

OILSEEDS

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The role of the Oil & Protein Seeds Development Trust and Oilseeds Advisory Committee

By Gerhard Keun, CEO of the Oil & Protein Seeds Development Trust

The Oil & Protein Seeds Development Trust (OPDT) and Oilseeds Advisory Committee (OAC) were founded in 1997 in terms of the provisions of the *Marketing of Agricultural Products Act, 1996* (Act 47 of 1996, as amended), following the dissolution of the former Oilseeds Board. In addition, the Groundnuts, Soya Beans and Sunflower Forums were established as part of these structures.

The OPDT and OAC objectives are set out in a trust deed and constitution respectively. Since 1997, all actions have been based on the objectives in the said documents.

In summarising the authority of the mentioned bodies, one may argue that the OPDT manages funding, the OAC manages research projects and that the above-mentioned forums create a platform for discussing matters of common interest in terms of the industries involved.

Funding of canola research

Since the establishment of these structures, sunflower, soya beans and groundnuts have comprised the oil seeds crops defined in the OPDT trust deed. Following requests from the industry, the OPDT trust deed was amended in 2013 to include the funding of canola research.

The OPDT and OAC did not always function in favourable circumstances. During the course of action, the commodity trusts were threatened with the alienation of funds, and a negative image had been created in respect of the work, particularly transformation work, performed by these trusts.

Despite these conditions, they have strived to achieve their objectives. Since 1997, an amount of R121 911 510 has been devoted to research relating to

sunflower, soya beans, groundnuts and canola by the OPDT. This includes funding of transformation projects amounting to R29 455 309.

Since the establishment of the bursary scheme in 2007, grants to the value of R2 820 000 have been awarded to deserving MSc and PhD students. The research has included the funding of various research projects in respect of the two fastest-growing commodities, namely soya beans and canola, in South African agriculture.

Stimulating stagnant industries

A key contribution to especially soya food research has also been made. Value chain studies in respect of sunflower and groundnuts have been funded in an effort to stimulate the stagnant sunflower and declining groundnut industries.

The role of an agricultural industry trust is to act as a catalyst to agricultural transformation.

Transformation has played an increasingly significant role, and in 2014 the National Agricultural Marketing Council (NAMC) introduced the *Generic Transformation Guidelines*. Some of the trusts remain subject to statutory levies. The guidelines determine that at least 20% of the collected statutory income from levies should be allocated to activities that are in line with the NAMC transformation guidelines. Since the OPDT is not subject to statutory levies, it was decided to apply these guidelines to transformation projects relating to oilseeds crops.

During a workshop in March 2016,

the minister of agriculture, forestry and fisheries, Senzeni Zokwana, provided clarity regarding the role of the trusts, stating that "the role of an agricultural industry trust is to act as a catalyst to agricultural transformation".

There are numerous challenges for the OPDT and OAC to overcome, not only in terms of transformation but also in terms of technology transfer and research in the interests of the total oilseeds industry. OPDT and OAC have always found a balance between transformation as defined by the NAMC, general research, information and promotion activities.

Soya food programme

Through the years co-operation has been sought with government departments and currently negotiations are underway with the Department of Science and Technology (DST) to obtain supplementary funding for a joint soya food programme which complies with transformation requirements.

With the co-operation of the Maize Trust, Winter Cereal Trust (WCT) and Sorghum Trust, the OAC and OPDT are also negotiating to take over the Grain Farmer Development Association (GFADA). The objective of these negotiations is to improve the management and co-ordination of transformation projects, as well as to eliminate duplication. Negotiations will also result in stretching the research rand through co-operation.

Interesting and challenging times await us. The OPDT and OAC will continue to position themselves to ensure a relevant contribution to the benefit of the oilseeds industry.

For more information, contact the offices of the oilseeds industry on 011 234 3400/1 or visit www.opot.co.za.

The political and economic environment influencing soya production

South Africa transitioned from an independent republic in 1961 to a fully inclusive democracy in 1994. The nation is hailed for what it has achieved thus far, yet is still in its growth stages and anxiously awaits a resolution to ever-present challenges and struggles to cope with the complex internal and global environment.

Less than six months ago, when the rand-dollar exchange rate was at 16,5, the common view among banks and the business community was that the local currency could only weaken further. The weakening of the rand was a logical assumption considering its dismal performance at the time. Overshooting to either side of fair value is also a historical phenomenon of the rand.

The recent speed of recovery shown by the currency took many by surprise. Although the effective local elections have re-confirmed our democracy, it was, in fact, global windfalls that have assisted the recovery of the rand rather than domestic achievements. The positive recent feedback by rating agencies has confirmed the fact that South Africa is once again geared for business.

Global soya bean production

The three major global soya bean-producing countries remain critical in the longer term to balancing the delicate global supply and demand of soya beans, in order to maintain the recent reduced price levels.

Argentina still has major agricultural potential that has not been unlocked to its fullest, due to the numerous years of government regulation and unfavourable trade policy which have placed a heavy burden on the industry. Recent shifts in the political regime have brought major changes and reform to that nation's agricultural industry and markets. South Africa could face more stiff competition in the form of wheat and maize imports from Argentina, given the reduced export taxes.

The economic and political environment in Brazil is currently not favourable, with major bureaucratic constraints, corruption and an unstable economic environment having an impact on the sector in that country. Despite the enormous investment in export ports to the north of the country, logistics remains a major challenge for Brazil.

The United States (US) production machine of soya bean oil demand dynamics is a unique one, with high-oleic soya beans (in an effort to alleviate the trans-fatty acid challenge) receiving major attention in an attempt for soya beans to regain market share in US oil consumption.

Local soya bean plantings

The ratio of soya bean to maize prices remains favourable for local soya bean hectares to continue to be planted in the new season.

The positive contribution of rotational cropping has been clearly visible in the Mpumalanga area. Crop rotation between maize and soya beans will have to be improved in the Free State, and the challenges experienced in the North West should be addressed in order for soya bean production to increase in these provinces.

Dr Erhard Briedenhan

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

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CONTENTS

- 1 Preface
- 2 Editor's note
- 4 News

AGRONOMY

- 6 Trends in Australian canola productivity
- 10 Can SA break through the yield barrier?

SEEDS

- 12 The ideal planting date for soya

CHEMICALS AND FERTILISER

- 16 Sulphur and nitrogen boost yield
- 20 Nitrogen fertilisation of soya
- 22 The effect of global warming

PROCESSING

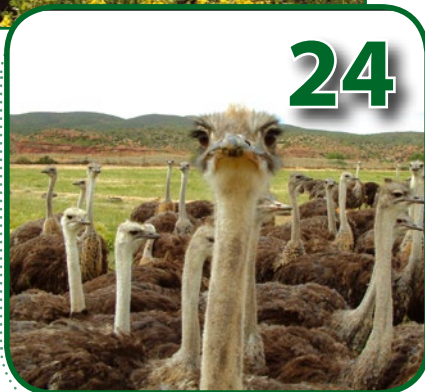
- 24 Canola feed for farm animals and ostriches

MARKETS

- 26 Impact of the drought on markets
- 29 Soya meal consumption in the US
- 30 Lows and highs of markets

GENERAL

- 32 Feedback from the Canola symposium



Import approval for Roundup Ready 2 Xtend

Monsanto Company recently announced that the European Commission has granted import approval for Roundup Ready 2 Xtend® soya beans. This milestone allows for the import and food/feed use of Roundup Ready 2 Xtend® soya beans into the European Union (EU).

The European Commission's approval follows Monsanto's February announcement of Chinese import approval. With both the EU and Chinese import approvals and the United States (US) Environmental Protection Agency (EPA) in the final stages of review for over-the-top use, Monsanto can now look forward to a full system launch in the US in 2017, and continues to be in a strong position to supply roughly 15 million acres US soya when the selling season arrives. A full system launch is also planned for Canadian soya bean growers in 2017, given the nation's previous regulatory approval for Roundup Xtend™ with VaporGrip™ Technology and XtendiMax™ herbicide with VaporGrip™ Technology.

"We've seen great demand from growers for Roundup Ready 2 Xtend® soya beans," said Brett Begemann, Monsanto president and chief operating officer. "Producers are telling us they're looking forward to the benefits of the full Xtend® crop system, including over-the-top use of dicamba and glyphosate. We're excited to give Canadian growers this opportunity in 2017, along with US growers pending final EPA approval." – *Press release*

Drought not over yet

The National Agro-meteorological Committee (NAC) noted in a recent statement that despite above-normal rainfall received over most parts of the country in May, drought conditions are still persisting in many areas. Although water levels have improved in major dams in some provinces as a result of recent rain, they remain lower compared to the previous year.

Absa Bank has stated that maize prices are trading lower and that there is a significant shortage of maize, which is expected to boost exports to neighbouring countries. It is projected that harvesting will weigh on the market and that the stronger rand will put pressure on prices. Wheat prices are trading lower. Soya bean prices are lower and as a result of harvest time nearing, the price of soya is anticipated to soften. However, the weakening rand will support prices.

The June Famine Early Warning Systems Network (FEWS NET) report stated that following an El Niño-induced drought, Southern Africa is experiencing one of its poorest harvests in recent years and an upsurge in households facing acute food insecurity. FEWS NET estimates that a higher-than-normal number of people are currently facing acute food insecurity and roughly 17 million will be in crisis (IPC Phase 3) between January and March 2017, requiring immediate assistance. At the height of the harvest period, many low-income households in Zimbabwe, Malawi, Mozambique, Madagascar, Lesotho, and Swaziland currently face crisis (IPC Phase 3) food insecurity outcomes.

FEWS NET indicated that imports from Zambia, Tanzania and other international markets will only partially mitigate this shortfall. – *Press release*

Canola production on the rise

Canola production has been in decline, similar to the rest of the agricultural sector over the last two seasons, due to the drought that has plagued the country, according to Wandile Sihlobo, senior economist at the Agricultural Business Chamber (Agbiz).

"The past two seasons have not been good for canola production in the world. In fact, since the 2013/14 season, global canola production has been on the decline – from 71,6 million tons to an expected 65,1 million tons in the 2016/17 season," Sihlobo says.

However, although there has been a decline in the past two years, South Africa is on the upward trend if one considers the longer term. The key global canola producers are Canada, China, EU, India and Ukraine, with a production share of 24, 19, 33, 10 and 2%, respectively.

"These countries make up 88% of global canola production," he says. "South Africa is the leader in canola production in sub-Saharan Africa. With the emergence of the middle class, people are opting to eat healthy foods and this is what is driving the canola market."

Paul Makube, senior agricultural economist at First National Bank, agrees. He says canola oil is in demand, fuelled by the emergence of the middle class.

"It has the lowest saturated fat content of any common cooking oil. There has been a huge demand as a result of its health benefits. In the last six years, South Africa has increased canola production by 70%," notes Makube. – *www.iol.co.za*

Canada and China canola dispute unresolved

The Chinese government is poised to effectively shut the door on \$2 billion in annual exports of canola seed from Canada – a potential blow to bilateral trade with the Asian giant that could land just as Justin Trudeau makes a historic visit to the country to attempt rebuilding relations with Beijing.

China is preparing to enact a regulation as of 1 September that would require the amount of extraneous plant material in canola seed exports to constitute less than 1% of each shipment. The Chinese are a major customer for 43 000 farmers, mainly in Western Canada but also Ontario and Quebec, who export their product via grain handlers. Last year, China bought more than 40% of all canola Canada sold abroad.

Canada's canola industry says this new measure would all but halt shipments to China, where the canola seeds are mostly used to produce cooking oil and livestock meal. It says it is impractical for Canadian shippers to filter and remove sufficient plant material to meet this new standard. – *The Globe and Mail*



Council calls for soya sauce regulation

A substance that is thought to cause cancer if consumed in large amounts has been found in 11 of 40 soya sauce samples taken by the Hong Kong Consumer Council (HKCC), the council has said in its latest monthly report.

Soya sauces and seasonings are common condiments in Chinese dishes, but more than one in four samples tested by the council were found to contain the chemical compound '4-methylimidazole' (4-Mel), including those from popular brands.

The chemical was identified as a possible human carcinogen by the World Health Organisation (WHO). However, experts claim that the chances of it causing the disease in humans are very low.

"Hong Kongers consume soya sauce almost daily," says HKCC chief executive, Gilly Wong Fung-han, urging the Centre for Food Safety (CFS) to investigate the matter and regulate the amount of 4-Mel allowed in food, taking reference from other countries.

Currently, there is no standard for the safety and quality of soya sauces and seasonings in Hong Kong. However, for instance, Californian legislation requires that businesses place a warning label on product packaging, warning against consuming more than 29µg of 4-Mel per day, the council has said. – *South China Morning Post*

High pesticide levels harm wild bees

Pesticides used on oilseed rape crops are harming native populations of wild bees, scientists have conclusively proved. Species numbers that feed mostly on the flowers of the now-profitable cash crop used for vegetable oils and animal fodder, are down by as much as 30%, according to the wide-ranging study published in the journal *Nature*.

The crop – once grown only sparingly to rest soils between grain harvests – must be intensively managed for farmers to attain the high yields they need to maximise profits, which means high use of pesticides. In the case of oilseed rape, many of these are of the neonicotinoid variety that is under close scrutiny by the European Union (EU) for its links with declines in bee populations.

The scientists said the 30% decline in the most susceptible species examined was attributable to neonicotinoid use, though some of the other declines noticed in the 62 bee species covered by the research could also be affected by other factors such as climate change. Overall, they have found that neonicotinoids were responsible for a 10% reduction in the distribution of bee species that forage on oilseed rape.

– *The Guardian*

China to embrace GM soya beans

To date, China has approved genetically modified (GM) technology for cotton, but has yet to approve bioengineered food crops due to perceived consumer prejudices.

However, with an aim to overhaul and modernise its agricultural sector, the Chinese government has specified in its latest five-year plan for science and technology to 2020, that it will work to develop GM soya beans for food production and animal feed, as well as GM maize.

The US Department of Agriculture (USDA) estimates that China will produce 12.5 million tons of soya beans in 2016/17 and will import a record-breaking 86 million tons. Despite this heavy dependence on imports, there is expected to be strong pushback against the acceptance of GM soya beans from both consumers and an industry that can sell its GM-free soya beans at a premium.

The acceptance of GM maize is expected to come easier, as maize in China is mainly used as animal feed and in the production of starches and sweeteners.

– www.oilseedandgrain.com



Upcoming events

Soil-borne plant diseases interest group symposium Email schoemana@arc.agric.za .	20–22 September 2016	ARC-Plant Protection Research Institute, Vredenburg Research Centre, Stellenbosch, South Africa
AMT Annual Agricultural Outlook Conference Email liaison@amtrends.co.za .	28 September	CSIR International Convention Centre, Pretoria, South Africa
AFMA Symposium Email admin@afma.co.za .	11 October 2016	CSIR International Convention Centre, Pretoria, South Africa
WPSA Day Email tyler@ukzn.ac.za .	12 October 2016	CSIR International Convention Centre, Pretoria, South Africa
GOSA Symposium Visit www.GOSA.za.net .	22–23 March 2017	Diaz Beach Hotel & Resort, Mossel Bay, South Africa

Drivers of trends in Australian canola productivity and future prospects

In Australia, canola was initially grown in more reliable rainfall areas (>400mm annual rainfall) due to its greater sensitivity to heat and drought than cereals, and the higher production costs increasing risk in more marginal environments (Colton and Potter, 1999). Improved varieties and agronomy, along with the overall farming systems benefits of weed and disease control in cereals, have expanded the area cultivated under canola, and it is now grown in all but the driest margins of the wheat belt.



which favoured cereals such as wheat and barley over canola.

Yield levels maintained

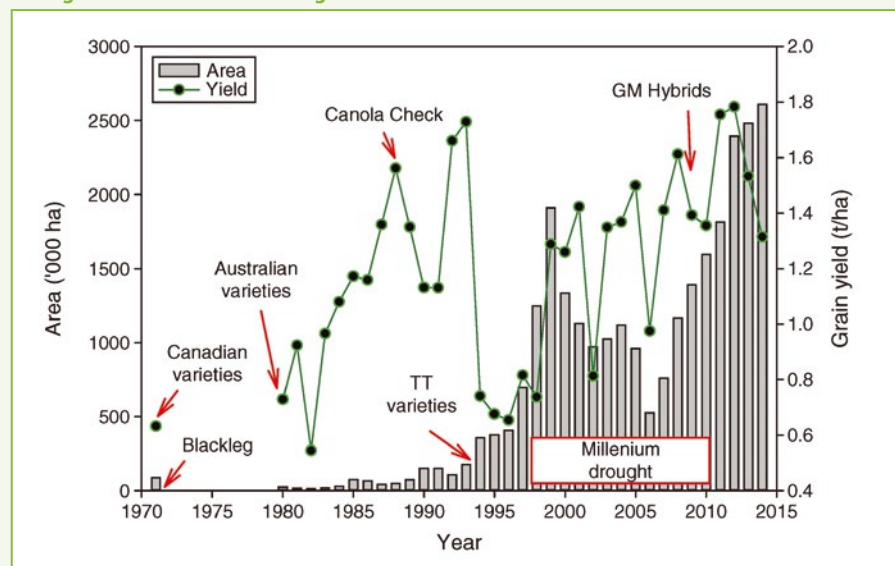
As the area of canola declined and the crop retreated to the more reliable rainfall areas, overall yield levels were

maintained, except for the notable drought-stricken years of 2002 and 2006. Although some interannual variability in area and yield is likely to continue in response to seasonal conditions and relative prices, the current area is at an all-time high (Figure 1).

A previous review of Australian canola productivity in 1999 ironically marked the beginning of a rapid decline in canola-planted area to approximately 0.5Mha in 2006, which resulted from a combination of poor seasonal conditions and changing terms of trade (Figure 1). During its swift expansion in the late 1990s, canola extended beyond the traditional, more reliable rainfall areas (annual rainfall >450mm) and into lower rainfall areas (<32 mm) especially in Western Australia, and in some cases onto less suitable soils.

The period from 1998 to 2010, now known in that country as the millennium drought (Verdon-Kidd et al., 2014) was characterised by dry autumns, late planting rains and limited soil water storage, together with hot, dry springs

Figure 1: Area and average national grain yield for canola in Australia, highlighting some of the significant events influencing the observed trends.



The linear trends (not shown) in grain yield fitted for the years 1980 to 1993 and 1998 to 2014, were 67kg/ha/year (3.8% p.a. of 1993 yields) and 34kg/ha/year (2% p.a. of 2014 yields), respectively. These periods represented times of relatively stable production areas of <0.3Mha before release of TT varieties, and 1 to 2Mha after the release of TT varieties. Data compiled from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) estimates (2014) and Australian Oilseeds Federation (AOF) estimates (2015).

As a result of the significant fluctuations in the areas sown to canola in Australia it is hard to establish meaningful overall yield trends, but the impressive early improvements were clear, rising from around 0,6t/ha in the 1970s to 1,8 t/ha in 1993 (*Figure 1*). This was largely due to the development of adapted, blackleg-resistant varieties (Salisbury and Wratten, 1999; Buzza, 2007; Cowling, 2007), along with highly successful agronomy packages such as CanolaCheck (Colton and Potter, 1999). The yield progress during this early period on the small (<0,3Mha) but relatively stable higher rainfall areas was a remarkable 67kg/ha/year or 3,8% p.a. (based on 1993 yields).

The introduction of triazine-tolerant (TT) varieties in 1993 led to an expansion of canola into more marginal areas of Western Australia, which combined with their inherently lower yield potential (Robertson et al., 2002b), and a devastating drought in 1994 saw average national yields collapse for several years as the area grown increased (*Figure 1*).

During the subsequent millennium drought period from 1998 to 2010 (Verdon-Kidd et al., 2014), the area stabilised at around 1Mha, and in the period 1998 to 2014 average yields steadily returned to the levels achieved in 1999. The linear yield trend during the 16-year period 1998 to 2014 was 34kg/ha/year or 2% p.a. based on 2014 yields, but in this case coincided with an increase in the area grown (*Figure 1*).

Crop comparisons

This basic estimate of recent national farm yield progress compares well with those established for the period 1991 to 2010 by Fischer et al. (2014) for China (37kg/ha/year, 2%) and Canada (33kg/ha/year, 1,7%), exceeding that of India (15kg/ha/year, 1,4%) and France (21kg/ha/year, 0,6%) but indicating a figure lower than that achieved in Germany (68 kg/ha/year, 1,7%).

A more recent estimate for yield gain in the Canadian Prairies for the period 2000 to 2013 is 54kg/ha/year or 2,6% per annum relative to 2013 yields, and factors driving this increase are discussed by

Morrison et al. (2016a). National trends of farm yield are of interest, but in order to drive productivity gains it is vital to compare current performance against a defensible yield potential to assess the exploitable yield gap between potential yield and that achieved in farmer's fields (Kirkegaard et al., 2006; Fischer et al., 2014).

The introduction of triazine-tolerant varieties in 1993 led to an expansion of canola into more marginal areas of Western Australia.

Yield potential can be estimated by simple crop comparisons (e.g. canola yield = 50–60% of wheat yield) (Holland et al., 1999), expected seasonal water-use efficiency (WUE) [e.g. 15kg/ha/mm of seasonal evapotranspiration (ET)] (Robertson and Kirkegaard, 2005), or crop simulation models sensitive to crop, soil, climate and management factors (Kirkegaard et al., 2006; Lilley et al., 2015).

The latter approach has recently been used to estimate potential canola yields and yield gaps on statistical local area (SLA) scale for the entire nation for the period 1998 to 2015, and has been made available in a web-based format. The analysis suggests that the overall average farm yields across 162 SLAs in the period 1998 to 2012 (range 0,9 to 1,4t/ha) were 42 to 68% of the water-limited potential yield (range 1,3 to 3,2t/ha) assessed using the simulation analysis.

Scope to increase productivity

A further estimate of yield potential can also be assessed from field experiments evaluating the latest varieties under optimum agronomy, such as those that have been conducted as part of the National Variety Testing (NVT) series across Australia for canola since 2005.

A summary of the site mean yields

achieved across a range of NVT sites in the period 2005 to 2014 confirms that for elite varieties under experimental conditions, average yields of 2,5 to 3t/ha and 1 to 2t/ha can be achieved in high- and low-rainfall sites, respectively.

Together these measured and modelled estimates of current yield gaps in canola suggest there exists significant scope to increase canola productivity on the country's farms with ongoing research, development and adoption of new technologies.

Key strategies

The early strategies and success of Australian canola breeders in developing adapted, disease-resistant varieties producing high oil yields of good quality have been previously reviewed (Salisbury and Wratten, 1999; Buzza, 2007; Cowling, 2007). Potter et al. (2016) report a study of historic non-herbicide-tolerant (NHT) canola varieties, suggesting genetic improvements may have contributed around 21,8kg/ha/year (or 1,25% p.a.) to overall yield improvement in the period 1978 to 2012.

However, the remarkable success of major global competitors such as Canada in achieving continuing improvements in yield and quality (Morrison et al., 2016a), highlights the need for ongoing innovation in the Australian industry to remain competitive.

The initial targets for Australian breeders – blackleg resistance, high yield and quality – remain the key targets for breeders today. Salisbury et al. (2016) chart the ongoing innovation in that nation's canola breeding in these chief areas and highlight some of the changes during the last 15 years. These include the switch from public to private breeding and the associated diversification in the genetic background of Australian canola, a concern previously discussed by Cowling (2007).

This has increased the development and release of hybrid varieties, new herbicide-tolerant types including genetically modified (GM) glyphosate-resistant crops, also known as 'Roundup Ready' (RR) varieties in 2008, new

speciality oil types, as well as new sources of blackleg resistance. In 2013, open-pollinated, TT varieties still comprised 81 and 70% of canola grown in Western and South-Eastern Australia, respectively, but the focus of breeding companies has switched to hybrid varieties with a declining number of new open-pollinated releases in recent years (Zhang et al., 2016).

New technologies

The increasing use of new technologies such as doubled haploidy, molecular markers and genomic selection and a range of other 'omics' technologies are likely to accelerate the identification of promising alleles for a range of traits and their breeding into elite varieties (Raman et al., 2016).

In the area of blackleg resistance, Van de Wouw et al. (2016) outline the significance of the increased recent understanding of the genetics controlling the interaction between *L. maculans* isolates and *Brassica* varieties, which has underpinned new breeding and management strategies to manage this devastating disease.

As canola production intensifies, managing the durability of polygenetic resistance presents the major challenge for the future and will require integrated approaches of new genetic resistance, new fungicide chemistry and improved cultural practices.

Nelson et al. (2016) describe the potential application of genomics to improve the phenological adaptation of canola which is a key driver for increased productivity in diverse and changing environments. Understanding the genetics controlling responses to vernalisation and photoperiod in wheat and using them as markers in breeding programmes and predictive models (Zheng et al., 2013), can unlock tremendous potential to tailor new varieties to specific environments with significant increases in yield potential. Such research is currently envisioned for canola (Nelson et al., 2016).

In addition to improved phenological adaptation, breeders and geneticists are also seeking further specific traits to improve the adaptation of canola to



drought (Norton 2007). Numerous traits such as carbon isotope discrimination, water-soluble carbohydrate remobilisation, osmotic adjustment, deeper roots, early vigour and canopy architecture have been investigated in cereals with ideotypes proposed (e.g. Reynolds and Tuberosa, 2008), but these are yet to be confirmed as beneficial in canola.

Breeding targets

As a result, there is currently little trait-based breeding in Australian canola, although the National Brassica Germplasm Improvement Programme (NBGIP) has initiated investigations of drought tolerance as a breeding target.

The ongoing empirical selection for early vigour, reduced height, flowering date and the move to hybrid varieties is likely to see ongoing improvements in yield under drier environments (Salisbury et al., 2016). The release in 2015 of a variety with a pod-shatter resistance trait (IH51-RR) may increase harvested yield under direct heading and in situations where harvest is delayed by rainfall or contractor availability.

In terms of canola quality, Potter et al. (2016) report that simultaneous improvements in both oil content (0.09% p.a.) and protein (0.05% p.a.) had been achieved over the period 1978 to 2012, while glucosinolate content was decreased from 7–16 µmol/g of meal by the mid-1990s. Innovative selection protocols indicate continuing improvements in the most recent releases

(Salisbury et al., 2016).

Further innovations in the Australian industry have consisted of high-stability oils, high in oleic acid and low in linolenic acid (Maher et al., 2007) and other speciality types, including recent development of canola varieties high in 'fish oil' omega-3 fatty acids, heralding a new era of speciality 'designer' oils (Lu et al., 2011).

At the time of writing, 44 varieties of canola were available to growers in New South Wales (NSW), including open-pollinated and hybrid varieties, five herbicide-resistant categories, conventional, triazine, imidazolinone (Clearfield), glyphosate (Roundup) and Roundup + triazine (RT), four different maturity classes, speciality oil types, winter grazing types and a pod-shatter resistance type (Matthews et al., 2015). This range of choice explains the wide adaptation and farming systems that canola has achieved across such a vast area of the country's cropping zone.

Farming systems evolution

The farming systems benefits of canola as a break crop for weed and disease control in cereal cropping systems have always been a major driver for adoption (Norton et al., 1999; Kirkegaard et al., 2008; Angus et al., 2015).

Originally canola was grown as the first crop after grass-clover pastures to control weeds and diseases before a sequence of cereals, and to capitalise on the high availability in relatively short (2–4 years) crop phases (Norton et al., 1999). However, as cropping intensity in Australia has increased at the expense of pasture area, canola is now grown more intensively in longer or even continuous crop sequences, often further down the rotation (Norton 2016).

This change in the farming system, together with recent changes in climate, adoption of modern no-till seeding technologies and the availability of new herbicide-tolerant and vigorous hybrid varieties (Zhang et al., 2016), has stimulated a re-examination of several aspects of canola agronomy in recent years.

Increasing the intensity of canola

production and its frequency in the crop sequence generates a significantly increased risk of blackleg, which requires more attention to in-paddock stubble management, separation from nearby infected residues and the rotation of canola varieties according to major resistance genes (Van de Wouw et al., 2016).

In Germany, where canola area doubled to 1,5Mt from 1990 to 2013 at a time when total agricultural area declined, Hegewald et al. (2016) have demonstrated associated reduction in seed (12%) and oil yield (14,6%) associated with increasing the intensity of canola production, despite full fungicide programmes applied to the crops.

Increased blackleg incidence

Although the cause of the yield decline in this study was not identified, similar studies in Canada using spring canola have demonstrated increased blackleg incidence and root maggot (*Delia* spp.) damage, both being implicated in yield decline as canola frequency increased (Harker et al., 2015).

Sowing times, seeding technologies and plant density targets have also been re-evaluated in different regions in the face of climate, equipment and varietal changes in recent years (Brill et al., 2015). The traditional optimal sowing window of late April to early May in Eastern Australia has been re-evaluated by Kirkegaard et al. (2016), who reviewed nine field studies (2002 to 2012) and conducted simulation analysis to investigate the benefits of earlier April sowing.

The study demonstrated declines in seed yield (-6,0 to -6,5%), oil content (-0,5 to -1,5%) and WUE (-3,8 to -5,5%) for each week-long delay in sowing after early April, suggesting opportunities to develop new earlier sowing strategies with appropriate varieties to increase productivity.

Brill et al. (2016) has shown that the risks of poor establishment in early sown crops, which are often sown deeply (>30mm) into stored moisture, can be reduced by increasing seed size, either by using hybrid varieties with inherently

larger seed or screening open-pollinated seed to >2mm diameter.

Optimum plant density

The higher cost and increased vigour of hybrid seed (Zhang et al., 2016) has also stimulated a re-evaluation of the optimum plant density required in different environments. Recommended plant density for canola was originally 50 to 70 plants/m² (Walton et al., 1999), but has gradually been revised down to between 30 and 50 plants/m² (GRDC 2009), although the recommended rates vary with region and row configuration.

Originally canola was grown as the first crop after grass-clover pastures to control weeds.

In a study comprising 24 experiments in the low- and medium-rainfall areas of Western Australia, French et al. (2016) found a median economic optimum density of 32 plants/m², but this differed for hybrid RR varieties (25 plants/m²), hybrid TT varieties (30 plants/m²) and farmer-saved, open-pollinated TT varieties (75 plants/m²).

Clearly there appears to be scope to adjust seeding rates according to variety choice and yield potential in different environments, but plant densities <20 plants/m² were less able to suppress annual ryegrass weeds. Therefore, maintaining adequate plant population is a key consideration in contemporary farming systems.

The changing position of canola in the rotation has increased the reliance of this oilseed on nitrogen (N) fertiliser, which is often the most limiting nutrient in canola production and the highest single input cost for growers. Norton (2016) provides a comprehensive review of the evolution of current N management in Australian canola.

Overall, there are few reported interactions between variety and N rates, and most growers use a budgeted N

rate requirement of 80kg N/t expected seed yield less indigenous N supply. Split applications provide options to delay decisions until there is more certainty regarding seasonal conditions with minimal loss in agronomic efficiency.

Reduce input costs

The recognised reduction in seed oil content associated with N application (-0,03 to -0,13%/kg N) is generally offset economically by the yield response, but this was not the case in a recent study conducted in the low-rainfall areas of Western Australia (Seymour et al., 2016).

In that study, while seed yield reached 90% of maximum at 46kg N/ha, gross margin was maximised at 17kg/ha N due to the relatively small yield increase compared to oil content decrease in response to N in that environment, and the uncapped premium price paid for oil content >42%.

Given that the relative yield and profit of hybrid compared to open-pollinated varieties declines in these lower rainfall environments, there will be ongoing efforts to reduce input costs in hybrid systems, and the continued availability of open-pollinated varieties will be advocated for such areas (Zhang et al., 2016).

As for the recent innovations that have led to increased productivity in Canadian Prairie canola production systems (Morrison et al., 2016a), there clearly exists an ongoing need to re-examine best management practices in the canola production systems in different regions of Australia, as farming systems evolve with new varieties and practices.

Malcolm J Morrison is from the Eastern Cereal and Oilseed Research Centre (ECORC), Agriculture and Agri-Food Canada (AAFC), Central Experimental Farm (CEF). John A Kirkegaard and Julianne M Lilley are from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia. For more information and references, email john.kirkegaard@csiro.au. For more on potential canola yields, visit www.yieldgapaustralia.com.au/maps/. Visit www.nvtonline.com.au for more on Australia's national variety testing. 🌱

Can South Africa break through the average soya bean yield barrier of 2t/ha?

During the 2014/15 soya production season the Crop Estimates Committee (CEC) indicated that South Africa produced an average soya yield of 1,56t/ha on 687 000ha, thereby breaking the one-million-ton barrier for soya for the first time.

Unfortunately, the soya crop in 2015/16 season was dramatically reduced due to the devastating drought. In the past season, an average yield of 1,45t/ha was achieved with a total yield of 728 650 tons produced on 502 800ha.

How do we compare?

According to the United States Department of Agriculture (USDA), 119 million hectares of soya were produced globally with an average yield of 2,6t/ha. When compared to the major soya-producing countries such as Argentina, Brazil and the United States (US), South Africa's yield difference is more than 1t/ha lower. (Figure 1)

Environmental risks are obviously the greatest influencer on yield reduction. The 2015/16 drought, probably the worst experienced in the last century, is a good example. Many other risks including weeds, pests and diseases, planting time and cultivation methods can fortunately be managed.

Can we achieve higher yields?

Yes, this objective is possible. Research-based companies such as Bayer invest US\$1 of every US\$10 earned into creating value in farming. In the case of soya, two key focus areas can largely contribute to yield.

Improving genetics: Fortunately, successful cultivars from countries such

as Brazil and Argentina can improve the yield potential in South Africa. The search for improved cultivars does, however, take time. Furthermore, seed companies have been hesitant to invest in high-performing cultivars due to the practice of saving seed at farm level.

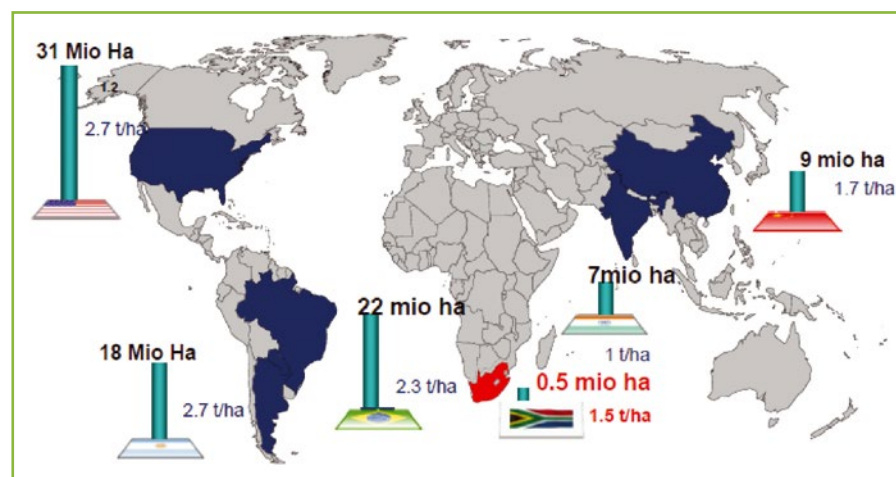
Fortunately, the introduction of a joint initiative to establish an end-point royalty (EPR) scheme is under discussion. This scheme will encourage the introduction of innovative genetic material, which will certainly create value for the soya bean farmer through improved yields as well as pest and disease tolerance.

Crop protection: Good progress is being made in creating micro-molecules for the control of yield-reducing problems, thereby targeting key issues in soya production. This includes nematodes, soya bean rust, *Sclerotinia* and stand reduction problems which contribute to damping off diseases and soil insects. It should be emphasised that the process of developing a new product takes around 10 years and starts with an idea or a new molecule.

This involves the maturation from a molecule, progressing through a rigid evaluation system which includes assessments in respect of environmental impact, crop safety, and of course the impact on the target indication. A part of this process also includes developing a durable and stable formulation to ensure easier and more effective application.

A typical project to develop a market-ready product will cost around €200 million, with only one in 100 000 substances eventually reaching the market. The process of developing a new

Figure 1: Main soya bean production regions and average yields. (Source USDA)



compound is summarised in *Figure 2*.

In South Africa, three or more years are spent on the evaluation of such a product under local conditions to ensure that these products are efficient in our environment. This includes the registration under Act 36 of 1947. This means the lead time is often very long and new pest and disease issues need to be identified well in advance.



The future of soya bean crop protection will rely on the integration of traditional

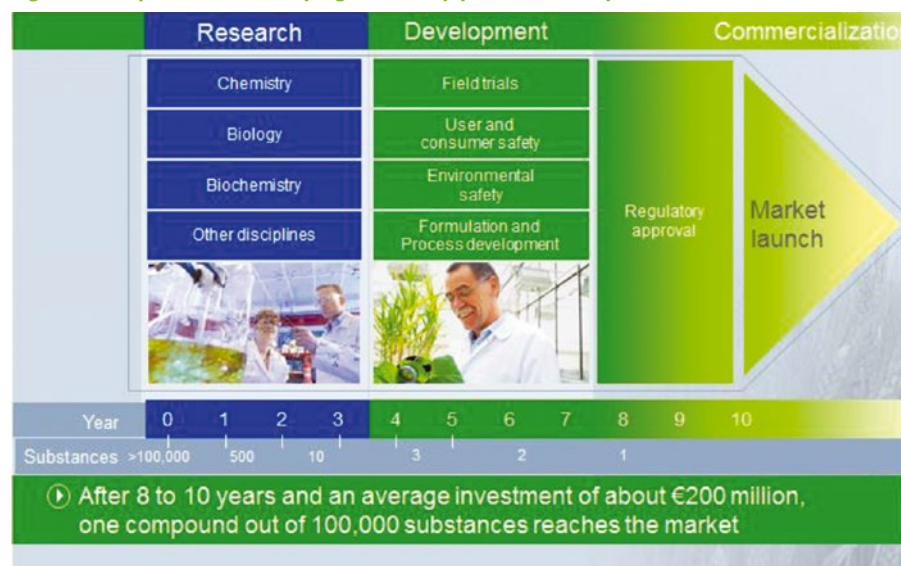
chemistry with biological compounds, which can be used effectively to reduce the impact of yield losses due to complex challenges such as nematodes and *Sclerotinia* rot.

Partnerships are key

In order to remain globally competitive, South African farmers need to embrace the latest innovations in crop protection. Unfortunately, the timeline to develop these indications are lengthy, and partnerships between research-based companies such as Bayer and growers will be even more crucial to ensure that the correct priorities are identified in ensuring that the true solutions are recognised and developed to optimise soya bean yields in this country.

According to the Bureau for Food and Agricultural Policy (BFAP), indications are that South Africa will be able to grow more than one million hectares of soya beans by 2021. The potential, therefore, does exist to achieve a national average of above 2t/ha, effectively breaking the two-million-ton barrier for soya to address our growing demand for protein. 🌱

Figure 2. The process of developing a new crop protection compound.



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Determining the ideal planting date for soya beans

Early planting of soya bean seed gives the plant more time to grow. This leads to a bigger plant with more internodes and a higher yield potential.

Soya beans and maize respond in essentially the same way to heat units. The more heat units are available during the growth season, the later farmers can plant. In cooler areas planting should however take place earlier to ensure the best results.

Another factor that should be borne in mind, is that soya beans should experience a certain number of dark hours per day, before they will convert from the vegetative to the reproductive stage. Since the flowering of soya beans is controlled by the number of dark hours they are exposed to, it is not possible to avoid the adverse effect of a midsummer drought by manipulation of the planting date.

Cold, wet soil early in the season can cause severe plant population losses.

Along with the growth class of the cultivar being planted, these two aspects determine the optimal planting date for

every region. By means of the nature of its response to daylight length, each cultivar has an optimum planting date for maximum yield potential.

Benefits of early planting date

- Soya beans have a particular need for dark hours which are influenced by the number of calendar days. An early planting date will lead to a larger plant. In turn, a bigger plant has more internodes and consequently more spikelets, resulting in increased yields.
- In the cooler eastern parts of the country, an earlier planting date leads to earlier ripening. This limits the risk of early frost damage in autumn.
- More rapid growth leads to earlier closing of the canopy over the rows, making weed control more manageable.
- This results in increased transpiration by the plants and a decrease in evaporation from the soil surface. The largest amount of available water is used to produce the yield.
- An early planting date results in bigger plants carrying pods higher above the ground. This makes harvesting easier and reduces wastage.
- An early planting date has a greater

effect on yield than row spacing. Therefore, special planters are not essential.

Risks of an early planting date

- Cold, wet soil early in the season can cause severe plant population losses.
- The longer germination period of the seed, increases the time weed killers need to be active to successfully control weed.
- Late frost can cause damage.
- In warmer regions, an early planting date can result in excessive vegetative growth which can cause toppling over.

The interaction between daylight length and temperature in flower stimulation, has a major effect on the ideal planting date. The impact is much greater in moderate to warm production regions than in cooler ones. In the cool regions, the 4,5 to 6,5 growth classes are best adapted.

The ideal planting date for the areas is from the beginning of October to the beginning of November. The shorter growth classes (4 to 5) normally have a lower dark hour need than the longer ones. Therefore, it is better to plant the growth class 6 cultivars very early and the growth classes 4 to 5 cultivars in mid-October.

If the weather does not permit a normal planting date and enforces a late one, it is better to start with the faster growth classes and to plant the longer growth classes afterwards. Any planting after the end of November is regarded as late.

Growth classes 5 to 7 are best adapted to moderate areas. The western part of the moderate regions usually receive rain later in the season, where it is better to plant 6 to 7 growth class cultivars. In the hot production areas, any growth class can be planted. However, the full season cultivars usually have the best yield in these regions.

Ideal soil temperature

With earlier planting dates, the soil temperature can play a major role in effective germination. Soya beans can germinate at 10°C, but the ideal soil temperature is 13°C for strong germination. If planting is done early in the cool production areas, it is advisable to measure the soil temperature before planting commences.

The interaction between daylight length and temperature in flower stimulation has a major effect on the ideal planting date.

Measure the temperature at 07:00 at a depth of 5cm, and if the temperature is higher than 13°C for at least three days in a row, planting can commence. Bear in mind that cold fronts or a hail storm can cause the soil temperature to drop drastically.

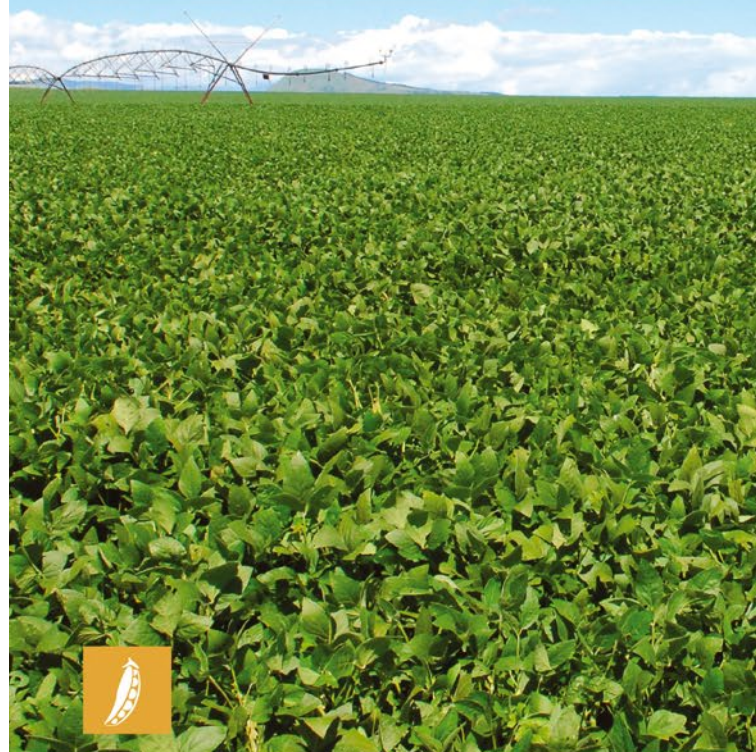
A few management aspects have to be addressed to make the best of a late planting date. Yield is determined by the amount of sunlight that can be intercepted. Soya beans that have been planted late, have a shorter period to absorb sufficient sunlight.

It has a particular impact on the grain filling stage when the days shorten. The plants themselves are smaller, with fewer nodes where pods can develop. That is the reason why soya beans that have been planted late must be managed to absorb more sunlight for maximum production.

Managing a late planting date

- By using narrow rows, more sunlight is captured at the beginning of the growth season for vegetative growth, and more internodes are produced per hectare.
- With the narrow rows, the plant population must be increased by 25%.
- A late planting date is normally associated with damper soil. Avoid compaction and ensure that seedlings emerge swiftly and grow strongly.
- Pythium is extremely destructive with regard to plant population in hot, wet conditions. Ensure that seeds are treated with a fungicide to protect the population.
- Plant the recommended growth class for a normal planting date for the specific area, as a shorter growth class cultivar undergoes the trial stages more swiftly, reducing the number of nodes. 🌱

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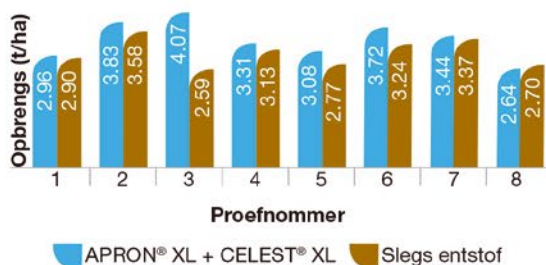
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Sulphur and nitrogen

boost canola yield and grain quality

Grain yields obtained from canola in the Western Cape are often variable and generally low, and need to be increased to compete financially with wheat and barley. Nitrogen (N) and sulphur (S) are key nutrients that affect yield and quality in canola, while timing of application and N and S sources may also be important because requirements differ for various growth stages, and sources differ in plant availability and mobility in soil.

Field trials to determine the N and S requirements of canola were conducted in three locations during the winter growing seasons of 2012 to 2014. In Altona and Langgewens in the so-called Swartland production area, almost 80% of the annual rainfall occurs in winter from April to September, but annual precipitation decreases from 645mm (long-term average) at Altona to 473mm (long-term average) at Langgewens. At Roodebloem, located in the Southern Cape, about 65% of the annual precipitation of 563mm (long-term average) occurs in winter.

At all localities, S-content was low. Compared to Roodebloem, the percentage carbon (C) and N at Altona and Langgewens was low, suggesting a much lower N and S mineralisation potential. Boron (B) also showed low values at all localities, but was applied as a foliar spray to prevent deficiencies.

Yield and quality of canola

Grain yield increased significantly on all localities due to increasing N application rates, but responses differed between localities and also due to S application rates (Table 1).

In case no N was applied, S had an effect at Altona and Roodebloem, but not at Langgewens. At the Swartland localities of Altona and Langgewens, which exhibited lower C and N soil contents before planting compared to Roodebloem, grain yields were significantly increased due to S applications for all N treatments from 40 to 160kg N/ha, but no yield differences were recorded when S application was increased from 30 to 60kg S/ha.

Although grain yields at the higher rainfall locality, Altona, were unexpectedly lower than at Langgewens, the highest yields were obtained where 120 to 160kg N and 30 to 60kg S/ha were applied. At the lower rainfall locality, Langgewens, N rates of above 80kg/ha and S rates of more than 30kg/ha had no effect on grain yield.

At Roodebloem, which showed higher C and N

soil contents before planting, no grain yield increases were obtained with N application rates of more than 80kg N/ha, and at high N rates S applications also had no significant effect on grain yield.

Use of agronomic efficiency (AE) of N, which showed the increase in grain yield per kilogram of N fertiliser applied, decreased at all localities, with an increase in N application rate. Although grain yield was not significantly increased with increases in N application rates from 80 to 120kg/ha, values for AE of N at rates of 120kg N/ha were still higher than 4,5 at all localities.

Applications of N fertiliser at this rate will therefore still improve profit margins of canola, if the cost of 1kg of N fertiliser does not exceed 4,5 times the price of 1kg of canola grain.

Table 1: Effect of increasing N (applied as LAN split between planting, 30 and 60 days after planting) and S (applied as gypsum at planting) application rates on canola grain yield (2012 to 2014) with AE use of N in (-).

Nitrogen (kg/ha)	Sulphur (kg/ha)	Grain yield kg/ha		
			Langgewens	Roodebloem
0	0	1 194e	1 553f	1 243f
	30	1 257de	1 599ef	1 561e
	60	1 315d	1 607ef	1 578e
Mean		1 255C	1 586C	1 461C
40	0	1 351d	1 735de	1 662e
	30	1 477c	1 934c	1 700de
	60	1 593bc	1 922c	1 849cd
Mean		1 474B (5,47)	1 864B (6,95)	1 737B (6,90)
80	0	1 516c	1 974b	1 899bc
	30	1 698b	2 156a	1 948abc
	60	1 742b	2 194a	1 959abc
Mean		1 652A (4,96)	2 108A (6,52)	1 935A (5,92)
120	0	1 668b	1 949bc	2 074a
	30	1 907a	2 196a	2 068a
	60	1 894a	2 232a	2 053ab
Mean		1 823A (4,73)	2 126A (4,51)	2 065A (5,03)
160	0	1 554c	1 891cd	1 987abc
	30	1 975a	2 163a	2 008abc
	60	1 881a	2 145a	2 016ab
Mean		1 803A (3,42)	2 066A (3)	2 003A (3,38)

Means in the same row for each one treatment with at least a common letter are not significantly different, LSD 0,05.

Although the oil content in the canola grain tends to decrease and the protein tends to increase with increasing N application rates at all localities, responses in oil content were affected by S application rates (Table 2). At Altona, oil content showed significant increases with the application of 60kg S/ha at all N application rates, except the highest rate of 160kg N/ha.

At Roodebloem, the increase in oil content due to the application of 60kg S/ha was also recorded where no N was applied. Grain protein content did not demonstrate any significant response to S application on any of the localities tested.

Table 2: Effect of N and S applications on oil and protein content (0% moisture) of canola. Mean 2012 to 2014.

Nitrogen (kg/ha)	Sulphur (kg/ha)	Altona		Langgewens		Roodebloem	
		% Oil	% Prot	% Oil	% Prot	% Oil	% Prot
0	0	38,7 ^f	18,2 ^c	37,6 ^b	21,7 ^a	38,8 ^c	18,6 ^a
	30	41,3 ^{def}	19,3 ^{bc}	38,9 ^{ab}	21,6 ^a	40,8 ^c	19,0 ^a
	60	46,6 ^a	19,2 ^{bc}	40,9 ^a	21,7 ^a	44,2 ^a	18,4 ^a
Mean		42,2 ^A	18,9 ^B	39,1 ^A	21,6 ^A	41,3 ^A	18,7 ^A
40	0	40,0 ^f	19,3 ^{bc}	38,9 ^{abc}	21,8 ^a	40,8 ^c	19,0 ^a
	30	39,9 ^f	19,2 ^c	38,8 ^{abc}	22,0 ^a	39,6 ^c	18,5 ^a
	60	45,4 ^{ab}	18,7 ^c	39,7 ^{ab}	21,3 ^a	44,0 ^a	18,6 ^a
Mean		41,8 ^A	19,1 ^B	39,1 ^A	21,7 ^A	41,5 ^A	18,7 ^A
80	0	40,1 ^{def}	19,2 ^c	37,0 ^c	21,6 ^a	41,0 ^{bc}	19,3 ^a
	30	39,6 ^f	19,5 ^{abc}	38,5 ^{abc}	22,4 ^a	39,9 ^c	19,4 ^a
	60	44,0 ^{abc}	19,3 ^{bc}	37,2 ^c	21,6 ^a	43,9 ^{ab}	19,7 ^a
Mean		41,2 ^A	19,3 ^B	37,5 ^A	21,9 ^A	41,6 ^A	19,5 ^A
120	0	40,0 ^f	19,8 ^{abc}	37,4 ^{bc}	22,6 ^a	39,8 ^c	20,5 ^a
	30	39,4 ^f	20,4 ^{abc}	38,0 ^{bc}	23,0 ^a	39,6 ^c	19,9 ^a
	60	42,8 ^{bcd}	20,8 ^{abc}	37,1 ^c	22,8 ^a	40,0 ^c	19,8 ^a
Mean		40,7 ^A	20,3 ^{AB}	37,5 ^A	22,8 ^A	39,8 ^A	20,1 ^A
160	0	40,6 ^{def}	21,2 ^{abc}	37,6 ^{bc}	22,8 ^a	39,6 ^c	20,7 ^a
	30	39,9 ^f	21,8 ^a	38,3 ^{bc}	22,9 ^a	38,6 ^c	19,6 ^a
	60	41,2 ^{def}	21,8 ^a	36,7 ^c	22,8 ^a	40,3 ^c	20,6 ^a
Mean		40,5 ^A	21,6 ^A	37,5 ^A	22,8 ^A	39,5 ^A	20,3 ^A

Means in the same row for each one treatment with at least a common letter are not significantly different, LSD 0,05.

Split S applications

Splitting (10kg S × 3 or 20kg S × 3) the S application between planting, 30 and 60 days after planting had no effect on grain yield at Altona (Table 3). At Langgewens, splitting of the 60kg S application into three applications of 20kg S/ha resulted in significant lower yields where 80kg N was applied, but not so if 160kg of N was applied.

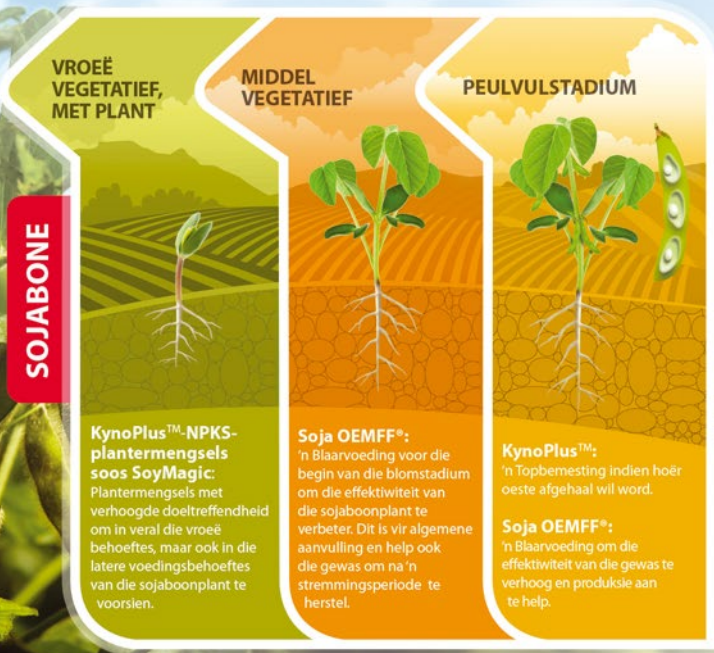
At Roodebloem, 60kg S/ha at planting resulted in significantly higher grain yields compared to 30kg S when applied in combination with 80 or 160kg N/ha. Splitting of the S application had no effect on grain yield where 80kg N was applied. However, in combination with a 160kg N application, three applications (planting, 30 and 60 days after planting) of 10kg S/ha instead of 30kg at planting, resulted in significantly higher grain yields for the period 2012 to 2014.

Grain protein content did not demonstrate any significant response to S application on any of the localities tested.

As shown for grain yield, top dressing with gypsum as a source of S did not have a major effect on oil or protein content of canola grain for the period 2012 to 2014 at the three localities tested.

These generally poor results obtained with split applications of S are in contrast to literature, which showed that top dressing (splitting) with S during the growing season can be implemented with good results. These results may be due to the use of gypsum as source of fertiliser in this study. Gypsum is known to have a low solubility and may therefore need to become plant available in future.

» Voeding volgens plantontwikkeling »



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Table 3: Effect of S applications (applied at planting or split between planting, 30 and 60 days after planting) on grain yield of canola grown with different N rates (split between planting, 30 and 60 days after planting. Mean 2012 to 2014.

Nitrogen kg/ha	Sulphur kg/ha	Grain Yield (kg/ha)		
		Altona	Langgewens	Roodebloem
0	0	1 666 ^c	1 755 ^e	1 338 ^f
	30	1 632 ^c	1 713 ^e	1 353 ^f
	60	1 744 ^{bc}	1 719 ^e	1 303 ^f
	10×3	1 683 ^c	1 725 ^e	1 373 ^f
	20×3	1 655 ^c	1 728 ^e	1 363 ^f
Mean		1 676 ^a	1 728 ^a	1 346 ^b
80	0	1 800 ^b	1 904 ^d	1 553 ^e
	30	2 053 ^a	2 110 ^{abc}	1 743 ^{cd}
	60	2 121 ^a	2 209 ^a	1 888 ^{ab}
	10×3	2 144 ^a	2 202 ^a	1 848 ^{abc}
	20×3	2 127 ^a	2 069 ^{bc}	1 813 ^{bcd}
Mean		2 049 ^A	2 098 ^A	1 769 ^A
160	0	1 827 ^b	1 994 ^{cd}	1 535 ^e
	30	2 024 ^a	2 128 ^{ab}	1 730 ^d
	60	2 030 ^a	2 073 ^{bc}	1 848 ^{abc}
	10×3	2 090 ^a	2 180 ^{ab}	1 873 ^{ab}
	20×3	2 028 ^a	2 060 ^{bc}	1 955 ^a
Mean		2 000 ^A	2 087 ^A	1 788 ^A

Means in the same row for each one treatment with at least a common letter are not significantly different, LSD 0,05.

Grain yield and quality

In a study where limestone ammonium nitrate (LAN) (28% N) as N and gypsum as a source of S were compared to urea-S (40% N and 5,5% S), grain yield showed significant increases with increases in N and S application rates at all localities, but sources of N and S did not have any effect on grain yield or quality (Table 4).

Producers can for this reason use the most cost-effective or most convenient source of N and S. It must however be borne in mind that urea-S (U-S) contains only 5,5% S. On soil with low S contents, or under conditions where little N fertiliser is required, this low percentage S may result in suboptimal S applications.

Table 4: Effect of different rates of LAN plus gypsum and urea-S (U-S) as N and S sources on grain yield, oil and protein content (0% moisture) of canola (2012 to 2014).

Treatments	Altona			Langgewens			Roodebloem		
N source kg/ha	Yield kg/ha	% Oil	% Prot	Yield kg/ha	% Oil	% Prot	Yield kg/ha	% Oil	% Prot
0	1 235 ^c	39,5 ^a	21,7 ^b	1 246 ^c	36,8 ^{ab}	24,4 ^a	1 149 ^c	36,5 ^a	20,9 ^a
60 LAN	1 658 ^b	36,3 ^b	23,0 ^{ab}	1 619 ^b	35,3 ^b	24,2 ^a	1 304 ^b	36,3 ^a	20,2 ^a
60 U-S	1 713 ^b	37,6 ^b	22,7 ^{ab}	1 658 ^b	37,9 ^a	24,2 ^a	1 332 ^b	36,7 ^a	20,1 ^a
120 LAN	1 813 ^a	36,8 ^b	23,4 ^a	1 772 ^a	35,1 ^b	24,5 ^a	1 509 ^a	35,6 ^a	21,2 ^a
120 U-S	1 787 ^a	37,1 ^b	22,6 ^{ab}	1 839 ^a	36,2 ^{ab}	23,5 ^a	1 591 ^a	35,7 ^a	20,0 ^a

Means in the same row for each one treatment with at least a common letter are not significantly different, LSD 0,05.

Conclusions

This research clearly illustrates the need to apply S to canola in the Western Cape production region with the aim of higher yields and even high oil contents in the grain. Optimum rates for both N and S depend on soil and climatic conditions, but despite very low S contents in the soil (as indicated by soil analysis at planting), very little support for S applications of more than 30kg/ha was found.

Responses to S applications were higher in soil with low organic C contents, and for this reason are of greater importance in the Swartland production

area compared to the Southern Cape.

Splitting S applications to apply a certain amount of S as top dressing did not improve grain yield in this study where gypsum was used as S source, but comparing gypsum to urea-S did not demonstrate any yield or quality penalty due to the use of gypsum. Canola producers can therefore use the most cost-effective source of S. Gypsum also contains a certain amount of calcium and should also be beneficial on soil with poor structure and salinity problems.

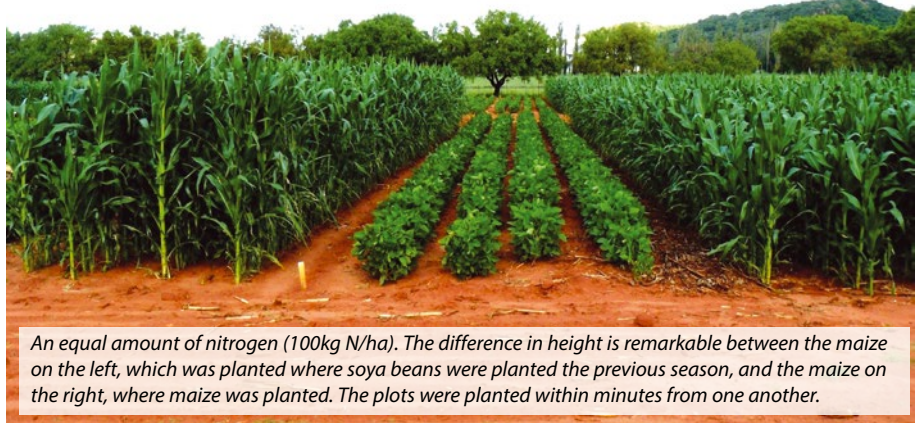
Optimum N application rates in this study varied between 80kg N/ha in the

lower-rainfall areas of the Swartland and on soil in the Southern Cape, which indicates high N and C contents at planting. However, in the higher-rainfall areas of the Swartland, which generally also show low C and N contents at planting, optimum rates varied between 120 and 160kg N/ha. Highest yields and oil content were only obtained if sufficient amounts of S were also applied.

Contact Prof Agenbag on 021 808 4803 or agronomie@sun.co.za for more information.📞

Nitrogen fertilisation of soya

As soya bean is a legume that can fix atmospheric nitrogen (N), it is commonly accepted that it is not necessary to fertilise soya with this chemical element. This position, however, is increasingly being questioned and is currently a very controversial topic.



An equal amount of nitrogen (100kg N/ha). The difference in height is remarkable between the maize on the left, which was planted where soya beans were planted the previous season, and the maize on the right, where maize was planted. The plots were planted within minutes from one another.

The general belief is that soya reacts well to residual soil fertility. In addition, it is accepted that soya is able to absorb sufficient nitrogen through *Bradyrhizobium* bacteria for an optimal yield and still leave enough of the chemical element for the following crop.

Nel (2016) found that soya is effectively nitrogen neutral. This means the soya plant does not leave extra nitrogen in the soil for the following crop. To the contrary, there are cases where less nitrogen was being left in the soil compared to that with which it commenced growth. Other researchers have achieved similar results and these question the old beliefs, causing the controversy.

Crop rotation is used worldwide to decrease risk in crop production and to produce sustainably. In South Africa we, in general, make very little use of crop rotation and often pay the price. The most common crop rotation programmes rotate monocotyledonous crops (such as maize, grain sorghum and wheat) with dicotyledonous crops (such as soya beans, cowpeas and even groundnuts). The use of a maize-sunflower rotation system will most probably not have the desired effect as the two crops have susceptibility to certain diseases in common.

Crop rotation

Using crop rotation holds various advantages. The root systems of the two groups of crops differ. These differences can achieve physical variations in soil profiles, in that the roots feed on different nutrients at different depths.

The variations in root systems can possibly improve the recycling of nutrients throughout

the soil profile, which could potentially improve yields. Unfortunately, it is also true that by continuing to plant the same crop, certain zones in the soil become depleted of nutrients over time.

The principal advantage of crop rotation most probably lies in the reduction of disease and pests. When different groups of plants are grown, the survival of diseases and pests decreases. With monoculture of, for instance, maize over many years, the incidence of root diseases becomes common. In contrast, a well-planned crop rotation system will significantly curtail these root diseases.

By decreasing the occurrence of root diseases, the efficiency of the maize plant's root system can be increased significantly, and this could be a main reason why maize plantings following soya perform better than maize on maize. The higher yields of maize following soya plantings are therefore most likely not due to transferred nitrogen, but rather the result of other crop rotation effects.

New cultivars

A possible additional contribution to the controversy could be the yield potential of new cultivars which is higher than older ones, and that current guidelines should be adjusted. Soya beans remove between 75 and 105kg N/ton grain (MVSA, 2007), which means, using 90kg N/ton, a 3,5t/ha harvest will remove 315kg N/ha.



Maize-on-maize on the left and maize-on-soya bean planting on the right. A visible difference!



Maize plantings after soya beans – no shortage of nitrogen.



Maize plantings followed by maize – visible nitrogen shortages.



The difference between maize on the left, where soya beans were planted the previous season, and maize-maize plantings on the right.

Salvagiotti, et al., (2008) found that nitrogen fixing can provide for around 50 to 60% of the soya plant's nitrogen needs in a 3,5t/ha yield. If 60% of a 3,5t/ha yield can be obtained this way, it implies that there is a shortage of 126kg N/ha (40% of 315) that must be acquired elsewhere.

Foreign information

The International Plant Nutrition Institute (IPNI) (2012) reports that the University

of Nebraska has studied 108 scientific articles on the nitrogen fertilisation of soya beans. In approximately 50% of the cases there was a positive reaction to nitrogen fertilisation. In twelve experiments the yield exceeded 4t/ha and 75% of the experiments reacted positively to nitrogen fertilisation. The economic viability should, however, be monitored closely and will be determined by the soya-nitrogen price ratio.

Kaiser, et al., (2011) found that should good nodulation not take place and should the nitrate-nitrogen level be less than 84kg/ha up to a soil depth of 600mm, between 55 and 85kg N/ha should be applied.

Local information

The fertilisation guidelines of the Fertiliser Association of Southern Africa (Fertasa) (2007) state that an increase in yield with nitrogen fertilisation is unlikely where soya bean plants have been

inoculated properly, and where growth conditions are favourable. It is mentioned, however, that an initial nitrogen fertilisation of 10 to 20kg N/ha should be beneficial, especially on sandy soils.

Soya beans are dependent exclusively on soil nitrogen during the vegetative phase (four to five weeks after emergence), after which biologically bound nitrogen can be utilised by the plant (Botha et al., 1996). During the pod-

filling stage (R5 to R6) the supply from the nodules decreases and nitrogen supply to the seeds is obtained from either the plant itself or from soil nitrogen.

Additional work by Botha et al. (1997) determined that nitrogen application during the V1 growth stage, increases the number of pods, seeds, leaves as well as seed mass, and increases the total nitrogen and protein production. Nitrogen application in the R2 growth phase had little effect on seed yield and protein quality.

The principal advantage of crop rotation most probably lies in the reduction of disease and pests.

With nitrogen application during the R4 growth stage, when atmospheric nitrogen is being actively fixed, seed yield, biological nitrogen binding, soil nitrogen intake and protein production were inhibited. Seed mass and protein production, however, increased with nitrogen application in the R5 growth stage. The conclusion of the authors was that the application of 40kg/ha of nitrogen during the V1 and R5 growth stages could be beneficial.

Where does this leave us?

Until more information becomes available, it seems that for soya beans – especially where organic matter in the soil is low and/or where soil fertility (in acid soils) is inadequate – an initial application of at least 10 to 20kg N/ha should be applied. For yields of more than 3 to 4t/ha, it should be advantageous to apply 30 to 40kg N/ha during pod-filling stage (R4 to R5).

Under irrigation, with targeted yields of 6t/ha and more, the nitrogen application should be much higher. These are preliminary indications, and the validity thereof should be investigated with long-term experiments on the same plot within a crop rotation system.

References are available from the author. 

The effect of global warming on weed-crop competition

The fundamental life process which sustains all living organisms and occurs in green plants, photosynthesis, is the process that releases oxygen (O_2) into the atmosphere, and fixes carbon dioxide (CO_2) in the production of energy-rich carbohydrates.

In the so-called 'light reaction' of photosynthesis, sunlight energy splits water molecules (H_2O) to yield oxygen and energised electrons. The latter's energy is built into carbohydrates that are consumed as energy-providing food by organisms both lower down (e.g. micro-organisms) and higher up (e.g. animals and humans) in the food chain.

Carbon dioxide is the foremost 'greenhouse gas' contributing to the human-induced increase in temperature observed on the earth's surface, which is referred to as 'global warming'. Elevated CO_2 levels in the earth's atmosphere cause more heat to be trapped there and radiated towards the underlying surface, where it causes temperatures to rise in the zone supporting all forms of life.

Nature's response

Of the total amount of CO_2 produced on earth, 50% remains in the atmosphere, 25% is used in plant photosynthesis and 25% dissolved in surface waters (Ziska, 2016). In 100 years, from 1860 to 1960, the average levels of CO_2 ranged from 285 to $325\mu\text{L/l}$ of air [= parts per million (ppm)], and continued to increase at about 0.7ppm

per annum, primarily due to the burning of fossil fuel (Edwards & Walker, 1983).

Today, average CO_2 concentration in the atmosphere is around 407ppm, which is 25% higher than in the 1970s. By the end of this century, it is expected to reach 1 000ppm. From now until then we should expect nature to respond in ways that may not be to our benefit, and plant responses is a given fact.

Theoretically, plants can assist in mitigating the effect of elevated CO_2 levels by absorbing and fixing these in carbohydrates, the primary products of photosynthesis. If existing plant communities' trapping of CO_2 could significantly increase, it theoretically can contribute to shifting atmospheric CO_2 levels to the hypothetical equilibrium in amounts produced and trapped, which would serve to mitigate global warming.

However, achieving equilibrium in CO_2 levels is a chimera, mainly because human industrial activities release CO_2 from the prehistoric products of photosynthesis, fossil fuels, thus making it impossible for current plants and surface waters to 'keep up the pace' in terms of acting as sinks or traps for CO_2 . Projected human population increases of 30% more people on the planet by 2050, do not bode well for prospects of significant increases in our plant communities and surface waters.

Current and future global warming scenarios, according to Ziska (2016), are: The greatest effect CO_2 will have on temperature increase due to global warming, will be where H_2O in the

atmosphere is lowest – therefore, in the arid and semi-arid parts of the world, as well as in the polar regions where there are substantial amounts of snow and ice but the air is dry. This explains why arctic ice fields are receding, and why global warming is characterised by more rapid increases in winter temperatures (cold, dry air in winter) compared to summer temperatures (warm, high humidity in summer).

Plants classified as either C3 or C4

Plant species differ in the first step by which CO_2 gets built into carbohydrates. In C3 plants, the primary product of CO_2 binding features three carbon atoms, while in C4 plants that product is different and has four carbon atoms.

C4 plants can produce carbohydrates at very low concentrations of CO_2 within the plant system ($\pm 10\text{ppm}$), i.e. a condition that occurs in water-stressed plants with closed stomata, which limits absorption of CO_2 . Whereas C3 plants require relatively high internal CO_2 levels ($\pm 120\text{ppm}$) in order to produce carbohydrates for growth.

This implies that C4 plants are generally better performers than C3 plants under drought stress. However, the advantage that C3 has over C4 plants is that the former species can utilise CO_2 for growth at levels beyond the CO_2 saturation level in C4 plants. This means that C3 species will be better adapted and be more productive than C4 species at projected future atmospheric CO_2 levels of around 1 000ppm.

Coupled with C3 species' ability to continue fixing CO₂ in the process of photosynthesis at levels up to 1 000ppm and beyond, in contrast to C4 species, is their relatively high water requirement and sensitivity toward high temperatures.

Therefore, the performance of C4 species in general should be superior to that of C3 species amid comparable warm, dry conditions. Explanation for these differences can be found in the species' origins. Generally, C3 species originate from temperate regions, and C4 species from the subtropical and tropical regions of the world.

Table 1: Examples of C3 and C4 crops and weeds.

Crop species (presented in no particular order)		
Species	Common name	Classification
<i>Zea mays</i>	Maize	C4
<i>Sorghum bicolor</i>	Sorghum	C4
<i>Pennisetum glaucum</i>	Pearl millet	C4
<i>Saccharum officinarum</i>	Sugar cane	C4
<i>Glycine max</i>	Soya beans	C3
<i>Phaseolus</i> spp.	Beans	C3
<i>Helianthus annuus</i>	Sunflower	C3
<i>Solanum tuberosum</i>	Potatoes	C3
<i>Triticum</i> spp., <i>Oryza sativa</i>	Wheat, rice	C3
Weed species (World's ten worst weeds in developing countries - Holm, 1969)		
Species	Common name	Classification
<i>Cynodon dactylon</i>	Bermuda grass, <i>kweekgras</i>	C4*
<i>Cyperus rotundus</i>	Purple nutsedge, <i>rooiuintjie</i>	C4*
<i>Echinochloa colona</i>	Jungle rice, <i>kleinwatergras</i>	C4*
<i>Echinochloa crus-galli</i>	Barley grass, <i>hanepootmanna</i>	C4*
<i>Eleusine indica</i>	Goosegrass, <i>jongosgras</i>	C4*
<i>Imperata cylindrical</i>	Cogon grass, <i>donsgras</i>	C4**
<i>Panicum maximum</i>	Buffalo grass, <i>buffelsgras</i>	C4*
<i>Sorghum halepense</i>	Johnson grass, <i>Johnson gras</i>	C4*
<i>Eichhornia crassipes</i>	Water hyacinth, <i>waterhiasint</i>	C3**
<i>Lantana camara</i>	Tick berry, <i>lantana</i>	C3**

*Weed in South African crops.

**Alien invader plant of mainly non-crop areas in South Africa.

Changes in crop production practices

The weeds list of Holm (1969) is still relevant today, because it contains the names of several important weeds of crops in mainly the summer rainfall region of South Africa. Of course, our main (problematic) weed species and their order of importance will differ according to region and type of crop involved.

Only some contenders for our own 'worst' or most destructive weeds list should be noted as: *Chenopodium album* (lamb's quarters, *withondebossie*), *Ipomoea* spp. (morning glory types, *purperwinde-soorte*) and *Xanthium strumarium* (cocklebur). It is interesting to note that they are all C3 plants, and yet, highly competitive in annual crops of the summer rainfall region. C4 weeds that can easily make the list are: *Digitaria sanguinalis* (crab finger grass, *kruisvingergras*), *Eleusine indica* (goosegrass, *jongosgras*) and *Urochloa panicoides* (herringbone grass, *beesgras*).

"Weeds represent the greatest biotic constraint to crop production" (Ziska, 2016).

Especially the most destructive weeds will probably adapt better and more swiftly than

crops to global warming effects and changes in resource inputs for crop production. We are already acutely aware of 'new' weeds gaining importance in no-till cropping systems, and several weed types exhibiting greater tolerance, and even resistance, to a wide range of herbicides which previously used to be capable of controlling them effectively.

Other cropping practices

Several other cropping practices affect weed biology and ecology. However, crop production practices are often not recognised as having such influence, partly because the effects are often of a subtle nature and insidious and may take several years to become obvious.

Generally speaking, the greater genetic diversity that exists in any given weed compared to crops they are associated with, is likely to give weeds the edge in the competition battle. This current reality will likely become progressively more pronounced as the effects of global warming and changes in production practices set in.

Modern biotechnology is the one set of tools we have at our disposal that can counter the genetic advantage which weeds have over crops. Classical breeding remains a key avenue for crops to acquire the necessary traits, and modern biotech in the form of genetic modification represents fast-tracking of such traits. For instance, enhanced nutrient and water use efficiency in crops are crucial biotech advances that we can look forward to in the near future. May the waiting period during the development stages be a short one! 🌱



References are available from Dr Charlie Reinhardt, dean of the Villa Academy, extraordinary professor of weed science at the University of Pretoria and extraordinary professor at the Department of Agronomy, Stellenbosch University. Contact him on 011 396 2233 or email creinhardt@villaacademy.co.za. He also leads a research project on the assessment of herbicide resistance at the University of Pretoria. Learn more by visiting www.up.ac.za/sahri.

The use of canola in diets for farm animals and ostriches

Canola is the third-largest oilseed crop produced in the world, with a current increase in its cultivation in the Western Cape. Approximately 71 000ha was planted this season, and it is predicted that this figure can increase to as much as 150 000ha in future. Production amounted to 93 000 tons in 2015.



More knowledge gained from studies on ostrich diets will improve economical production of ostriches and result in better utilisation of canola as a feedstuff.

Most of the canola is used for oil production, although oilcake is a by-product that is available for animal feeds. However, a portion of the canola, in unprocessed form or as full-fat canola, is available as an animal feedstuff for livestock. Both full-fat canola (unprocessed seed) and canola oilcake (residue after the oil has been mechanically extracted) are high-quality products that can be utilised effectively by livestock.

The protein content of locally produced full-fat canola is currently around 24%, with an oil content of approximately 41% on an as-fed basis. Solvent-extracted canola oilcake, which is available in South Africa, has a protein content of 35% with an oil content of approximately 2%. Cold-pressed canola oilcake has an average protein content of 32% and an oil content of 10%. The so-called non-degradable protein percentage of canola oilcake is approximately 28%, and is comparable to the value of soya bean oilcake.

The relative economic value of full-fat canola is 90 to 95% of the value of soya bean oilcake, while that of oilcake is 70% of the value of soya bean oilcake.

Studies performed by Elsenburg and

The total metabolisable energy values for canola oilcake and full-fat canola were much higher for ostriches than for chickens.

the University of Pretoria (UP) indicate that the ideal inclusion level of full-fat

canola is around 12% in lamb feeds and approximately 6% in the diets of dairy cows. Canola oilcake can be included in sheep feeds at 15 and in dairy cow feeds at 12%. For chickens, it seems as if the maximum inclusion level lies between 5 and 10%.

It is interesting to note that the inclusion of full-fat canola in the diets of chickens, pigs and dairy cows can achieve a favourable fat content and milk fat profile, by increasing the level of unsaturated to saturated fatty acids.

Furthermore, it is imperative to keep in mind that the most optimal utilisation of full-fat canola can be achieved when the canola seed is mixed with the grain during the milling process.



Growth tests are being conducted at Elsenburg to determine the optimal inclusion levels of full-fat canola and canola oilcake in ostrich diets.

Canola stubble

A study conducted on canola stubble fields at Langgewens research farm, indicated that sheep grazing on canola stubble, without supplementary feed, performed better than those that grazed on wheat stubble. The study showed that canola stubble is generally well utilised by grazing animals, and with correct supplementation

a stocking rate of more than two ewes per hectare can be maintained for a period of three months.

Reputable scientific information regarding the use of canola oilcake, as well as full-fat canola, for ostrich feeds does not exist. Information on this topic is crucial, due to the scarcity and high costs associated with protein for animal and ostrich feeds in particular.

In a local study at Elsenburg, an experiment was conducted to establish the nutritional value and utilisation of these two potential alternative protein sources for ostriches. It was found that the energy values of both of these sources – total metabolisable energy values of 13,76 and 22,50MJ/kg feed, respectively for canola oilcake and full-fat canola – were much higher for ostriches



Ostriches achieve better utilisation of the fibre fractions in canola than chickens.

than for chickens – 7,81 and 16,65MJ/kg feed, respectively.

Inclusion in ostrich diets

The better utilisation by ostriches was as a result of the additional utilisation of approximately 32% of the fibre fractions (hemicellulose and cellulose) in the sources which cannot be utilised by chickens. Growth studies are currently being conducted at Elsenburg to

determine the optimal inclusion levels of both full-fat canola and canola oilcake in ostrich diets.

Results from these studies will contribute to the currently limited knowledge regarding the nutritional value of these raw materials for ostriches. This knowledge can then be used to formulate more accurate diets for ostriches, which will improve their economical production

and create an alternative market for full-fat canola and canola oilcake in South Africa.

Prof Tertius Brand is from the Directorate: Animal Sciences of the Western Cape Department of Agriculture, and the Department of Animal Sciences of Stellenbosch University. For more information, contact him on 021 808 5225 or email TersB@elsenburg.com.



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The impact of the drought on South African consumers and the agricultural sector

The impact of the 2015/16 drought has been far-reaching. Since the end of 2015, the severity of the drought has been evident across the key summer crop production regions. The greatest shock occurred in the white maize market where the total area under production plummeted by more than 25%. This has caused the local market to move from export to import parity price levels.

The effect of the depreciation of the rand also had a significant impact on commodity and food markets. The exchange rate not only shifted the level of the import and export parity price band, but also impacted on every stage of the food value chain.

Average white maize prices increased by more than 60% over the past year. Consequently, by June 2016, the cost of a typical staple basket (maize meal, bread, rice and potatoes) of a low-income household had increased by approximately 29% year-on-year.

Food price inflation

The last official publication by Statistics South Africa reported an overall food price inflation rate of 10,8%. The Bureau for Food and Agricultural Policy (BFAP) Baseline projections suggest that food price inflation will peak at 14% by the end of 2016, as the inflationary cost components within the value chain are gradually feeding through to retail prices (*Figure 1*).

Figure 1: Outlook on food price inflation. (Source: BFAP Baseline 2016)

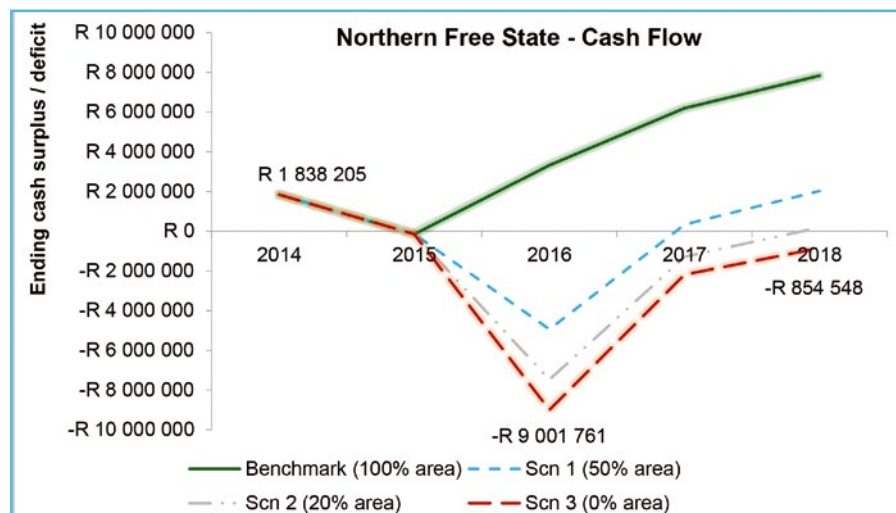


Whereas low-income consumers are faced by high staple food prices, producers in drought-stricken areas are facing financial distress. The drought has not only affected the current production season, but will also have financial and debt implications for farm businesses in the near future.

The cash flow position of a prototype farm in the Northern Free State producing

maize, soya beans and sunflowers is presented in *Figure 2*. In a scenario where the producer was unable to plant in the 2015/16 production season, it will take more than two years to return to a positive cash flow position if he has access to credit in order to finance the input costs in the following production season.

Figure 2: Cash flow projections of different scenarios for a Northern Free State prototype farm. (Source: Baseline 2016.)



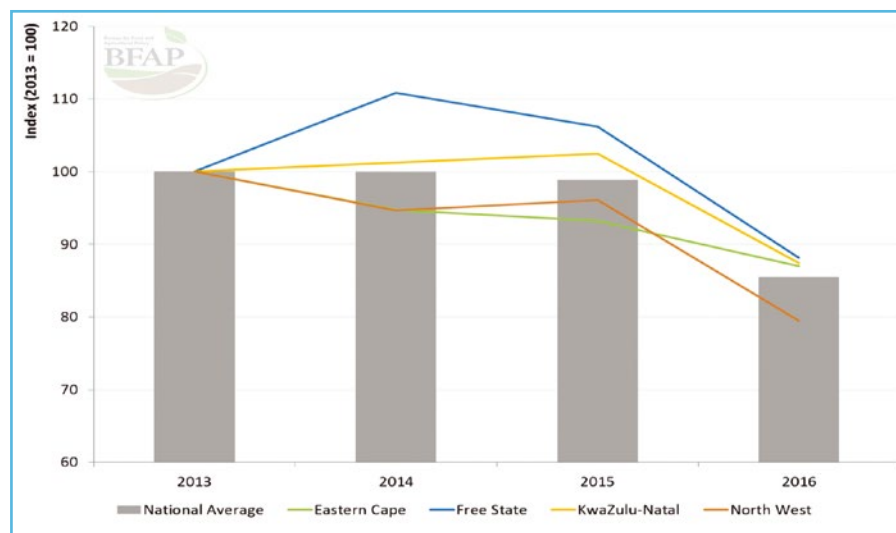
Yellow maize, soya bean and sunflower prices have also increased sharply, resulting in considerably higher feed costs and placing profit margins of intensive livestock operations such as poultry, pork and dairy under severe pressure.

Higher feed costs

While the impact of the drought on intensive industries has resulted in higher feed costs, the impact on extensive livestock industries that depend on grazing has been even more profound. The number of cattle slaughtered increased over the second half of 2015. The national cow herd has declined by as much as 15% from 2013 levels.

Figure 3 illustrates that the sharpest decline occurred in the North West and the Free State, where cow numbers in early 2016 dropped by approximately 17% from 2015 levels. The four provinces presented alongside the national average (Eastern Cape, Free State, KwaZulu-Natal and North West) jointly account for more than 70% of the national cattle herd.

Figure 3: Index of cow herd numbers. (Source: UFS and RPO with BFAP calculations, 2016)



The drought has not only impacted South Africa but also most of the countries in the region, causing white maize prices to increase sharply. Figure 4 compares the maize crop over the past three seasons for countries in the Southern and Eastern African regions and presents the percentage increase in white maize prices since 2015. South Africa, Mozambique, Malawi and Zimbabwe were affected the most severely.

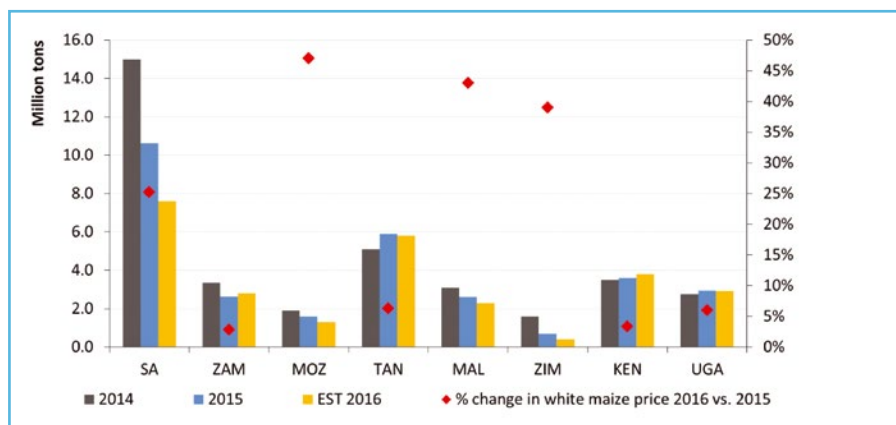
Dependence on imports

Although Zambia is currently expected to have surpluses of approximately 600 000 tons available to export into the region due to favourable rainfall in the northern parts of that country, a number of deficit countries such as Swaziland, Lesotho, Namibia, Botswana and southern Mozambique will remain dependent on white maize imports from South Africa.

By June 2016, the cost of a typical staple basket (maize meal, bread, rice and potatoes) of a low-income household had increased by approximately 29% year-on-year.



Figure 4: Impact of drought on regional trade flow patterns. (Source: ReNAPRI, 2016)



Based on the latest estimates by the South African Supply and Demand Estimates Committee (SASDEC), the country would have to import approximately one million tons to supplement local supplies and ensure sufficient carry-over stock until the early deliverers enter the market in February and March 2017.

By August 2016, South Africa had only imported 140 000 tons of white maize. However, the question remains where the maize will derive from. The United States (US) and Mexico are the only potential sources of white maize on the global market.

Although American farmers have responded to premiums on white maize and have greatly expanded the area under production, genetically modified (GM) white maize cannot be imported from the US as the required registration of specific genetically modified organism (GMO) events present in the seed planted in the US has not taken place in South Africa.

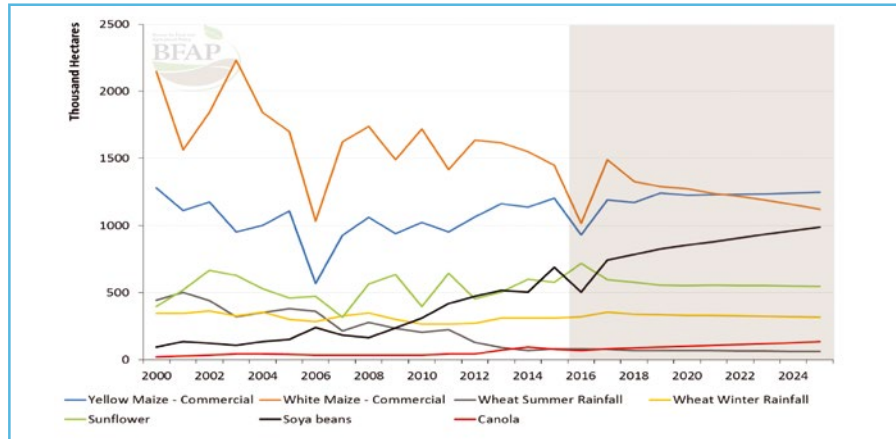
Food security vulnerable

This issue is currently being dealt with by the Department of Agriculture, Forestry and Fisheries (DAFF), and until it has been resolved the white maize, and therefore food security, situation in South Africa will remain vulnerable.

Over the next 18 months, if rainfall in the 2016/17 season returns to normal, BFAP projects (Figure 5) that the area under production will increase significantly as a result of higher grain and oilseed prices. Average white maize prices for 2017 could be 36% lower than in 2016. This should result in average maize meal prices being roughly 19% lower than in the current year.

Similarly, the area under soya beans is also expected to greatly increase to approximately 750 000ha from its current level of just over 500 000ha. With higher availability of feed grains and oilseeds, prices are expected to decline and profit margins in the intensive livestock industries are expected to improve.

Figure 5: The area planted under main field crops in South Africa. (Source: BFAP Baseline, 2016)



The agricultural sector has demonstrated its resilience in the past, and with well-informed, timely reactions it will recover. There are a number of lessons to be learned regarding actions that have to be taken not only in order to improve the country's resilience in times of drought, but also to bring the industry back on the growth path of the National Development Plan (NDP).

Average white maize prices for 2017 could be 36% lower than in 2016.

For instance, as a result of climatic risks, international reinsurance companies are considering a partial withdrawal and restructuring of local agricultural insurance. This would have a detrimental effect on future growth and broad-based development of agriculture in South Africa.

Crop insurance

Local government needs to consider the crop insurance programmes offered by various other countries, where the state provides an agricultural insurance guarantee of last resort to reinsurance companies, ensuring cost-effective availability of crop insurance.

Another action to be considered is the development of a drought early warning system, which provides monthly reports on seed sales, planting progress, crop estimates via the Crop Estimates Committee (CEC), household food consumption per district, dam levels and water availability in rivers, infrastructure conditions and the utilisation of key infrastructure such as ports, railways and water canals.

Response to the current drought must continue to foster an enabling environment where investment can flourish, in order for the sector to demonstrate growth.

Contact BFAP on 012 420 5021 or admin@bfap.co.za for more information.

Article courtesy of AllAboutFeed

Soya bean meal consumption in the United States

During 2014, livestock in the United States (US) consumed an estimated 27,9 million tons of soya bean meal (SBM), approximately the same amount as in 2013. These statistics are stated in the report titled *Economic Analysis of Animal Agriculture, 2004–2014*, prepared for the United Soya Bean Board (USB) in the United States.

According to results from this study, domestic animal agriculture consumed approximately 27,9 million tons of SBM in the US in the 2013/2014 soya bean marketing year, making animal agriculture the largest source of demand for SBM in the country. The SBM was fed primarily to broilers (11,2 million tons), pigs (7,9 million tons) and dairy cows (2,7 million tons). Figure 1 illustrates these numbers.

Figure 1: Total SBM consumption in the US for 2014 (in millions).

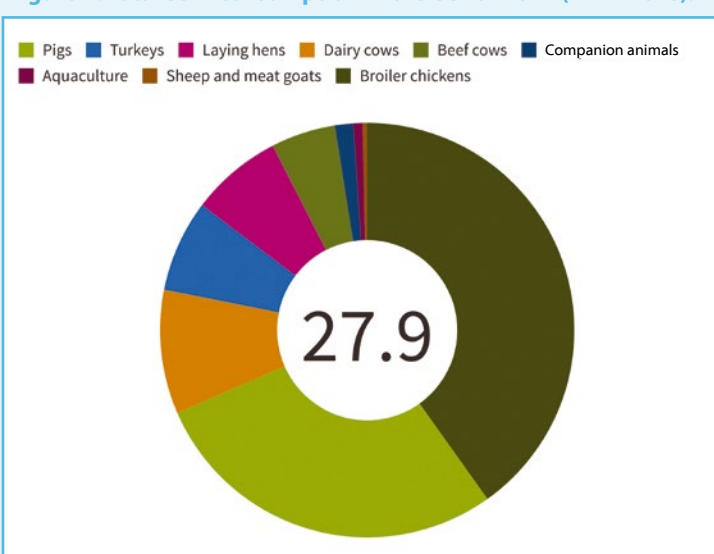
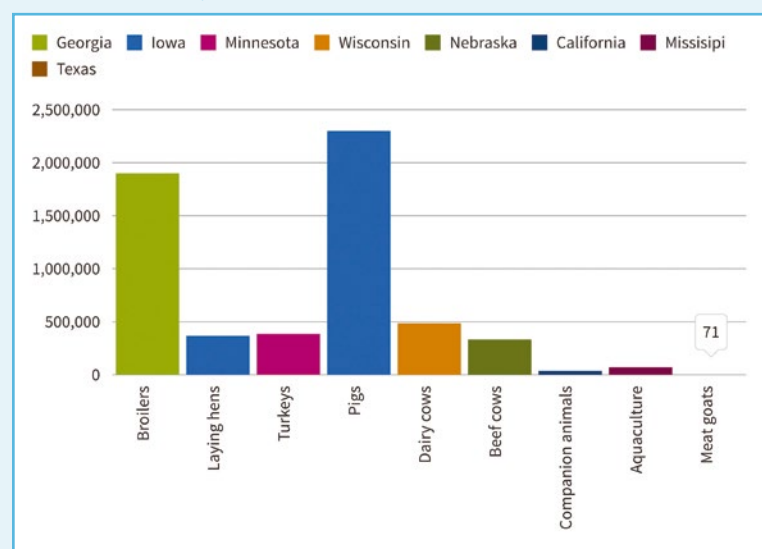


Figure 2: The states which consumed the majority of SBM according to animal category, 2014 (in tons).



Analysis per state

Due to its large number of animal units, the state of Iowa is the leader in SBM usage. Other states which also use large amounts of SBM include North Carolina, Georgia, Arkansas, Alabama, Minnesota and Texas. Georgia's broiler chickens consumed nearly 1,9 million tons of SBM in 2014.

Other states that use significant amounts of SBM in their broiler diets include Alabama, Arkansas, Mississippi and North Carolina. In 2014, Iowa's laying hens consumed over 368 000 tons of SBM. Other top states for the feed's consumption by laying hens include Indiana, Ohio and Pennsylvania.

Iowa leads the nation in pig production and the state's pigs consumed roughly 2,3 million tons of SBM in 2014. Pigs in Minnesota, North Carolina and Illinois also consumed large amounts of SBM in that year. These statistics are illustrated in Figure 2. 🌱

To view the full report, go to: <http://unitedsoybean.org/wp-content/uploads/Economic-Analysis-of-Animal-Agriculture-FINAL-Low-Resolution.pdf>.



Lows and highs

of oil and seed markets

Currently the various stock levels of plant oil resources in the world differ tremendously. These differences create some opportunities but also certain concerns, which ultimately also create uncertainty.

International market

The production of the seven largest oilseed markets is expected at 524,6 million tons for 2016/17. However, due to greater demand for oilseeds, the ending stock will most probably decrease to 90,2 million tons from 94,2 million tons in 2015/16 (Table 1).

The global sunflower seed crop level is currently very favourable. This is in particular the case in Eastern European countries. International traders are expecting the world's sunflower seed production to be at an all-time high of 46 million tons.

In terms of soya bean production, it is expected that global production would realise at 328 million tons, which is 14,7 million tons more than the previous year. A record crop of 110 million tons is expected from the United States (US). However, it is anticipated that South America will plant less in the next planting season.

Although the current crop supply appears favourable as of middle August, the risk of a La Niña weather pattern damaging the crops at a later stage still exists.

Table 1: Seven oilseeds: World supply and demand (million tons). (Source: Oilworld)

	14/15	15/16	16/17*
Opening stock	77,9	97,7	94,2
Production	521,8	503,1	524,6
Soya beans	320,5	313,2	327,9
Sunflower seed	41,1	42,1	46
Groundnuts	27,6	29	29
Other	132,6	118,8	121,7
Total supplies	599,7	600,8	618,8
Disappearance	500	506,5	528,6
Soya beans	299	315,7	332
Sunflower seed	41	42,3	45,8
Other	160	63,5	63,5
Ending stock	99,7	94,3	90,2
Soya beans	84,9	82,3	78,2

*Forecast

Global dependence on oilseeds will continue, mainly due to shortages in vegetable oils, canola and rapeseed, creating additional on top of the normal demand growth prospects. World rapeseed production is at a five-year low of 61,7 million tons. Global production of eight vegetable oils has declined by 1,3 million tons, while consumption is expected to increase by more than 4,7 million tons. This means that the world is set to look at oilseeds to satisfy this oil demand.

According to Oilworld, the worldwide crushing of seven oilseeds are likely to increase to 447,1 million tons for the 2016/17 season. This represents an increase of 18,2 million tons, the greatest of which entails soya beans, sunflower seed and palm kernels. Worldwide soya bean crushing is expected at 287,3 million tons, which is 14 million tons higher than the previous season.

Increase in crushing

In the US it is expected that crushing will increase to record levels of 53 million tons. As of the middle of August, the demand for US soya beans was very strong as well, as

American export figures more than doubled on a year-on-year basis. This consisted predominantly of China taking advantage of the bearish market outlook.

In summary, prices should experience pressure in the short term due to higher supply levels of oilseeds (Table 2). The increase in demand due to lower vegetable oil levels will, however, buffer this price pressure, and in the medium to longer term it is foreseen that the oilseed market of soya beans in particular may move toward exhibiting a bullish tendency.

Table 2: Global and local oilseed prices. (Source: Grain SA, South African Reserve Bank and Oilworld)

Product	04/08/2016	July 2015	% change
Soya beans (US CIF Rotterdam)	403	429	-6,06
Soya beans (Brazil)	430	429	0,23
Sunflower seed (EU)	395	432	-8,56
Groundnuts (US 40/50)	1 550	1 280	21,09
Palm oil (Malaysia)	645	610	5,74
Soya bean oil (US)	736	732	0,55
Sunflower oil (Argentina)	775	817	-5,14
Soya meal (Argentina)	379	384	-1,30
Fishmeal (Peru)	2 250	1 994	12,84
Rand/\$	13,7	12,67	8,13
Sunflower seed	5 550	5 541	0,16
Derived sunflower	5 754	5 630	2,20
Soya beans	6 438	5 003	28,68
Derived soya beans	6 419	5 855	9,63

In respect of oil meals, it is projected that significant growth in stock levels will occur due to the greater crushing figures as explained above. It is expected that the total oil meal production will be at 316,7 million tons, which is a 4,4% increase on a year-on-year basis.

The total soya meal production will increase by 5,2%, resulting in production of 225,8 million tons with an ending stock level of 8,2 million tons. In terms of pricing, this means that oil meal prices should remain under pressure due to increased production and stock levels.

Local market

Most of the oilseeds in South Africa have already been harvested, and the yields differ vastly between regions and planting dates. Most of the oilseeds planted later than the optimal planting dates performed considerably well. The sunflower seed crop has taken the market by surprise with higher than expected yields, while soya beans mostly underperformed due to extremely high temperatures and the severe drought experienced.

According to the South African Supply and Demand Estimates Committee (SASDEC) (27 July 2016), the 2016/17 sunflower seed will result

in an ending stock level of 77 367 tons, which is 31 500 tons higher than the previous marketing season. This is mainly due to higher production and import figures.

Soya bean production was 250 000 tons lower than the previous season, resulting in 300 000 tons worth of imports. The main question is whether crushing plants in South Africa will run at high utilisation percentages, or whether it will be more economically viable to import oil meal and keep utilisation levels lower. If the crushing margin does not improve, this will certainly be a marketing option for crushing plants.

Global conditions

In terms of prices, both sunflower seed and soya beans are trading close to derived prices due to the high demand and low supplies. Until the time of the new planting season, prices should closely follow the international market. Therefore, it would be vital to monitor global weather conditions and the exchange rate in the medium term.

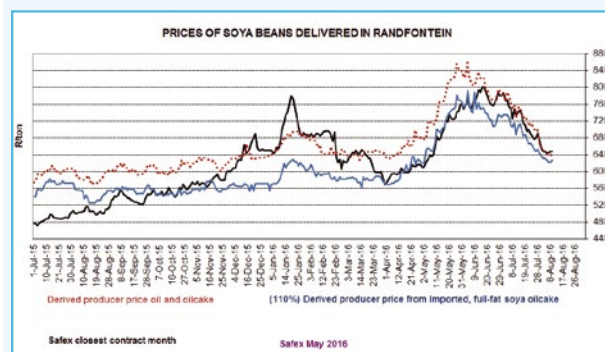
Considering the new production season, the maize-soya price ratio is currently favouring maize according to current price levels. However, if the La Niña is favourable in terms of rain at the right time for production, this ratio can easily alter in favour of soya beans.

The crushing margins of soya beans delivered in Randfontein are indicated in Figure 1, while Figure 2 provides an outline of the derived producer price of oil and oilcake and that of imported, full-fat soya oilcake.

Figure 1: The crushing margins of soya beans. (Source: Grain SA)



Figure 2: Derived producer prices of oil and oilcake and that of imported, full-fat soya oilcake. (Source: Grain SA)



In summary, the monitor points for the coming season consist of the following:

- Northern hemisphere weather and crop conditions.
- Southern hemisphere planting intentions and conditions.
- Crushing margins and oil meal prices/imports.
- Exchange rate movements.
- Maize-soya bean price ratio for new production season.

Contact Dr Strydom on 086 004 7246 or dirks@grainsa.co.za for more information.

Canola symposium of the Protein Research Foundation: Exciting times ahead

Canola can potentially be more profitable than wheat and barley, but producers will have to increase their average yield by 0,4t/ha. New hybrids and genetically modified (GM) cultivars that are in the pipeline, can give the industry a boost.

In the winter rainfall region of the Western Cape, the profitability of wheat and barley can be better than canola. However, if producers can increase the average yield of their canola from the current 1,4 to 1,76t/ha, canola will be just as profitable. This was the opinion of Prof Ferdi Meyer, director of the Bureau for Food and Agricultural Policy (BFAP), at a canola symposium presented by the Protein Research Foundation (PRF) at Kronenberg near Paarl.

With new technology and good management practices, the yield can be increased to 2t/ha. Certain producers have already achieved yields of 3t/ha, said Gerhard Scholtemeijer, PRF chairman.

Dr John Kirkegaard of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Canberra, Australia, said canola can potentially produce a yield of 5t/ha. In Australia yields of 4 and 5t/ha have been achieved in trials.

Rob Wilson of DuPont Pioneer from Wagga Wagga, Australia, said yields of 3t/ha are possible in the right areas. New hybrids and GM canola can play a major role, adding advantages such as vigorous seeds, uniform ripening, higher yield and oil content, resistance against certain diseases and risk management.

A welcome boost

Scholtemeijer said GM canola will provide a welcome boost to the Western Cape canola industry. With Roundup Ready®

canola, up to 100 000ha of small grain fields can be brought back into production. The PRF is aiming to get GM canola for the Western Cape.

The first canola in South Africa was planted in 1992. Approximately 400 tons were harvested from 400ha. In 1994 the PRF provided the first funds for canola research, because the organisation recognised the oilseed's potential of making a valuable contribution in the production of sufficient protein for animal consumption in South Africa. In 2014/15, more than 123 000 tons of the crop were harvested.

Andries Theron, vice-chairman of the PRF, said the organisation plays a major role in the funding of canola research. With traditional institutions' standard of research being under suspicion, partnerships between producers and companies such as Bayer and Du Pont Pioneer will have increasingly greater importance.

Managing higher yield

Dr Kirkegaard said producers have to keep up with the changing climate. The current trend in Australia is to plant earlier in an effort to adapt to changing weather patterns. Management and cultivar choice play a major role.

In early planting systems, it is vital to:

- Identify the optimum flowering period for the site. Factors to consider are



Speakers at the symposium were, from the left: Andries Theron, vice-chairman of the PRF, Rob Wilson of DuPont Pioneer in Australia, Rick Horbury, technical adviser of Bayer in Western Australia, Gerhard Scholtemeijer, PRF chairman, Dr John Kirkegaard of the CSIRO in Canberra, Australia and Prof Ferdi Meyer, director of BFAP.

frost, heat, water stress and radiation.

- Target the earliest planting date to hit the optimum flowering period. Plant long growers first.
- Manage for adequate biomass at flowering for yield target. Make sure of the most cost-effective nitrogen, seeding rate, growth type.
- Identify ways to allocate more of the biomass to grain. Suitable cultivars are important.

Producers should ensure that they plant seed of good quality and vigour, and preferably large in size. In respect of seed quality, the seed size is the main factor. This can have a greater effect on yield than planting depth. He warned that producers must target a suitable and even planting depth, however. In ideal conditions, the optimum depth is 10 to 15mm, but in practice a depth of 25mm is more common for adequate moisture.

There must be good soil-seed contact and adequate moisture, and seeds must be separated from the fertiliser and protected from pests. Canola seeds are small, and therefore pressure wheels should not place excessive pressure on them.

For more information on the canola symposium, visit www.proteinresearch.net



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