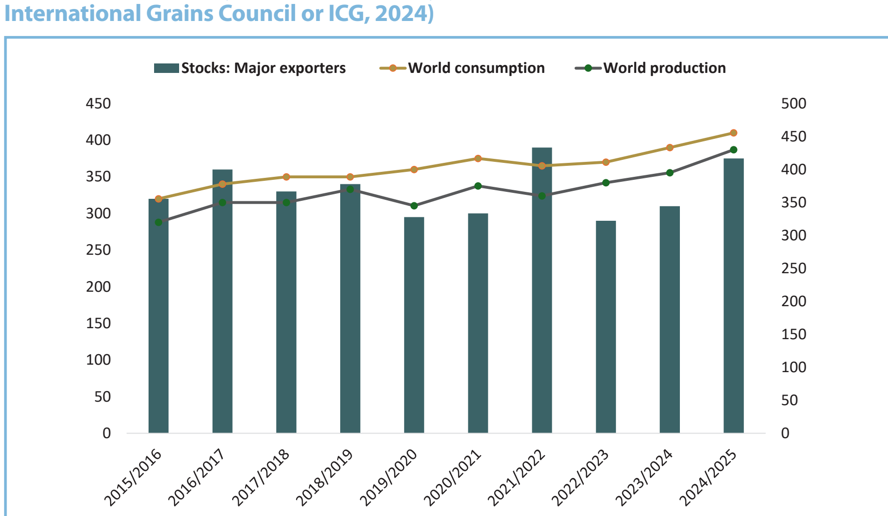
Sunflower seed: Supply and demand

Similarly, the outlook for sunflower is challenging, with global output expected to fall by 10% year-over-year, impacted by smaller harvests in Europe and the Black Sea region. Tight supplies will drive global consumption down by over six million tonnes year-over-year, leading to a reduction in end-season stocks, which are anticipated to reach below-average levels. Sunflower trade is projected to decline for the third consecutive season.

Global market forces

Key drivers of oilseed demand include biodiesel and animal feed, with global

Figure 1: World supply and demand of soya beans, 2015 to 2025. (Source: International Grains Council or ICG, 2024)



biofuel production and consumption expanding significantly in recent decades. This growth has been fuelled by government policies mandating renewable energy use to enhance energy security, lower emissions, and support domestic markets – initially focussed on grain-based ethanol and vegetable oils. Biodiesel production, including hydro-treated vegetable oil or renewable diesel, has seen a substantial upswing, increasing nearly fourfold in the 15 years leading up to 2024.

US biodiesel and renewable diesel production surged by approximately 40% year-over-year in 2023, reaching a record 16,2 billion litres, with output expected to rise further to 17,8 billion litres in 2024. This growth has been driven by federal and state renewable fuel programmes, such as California's *Low Carbon Fuel Standard*. Over the past decade, renewable diesel contributed almost 90% of the overall increase in production. Supported by strong demand, recent years have also seen significant expansions in manufacturing capacity.

Brazil has become a major force in global production growth, driven largely by the National Biodiesel Production Programme, established in 2004 to encourage investment. The current biodiesel blending rate, set at B14 (14%) in March 2024, is expected to increase to B15 (15%) by March 2025. Over the decade leading to 2023, Brazil's output more than doubled to 7,5 billion litres and could reach a record 8,6 billion in 2024. As the world's top soya bean producer, soya oil dominates Brazil's feedstock usage, comprising over 70% of total feedstock, while palm oil, cottonseed oil, animal fats, and used cooking oils are used in smaller amounts.

Ukraine has exported 12,5 million tonnes, which is 7,7 million tonnes more soya beans than last year. Brazil plans to grow by 2,5% in the 2024/25 season. If this growth is realised, the increase alone will be more than double South Africa's total local production.

Figure 2: World supply and demand of canola, 2015 to 2025. (Source: IGC 2024)

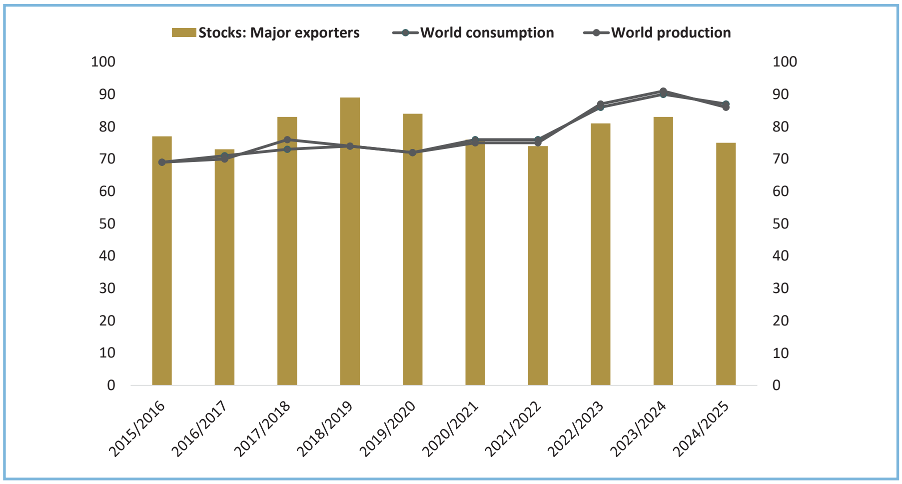


Figure 3: World supply and demand of sunflower seed, 2015 to 2025. (Source: IGC, 2024)

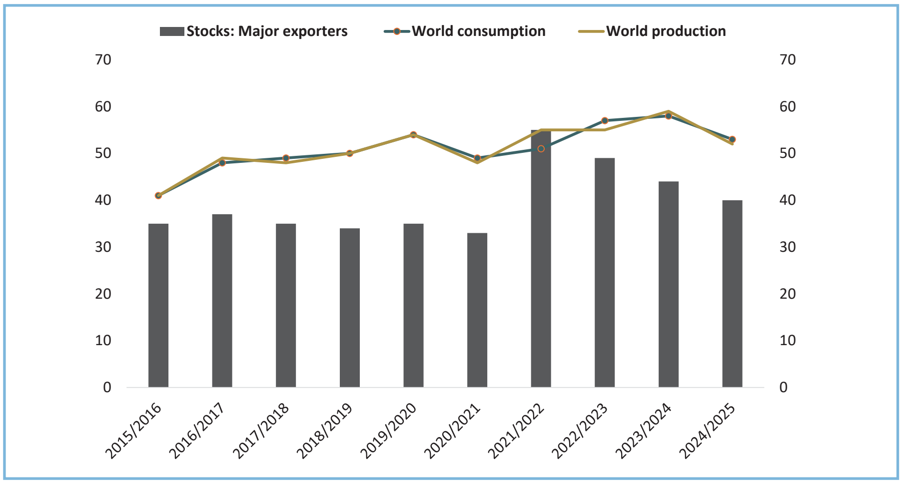
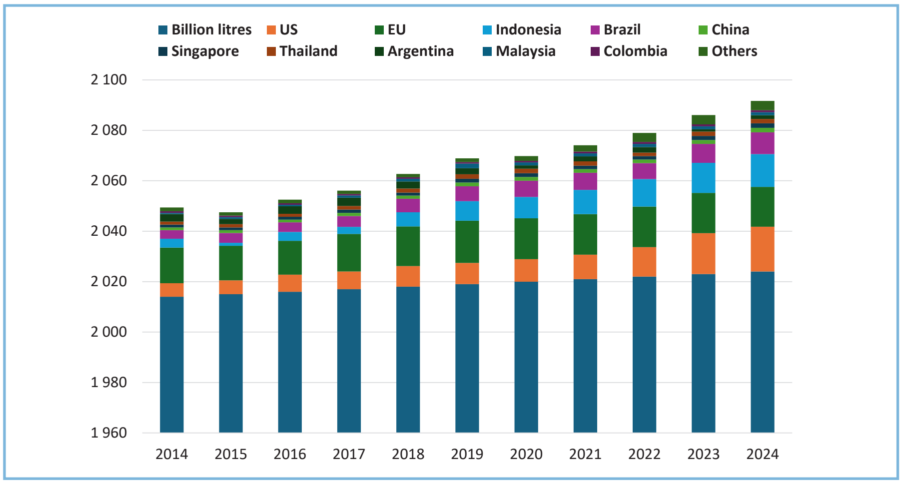


Figure 4: World production of biodiesel from 2014 to 2024. (Source: IGC, 2024).



Production outlook for 2024/25

In South Africa, soya bean, sunflower, and canola are key oilseed crops, each contributing uniquely to the country's agricultural sector. Soya bean production has expanded steadily, supported by rising domestic demand in the animal feed and food industries. Sunflower remains a staple crop, known for its adaptability to South Africa's semi-arid conditions, while canola, though produced on a smaller scale, is increasingly cultivated, especially in the Western Cape, to meet the growing demand for vegetable oils and support crop rotation practices.

South Africa's 2023/24 production season was marked by extreme heat and dry conditions, including a severe mid-summer drought that significantly reduced yields across the country's summer crops. Soya beans were among the hardest hit, with production declining by 34% year-over-year, despite a slightly larger planted area compared to 2022/23. Of all the oilseeds planted, sunflowers proved to be the most drought-tolerant, achieving average yields.

For the 2024/25 production season, sunflower seed plantings are projected to cover 540 000ha, reflecting an increase of 2,1% (or 11 000ha) over last season's 529 000ha. Soya bean plantings are also expected to rise slightly, by 0,2% (or 2 700ha), from 1,150 million ha last season to 1,153 million ha this season. This is the intentions to plant. The preliminary area planting will only be out at the end of January 2025. Rainfall and crop conditions will play an important role in determining if this will be realised.

According to the third production estimate, the anticipated canola crop is 295 165 tonnes, marking a 0,18% (or 520t) increase from the previous forecast of 294 645 tonnes. The area dedicated to canola is estimated at 165 750ha, with an expected yield of 1,78t/ha.

In summary

The global oilseed market has seen varied developments, with biodiesel, renewable diesel, and animal feed as key demand drivers. Government policies promoting energy security and lower emissions have fuelled expansion in biofuel production, particularly biodiesel and renewable diesel, which rose nearly fourfold in the 15 years leading to 2024.

In South Africa, the 2023/24 season faced extreme heat and drought, causing significant yield losses in summer crops. Soya bean production dropped by 34% year-over-year, despite a slight increase in planted area, while sunflowers demonstrated resilience, achieving average yields.

Globally, Ukraine and Brazil are key contributors to oilseed supply, with Ukraine significantly boosting soya bean exports and Brazil expanding production, driven in part by its biodiesel programme. These dynamics underscore the increasing importance of oilseeds in energy and food markets.

Figure 5: Soya beans: Area planted, production, and yield. (Source: Grain SA, 2024)

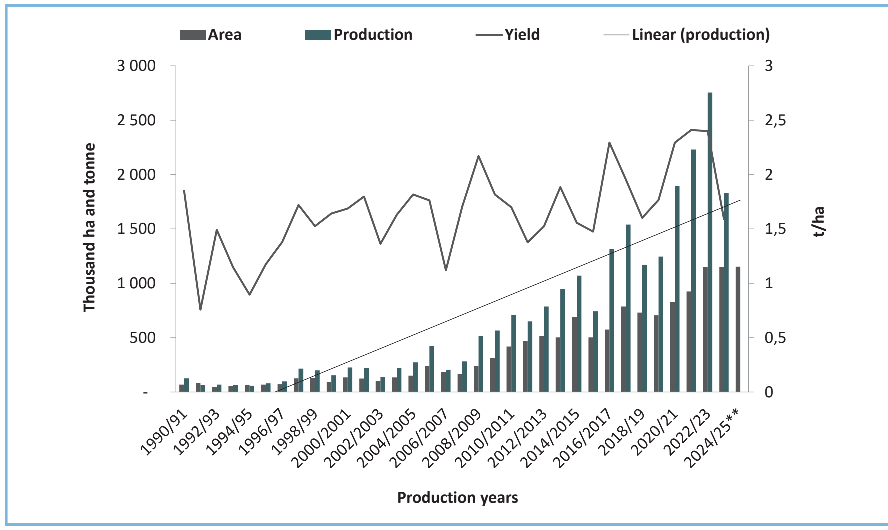


Figure 6: Sunflower seed: Area planted, production, and yield. (Source: Grain SA, 2024)

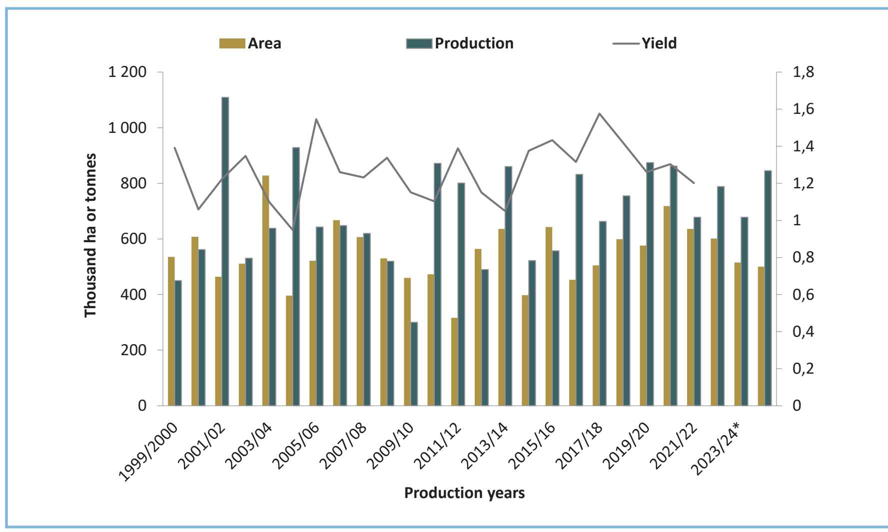
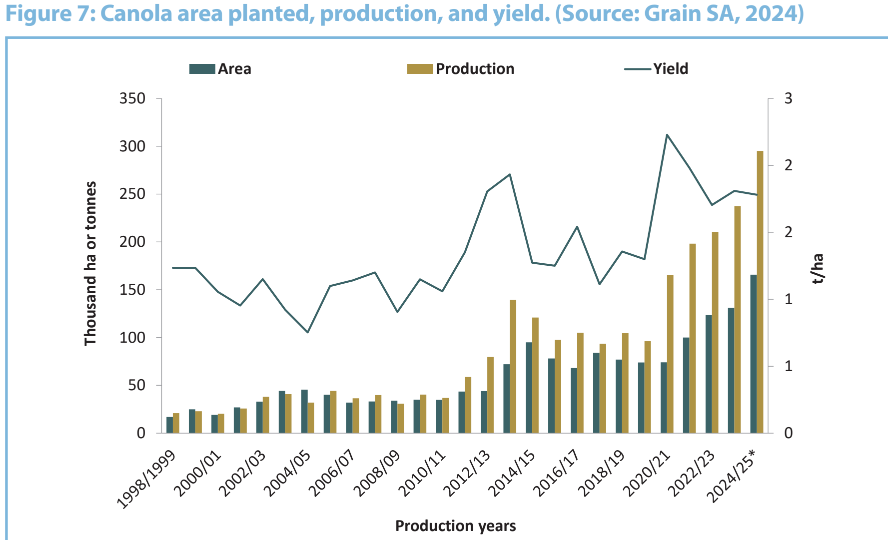


Figure 7: Canola area planted, production, and yield. (Source: Grain SA, 2024)



For more information, send an email to the author at marguerite@grainsa.co.za.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Soya beans: The new season's crop

By Lourens Uys, oilseeds trader, Bester Feed & Grain

South Africa's oilseed producers are closely monitoring weather patterns, commodity prices, and moisture conditions as the 2025 soya bean planting season approaches. Following two consecutive years of record plantings but contrasting yield outcomes, producers face the pivotal decision whether soya beans will remain their crop of choice, or whether high maize prices and uncertain rainfall expectations will shift the focus elsewhere.

Three key factors will shape the new soya bean season: weather conditions, the number of hectares planted, and price dynamics in the months ahead.

Weather conditions

With some rain arriving at the end of September across most summer grain regions, soil moisture levels ensured a promising start for planting preparations. However, more recently the weather has generally been hot and dry, requiring additional rain to ensure optimal planting conditions. With some rain having arrived at the end of September across most of the summer grain region, soil moisture levels ensured a promising start for planting preparations.

However, weather patterns need to be favourable with good rainfall required come December onwards. This will ensure that moisture levels stay on point and that crops can continue growing well going into the new year. The critical period for rain will be between January and March to ensure a good quality crop.

Hectares planted

The past two seasons saw record soya bean plantings – 1 148 300ha in 2023 and 1 150 500ha this year – but with drastically different outcomes. The 2023 harvest yielded 2 770 000 metric tonnes, while 2024 produced just 1 810 790 metric tonnes, largely due to a drought between January and March. Similar planting intentions are expected for the new season, provided moisture levels are sufficient.

However, factors such as rising maize prices could encourage some producers to switch to maize. In the event of continued dry conditions, others might opt for sunflower, given its longer planting window.

Price dynamics

Despite a smaller crop in the 2024/25 season, soya bean prices did not rise as sharply as anticipated, thanks to ample world stock and effective stock management by crushers. These efforts aim to prevent supply shortages later in the year. Additionally, soya bean imports scheduled for delivery in November will further boost stock levels and help stabilise prices. If the 2025 crop yields well, exports may resume during harvest, as seen in the 2023/24 season. With new season prices currently around R7 300/tonne for May 2025 soya beans, the market is approaching export parity.

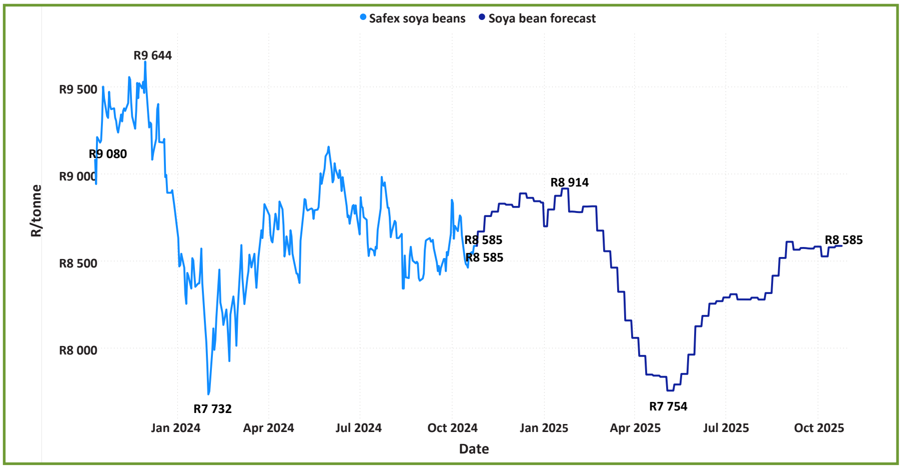
Navigating the new season will require careful planning, adaptability, and close monitoring of market trends. Success will rest on balancing environmental factors, crop strategies, and economic opportunities.

At Bester Feed & Grain thorough and continuous research is conducted on events impacting the grain market to ensure that the best decisions are made for our clients. We serve as a strategic partner to help grain producers maximise sustainability. Our grain trading specialists focus on managing market price risks, optimising the marketing of physical grain, providing logistical solutions from the farm, and developing long-term sustainability plans. Our goal is to unlock value for grain producers across the whole value chain.

According to *Figure 1*, there is not a lot of upward momentum on the cards and depending on crop size for the 2025 season, we can expect prices to come under pressure.

Lourens Uys, oilseeds trader, Bester Feed & Grain.

Figure 1: Soya bean forward price trend (spot price). (Source: AMT weekly oilseeds report, 43 of 2024)



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World oilseeds production forecast

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

Venezuela's soya bean production was revised from 2004/05 to 2024/25 due to the adoption of production data from the Food and Agriculture Organization (FAO) of the United Nations. In line with this change, the utilisation of soya beans in Venezuela was also revised with adjustments to crush impacting soya bean oil and soya bean meal production and consumption.

An overview of 2024/25

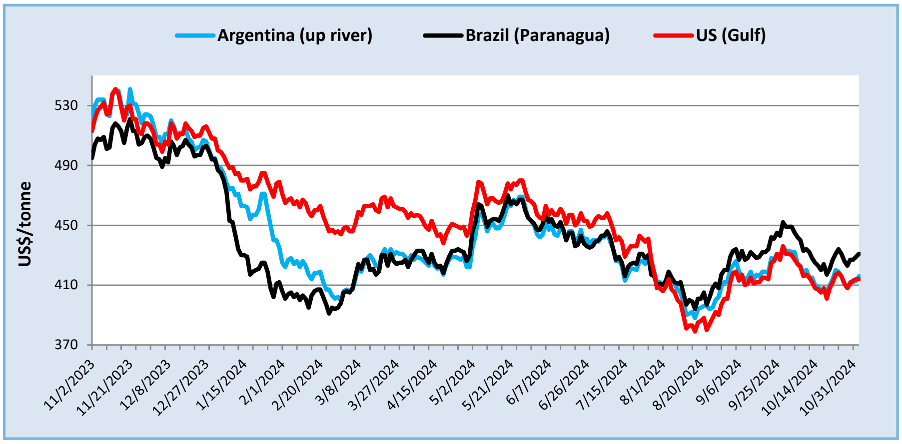
The global oilseeds production forecast was down over 5,1 million tonnes to 682,2 million on lower United States (US) soya beans and Sudan peanuts. Oilseeds trade was lowered over 200 000 tonnes to 207,4 million tonnes as declines in US soya bean exports were not offset by higher Brazil soya bean exports. Oilseeds ending stocks were lowered by almost 3,2 million tonnes on reduced US, Brazil, and Argentina soya bean stocks.

Global crush has decreased by over 800 000 tonnes to 556,9 million tonnes on lower US soya bean crush and Turkey sunflower seed crush, not offset by higher Pakistan soya bean crush. Global meal trade was down over 100 000 tonnes to 106,1 million tons on lower European Union (EU) rapeseed meal exports and US soya bean meal exports. Global vegetable oil trade was up over 100 000 tonnes to 86,7 million tonnes on increased Argentina soya bean oil and EU and Tunisia olive oil trade, not offset by lower Belarus and EU rapeseed oil exports.

Table 1: 2024/25 oilseed outlook changes (all figures in thousand metric tonnes).

Country	Commodity	Attribute	Previous	Current	Change	Reason
Brazil	Oilseeds, soya bean	Exports	105 000	105 500	500	Higher global demand and lower US exports
Canada	Oilseeds, soya bean	Exports	4 300	4 600	300	Higher 2023/24 carry-in
EU	Oilseeds, rapeseed	Exports	500	300	-200	Reduced production outlook
Pakistan	Oilseeds, soya bean	Imports	1 200	1 500	300	Raised in line with 2023/24 forecast
US	Oilseeds, soya bean	Exports	50 349	49 668	-681	Lower production and sales to date

Figure 1: Soya bean export prices. (Source: International Grains Council)



All prices are free on board: US Gulf, Argentina up river, and Brazil Paranagua.

The projected US season-average farm price for soya beans was unchanged at US$10,80 per bushel.

Export prices

Since the last *World Agricultural Supply and Demand Estimates Report*, soya bean prices fell on improved rainfall and planting progress in Brazil but rose due to reduced exportable supplies in Brazil before next year's harvest. Brazil soya beans have traded at a premium to US and Argentina beans since early September as their exportable surplus seasonally declined, increasing demand for US soya beans as the harvest started to conclude.

Strong soya bean crush in the US and Argentina and the delayed implementation of the *EU Deforestation Regulation* are contributing to falling prices for soya bean meal. Tight supplies of palm oil and new government policies in Indonesia are contributing to higher palm prices. In October, the government of Indonesia announced plans to increase the current biodiesel mandate to B40, prompting importers to increase purchases in anticipation.

Additionally, the government of Indonesia imposed a new tax on palm oil exports. This tax contributes to the premium on Indonesian palm oil, highly relative to soya bean oil. US soya bean oil is trading at a discount to South American soya bean oil, prompting sales to price-sensitive markets such as India.

This article was condensed for publication in *Oilseeds Focus*. To read the full article, visit *www.fas.usda.gov*.

Handling and storage of soya beans and soya bean meal

By Ulysses Acasio

Soya beans represent the world's most important oilseed as a source of vegetable oil and protein. It is extensively grown in the United States (US), Brazil, Argentina, and China. The beans can be processed into flour for food and meal for animal feed. In China, Japan and Southeast Asian countries, soya beans are used primarily in various food products. In the US and Europe, soya beans are mainly used for oil and meal production. There are hundreds of soya bean cultivars found in different parts of the world, but only a few dozen is commercially cultivated.

Two types of soya bean meal exist: full-fat and defatted. Both are utilised in the feed industry. Defatted soya bean meal, a by-product of the oil extraction process, comes in either loose or pelleted form. Brazil and Argentina export their soya bean meal in pelleted form, while the US primarily exports it in loose form.

Given the enormous worldwide economic and nutritional importance of soya bean products, it is essential to recognise the various factors contributing to the deterioration of soya beans and soya bean meal. Deterioration can occur during handling and storage, from harvest until reaching the end-user. The various deteriorative factors and how to minimise the effects on soya beans and soya bean meal are the main focus of this article.

Handling soya beans and meal

In developed countries, soya beans and soya bean meal are normally handled in bulk form, whereas in developing countries, bag handling is prevalent. Some countries are transitioning from bag to bulk handling systems. Regardless of the system used, it is essential to recognise the advantages and disadvantages of each system to minimise product deterioration and economic losses.

Whole soya beans

The handling of whole soya beans involves conveying and transporting them from the farm to the end-user. In the US, soya beans may be handled as many as 15 times from the time they leave the farm until processing into oil and meal. This number may increase to as high as 20 for exported material.

The structure of a soya bean seed makes it susceptible to splitting and breakage during mechanical handling. The extent of breakage in soya beans during conveying varies with the impact force imposed on each seed. The percentage of broken soya beans can be as high as 4,5% with a free fall drop of 30m. The least breakage occurs when soya beans are conveyed in a bucket elevator as compared to other conveying methods studied.

The storability of soya beans is affected by the degree of damage to the seed coat and by other factors such as mould or insect attack. It is therefore important to inspect soya beans for mechanical and other forms of damage before storage. If the amount of broken or split soya beans is very high, it may be prudent to separate the broken or split grains by sieving. This material can then be used first as opposed to long-term storage with the original stock.

Soya bean meal

Soya bean meal is difficult to handle because of poor flow ability and bridging characteristics. Soya bean meal tends to settle or consolidate over time. This phenomenon occurs in most granular materials and becomes more severe with increased moisture, time, and small particle size. Because of this, bulk soya bean meal is best stored in flat storage buildings instead of vertical silos.

Standard conveyors can be used for loading into the building and front-end loading tractors can be used in combination with standard conveyors for reclamation. New sweep auger designs are now available that effectively reclaim meal products from silos. Various models and capacities are available. One model is designed to reclaim meal products from flat-bottom silos and another for hopper-bottom silos. However, because of their very high initial cost, they have not become standard equipment yet in the industry.

The addition of calcium carbonate, calcium bentonite, or sodium bentonite at a level between 0,25 to 0,5% is effective in improving the flowability of soya bean meal of the additive, and the mixing process may outweigh the potential advantage gained in improving its flowability. Other innovations such as electric vibrators and compressed air to fluidise the meal are available to improve the discharge of soya bean meal from storage bins.

The flow characteristics of bulk materials are dependent on individual particle shape, density, frictional property, and moisture content. Flow problems of meal products discharged from storage silos are usually due to a combination of factors such as poor hopper design, high moisture content and storage time.

Find the original article at *www.feedmachinery.com/articles/feed_ingredients/soybean_storage1/.*

Canola meal for poultry

By the Canola Council of Canada

Canola meal is fed to all types of poultry throughout the world. The meal provides an excellent amino acid profile and is an alternative to, or complement to, other protein ingredients such as soya bean meal. Canola meal provides excellent value in diets where the greatest emphasis in formulation is placed on amino acid balance.

Canola meal can also be a cost-effective alternative to other proteins in high-energy broiler diets. Care must be taken to formulate diets on a digestible amino acid basis to ensure performance is optimal when canola meal is included in diets for poultry.

Canola meal and profitability

The rate of production is the basis for ingredient comparison in most academic trials. However, in industry, cost/unit of gain is the integration of several factors, including ingredient cost, production, health, and survival. While feeding canola meal to poultry may not always result in the maximum rates of gain, there can be reductions in the cost/unit of production when canola meal is incorporated into diets.

Sustainability

In an elaborate study evaluating both rapidly growing and slowly growing broilers, Berger *et al*. (2021) showed that broiler chickens readily adapt to diets containing alternative protein sources to soya bean meal and included canola meal in their evaluation.

They determined that replacement may result in a slight increase in the cost of production (under 2%) due to greater feed intake but can result in major reductions in greenhouse gas emissions, often associated with the production systems used to produce and acquire soya bean meal. While this may not consistently be the case, better information is being generated to allow sustainability to be predicted with greater accuracy.

Palatability and feed intake

Birds have been demonstrated to be averse to bitter compounds (Yoshida *et al*., 2022). Glucosinolates tend to impart a bitter taste and older varieties of canola meal, which contained higher concentrations of these compounds, resulted in reduced intakes (Khajali and Slominski, 2012).

In general, poultry maintain appropriate feed intake levels if given diets high in canola meal that are properly formulated for available amino acids. However, studies in raising poultry suggest that canola meal should be limited during the starter period to 20% for broilers and turkeys, and 10% more for less studied species such as ducks, geese, and quail. Concentrations of 30 to 40% of the diet are readily tolerated at later stages of growth.

Oryschak and Beltranena (2013) and Rogiewicz *et al*. (2015) demonstrated that proper diet formulation allows canola meal to be included at 20% of the diet with no negative effect on feed intake in laying hen diets. Feed intake was maintained for broilers fed up to 20% canola meal from days one to 35 of life (Naseem *et al*., 2006), and broiler growers can be given diets with up to 30% canola meal (Newkirk and Classen, 2002; Ramesh *et al*., 2006).

Protein and amino acids

Using canola meal at high levels in poultry diets is best accomplished by balancing diets for available amino acids. Extensive research has been conducted in recent times to determine the standardised ileal digestibility (SID) of amino acids from solvent-extracted canola meal. Results for broilers are provided in *Table 1*.

Huang *et al*. (2006) found that there were no differences in apparent ileal digestibility of amino acids between broiler chicks, laying hens and adult roosters, which is not the case for all feed ingredients (Adedokun *et al*., 2009; Huang *et al*., 2006). Therefore, the values shown may be useful in extrapolating SID values for other poultry species.

Energy for poultry

The energy value of canola meal for poultry is lower than that of soya bean meal, the most common vegetable

Table 1: Standardised ileal digestibility of amino acids in canola meal for broiler chickens[1].

Amino acids	Average, %[2]	Standard deviation
Indispensable		
Arginine	87,23	2,33
Histidine	76,51	11,31
Isoleucine	82,66	3,71
Leucine	83,68	2,58
Lysine	79,32	3,06
Methionine	88,93	2,10
Phenylalanine	83,89	2,21
Threonine	76,48	3,68
Tryptophan	87,15	5,18
Valine	78,85	3,94
Dispensable		
Alanine	82,96	3,04
Aspartic acid	77,59	4,17
Cysteine	75,47	3,77
Glutamic acid	89	3,54
Glycine	78,80	4,08
Proline	77,45	3,31
Serine	80,51	4,73
Tyrosine	82,66	5,28

[1]Adewole et al., 2017; Agyekum and Woyengo, 2022; Ariyibi, 2019; Chen et al., 2015; Gallardo et al.; 2017; Kim et al., 2012; Kong and Adeola, 2013; Osho et al., 2019; Park et al., 2019, Ross et al., 2019. [2]Average of 41 values.

Source: www.freepik.com.

protein used in poultry diets. In certain diets, where the energy value of the diets is of great importance, such as for broilers, canola meal inclusion levels may be restricted. Egg layer diets and early-phase, high-protein turkey diets based on least-cost formulation may at times restrict canola meal inclusion levels if high-energy ingredients are unavailable.

Table 2 provides apparent metabolisable energy corrected for nitrogen balance (AMEn) values for expeller-extracted canola meal. As the table indicates, the lipid content of the meal can be variable depending on the source and is expected to impact the energy value of the meal.

Enzymes to increase energy

The use of dietary enzymes is common in poultry feeds, especially those containing barley and wheat. These additives have been demonstrated to improve carbohydrate digestibility. Canola meal contains a significant portion of cell wall components that are undigested by poultry.

Extensive research has been conducted at the University of Manitoba to investigate cell wall composition and non-starch polysaccharide (NSP) digestion with the inclusion of NSP degrading enzymes. Meng and Slominski (2005) examined the effects of adding a multi-enzyme complex (xylanase, glucanase, pectinase, cellulase, mannanase, and galactonase) to broiler diets. The enzyme combination increased the total tract NSP digestibility of canola meal, but no improvements were observed in other nutrient digestibility values or animal performance.

Jia *et al*. (2012) fed broiler diets containing canola meal and a multi-carbohydrase enzyme to determine their effect on AMEn values and found a 6% increase in AMEn. Gallardo *et al*. (2017) calculated an 8% improvement in the energy value of canola meal. An improvement in AMEn of 6,6% with the use of multi-carbohydrase enzymes was witnessed and reported by Rad-Spice (2018).

Most recently, Niu *et al*. (2022) determined that the inclusion of a multi-carbohydrase enzyme cocktail increased NSP digestion from zero to 20%. Bodyweight gain by broilers in the same study was improved by 5%. Although the data is not completely conclusive, moderate enhancement of canola meal digestion may occur. The enzymes may also improve the digestibility of other dietary ingredients.

Ether extract

The lipid content of canola meal is higher than many other vegetable protein sources, making a significant contribution to the energy value of the meal (Newkirk, 2011). A study by Barekatain *et al*. (2015) revealed that the digestibility of the oil in canola seed was as digestible as added canola oil is for broiler chickens.

Table 2: Energy value of expeller extracted canola meal for poultry (AME_n, Kcal/kg).

Reference	Species	As fed	Dry matter basis	Lipid % of dry matter
Agyekum and Woyengo	Broilers	1 994	2 265	15,3
Bryan *et al*., 2019	–	2 623	2 997	11,4
Bryan *et al*., 1019	–	2 917	3 314	15,9
Sessingnong *et al*., 2014	–	2 043	2 322	–
Toghyani *et al*., 2014	–	2 258	2 566	–
Woyengo *et al*., 2010	–	2 370	2 694	12
Zhong and Adeola, 2019	–	2 584	2 937	18,1
Oryschak *et al*., 2020	Layers	2 556	2 904	13,2

Minerals and vitamins

Canola meal is notably a rich source of phosphorus, which is a critical nutrient for all classes of poultry. In the past, only the non-phytate portion of the phosphorus in canola meal was assumed to be available, which is approximately 35% of the total phosphorus of the meal. Using the ileal digestibility technique, Mutucumarana *et al*. (2015) calculated that 47% of the phosphorus in canola meal was digestible by broilers and that a portion of the phytate phosphorus was also digested by birds.

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In a more recent experiment, Munoz *et al*. (2018) using the precision-fed rooster bioassay technique found phosphorus retention to be 44% of the total when intakes approached requirements, but declined when requirements were exceeded. The authors suggested a value of 38% based on their studies.

Phytase is effective in improving phosphorus bioavailability in rapeseed meal varieties (Czerwiński *et al*., 2012) and more recently in canola meal for broilers. In an Australian study (Moss *et al*., 2018), the availability of phosphorus was increased from 32 to 52% with the inclusion of phytase and 69% when both phytase and xylanase were added. Phytase also improved the availability of calcium. An improvement of 40% in phosphorus digestibility by broilers was noted by David *et al*. (2021).

It is common practice to formulate poultry diets based on cation-anion balance. Diets are generally formulated to a positive cation-anion balance. Canola meal has a negative cation-anion balance and is high in sulphur, which can interfere with calcium absorption. Supplementing the diet with extra calcium helps to a certain extent, but care is advised, as too much dietary calcium can depress feed intake. Adding potassium bicarbonate to diets is a better alternative.

Feeding expeller canola meal

Much of the canola used for poultry is solvent extracted, but there has been growing interest in the use of expeller canola meal due to its greater energy content. One item that hinders use is oil content, which can vary with the source of the meal (Woyengo *et al*., 2010), making it important to know the oil content for feed formulation.

Broiler chickens

Several studies support the use of expeller canola meal for broilers. An expeller pressed yellow variety of canola was evaluated in a Dalhousie study (Bryan *et al*., 2019a) with and without inclusion of fibre digesting enzymes. The canola meal was substituted for soya bean meal and maize with an inclusion level of 30%. Additionally, expeller meals with two levels of residual oil (10 vs 14%) were evaluated. The energy value of the meal increased with residual oil and was further increased with the inclusion of carbohydrase enzymes.

Inglis *et al*. (2021) provided boilers with diets containing 20% expeller meal in the starter, grower, and finisher rations. Expeller canola meal and canola oil were incorporated in the diet in exchange for soya bean meal and maize to provide the birds with isoenergetic and isonitrogenous diets. The researchers found no differences in average daily gain or feed conversion for the duration of the 35-day feeding trial.

Laying hens

A feeding trial was conducted by Oryschak *et al*. (2020) to evaluate the effects of expeller canola meal compared to solvent extracted canola meal and soya bean meal. Two varieties of meal were also included in the 36-week evaluation with a 20% level of inclusion. There were no differences in percentage lay or hen bodyweights with any of the diets. Egg to feed ratio decreased slightly with the expeller meal. Diets with canola meal increased the percentage of mono-unsaturated fatty acids in the eggs. These results were similar to findings of Savary *et al*. (2017; 2019).

Canola meal and gut health

As the use of chemical growth-promoting agents continues to diminish in the poultry industry, more and more information comes to light concerning the role of ingredients and specific nutrients in health maintenance. Canola meal has been highlighted in several feeding trials as an ingredient that may contribute to gut health and digestion.

The fibre in the canola meal is partially digested in the caeca of birds, resulting in the production of volatile fatty acids (VFA). These fatty acids, and in particular butyrate, serve to inhibit pathogenic bacteria (Elnesr *et al*., 2020) and supply required nutrients for colonocytes in the caeca and large intestine.

Kozlowski *et al*. (2018) found that turkeys given diets with 20% Canadian canola meal as a replacement for soya bean meal experienced a shift in the proportion of butyrate as a percentage of total VFA. The amount of total VFA in the caecal contents was enhanced when multi-carbohydrase enzymes were also added to the diet. Inglis *et al*. (2021) reported greater fermentation in growing broilers when diets contained canola meal. These researchers also reported differences in the bacterial profile of the caecal contents.

Older studies suggested that canola meal might alter the integrity of the gut lining in poultry. Gopinger *et al*. (2014) provided male broiler chickens with starter and grow-finisher diets that provided 0, 10, 20, 30 and 40% canola meal. They found no loss in the integrity of the mucosal lining.

Researchers at the University of Georgia recently evaluated the effects of expeller rapeseed meal, solvent-extracted canola meal and a metabolite of glucosinolate degradation (allyl isothiocyanate, AITC) in two challenge studies with *Eimeria maxima* and *Salmonella typhimurium*. The same diets were used in both studies: soya bean meal control, 10% expeller rapeseed meal, 30% expeller rapeseed meal, 20% solvent-extracted canola meal, 500ppm AITC and 1 000ppm AITC.

The *Eimeria* (coccidiosis) study (Yadav *et al*., 2022a) revealed that there were differences in growth rates that were not related to the *Eimeria* challenge that was imposed. Therefore, this test was not a meaningful measure of the outcome of the two trials. However, the intestinal permeability increased to a greater extent with the soya bean meal and rapeseed meal than with the canola meal diet. Furthermore, the protective ability of the canola meal was numerically improved when the diet contained 40%, as compared to 20% canola meal. The AITC was also highly effective at reducing intestinal permeability.

In the second study (Yadav *et al*., 2022) broilers were challenged with *Salmonella* at hatch. Gut permeability was not elevated by exposure to *Salmonella*. Intestinal villus height was greatest with the 30% rapeseed meal diet, with other treatments being the same as the control. Mortality was highest with the soya bean meal challenge treatment. Therefore, canola meal may provide advantages when suffering from *Eimeria* infections and may provide an advantage over soya bean meal through lower mortality when birds are exposed to *Salmonella*.

This article was shortened for use in *Oilseeds Focus*. For the complete guide and references, visit *www.canolacouncil.org/canolamazing/feed-guide/*.

Information dissemination in a modern world

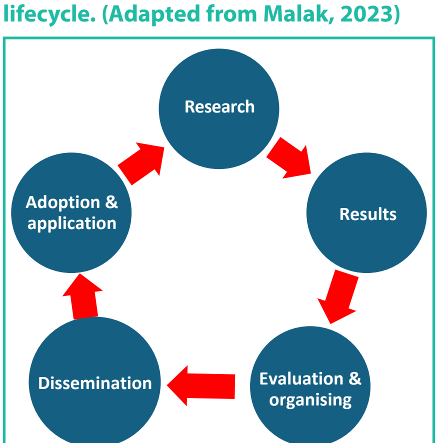
By Dr Pieter Bruwer, agronomist, Langfontein Seeds

Land, as a primary natural resource, and the use thereof, is under enormous pressure for basic needs such as agriculture, urbanisation, conservation and recreation, to name a few. This pressure may limit the availability of fertile agricultural land and force food production to marginal lands, compromising sustainable yields. However, research has provided invaluable scientific information on practices and concepts to manage these challenges and minimise the impact on most living organisms and our natural resources.

In the summer crop sector, one of the best examples is the transformation of marginal soils, previously found to be unsuitable for crop production, into some of the top-producing soils in South Africa. This process was made possible by agronomists and producers applying scientific principles established through many years of research.

Other studies have shown that newer agronomical practices and a combination of various species have significantly impacted the sustainability of resources and production. These are good examples of a successful chain of events in a dissemination model (*Figure 1*). Continuous research is therefore encouraged to keep agriculture and food production sustainable, and thus, the interaction between the researcher and producer remains critically important.

Figure 1: The knowledge management lifecycle. (Adapted from Malak, 2023)



However, over the past decade, communication between researchers and crop producers has deteriorated. There are many reasons for this state of affairs, and it is not a phenomenon unique to agriculture or crop production.

The data tsunami

To some extent, almost every sector or industry across the world is affected by a breakdown in communication. It is closely linked to the enormous amount of information that has become so easily accessible and available – a situation referred to as 'the information tsunami'.

In the agricultural world, the problem with information overload lies within scientific validation – something that is not necessarily within the field of reference of the ordinary citizen or in this case, the producer. The scientific nature of research results often requires interpretation and conversion into layman's terms to maximise adoption and application by the producer.

In the absence of this process, uncertainty and distrust are created. During this sensitive period, effective communication between researcher and producer becomes critical to minimise and prevent the exploitation of producers. Information overload allows pseudo-science, also known as fake science, to blend with true science.

Pseudo-science

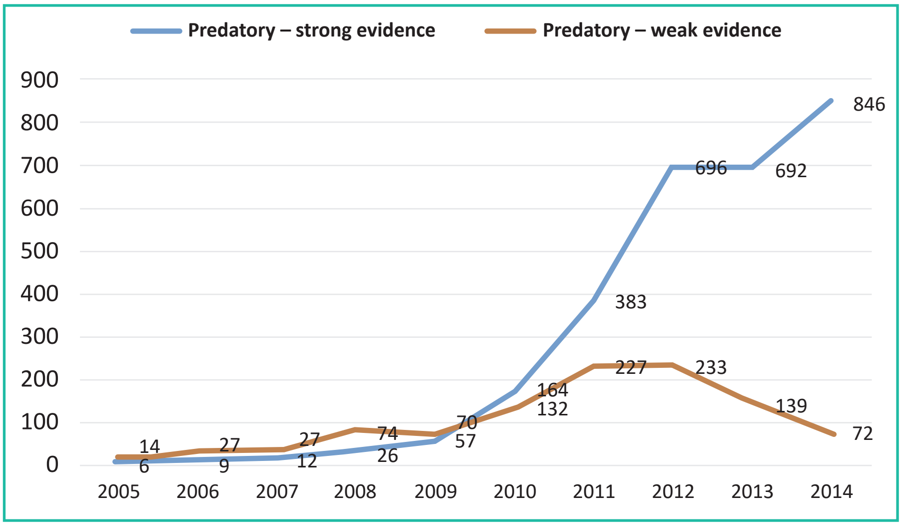
Understanding the implications of a breakdown in scientific communication requires an examination of the dangerous alternative called pseudo-science. Pseudo-science is "a collection of beliefs or practices mistakenly regarded as being based on scientific methods" and "a system of theories, assumptions, and methods erroneously regarded as scientific". Similar to other regions globally, the South African agricultural sector is also affected by pseudo-science.

When producers lack access to formal extension services, they often turn to other information sources, such as mobile phones and Internet options. These platforms, along with social media, typically generate an information overload, fostering a environment conducive to pseudo-science. Unfortunately, information created in such circumstances often confuses and blurs the otherwise definite line between science and fake science, and is called professional jargon. If nothing else, the professional jargon of different disciplines can hinder effective communication and open the door to pseudo-science.

Scientists are not entirely absolved from their responsibility regarding information overload and fake science. The pressure to publish in an increasingly competitive environment has led to more publications emerging every year. Still, it has also led to more rampant research misconduct and lower-quality science being published in predatory journals. These journals provide content that has not been properly vetted and is often of poor quality, exploiting a trend in which researchers are judged more by the number than the quality of their scientific publications.

Figure 2 illustrates the timeline of the inception and subsequent sharp increase of predatory publications in South Africa. These journals are most rampant in the fields of medicine but have also penetrated the agricultural research publications scene. The ongoing application of pseudo-science in agriculture is hazardous; it wastes science resources, results in misleading advice

Figure 2: Increase in number of papers published by South African authors in predatory journals from 2005 to 2014. (Adapted from Mouton and Valentine, 2017)



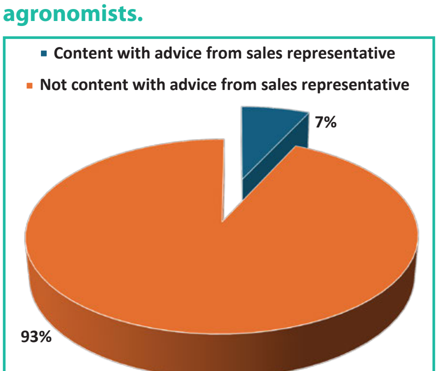
to producers, undermines producers' confidence, and results in significant financial losses due to lost productivity.

Agricultural research

Traditionally, researchers are regarded as individuals who meticulously study and discover new facts regarding their field of study. However, agricultural research organisations and their researchers are increasingly called upon to work on complex societal challenges as well. These challenges add a different dimension to research, compounded in agriculture, because of the interaction between land and people. It illustrates the importance of innovative research and, most importantly, effective communication to ensure the timely adoption and application of the results.

A recent study revealed that most of South Africa's agricultural researchers are

Figure 3: Crop producers' preference towards qualified advice from agronomists.



highly esteemed and regarded as on par with their global peers. These researchers are affiliated to world-class academic institutions as well as public and private research centres. Commodity-based organisations conduct research using their own researchers, academic institutions, public institutions, and private researchers. In a situation where results are continuously generated, yet producers feel they lack sufficient access to this information, the issue likely lies in the way that science is communicated and disseminated.

State of advisory services

In the crop sector there is a growing demand for qualified advisors such as agronomists and 93% of crop producers on the Eastern Highveld of Mpumalanga have indicated that they prefer receiving advice from qualified advisors, and prefer dealing with the companies that employ them (*Figure 3*). There is significant potential for more private consultants in the country, as the demand for specialist advice far exceeds the number of established companies or individuals currently operating as consultants. However, only 48% of the same respondents are willing to pay for private advisory services. This leaves South Africa's extension services in a transitional phase, between that of public and private advisors.

Agricultural supply companies provide some extension and advisory services that are mostly limited to a specific area of expertise closely tied to their product offerings. While this is expected, implementing successful dissemination models could significantly improve their advisory capacity and promote the responsible application of their products. The literature presents different opinions on the relevance and role of advisors in this era of new technologies. While some argue that these specialists will become obsolete, multiple studies have found the opposite to be true.

Most producers feel overwhelmed by the amount of available information and the vast amount of data collected on farms. They are in desperate need of qualified advisors to help interpret and apply this information. The need for qualified advisors is particularly significant in the summer grains production sector.

Going forward

Agricultural researchers and scientific advisors are arguably the most important role-players in the agricultural production of food, fibre, timber, and other products. Qualified advisors are best equipped to filter through the mass of information overload and establish effective communication between producers and researchers to ensure scientific sustainability in agriculture.

These advisors possess the knowledge and skills to assess the entire system, have access to scientists and fully comprehend the research, including the results. They also understand the needs of and challenges faced by producers, and play a pivotal role in the ability of agriculture to respond to variables such as climate change and population increase, and establish sustainable practices.

Researchers should place more emphasis on a plan to disseminate generated results. At the same time, greater and continuous collaboration between themselves and advisors is needed. Collectively speaking, we are drowning in knowledge and starving for wisdom.

A sincere thanks to the Oil and Protein Seeds Development Trust for funding the research and for creating opportunities where these important results can be shared. For more information, email Dr Pieter Bruwer at pieter@bruwer.net.

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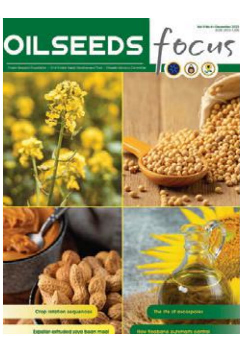

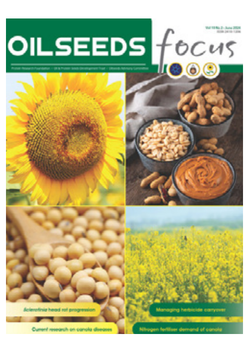

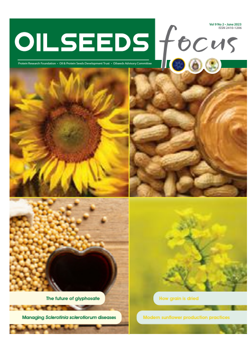

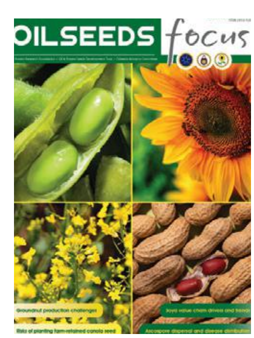

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Farm structures and building plans

By Hans-Jurie Moolman, Moolman & Pienaar Incorporated

Local authorities or municipalities used to be limited to urban areas when exercising their power of controlling any building or construction project. However, that is no longer the case; these days we have back-to-back municipalities with the legislative capacity to control a large geographical area, including rural and urban areas. This is one reason why property tax is payable on agricultural properties within the geographical areas of South Africa's local authorities.

However, the influence of local authorities over agricultural properties is not limited to property tax. Other national, provincial and local legislation also applies to agricultural land, in particular the development or construction of buildings and structures on agricultural land.

The purpose of the *National Building Regulations and Building Standards Act, 1977 (Act 103 of 1977) (Building Act)*, as amended, is to provide for uniformity in the legal provisions relating to the construction of buildings within the jurisdiction of local authorities, as it pertains to the prescription of building standards and other related matters.

Scope of the *Building Act*

Although local authorities or municipalities possess the inherent power to formulate local by-laws for buildings, the by-laws of most of South Africa's local authorities are formulated according to *Building Act* standards. It is essential to understand what the scope of the law entails.

Section 4(1) of the *Building Act* stipulates that no one may erect a building, the plans and specifications of which must be drawn up and submitted in terms of the relevant piece of legislation, without the prior written approval of the relevant local authority.

According to Section 1 of the *Building Act*, a building includes:

- Any other structure, whether of a temporary or permanent nature and irrespective of the materials used in the erection thereof, erected or used for or in connection with:
  - The accommodation or convenience of people or animals.
  - The manufacture, processing, storage, display or sale of any goods.
  - The rendering of any service.
  - The destruction or treatment of refuse or other waste materials.
  - The cultivation or growing of any plant or crop.
- Any wall, swimming bath, swimming pool, reservoir or bridge or any other structure connected therewith.
- Any fuel pump or any tank used in connection therewith.
- Any part of a building, including a building as defined here.
- Any facilities or system, or part or portion thereof, within or outside but incidental to a building, for the provision of a water supply, drainage, sewerage, stormwater disposal, electricity supply or other similar service in respect of the building.

The *Building Act's* provisions are applicable to a local government's legislative jurisdiction; however, it does provide for the national government, and responsible minister, to grant exemption from specific provisions of the *Act*. Therefore, any owner of land (which the *Building Act* also defines) will have to scrutinise the local by-laws of the relevant local authority to ascertain what requirements the intended building or construction of a building on land, and as defined here, must comply with.

Illegal structures

In addition to complying with national and/or local legislation, it is important to note that improvements on land come into play when property is transferred from one owner to the next. In this regard, the construction of buildings that have not been legally approved could culminate in a legal dispute if the local authority orders the new owner to demolish the illegal structure that is part of the improvements and for which a specified purchase price was paid.

Historical satellite images can also be utilised to determine when structures were erected. If this took place after the *Building Act* or applicable local by-law came into force, it could have serious implications if the action was not legal.

The Constitutional Court is currently adjudicating a case in which local authorities/municipalities refused to issue clearance certificates for the transfer of land on which improvements were made or developments had taken place that were not legally approved. Although the ruling will determine the position regarding these local authorities' actions, it is important to also keep in mind what implications this will have for future transactions involving property.

Owners of agricultural land must consider the aforementioned legal implications when deciding whether to make improvements to property. The best course of action is to obtain advice on property from a lawyer or city or regional planner, as this will give landowners peace of mind that an expensive investment in property is legal and that a negative outcome can be avoided.

For more information, send an email to the author at hj@mmlaw.co.za or phone 033 032 0241.

Addressing defamation in the digital age

By Madeleine Ackermann, client relationship manager, LWO Employers Organisation

In an era dominated by social media, the spread of misinformation and defamatory statements have become a significant concern for individuals and organisations alike. Defamation, which is the unlawful publication of a statement that harms another's reputation, has found a new and powerful medium on social media platforms.

Employers in South Africa must now navigate this complex landscape, balancing the right to freedom of expression with the need to protect their reputation and that of their employees.

Understanding defamation

Defamation involves the publication of a statement, whether verbal or written, that is intended to harm a person's reputation. For a statement to be considered defamatory, it must meet several criteria:

- **Publication**: The statement must be made public, either spoken or written.
- **Intent**: The person making the statement must have intended to defame another person.
- **Harm and injury**: There must be demonstrable harm or injury to the person's reputation.
- **Violation of rights**: The statement must violate the person's right to their good name, reputation, and dignity.

In the context of social media, defamation can include publishing false information, making derogatory comments, or sharing misleading information that portrays someone, or an organisation, negatively.

Legislative requirements

To combat the rise of false information and defamation on social media, South Africa has introduced the *Prevention and Combating of Hate Crimes and Hate Speech Act, 2023 (Act 16 of 2023),* signed into force by president Cyril Ramaphosa on 9 May 2024.

The *Act* aims to uphold constitutionally enshrined rights such as human dignity, equality, and the right to freedom and security, while also addressing hate crimes and hate speech. This legislation complements existing employment legislation, such as the *Employment Equity Act, 1998 (Act 55 of 1998)* and the harassment code published under the *Employment Equity Act*.

> The guiding principle for employees should be to think carefully before sharing content online, as it could resurface in a disciplinary context.

The *Act* criminalises hate speech and hate crimes, allowing employers to take disciplinary action alongside any criminal proceedings against individuals engaging in such conduct.

Protective measures for employers

To safeguard against the dangers posed by social media, employers can implement several proactive measures:

- **Social media policies**: Develop and enforce comprehensive social media policies that outline acceptable behaviour and the consequences of defamation or spreading false information.
- **Monitoring**: Keep a close watch on social media channels for any negative or false statements about the business or its employees.
- **Professional response**: Address negative or defamatory statements promptly and professionally, correcting any false information as quickly as possible.
- **Legal action**: In cases of serious defamation, consider pursuing legal action to protect the business' reputation.
- **Disciplinary action**: Take disciplinary steps in accordance with your social media policies against employees who engage in defamatory conduct. Ensuring that employees understand the serious implications of their online actions can help deter such behaviour.

The role of employees

Employees must also be aware of the impact their social media activity can have on their professional lives. Sharing false information or making inappropriate comments online can lead to disciplinary actions, especially if their posts reference their employer or if they are publicly associated with the business. The guiding principle for employees should be to think carefully before sharing content online, as it could resurface in a disciplinary context.

Conclusion

As South Africa continues to embrace the digital age, both employers and employees need to remain vigilant about their online conduct. By implementing robust policies, providing training, and staying informed about legal developments, businesses can better protect themselves against the reputational and legal risks associated with defamation on social media.

The LWO Employers Organisation assists employers to comply with labour law, and to use it to their advantage to protect their business. As a registered employers' organisation with the Department of Employment and Labour, the LWO has the right to represent members at the Commission for Conciliation, Mediation and Arbitration (CCMA). Take note that this article is not legal advice – consult one of our legal advisors about any specific legal problem or matter. For more information, send an email to Madeleine Ackermann at madeleine@lwo.co.za or info@lwo.co.za, or visit *www.lwo.co.za*.

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