

OILSEEDS

focus

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

Soya beans • Sunflower • Canola • Groundnuts



Sclerotinia in crops

Nitrogen and soya beans

Efficacy of glyphosate

Drought and markets

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By Gerhard Scholtemeijer, chairperson of the Protein Research Foundation

– a burning issue in the oilseeds industry

The importance of the South African oilseeds industry to man and beast can hardly be overestimated. Yet, in the past (and currently) it wasn't a priority, despite the currency outflow from South Africa annually amounting to billions.

Traditionally South Africa was mainly a maize-producing country, specifically in the summer rainfall areas. This was backed by sunflower. In the winter rainfall region wheat was the primary agricultural product in the Western Cape, supplemented by large volumes of wheat from the Free State and parts of the Highveld.

Prior to 1994 no vegetable protein for animal feed or edible oil was produced in the Western Cape, whereas sunflower was traditionally utilised as edible oil and the major source of vegetable protein for animal use. Fishmeal was in high demand due to its nutritional quality and sufficient quantities were available until the mid 1970s.

The two oldest oilseeds industries in South Africa are groundnuts and sunflower. The newcomers making a significant contribution are soya beans and canola.

Wheat lost its lustre

When a natural disaster such as the heat and drought of 2015/16 occurs, producers tend to scrutinise every crop. It has a major effect on continuous crop cultivation. Profitability that depends mainly on yield, is vital for, among others, crop financing during the next year.

In the summer rainfall region maize and sunflower are reliable stalwarts, while wheat has lost its lustre, especially in the summer rainfall region. In the preface to the previous edition of *Oilseeds Focus*, Andries Theron spoke in detail regarding the position of wheat in the Western Cape.

Different scenarios exist with regard to

the four most important oilseeds, namely sunflower, groundnuts, soybeans and canola.

Yield undoubtedly is the biggest issue in oilseeds production. Compared to the maize industry where yield per hectare has multiplied during the past 30 to 40 years, sunflower yields kept on plodding ahead and only a few research projects gave marginal attention to higher yields.

Sunflower research

Research on sunflower naturally received attention over the past forty years, but unfortunately it was fairly directionless. The quality of sunflower oil and the protein in sunflower oilcake seldom turned out to be the objective of purposeful research. Over the years we were able to control diseases and insects, except in the case of *Sclerotinia*, which is still causing problems internationally with little progress in combating it.

The latest crop estimate for 2015/16 shows that 617 000ha were planted with an expected yield of 622 000 tons. The average yield therefore is approximately one ton per hectare, which isn't uncommon in dry years.

The number of hectares will probably be adjusted upwards because, on the one hand, producers planted less maize and soya beans due to late rainfall. On the other hand the price of up to R7 500/ton saw the planting season for sunflower stretched until the typical "fortieth" of January. Just keep in mind that the highest average yield of 1,55t/ha the past 40 years was achieved in 2008.

Groundnuts

Groundnuts are aimed mainly at the human food market and never contributed to the edible oil market or protein source for animal consumption. A flourishing groundnut industry with special status as

an exporter of quality product, has however collapsed into a struggling industry with no international status.

The groundnut industry is working on a turnaround strategy, but was dealt a blow by the current drought. According to the latest crop estimate the area under groundnuts decreased to 24 000ha with an estimated yield of 29 600 tons. The status of the industry is obvious considering that in 1973/74 364 000ha yielded 384 000 tons.

The soya industry

Although the soya bean industry has been in production since the 1970s and earlier, it only gained true momentum in 1998. Total production in 1973 was 20 000 tons. The first year that marked production of more than a million tons was in 2015 on 687 300ha, which represents an average of approximately 1,52t/ha. The 2t/ha mark was exceeded only once in 2009 with an average of 2,17t/ha.

Despite the severe heat and drought, the latest production estimates indicate that 535 000ha of soya beans were planted with an expected yield of 768 000 tons.

The canola industry

Canola is the Western Cape's contribution to the edible oils market and a protein source for animal feed. Although the industry only truly came into being in 1994, it grew dramatically to a high of 121 000 tons on 95 000ha in 2014. The average yield per hectare is also the most limiting factor in canola production.

South Africa is still experiencing a shortage of protein for animal consumption and of edible oils for human consumption. Oilseeds (excluding groundnuts) can be grown successfully over the next few years, notwithstanding the drought. However, higher yields, especially in respect of soya beans and canola, will require dedicated attention. 🌱

The effect of the drought on the oilseeds industry

The implications of the drought on the agricultural industry are already being felt, but the worst is yet to come. Higher interest rates and a deterioration in the exchange rate add to the devastating effect that the drought will have on food inflation. The impact of the drought will be felt both upstream and downstream, with input suppliers and processors severely affected.

Crop estimates

The government's request for the Crop Estimates Committee (CEC) to produce an early preliminary production forecast due to the influence of the drought, was well received and at least has put some perspective on the impact of the drought. Not only did farmers lose hectares due to the impeded ability to plant in many cases, but also an anticipated major reduction in yield.

Sunflower, which can be planted later than soya beans and maize, benefitted from these late plantings. With anticipated hectares increasing by 7,11%, while production reduced by 5,89% due to lower yields, according to the CEC, it will be interesting to see just how much sunflower benefitted once the latest crop estimate is announced.

An estimated soya bean crop of 768 560 tons, a reduction of 27,48% from last season, will require approximately 200 000 tons of soya bean imports, should crush margins support the high imported soya bean prices.

Processors face higher prices

Oilseed processors are faced with not only a tight supply of oilseeds available to crush, but also the increase of oilseed prices to import parity levels, resulting in negative crush margins.

In order to utilise crush capacity, significant soya bean and some sunflower seed importation need to take place, adding to the already burdened logistics system which will be required to handle an estimated more than five million tons of grain imports.

On the positive side, global soya bean stocks are at record levels and international prices have reduced drastically over the last two years. High international prices in addition to the exchange rate deterioration would have proven even more challenging to our local industry.

The future

Livestock farmers are required to buy feed to maintain the condition of their animals. Feed prices have escalated drastically due to the drought, adding to this burden. Input financing for grain and oilseed producers next season will prove extremely challenging, as well as the fact that many farmers' financial reserves will be depleted.

There will be a squeeze on all involved in the supply chain. The end-consumer of agricultural products will not have the resilience or means to absorb these major food price increases, inevitably resulting in reduced demand.

We hope that 2015 was an abnormal year with record low rainfall and record high temperatures, and that we have not entered into a hot, dry cycle that persists. Without support the already strained industry would be severely damaged if rainfall and temperatures do not normalise in 2016.

We trust that all will remain positive and put in the effort to make the industry as efficient and sustainable as possible, given the current external challenges.

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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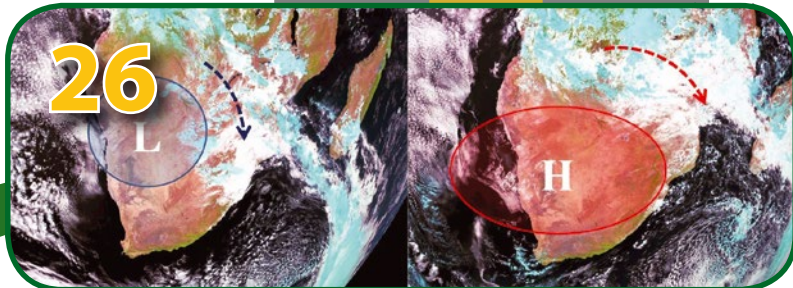
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Dirk Strydom joins Grain SA

Grain SA recently announced that Dr Dirk Strydom will join the Grain SA management team as manager of the Grain Economics and Marketing Department. Strydom is currently head of the Department of Agricultural Economics at the University of the Free State. His task will be to manage everything related to agricultural economics, marketing and public relations.

– Press release



Dirk Strydom

Save these dates!

- 20 to 24 June 2016, VUT Soya Food Seminar (Vanderbijlpark)
- 19 July 2016 – PNS Canola symposium (Bredasdorp)
- 20 July 2016 – PNS Canola symposium (Paarl)

Glyphosate does not cause cancer

Two of the world's renowned and highly respected health and food safety authorities – the European Food Safety Authority (EFSA) and Canada Health – have outrightly confirmed that glyphosate, the active ingredient in the world's most popular herbicide, Roundup, is "unlikely to cause cancer in humans and poses no health risks to farmers and other occupations that handle the product".

Announcing this in a statement released in Johannesburg, Kobus Steenekamp, managing director of Monsanto, South Africa, added: "This unequivocally trumps the conclusion in March 2015 by the International Agency for Research on Cancer (IARC) which listed glyphosate as 'probably carcinogenic to humans.'"

"The EFSA conclusion on the peer review of the pesticide risk assessment of glyphosate, was published in the EFSA journal on 12 November 2015. In contrast to the IARC evaluation, the EU peer review experts, with only one exception, concluded that glyphosate is unlikely to pose a carcinogenic potential according to Regulation (EC) No 1272/2008. Glyphosate is not classified or proposed to be classified as carcinogenic or toxic. As concluded by EFSA, the overwhelming weight of evidence from decades of research on glyphosate does not provide any credible data to suggest a relationship between glyphosate and cancer."

Scientists from the Pest Management Regulatory Agency (PMRA) of Canada concluded in April 2015 and published on Health Canada's website that "glyphosate poses no health risk to farmers and other occupations who handle the product. Pesticides are registered for use in Canada only if the level of exposure to Canadians does not cause any harmful effects, including cancer." – Press release

15-year rotation not enough to halt nematode damage

The peanut root-knot nematode (*Meloidogyne arenaria*) is a force to be reckoned with and caused yield limiting damage again after all those years since we used no nematicide or resistant variety.

Nematodes are some of the most common animals on earth. There are about a million types of them worldwide, second only to insects in diversity. We don't often see them as many are microscopic. But some are large, like those found in whales that can reach 20 feet in length. About 10% are plant parasitic, and those are the ones that really hurt agriculture.

Among actions to take are crop rotation, resistant varieties, chemical control (including fumigants) and crop destruction. And just because we didn't have a problem in cotton last year, doesn't mean much if we will plant peanuts in the field this year. We need to consider the last time peanuts were in that field, like my friend who switched from pasture to peanuts and still had nematode damage. Nematode sampling is a good thing, but it must be done right and the sample kept in good shape until it gets to the lab. What must be considered is what crop had just grown in the field when the sample was taken.

The grower that got hit with a nematode problem after so many years of good rotation with pasture, got a lower peanut

yield than expected that year. But we learned a good lesson. He plans to plant a resistant peanut variety the next time peanuts are planted there. If you've seen the evidence of the peanut root-knot nematode in a field, or the swollen knots on the roots (not the nitrogen producing nodules stuck to the side of the roots) and unthrifty, or dying areas in the field, then we will likely fight it for a good while.

So a couple of questions to consider are: "Did we take a nematode sample at harvest time and did nematodes show up in it and what type?" Maybe more importantly: "Were there areas of stressed plants and dead spots in the field due to nematodes?"

Considering your crop mix for 2016, keep nematodes in mind. If peanuts or other crops are planted in close rotation we could see a worse problem in specific fields. We have lost some nematode control chemicals in recent years but we have some new resistant varieties and a new chemistry or two.

Extension scientists and agriculture agents will have up-to-date information on nematode control at winter Extension meetings across Georgia and other Southeastern states. Go see and hear what they have to say and get prepared for nematodes this growing season. They're out there and don't mind sticking around a field for a long, long time. – Rome Ethredge, Southeast Farm Press Daily.

SA groundnut crop fails

South Africa will probably return to being a net importer of groundnuts as the worst drought in living memory cuts the country's crop to the smallest on record.

The nation may need to bring in 20 000 metric tons of groundnuts in the 2016/17 season starting March to supplement local supply, according to Wandile Sihlobo, an economist at Grain SA. The country, which was last a net importer in 2013/14, risks losing its position as the third-biggest supplier to Japan.

South Africa had the lowest rainfall last year since records began more than a century ago as the El Niño weather pattern decimated crops of everything from corn to wheat. Five regions have been declared drought disaster areas, including the Free State and North West. The Free State and Northern Cape provinces are the main growing areas for groundnuts, accounting for about 70 percent of production last year.

"The current drought did not only affect the bigger crops like maize, sunflowers and soya beans, but also the small crops such as groundnuts," Sihlobo said in a phone interview. "More imports will likely come from other countries outside of Africa because they are in the same state as us."

South African farmers may harvest 29 600 tons of groundnuts next season, according to the Crop Estimates Committee. That would be down 48% from a year earlier and the lowest amount since at least the 1990/91 season, when the South African Grain Information Service started collecting data.

The country will probably import 10 000 tons of groundnuts in the season ending February and ship out 11 800 tons, according to Grain SA forecasts. It didn't have an estimate for the potential size of net-imports in the coming season.

Mozambique, Malawi, India and the US have been the leading suppliers to South Africa in the last five years, while the country exports to countries including the Netherlands, Mozambique, Belgium, Egypt, and the UK, Sihlobo said. China and the US are the biggest providers to Japan.

"Japan is an important groundnut market," according to Sihlobo. "We might see Argentina taking our spot as the third- biggest supplier of groundnut to Japan." – *Tshepiso Mokhema, IOL*

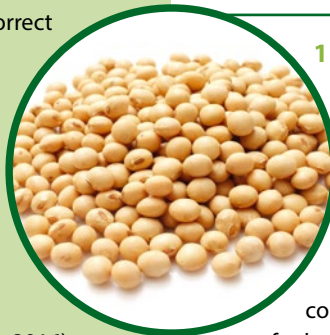
New regulations for grain and oilseeds

New regulations relating to the grading, packing and marketing of various grain and oilseeds products were recently published. In its most recent newsletter, Agbiz emphasises that grading regulations promote fair business practices and a competitive marketing environment for grain and oilseeds. By the correct application of the grading regulations, fair and competitive trading practices are promoted to the overall benefit of consumers and the agricultural industry.

Below is the list of new regulations relating to the grading, packing and marketing of grain and oilseeds products intended for sale in South Africa:

- Sorghum Grading Regulations (*Government Gazette*, 8 January 2016).
- Soft Wheat Grading Regulations (*Government Gazette*, 22 January 2016).
- Durum Wheat Grading Regulations (*Government Gazette*, 22 January 2016).
- Bread Wheat Grading Regulations (*Government Gazette*, 29 January 2016).
- Sunflower Seed Grading Regulations (*Government Gazette*, 22 January 2016).

All of the relevant documents can be downloaded on the website www.agbizgrain.co.za. – *Agbiz newsletter*



11th Oilseed and Grain Summit

The eleventh Oilseed and Grain Trade Summit will be held in Minneapolis in the USA from 15 to 16 November 2016. This year will see an expansion of the Organic and Non-GMO Forum.

The event provides actionable content and networking opportunities for key decision makers in the global oilseed (soya beans, canola/rapeseed, sunflower seed and oil palm) and feed grain (corn, wheat, sorghum and barley) value chains.

For more information, visit www.oilseedandgrain.com 

Companies must explore Africa

In a bid to address domestic shortages, Indian companies should consider investing in Africa for production of pulses and oilseeds, Indian agriculture minister Radha Mohan Singh said recently.

India is dependent on the import of pulses and edible oils due to a huge supply-demand gap. It imports 4 to 5 million tons of pulses and 13 to 14 million tons of edible oils annually. "Can we think of a dispensation where Indian companies can consider investing in Africa for growing pulses and oilseeds, which are in short supply in India? Similarly, African businesses can think of engaging mutually beneficial collaborators in India," Singh said at India-Africa Agribusiness Forum organised by industry body Ficci.

"I am happy to note that recently our government has taken a decision to set up a food processing cluster in Africa. I am also aware that some of the Indian companies have invested in agriculture in Africa and many are looking forward to doing so," he added.

His African counterparts, especially from Zambia, Botswana and Seychelles, showed interest in collaborating with Indian companies in various areas of agriculture sector.

India imports pulses from African countries such as Malawi and Mozambique. There is a huge potential to invest in Malawi, where almost 50% of areas remain unused due to lack of irrigation, lack of seeds and technology and poverty. – *The Economic Times*

SCLEROTINIA

– a disease of note in numerous crops

Crop farmers often suffer enormous yield losses because of sclerotinia. While it is a formidable foe, there are interventions to make it as difficult as possible for the pathogen to infect.

Losses of up to 65% are possible due to *Sclerotinia sclerotiorum*, the causal organism of stem and/or head rots. In South Africa, the sunflower and soya bean industries are the most severely affected by this disease. Sclerotinia stem rot can, however, also occur on crops such as dry bean, groundnut, cowpea, lupine and canola.

Results from a national disease survey conducted during the 2013/14 season on sclerotinia head rot of sunflower, revealed that disease severities as high as 65% have been recorded at Welgelegen and Kroonstad. Similarly, soya bean producers suffer losses either directly as a loss of yield or indirectly from reduced grain quality, with losses estimated to be as high as 60% in South Africa in certain seasons and localities.

Economic impact

As stated, *S. sclerotiorum* is capable of infecting all dicotyledonous plants. With limited options available with regard to crops that can be utilised within crop rotation systems, the economic impact caused by this disease could result in farmers resorting to maize monoculture, which is less than ideal.

Producers must be able to outsmart the pathogen by taking away things it requires to infect its host. During its lifecycle, *S. sclerotiorum* has certain phases that has



Sclerotinia head-rot of sunflower. (Photograph: M Ramusi)

to be completed. The sclerotium, which is the survival structure of this fungus in or on the soil, is a hard, irregular darkened and rounded mass of dormant hyphae. Sclerotia can vary in size and shape according to the host tissue they grew in. These structures can survive within the soil for as long as four years and withstand dry heat of up to 70°C.

Favourable conditions

When conditions are favourable (approximately ten days of wet soil and temperatures of 11 to 15°C), the sclerotium can germinate in one of two ways. Most common is through the production of apothecia. All above-ground infections result from this type of germination. Sclerotia that are within 5cm of the top soil germinate and produce apothecia.

Apothecia can be seen as the incubators for the next phase in the lifecycle, the ascospores. Saturated

soils (of up to ten days) and prolonged periods of low soil temperatures (5 to 15°C) are favourable for the production of apothecia, which usually appear after the crop canopy has at least partially closed to shade the soil surface.

Ascospores produced by the apothecia are forcefully ejected and can spread within the same crop or to other crops by means of air currents as far as 50m from the source. At this point in its lifecycle *S. sclerotiorum* requires a host. If sunflowers are in close proximity, the spores will infect the flowers of the sunflower head during



Sclerotia, the survival structures of Sclerotinia sclerotiorum, can vary in size and shape depending on the host it grew in. (Photograph: Pannar Seed and M Craven)



Sclerotinia stem-rot of soya bean (A) and dry bean (B). (Photograph: M Craven and the Dry Bean Group)



Sclerotinia stem-rot of sunflower. (Photograph: M Ramusi)

wet weather, resulting in head rot. If soya bean or canola is the neighbour to the pathogen, the flowers of these plants will be colonised.

Basal stem infections

Sclerotia can also germinate through the production of small hyphae that grow through the soil and infect roots directly, resulting in basal stem infections. This method of infection is common in sunflowers, but less common in canola.

Once the pathogen has gained access to the plant, it produces oxalic acid, which



Spore-producing apothecia which develop on sclerotia buried in the ground. (Photograph: Pannar Seed and the Dry Bean Group)

kills tissue, as well as extracellular enzymes, which digest tissue, and enables rapid ramification of the fungus. Lesion development follows suit and is favoured by humid conditions and moderate temperatures (20 to 25°C), and is usually accompanied by a white mould growth.

Some general guidelines can limit the impact the pathogen can have on the yield.

Varietal selection:

The focus must firstly be on whether cultivars are available that have tolerance to the disease. Resistance against the disease, in most crops, is not available. Tolerance, however, indicates that although a cultivar is infected and the disease manifests, the yield is not significantly affected.

Tolerance is influenced by weather conditions and will not be as effective in

all environments or seasons. Sclerotinia stalk rot of soya beans can similarly be managed through proper varietal selection. It is advisable to choose cultivars which have shown high yield under disease pressure when planting in soils with a history of the disease.

Row spacing: Under low to moderate disease pressure, sclerotinia stem rot of soya bean increases as the row spacing is narrowed. Under high disease pressure, row spacing may have no effect on disease severity. Lower seeding rates can also be considered to increase airflow through the canopy, reducing the moisture that facilitates infection.

Crop rotation: Every year, a portion of the pathogen population dies because

of adverse weather conditions or the activities of other organisms. Rotation with a non-host crop such as maize, sorghum, wheat or other grass will provide time for the fungal population to drop and reduces the risk for severe disease.

Minimum tillage: Deep ploughing can bury sclerotia deep enough that they can no longer germinate and release spores. However, buried sclerotia survive longer than those on the soil surface. Subsequent ploughing in the following seasons can bring them back near the soil surface. In contrast, minimum tillage and no-till practices favour the natural decline of the fungal populations.

Biological control: Contans® WG (*Coniothyrium minitans*) is a commercial biological product developed for the control of *S. sclerotiorum* in agricultural soils. The best and most economical times for application are during pre-planting or post-harvest on the stubble of a previously diseased crop, and incorporated in the upper soil layer. For the greatest impact Contans® WG should be applied three months prior to soya bean flowering.

Chemical control: Seed treatments may be used to reduce the spread of sclerotinia stem rot of soya bean in the field. Fungicides can provide good control of sclerotinia stem rot of soya bean if applied correctly. There are limited fungicides registered for control of sclerotinia and timing is critical.

With sunflowers, desiccants that result in early dry-down can be considered. When sprayed on the crop after physiological maturity, the impact of further development of sclerotinia head rot and sclerotia development can be reduced.

Weed management: Many of the 400 different plant species which are susceptible to infection by *S. sclerotiorum*, are broadleaf weeds. Weeds should, therefore, be removed accordingly from within, as well as from surrounding fields.

For more information, contact the ARC Grain Crops Institute in Potchefstroom on 018 299 6100. ☎

PLANNING AND MANAGEMENT:

A recipe for success

When it comes to soya bean yields, South Africa cannot compete with the rest of the world. Our biggest challenge comes in the form of drought and this makes the management of soya beans all the more important if we are to manage and limit varying yields due to drought. For every decision you make, you also have to consider the impact of your action on the harvest.

Here are five guidelines that can assist soya bean producers to manage the effect of drought on the harvest and to increase the yield.



Yield losses of 6% and less are regarded as acceptable. At 1,8 tons this equals 100kg less beans harvested per hectare. This represents a handful of beans per square metre.

Keep abreast of technology

Looking at national cultivar trials, a difference of 500kg/ha can be expected between the best and worst cultivar. This clearly indicates that one should select the best among the various registered cultivars. Data from the past three years released by the Agricultural Research Council (ARC), shows that new cultivars planted over the past two seasons performed much better than the cultivars that dominated trials and the market during the previous three years. In short, the producer should rather opt for new cultivars than those that performed in the past.

It is always good practice to not put all your eggs into one basket. Spread the risk by rather planting a package consisting

of different cultivars and different growth classes. Once the cultivars have been arranged in different growth classes, one is able to select the best from each class. This is the best way of managing risk.

Planting date and density

Planting dates that are later than mid-November, require an increase in planting density. Bear in mind that accurate seed placement (planting depth, seed spacing and contact with the soil) is more important than density. Be sure to use proper planting equipment. Seed mortalities requires that one plants 20 to 30% more seed.

Each row width has its own ideal plant population, as indicated in *Table 1*.

Table 1: The ideal row width for each plant population.

Row width (metres)	Seeds per metre	Plant population
1,52	25 - 32	180 000 - 210 000
0,91	24 - 28	260 000 - 300 000
0,76	22 - 26	280 000 - 340 000
0,5	14 - 18	300 000 - 360 000



Soya beans utilise large amounts of phosphates and potassium. If these minerals are not supplied to the plant, the effect on the yield will be negative without symptoms necessarily being visible. This is especially true for phosphate. Our soils contain relatively low levels of phosphate, while soya beans easily withdraw 9kg of phosphate for every ton that you harvest.

Inoculants and fertilisers

Given this situation, it is clearly a myth that soya beans don't need fertiliser. While it doesn't react to fertiliser band placement as quickly as maize does, it does react well to soil reserves that have built up over long periods of other crop fertilisation.

Although soya beans utilise large amounts of nitrogen, the application of nitrogen isn't recommended. The nitrogen requirement of soya beans is met by treating the seed with the right nitrogen-correcting nodules (Rhizobium – WB74) before each planting season. It is a cheap and labour-intensive, but essential process.

Conserving soil moisture

All soil preparation for soya beans has an effect on the availability of soil moisture to plants. It applies especially to early weed control and seedbed preparation. Soya beans require a properly prepared, fine, weed-free seedbed for good germination. Avoiding large clods of soil, furrows and ridges will ease the planting process and ensure a good stand. Herbicides are also more effective in a fine, well-prepared seedbed.

Harvesting of soya beans

The success of soya bean production is determined by the amount of soil moisture available during the grain-filling period. The availability of soil moisture at the end of the season is an indication of whether your actions at the start of the season were successful.

Timeous harvesting is more important than one realises. If one waits too long to harvest, the soya beans become dry and more losses will occur due to pods snapping open.

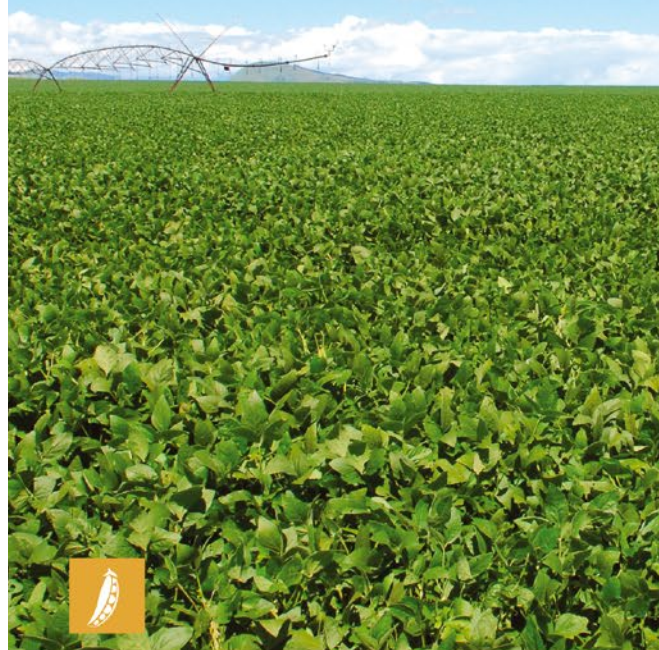
Yield losses of 6% and less are regarded as acceptable. At 1,8 tons this equals 100kg less beans harvested per hectare. This represents a handful of beans per square metre.

Eighty percent of overall yield losses are ascribed to beans that never pass through the harvester and are wasted by the table. This means that maintenance and adjustment to the harvester table are crucial processes on a soya bean farm. These losses are limited when one harvests soya beans with a moisture content of more than 12.

Almost every action a soya bean producer takes, must be carefully planned to ensure proper execution and profitable yields. Mistakes made during the planting season, are very difficult, if not impossible, to correct.

For more information, phone Nico Barnard on 082 850 1503.

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GM FOODS

are truly safe

By Hans Lombard

Claims by anti-GMO activists in media reports that GM (genetically modified) foods are “toxic, remain a health risk, have not after 20 years of GM crops been able to deliver the promised improvement in food security and the promised reduction in pesticides” are devoid of truth. It is time that the scientific facts are highlighted to emphasise the global safety and development of GM crops to repudiate these assertions.

I refer to some of these claims, in green italics, with my response.

After 20 years GM crops were unable to deliver the promised improvement in food security and the reduction in pesticides.

This is not true. GM-maize was planted for the first time in South Africa in 1998. According to Grain SA, in the 1990/91 season we harvested 7 825 000 tons of maize on 3 207 000ha or 2,44t/ha. The average maize yield before the advent of GM was 1,5t/ha. In the 2013/14 season we harvested 14 250 000 tons of maize on 2 688 200ha or 5,30t/ha – a 54% improvement to ensure food security. According to the latest figures, farmers are yielding over 7t/ha GM-maize on dry land and more than 20t/ha under irrigation.

Significant improvement in yields have been achieved of which the use of GM technology is a contributing factor.

One out of four South Africans suffer from hunger.

This has nothing to do with GM-food. There is no shortage of food in our supermarkets, shops or fresh produce markets. For many years South Africa has been producing a surplus of food that is being exported. Food insecurity is largely driven by the lack of disposable income. It is not only in South Africa where people are faced with starvation.

According to the latest report from the Food and Agricultural Organisation (FAO) of the United Nations, 214 million people in sub-Saharan Africa live below the poverty line. With the exception of South Africa, no GM-food is produced in Africa.

The World Health Organisation's (WHO) International Agency for Research on Cancer (IARC) reported that glyphosate, the active ingredient in the herbicide, Roundup Ready, “probably” causes cancer.

This report was based on studies done years ago with rats and rejected by scientists worldwide as flawed. The

chairman of the panel who came to this conclusion, Dr Aaron Blair, emeritus scientist at the National Cancer Institute, emphasised that “glyphosate definitely may not be classified as carcinogenic”. The report provided no substantiated evidence that any human being, anywhere in the world, has developed cancer due to glyphosate.

Undisputed independent scientific research on the safety of glyphosate includes the following:

- The German Federal Institute for Risk Assessment (BFR) after a four-year glyphosate study for the first time evaluated more than 150 new toxicological studies. In addition, all available 300 toxicological studies were reassessed and it was concluded that: “The available data does not show carcinogenic or mutagenic properties.” (BFR Study 2014).
- The joint United Nations’ agencies FAO/WHO (Food and Agricultural Organisation and the World Health Organisation) meeting on pesticide residues in Rome, September 2014, reported: “Glyphosate has no acute toxicity, is not genotoxic nor carcinogenic.” (FAO/WHO JMR report 2014)



In the 2010/11 season in South African glyphosate, Roundup Ready herbicide, was applied on one million ha of maize, 400 000ha of soybeans and 10 000ha of cotton. Worldwide in 2012 Roundup Ready was used on 120 million ha of crops. To date not a single substantiated medical or scientific case of cancer anywhere in the world has been recorded due to glyphosate.

To meet the increasing worldwide demand for glyphosate, Russia is currently in the process of establishing a glyphosate plant of US\$150 million. China already boasts the biggest annual glyphosate production of 835 000 tons. Will these two countries invest so much capital in a product that causes cancer?

Roundup Ready has been on the market for more than 40 years, in more

than 130 countries, and is the herbicide market leader.

Research on the safety of GM crops is questionable. Research is sponsored by the GM companies. Independent research is hampered as permission has to be obtained from the companies concerned.

Any person or research entity can at any time conduct research into any GM products, provided that they adhere to the existing permit regulations laid down by the regulatory authorities. The most authoritative research studies on the safety of GM foods have been conducted by independent researchers with no sponsorship from GM companies. This includes research by and paid for by the European Commission, spanning 25 years and costing over €300 million.

More than 150 research projects were conducted by 500 independent scientific groups and concluded: "GMOs are not riskier than conventional crops." Seven of the world's scientific academies, including the Royal Society of London, concurred.

Martin Quaim and Wilhelm Klümper, two economists at the University of

Göttingen, Germany, conducted meta research on GM crops and found that biotechnology reduced chemical pest applications by 37%, increased crop yields by 22% and increased farmers' profit margins by 68%.

After 19 years of GM-crop production (16 in South Africa), South Africa is recognised as the most practical example of the safety of GM food. The country is the largest per capita consumer of GM foods. Maize is our staple diet. According to the Maize Trust, a cumulative total of 12 million ha was planted to GM maize between 2002 and 2012, producing a cumulative yield of 40 million tons.

This grain, in one way or another, was consumed annually by 50 million South Africans, 800 million broiler chickens, 1,4 million feedlot cattle and 3 million pigs without any substantiated medical or scientific proof of adverse effects for humans, animals or the environment.

Hans Lombard is an independent agricultural analyst and consultant to the agricultural biotechnology industry. For more information, email him at hans.lombard@neomail.co.za

THIS IS HOW WE ARE GOING TO FEED A GROWING POPULATION

PROBLEM

RAPID POPULATION GROWTH

7 BILLION (2012) → 8 BILLION (2025)

(238 babies born every minute)

Source: <http://www.worldometers.info/world-population/>

THREAT TO FOOD PRODUCTION

- Climate change
- Limited and shrinking resources
- Pests

SOLUTION

GM CROPS

Plant varieties that deliver:

- More yield
- More efficient use of resources
- Insect tolerance
- Herbicide tolerance
- More biodiversity
- Increased yield

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***GM crop benefits:**

- Increased food security
- Increased sustainability
- Decreased emissions
- Decreased use of pesticides

ENOUGH HEALTHY FOOD**

15 years of production on more than 1 billion hectares worldwide

NO ADVERSE EFFECTS DOCUMENTED

* According to Brookes and Barfoot, 2013, from 1996 to 2011 biotech crops contributed to food security and sustainability by increasing crop production valued at US\$ 98.2 billion. It also provided a better environment by reducing pesticide use by 473 million kg of active ingredient. In 2011 alone CO₂ emissions were reduced by 23,1 billion kg, equivalent to taking 10,2 million cars off the road.

** Regulatory agencies worldwide, such as the Food and Agriculture Organization, World Health Organization, the European Commission, the French Academy of Medicine, the American Medical Association, and the American Society of Toxicology have agreed that GM foods are safe for human health.

<http://www.sho.int/foodsafety/publications/biotech/20questions/en/>
http://ec.europa.eu/research/biosociety/pdf/a_decade_of_eu-funded_gmo_research.pdf

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By André Nel, ARC Grain Crops Institute, Potchefstroom

Does soya bean really add NITROGEN to the soil?

The statement is often made that soya bean adds nitrogen to the soil through its symbiotic nitrogen-fixing ability with *Rhizobium* bacteria. Farmers observe it as vigorous growth of maize following a soya bean crop and then ascribed it to the additional nitrogen.

Some research confirmed that a person needs to apply an amount of nitrogen to maize following maize, to match the yield of maize following soya bean without any addition of nitrogen. This conclusion is, however, wrong for most cases as some research has shown that soya bean is nitrogen-neutral.

The soil, after the soya bean crop, is left with about the same amount of nitrogen it initially had. What most likely happens, is an improvement in the efficiency of nitrogen uptake by the following maize crop from the soil.

Nitrogen fixing

Leguminous crops, of which soya bean is a member, have the unique ability to supplement the soil nitrogen supply through a symbiotic nitrogen fixing process with *Rhizobium* bacteria. The bacteria penetrate hair roots on young growing roots and form the well-known root nodules.

Symbiosis is a beneficial cohabitation between organisms. In the case of *Rhizobium* and soya beans, the bacteria live on the energy supplied by the photosynthetic process of the plant. The bacteria, in turn, fix nearly inert atmospheric nitrogen (N_2) into compounds useful to the soya bean plant.

To take advantage of this symbiotic process, nitrogen fertilisation of soya

beans is not recommended, except on sandy soil where the nitrogen supply is usually low. Small amounts of nitrogen fertiliser are therefore recommended on such soils for enhanced growth of young plants. Inoculation of the seed or soil with a specific *Rhizobium* species, *Bradyrhizobium japonicum*, associated with soya bean, is very important as it does not occur naturally in South African soils.

Maize yield improvement

The yield of maize following soya bean on a particular field is often noticeably better than that of maize following maize. Our own research, stretching over several years and localities, showed that the maize yield improvement is about 13% on sandy textured soils.

The soya bean rotated maize usually shows no nitrogen deficiency symptoms, while it often appears in mono-cultured maize during the reproductive part of the growing season. The popular interpretation is that some of the symbiotic fixed nitrogen is still available for uptake by the soya bean following a maize crop.

Closer investigation has, however, showed that this is unlikely. Roughly the same amount of nitrogen that is fixed by soya bean is removed by the grain. Increases in the soil's residual nitrogen after soya bean are usually too small to explain maize yield improvements. Some results even showed that soya bean can decrease the amount of residual nitrogen in the soil.

The yield of mono-cultured maize is often lower than that of maize preceded

by a soya bean crop, no matter the amount of fertiliser nitrogen applied. This indicates that something else aside from nitrogen is causing the yield increase of soya bean rotated maize.

Improved efficiency

Several possible explanations, some with supporting evidence, have been presented. Among them are the carry-over of soil moisture from the soya bean to the follow-up maize crop, an improvement of the soil's physical properties, a decrease or increase in growth suppressing or promoting substances respectively, and a decrease in disease pressure.

Decreases in maize root diseases probably also play a role in our environment. According to pathologists, root rot with varying intensity and extent can be found on nearly all maize plants annually. Root rot, which usually go unnoticed, damage and kill parts of the root system, especially during the reproductive phase. The root system is consequently restricted and the uptake of moisture and nutritional elements such as nitrogen is limited, eventually affecting the growth and yield.

Trials at Viljoenskroon showed that the root system of maize following soya bean measured after pollination was 16% larger than that of mono-cultured maize. This value agrees well with the yield increase found for soya bean rotated maize.

Generally, maize takes up only about 50% of applied nitrogen fertiliser. This efficiency of nitrogen uptake can, however, vary between 20 and 80%, depending on

The popular view is that soya bean leaves some of the symbiotic fixed nitrogen in the soil for the follow-up crop. Research, however, suggests otherwise.

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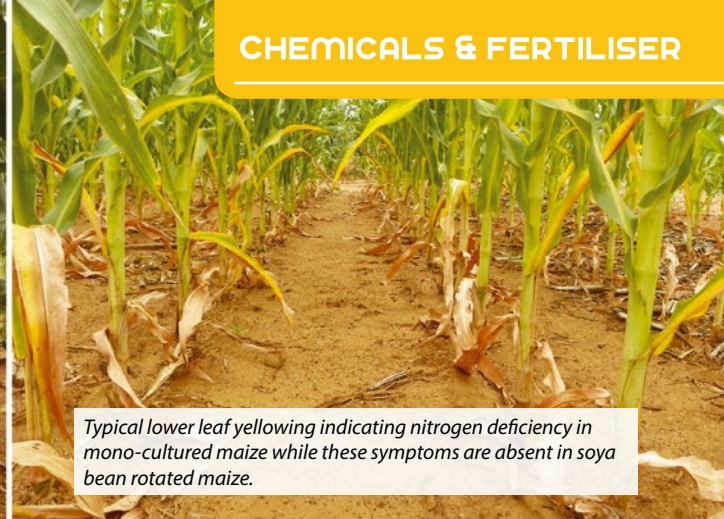
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Typical lower leaf yellowing indicating nitrogen deficiency in mono-cultured maize while these symptoms are absent in soya bean rotated maize.

circumstances. The enhanced performance of maize following soya beans is most probably the result of an increase in the efficiency of nitrogen uptake, through a larger and probably healthier and longer living root system rather than a larger nitrogen supply in the soil.

Nitrogen replacement value

In addition to the maize yield improvement, the nitrogen fertiliser application rate on maize following soya bean can be lowered, therefore improving the net return even further. The question is, with how much?

The answer is explained by *Figure 1*, where the yield response of maize grown in rotation with soya bean and in mono-culture is compared from trial work done on sandy soil near Viljoenskroon. Note that the term “nitrogen replacement value” of soya bean is used rather than the more popular “nitrogen credit” due to the crop’s nitrogen neutrality.

The yield response of maize in crop rotation with soya beans (upper curve) is different from that of mono-culture maize (lower curve) as shown in the figure. Points A and B represent yield at the economically optimum nitrogen fertiliser rate for maize in rotation and in mono-culture, respectively.

The yields at these points are 6,53t/ha for the soya bean rotated maize and 5,9t/ha for the mono-cultured maize, while the corresponding optimum nitrogen application rates are 54 and 95kg/ha respectively.

The nitrogen replacement value of soya beans in this case is 95 minus 54, which equals 41kg/ha. This value agrees with that found in the USA but is not applicable everywhere, as it can be influenced by various factors.

Indications exist, for example, that soil with a higher clay or organic material content will have a lower nitrogen replacement value than sandy soil with

a low organic material content, such as those on which the trial was done. Some evidence also indicates that the nitrogen replacement value will be smaller where no-till is practiced in comparison with conventional tillage.

No relationship

Contrary to what was previously thought, the nitrogen replacement values have no relationship with the yield of soya beans. Consequently, replacement values cannot be estimated from the yield of soya beans.

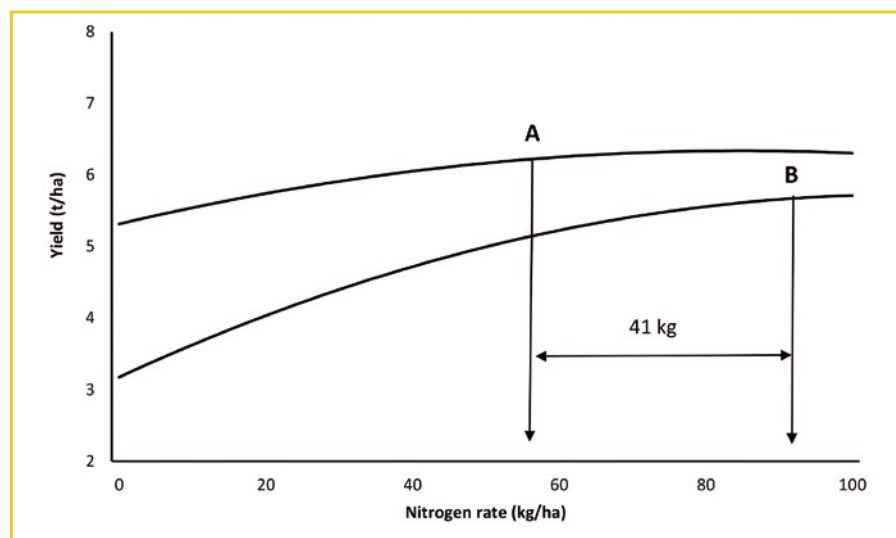
With the limited information currently available, it seems relatively safe to reduce the nitrogen fertilisation rate of mono-cultured maize on sandy soil, with 20 to 30kg/ha for maize following a soya bean crop.

Maize can thus benefit in two ways from the preceding soya bean crop. Firstly, by the yield enhancement which is often present and secondly from the saving on nitrogen fertiliser. To take advantage of these benefits, soya bean should be followed by a non-leguminous crop such as maize rather than other dicotyledonous crops such as sunflower, with which it has several diseases in common.

Results suggest, against the popular impression, that soya bean does not add nitrogen to the soil but rather improves the nutrient uptake efficiency of follow-up crops such as maize. Due to this improved efficiency, the application rate of nitrogen fertiliser on the following maize crop can be significantly reduced.

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Figure 1: The yield response curves of soya bean rotated and mono-cultured maize with points A and B indicating their respective optimum nitrogen application rates.



GLYPHOSATE

is a miraculous molecule

By Dr Charlie Reinhardt

The world's best-seller and most widely used herbicide has turned 40! Let us applaud this 'one in 100 years' herbicide for not only its unique herbicidal efficacy, but also for the way in which it revolutionised crop production on a global scale.

Glyphosate's pivotal role in the success of conservation agriculture, in particular the advent and uptake of reduced tillage practices, cannot be extolled enough. This unique herbicide not only made crop production more profitable, but concomitantly reduced human-footprint pressure on the environment through soil and water conservation that accrued from reduced tillage.

Glyphosate is the best-known inhibitor of amino acid biosynthesis in plants. The target enzyme of glyphosate is EPSPS, the penultimate enzyme in the shikimate pathway. This pathway produces critically

important compounds that drive several key life processes in plants.

Perennial weed control

Glyphosate can be considered as a non-selective herbicide, which implies that it can kill all plant species. Exceptions are plants that can withstand glyphosate, such as glyphosate-resistant weeds and crops that have been engineered to be glyphosate-tolerant.

The remarkable efficacy of glyphosate can be attributed to its high target-site activity, efficient translocation within plants and accumulation in meristems (tissues where growth is most rapid). These attributes combined make glyphosate an

excellent choice for perennial weed control and the management of 'hard-to-control' weeds.

Glyphosate only affects plants by making contact with live, green foliage and green bark. Its residual activity in soil and water is negligible to absent due to rapid bonding of the molecule to soil colloids, and because predation by microbes rapidly degrades this herbicide to the benign elements C (carbon), H (hydrogen), O (oxygen), N (nitrogen) and P (phosphorus).

Claimed negative effects

Reports that from time to time stir up sensation and emotions on the so-called 'disadvantages' of glyphosate, typically fail to prove the practical relevance of research which is often restricted to laboratories. Sorely lacking in such superficial investigations is the linking of claimed negative effects with the relatively low number of glyphosate molecules that actually can interact with soil, water, atmosphere, fauna and flora.

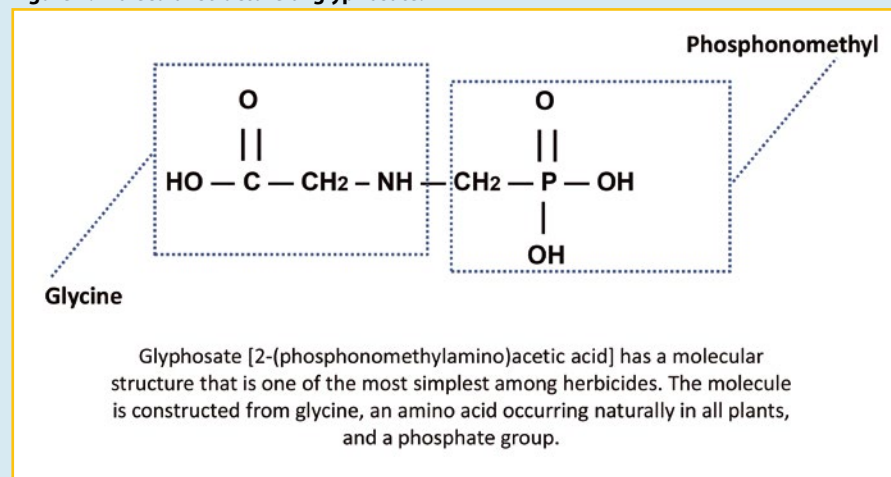
Simply put, the dilution effect of the environment on glyphosate at the dosages and frequency it is used at contradicts claims that are often based on findings obtained with impractical dosages under laboratory conditions.

In a highly acclaimed review article,



A view of Villa Crop Protection's 'Answer plots' site in the Delmas district.

Figure 1: Molecular structure of glyphosate.



Duke *et al.* (2012) concluded that, despite there being contradicting research findings on the role of glyphosate in the promotion of plant diseases and nutritional imbalances, the preponderance of studies has found that such effects, if they exist, have low incidence, are transient, and do not have appreciable effects on crop yield.

Coffee and wood smoke

Space does not allow elaboration on recent sensational claims in the press about glyphosate being a carcinogenic compound. Suffice to say these reports failed to mention that glyphosate has been placed in the same category as coffee and wood smoke by the International Agency for Research on Cancer (IARC).

Here follows the best possible unbiased perspective on this issue: "European Food Safety Authority (EFSA) has today (12 November 2015) published the European Union's peer review of the active substance glyphosate. The report concludes that glyphosate 'is unlikely to pose a carcinogenic hazard to humans'. This is a direct contradiction to the International Agency for Research on Cancer (IARC), which classified glyphosate as 'probably' carcinogenic to humans in March 2015."

Contradictory research findings on glyphosate sensitivity of rhizobacteria

symbionts of soya bean appeared soon after the commercial release of Roundup Ready™ soya beans in 1996. Concerns were that the possible sensitivity of rhizobacteria could interfere with nodulation and nitrogen fixation.

In an in-depth study, Reddy *et al.* (2000) reported non-significant effects of glyphosate on nodulation, chlorophyll content and biomass accumulation of soya bean cultivars. Their findings showed that glyphosate treatment of the legume host may cause transient inhibition of certain strains of rhizobacteria, without significant effects on nodulation, nitrogen fixation and crop yield.

Resistant to glyphosate

To date, there are 462 unique cases of weeds (248 species) reported to be resistant to various herbicides (Heap, 2016). The first case of resistance to glyphosate was reported for *Lolium rigidum* in Australia in 1996, about 20 years after glyphosate appeared on the market. Of the 248 weed species currently listed as resistant to various herbicides, 32 have been found to be glyphosate-resistant.

Although 20 of the glyphosate-resistant types also occur in South Africa, resistance to glyphosate has been proven for only three, namely rye grass (*Lolium* spp), small-

leaf plantain (*Plantago lanceolata*) and flax-leaf fleabane (*Conyza bonariensis*). Important to note is that although all three cases have been confirmed only in the Western Cape, these weeds occur throughout South Africa.

The growing popularity of reduced tillage in the summer rainfall region has created ideal conditions for the development of herbicide resistance, through reduced or zero tillage, which eliminates mechanical weed control as a management tool, and over-reliance on, or over-use of, highly active herbicides such as glyphosate.

Fundamental to effective resistance management strategies is preventing weeds from producing seed, year round, and the use of multiple herbicide mechanisms of action, preferably in the form of flexible tank mixtures.

Weed resistance to herbicides is a research focus at the University of Pretoria, with Dr Charlie Reinhardt as the project leader.

For more information, contact Dr Charlie Reinhardt, dean of Villa Academy and extraordinary professor of weed science at the University of Pretoria, on 011 396 2233 or email creinhardt@villaacademy.co.za, or visit the website <http://www.up.ac.za/sahri>.

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Weed resistance to herbicides is a research focus at the University of Pretoria, with Dr Charlie Reinhardt as project leader. To learn more, visit the website www.up.ac.za/sahri. Dr Reinhardt is an extraordinary professor of weed science at the University of Pretoria and dean of the Villa Academy. Contact him on 011 396 2233 or email creinhardt@villaacademy.co.za, or visit www.villaacademy.co.za for more information.

NUTRITIONAL VALUE

of sunflower meal

The nutritional value of sunflower meal has an effect on performance, digestive enzyme activity, organ weight and histological alterations of the intestinal villi of broiler chickens.

Sunflower (*Helianthus annuus*) is an oilseed cultivated worldwide for oil extraction because of its great capability for adaptation to different climate and soil conditions. The by-product rendered by the oil industry, sunflower meal (SFM), is used as an alternative source of protein in animal and poultry nutrition. Its CP content, which ranges from 29 to 45%, depends on the dehulling and oil extraction process, in inverse relation to the fibre content (32 to 14% of the CF).

The use of SFM in broiler diets has been restricted to less than 150g/kg because of its high fibre, low energy, and lysine contents. Several authors have shown that supplementing limiting amino acids and oil to SFM-based diets can increase SFM inclusion levels up to 200 to 350g/kg without affecting broiler performance (Arija *et al.* and Suresh *et al.*).

No adverse effects

No adverse effects are reported from including up to 50 and 120g/kg, respectively, of sunflower seed hulls in broiler diets. Therefore, on the basis of data from the literature, it is possible to incorporate greater concentrations of SFM in broiler diets.



Because many studies have resulted in contradictory conclusions and, to our knowledge, no information is available on the use of SFM on digestive enzyme activities and histological alterations of the intestinal villi of broiler chickens, the current study was designed with the following objectives:

- To determine the ME content of SFM (cultivated in the north of Iran).
- To evaluate the effects of increasing levels of SFM on performance, blood parameters, carcass traits, digestive enzyme activities and histological alterations of the intestinal villi of broiler chickens.

Values for CP and EE were similar to those reported by Zatari and Sell, whereas CF content was higher, probably because of the processing conditions during the extraction procedure. Additionally, hull content, preconditioning, dehulling, cooking and solvent extractions determined the subsequent nutritive value of SFM.

An increasing inclusion rate of SFM decreased the AMEn of the diets. To further assess this trend, the dietary AMEn values were regressed against the inclusion level of SFM by using linear and quadratic models. The linear component was highly significant, whereas the quadratic component was not significant.

AMEn data

Therefore, the energy contribution of SFM to the diets was additive, and the inclusion rate did not alter the use of other dietary ingredients. By using the AMEn values determined for the basal diet and the basal diet containing a given amount of SFM, the AMEn (kcal/kg) of this feed was calculated by the difference.

The AMEn values obtained for diets in the experiment reported here were regressed on the level of SFM in the basal diet to estimate the AMEn content in SFM. The equation derived from fitting a linear model was as follows: $y = 2,957 - 1,735x$; $R^2 = 0,736$ ($P < 0,05$). An estimate

of the AMEn of SFM was obtained by extrapolation from the equation, where 1 000g/kg of SFM in the diet gave a value of 1,219kcal/kg.

The low value of AMEn of SFM in this study may be related to CF content. The cell walls of grains and oilseeds can serve as a physical barrier for digestive enzymes and nutrients contained within the cells, and can either entirely prevent or delay digestion of nutrients in the last part of the duodenum.

Not only the total fibre content, but also the physical and chemical structure of fibrous polysaccharides and their anatomical arrangement within each specific ingredient, can affect the accessibility of enzymes for the digestion of nutrients.

Protein and many other nutrients are "encapsulated" to variable degrees inside fibrous structures, and they remain less available for digestion by the proteases and other endogenous enzymes of the bird. These effects may decrease the AMEn value of seed meals. In our experiment, the CF of the diets increased with an increasing level of SFM. Thus, the AMEn value of the diets decreased. Mandal *et al.* determined values of 1,458, 1,458, and 1,481kcal/kg of AMEn in SFM for cockerels, guinea fowl and quail, respectively.

Growth performance

The FI increased quadratically ($P < 0,01$) with increasing levels of dietary SFM during the grower (22 to 42 days) and finisher (43 to 49 days) periods, as well as overall. In addition, FI tended to increase quadratically ($P = 0,0673$) at the starter phase with the treatments. The BWG responded quadratically ($P < 0,01$) with increasing levels of dietary SFM.

In the grower and finisher phases, FCR improved quadratically with increasing levels of SFM ($P < 0,01$). The improved performance of broilers fed lower levels of SFM compared with the performance of control birds was related to cellulose content of the diet. It has been shown that SFM has 220g/kg of cellulose.

These results are in accordance with the results of Rama Rao *et al.*, who showed that FI was significantly higher in broilers

fed 170 and 340g of SFM/kg of the diet compared with those fed the basal diet, and BWG was significantly higher for chickens fed 340g of SFM/kg of the diet. They also determined that the total replacement of soya bean meal with SFM resulted in similar FI, but a significant decrease in BWG.

The demand for energy and protein for gut maintenance is higher compared with other organs.

This is in agreement with the results of Ibrahim and Zubeir, who reported that a high-fibre (230,5g of CF) SFM could be included at up to 300g/kg of broiler diet with no adverse effects on growth rate or FE. This confirms the findings of Jacob *et al.*, who showed that replacing a portion (80g/kg) of imported soya bean meal in broiler diets with SFM had no significant effect on growth rate or FE.

Zatari and Sell reported that up to 100g/kg of SFM can be used in diets without adversely affecting growth or FCR up to seven weeks of age in broiler chickens. In addition, Elangovan *et al.* showed that BWG, FI, nutrient retention and carcass characteristics of quails did not vary significantly ($P > 0,05$) when SFM was increased in the diets.

Digestive enzyme activity

The activities of neither protease nor α -amylase in chick digesta were significantly affected. In the literature reviewed, no information was found on the determination of digestive enzyme activities of broilers fed SFM. In our experiment, only α -amylase actified by treatments.

Increasing dietary fibre content can increase the production of saliva, gastric juices, hydrochloric acid and pepsin. Graham and Aman noted a similar increase in pancreatic flow, accompanied by a closely related increase in electrolyte production.

Thus, activities of lipases and amylases may increase. The presence of chlorogenic acid (a group of phenolic compounds) in amounts of 10 to 40g/kg in the sunflower kernel could justify the negative effect on the growth of the birds.

In the literature reviewed, information was found on the determination of digestive enzyme activity of broilers fed SFM. In our experiment, the linear decrease ($P = 0,12$) in protease activity may have been caused by the presence of chlorogenic acid because this material has been shown to inhibit the activity of trypsin by 30%.

Organ weight

There were no effects ($P > 0,01$) of increasing levels of SFM on relative weights (g/kg of BW) of the breast and abdominal fat. Similarly, Reddy, Ramesh Kumar and Rama Rao *et al.* reported no effect of feeding SFM on the relative weights of breast and abdominal fat in broilers. Relative weights of the thigh and liver were quadratically ($P < 0,01$) increased and decreased, respectively ($P < 0,01$), as SFM levels increased in the diets.

Likewise, relative weights of the gastrointestinal tract and gizzard were linearly increased ($P < 0,01$) as dietary levels of SFM increased. The higher levels of fibre in the SFM-based diets might be responsible for hypertrophy of these organs, as was evident in previous studies in broilers on high-fibre diets.

Blood parameters

Cholesterol, calcium and protein concentrations did not demonstrate a linear or quadratic response to increasing levels of SFM. However, glucose and phosphorous concentrations linearly increased as the dietary SFM levels increased ($P < 0,05$). Triglyceride and HDL concentrations increased quadratically ($P < 0,01$) with an increasing level of SFM.

In addition, the LDL concentration decreased quadratically as the dietary levels of SFM increased ($P < 0,01$). However, there was no increase in alkaline phosphatase activity, either linear or quadratic, in response to increasing levels of SFM ($P > 0,05$).

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Because a higher dietary fibre content is known to reduce dietary fat utilisation by deconjugation of bile salts, which might have reduced fat absorption through the gut, the body fat (liver fat) might have been utilised for the metabolic needs and thereby increased the HDL concentration in serum.

The reduced triglyceride concentration in the serum of broilers fed a higher level of SFM (210g/kg of diet) also supports this hypothesis. A similar trend was observed in the experiments of Rama Rao *et al.*, in which the serum concentrations of LDL and triglycerides decreased in birds receiving high-fibre diets.

Intestinal morphology

A quadratic response was observed for villus heights of the duodenum and jejunum with increasing levels of SFM ($P < 0.01$). Villus height of the ileum did not exhibit a linear or quadratic response. A quadratic response to increasing levels of dietary SFM was observed for crypt depth of the duodenum and jejunum ($P < 0.01$). However, no effect on crypt depth of the ileum, either linear or quadratic, was due to increasing levels of SFM.

A quadratic response to increasing levels of SFM was observed for villus width of the duodenum ($P < 0.01$). With increasing levels of SFM, villus width of the jejunum decreased linearly ($P < 0.05$). The villus height-to-crypt depth ratios of the duodenum and jejunum responded quadratically to increasing levels of SFM ($P < 0.01$).

However, this parameter was not significant for the ileum. In the literature reviewed, no evidence was found of the effect of SFM on the histology of broiler chickens. The structure of the intestinal mucosa can reveal some information on gut health. Stressors that are present in the digesta can lead to relatively rapid changes in the intestinal mucosa because of the close proximity of the intestinal contents to the mucosal surface.

One possible hypothesis about changes in intestinal morphology, such as shorter villi and deeper crypts, has been associated with the presence of toxins. Shortening of the villus decreases the surface area for nutrient absorption. The crypt can be regarded as a villus factory, and a large

crypt indicates fast tissue turnover and a high demand for new tissue.

The demand for energy and protein for gut maintenance is higher compared with other organs. A fast-growing broiler devotes about 12% of the newly synthesised protein to the digestive tract. Any additional tissue turnover will increase nutrient requirements for maintenance and will therefore lower the efficiency of the bird. A shortening of the villus and a large crypt can lead to poor nutrient absorption, increased secretion in the gastrointestinal tract, diarrhoea, reduced disease resistance and lower overall performance.

Renewal of the villus

In the present study, the villus heights of the duodenum and jejunum were quadratically affected as the dietary levels of SFM increased. These results are in accordance with the results for performance. There was an improvement in the performance of broiler chickens fed SFM up to 140g/kg of the diet.

It is possible to incorporate greater concentrations of SFM in broiler diets.

However, the performance parameters of birds fed a high level of SFM in the diet (210g/kg) decreased. The crypt is the area where stem cells divide to permit renewal of the villus – a large crypt indicates fast tissue turnover and a high demand for new tissue.

In previous studies, anti-nutritional factors in SBM, such as trypsin inhibitor (TI) and soya bean globulins, had an adverse effect on the morphology and function of the digestive tract in animals. It is known that TI interfered with the proper functioning of trypsin and chymotrypsin, leading to abnormal intestinal morphology. Zarkadas and Wiseman demonstrated a negative correlation between the TI level in soya bean meal and villus height in weaned piglets.

Additionally, many have suggested that the morphological changes observed

in young animals and poultry are due to transient hypersensitivity to antigenic components of soya bean diets. Antigenic materials in soya bean proteins are associated with villus atrophy, increased crypt cell mitosis and crypt hyperplasia, and thereby cause malabsorption syndrome. Therefore, in our experiment, histological alterations may result from some anti-nutritional factors, such as chlorogenic acid, in SFM.

In addition, changes in small intestinal mucosa may be caused indirectly by the viscous characteristics of non-starch polysaccharides. Malathi and Devegowda determined that SFM contains 110,01, 220,67, 40,92 and 410,34g/kg of pentosan, cellulose, pectin, and non-starch polysaccharides, respectively. Pectin is a non-starch polysaccharide that is not readily digested by the endogenous gut enzymes of broilers.

Sakata demonstrated that an increase in bacterial activity in the gastrointestinal tract was associated with a change in the morphology of the gut wall. They attributed this to the presence of the high level of pectin found in dates.

Conclusions and applications

- The AMEn of local SFM (cultivated in the north of Iran) obtained was 1,219kcal/kg.
- Increasing levels of SFM in the diet quadratically affected FI (in the grower and finisher phases), but BWG (in the starter and grower phases) and FCR (in the grower phase) were linearly affected.
- A quadratic response was observed in the relative weights of the thigh and liver with increasing levels of SFM.
- The triglyceride and HDL concentrations increased and the LDL concentration decreased as the dietary levels of SFM increased.
- Sunflower meal can be used in broiler chick diets at levels up to 140g/kg, and its fibre content had no significant effect on nutrient intake.

Article published courtesy of the Poultry Science Association Inc. This is shortened version of the study report. For the full report visit <http://japr.oxfordjournals.org/content/21/2/293>.

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LARGE INTERNATIONAL STOCK vs local drought pressure

International oilseed markets were in a difficult space over the last year. This was due to the low availability of vegetable oils.

A global production deficit is subsequently developing for vegetable oils in the current production season. According to international traders, the production growth of vegetable oils changed from 4,1 million tons last year to 2,1 million tons in the current production year.

Palm oil and palm kernel oil have the slowest growth, however, various other vegetables such as rapeseed oil, cotton oil and coconut oil also showed slow growth. This changes the demand to seed oils such as soya and sunflowers. However, this additional demand is still not enough to decrease the high supplies in the oilseeds markets.

Soya beans

Expectations are that the current South American crop will move close to the previous year's levels. The overall world supplies of soya beans are abundant and will cover prospective demand, and even have record-ending stocks. However, there are still concerns regarding wet conditions in Brazil which are delaying harvesting. Argentina is experiencing dry conditions, which can lead to reduced yields.

The expected high-ending stocks are overshadowing the last few constraints within the South American market and prices are expected to come under additional pressure in the near to medium term, once these supplies start to move into the export market.

Table 1: World supply and demand of soya beans (million tons).

	Jan/Aug		
	2015/16	2014/15	Apr 13
Opening stock	87,11	64,75	59,54
Production	317,08	320,2	282,02
Total supply	404,19	384,95	341,56
Crush	273,92	257,6	238,81
Other usage	42,05	40,24	38,00
Ending stock	88,22	87,11	64,75

Source: Oil World

Sunflower seeds

World sunflower seed supplies are ample and the lower levels of vegetable oils created a spike in the demand for sunflower oil. This in turn led to increased levels of crushing within the sunflower market. However, these levels are still not high enough to put pressure on supplies.

The forecast for the current world production season (Jan/Aug) in terms of ending stocks is 2,63 million tons, which is similar to the 2,62 million tons of the previous seasons. Total supplies were very high, but the high supplies were dampened by an increase in crushing, which balanced total supplies at 2,63 million tons. Crushing increased from 22,57 million tons to 23,33 million tons during the same production period.

Table 2: World supply and demand of sunflowers (million tons).

	Jan/Aug		
	2016	2015	2014
Opening stock	25,1	24,35	26,69
Production	3,89	3,82	3,81
Total supply	28,99	28,17	30,5
Crush	23,33	28,17	30,5
Other usage	3,03	2,98	2,91
Ending stock	2,63	2,62	2,81

Source: Oil World

Canola stocks

Global end stocks of canola decreased to 5,2 million tons, which is almost a million tons lower than the previous production season and almost 2,5 million tons less than the 2013/14 production season. Important variables to monitor over the short term are Canadian crushing volumes and farm sales. Canada is expected to crush more, which means that farmers will have an incentive to sell more.

In short, the international market for the most popular oilseeds is currently in a very good ending stock position. This increase in supply will cause some price pressure on oilseeds prices and more specifically on meal prices, since the demand for oil is currently very high.

A decreasing trend in meal prices will also put pressure on soya bean crushing margins, necessitating oil to shoulder an increasing share of the joint product value. Thus it would be very important to evaluate the derived prices in the current production season.

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Table 3: Most important oilseed prices (US\$/ton).

Product	Jan 16	Jan 15	% change
Soya beans (US CIF Rotterdam)	367	436	-16
Soya beans (Brazil)	374	436	-14
Sunflower seed (EU)	465	438	6
Groundnuts (US 40/50)	1 175	1 350	-13
Palm oil (Malaysia)	550	652	-16
Soya oil (US)	674	794	-15
Sunflower oil (Argentina)	746	852	-12
Soya meal (Argentina)	333	451	-26
Fishmeal (Peru)	1 508	1 933	-22
Rand/\$	16,39	11,57	42

Source: Reserve Bank and Oil World

South African market

The current production season is a difficult one due to drought conditions. The drought caused numerous uncertainties within the marketplace and these uncertainties, in turn, are creating volatile price movements. This is further exacerbated by the current volatile South African economy.

Despite slow growth, there was a drastic devaluation of the exchange rate due to various factors such as the restructuring of global markets, political concerns in South Africa, the local investment environment and the possibility of a downgrading to credit junk status (Figure 1). These changes in the financial market also have an effect on commodity prices due to changes in import and export parity prices.

Figure 1: The increase in the exchange rate (R/\$).

Source: SA Reserve Bank

According to a preliminary crop estimate, South Africa will produce 27% less soya beans, 6% less sunflower seeds and 48% less groundnuts in the coming season. This is mainly due to the drought.

The majority of farmers were unable to plant maize or soya beans, and therefore opted to plant alternative crops such as sunflowers. Hectares under sunflowers increased from 576 000ha to 617 000ha. However, yields are expected to be lower due to the drought, hence the decrease in production.

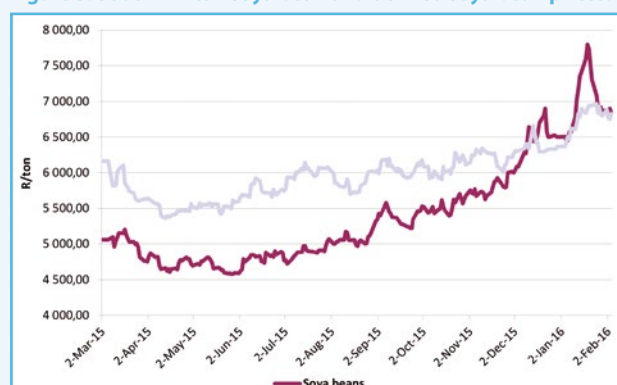
Stock levels in the South African oilseeds market will be under pressure. Higher imports will therefore be a reality. However, the possibility of a decrease in international meal prices and high local seed prices, could see local processors switching from seed imports to meal imports, as this will

enable better crushing margins.

The effect of the price movements between derived and seed prices are illustrated in Figures 2 and 3. It is still early in the season and yields can easily change over the next few months. These changes will have a direct impact on prices.

Figure 2: South African sunflower and derived sunflower prices.

Source: GrainSA

Figure 3: South African soya bean and derived soya bean prices.

Source: GrainSA

In a nutshell

While international oilseed prices are under pressure due to high stock levels and good production figures, the opposite is true for South Africa. The drought has led to limited production and pressure on stocks.

In the next two months it will be very important to monitor the following:

- International production, more specifically in the southern hemisphere.
- The local economy, more specifically the exchange rate.
- Rain and frost predictions in South Africa.
- Meal and seed import figures.
- Derived prices vs Safex prices. 📊

DROUGHT AND THE WEATHER: 2015/2016 in review

This past summer South Africa was in the grips of one of the worst El Niño effects to date. This means that ocean surface temperatures in the Niño 3,4 region over the eastern equatorial Pacific increased to as high as 28,8°C in October 2015. With ocean surface temperature ranges in the Niño 3,4 region that compare well with the occurrence of droughts in South Africa, there is reason for concern.

Does this, however, mean that we should be prepared for one of the worst droughts in living memory? The answer is no, because more extreme Niño 3,4 ocean surface temperatures of as high as 29,1°C also occurred in October 1997. It is insightful that the pre-summer rainfall during the 1997/1998 summer season, however, was only slightly below normal, while the post-summer rainfall was above normal and South Africa experienced yet another good harvest year. It is therefore not necessarily the size of an El Niño or 3,4 Niño ocean surface temperatures that can be equated to the magnitude of South African droughts.

Moisture from the Indian Ocean

It is important to remember that most of the moisture that causes summer rainfall over South Africa originates from the Indian Ocean, and this moisture from the ocean can only reach the African continent via onshore air currents. Onshore flow of rain moisture is then spread across Southern Africa by continental flow patterns created by differences in surface and upper air pressure patterns. For example, more rain moisture flows to

South Africa from the equator if the pressure over the western parts of the country is lower compared to higher pressures in the east.

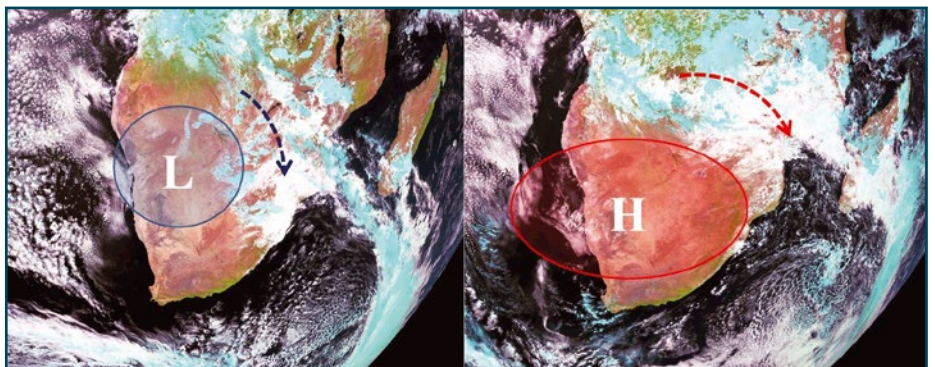
In contrast, relatively less rain moisture flows to the summer rainfall region if the air pressure on the west begins to rise, with the result that the west-east air pressure gradient and the flow of air from the humid equatorial regions, weaken. Cloud bands then move east so that summer rainfall occurs over the Mozambique Channel or Indian Ocean. The latter are typical conditions that occur during dry years.

This is what took place from October 2015. High air pressure has mostly come in over the interior from the Atlantic Ocean. These higher air pressure patterns have also accompanied large volumes of air that descend from the upper atmosphere, and thus not only suppressed rainfall but also compressed to cause heat waves.

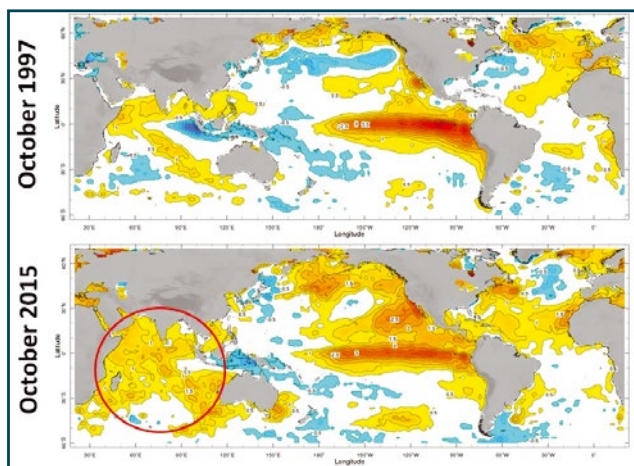
Extreme summer temperatures

What made the 2015 early summer season exceptional, is that several extreme temperatures were measured. During the heat wave conditions that commenced on 7 November 2015, the highest maximum temperatures on record were respectively measured on 9, 10, 11 and 12 November 2015 by 16, 15, 31 and 12 weather stations of the South African Weather Service respectively. These heat wave conditions were caused by a strongly developed high-pressure system over South Africa.

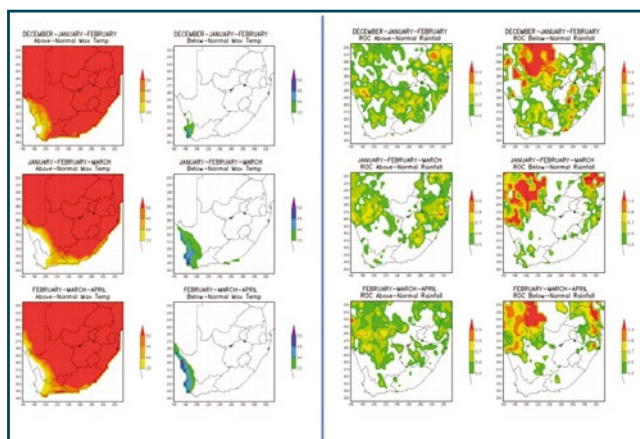
However, why was the 2015/2016 early summer so much drier than the



Lower air pressure over the western parts of South Africa can cause rain moisture from the equatorial regions to blow towards the eastern parts of the country (left), while higher air pressure from the west can result in dry conditions (right).



The biggest difference between the extreme El Niño of 1997/1998 and that of 2015/2016 is that warm water occurs over virtually the entire Indian Ocean in 2015/2016.



The percentage probability of above-normal rainfall expectations for the period December-January-February, January-February-March and February-March-April (far left), and the corresponding percentage probability of below-normal rainfall expectations (second from the left). The corresponding skill of the forecast is given to the right – note that forecasts in the white areas can simply be attributed to chance. (Source: South African Weather Service)

1997/1998 early summer, while the most extreme El Niño conditions in fact occurred in 1997/1998? The reason for this can probably be attributed to the high ocean surface temperatures which occurred in the Indian Ocean of late. In harmony with El Niño ocean surface temperatures, large areas of both below- and above-normal ocean surface temperatures in the Indian Ocean played a key role in the creation of onshore air currents that blew rain moisture to the African continent, which is what occurred during the 1997/1998 El Niño year.

During the 2015/2016 summer season, ocean surface temperatures across the entire Indian Ocean were, however,

that it is not only El Niño ocean surface temperatures that influence rainfall over South Africa, but rather ocean surface temperatures across the entire globe. This is also why the latest seasonal rainfall forecasts are compiled by making use of complex coupled ocean-atmosphere models, which take into account the impact of global ocean surface temperatures on the earth's atmospheric circulation when this system is simulated.

The seasonal rainfall and temperature forecasts issued by the South African Weather Service are a compilation of forecasts from various ocean-atmosphere models. Historical model results are then also compared with historical observations

abnormally warm. A warm Indian Ocean can weaken the Indian high pressure cell, which in turn can weaken easterly winds to the African continent. In addition, the warm sea water will encourage evaporation, lifting and rain over the ocean, which can even cause rain moisture to be drawn away from the African continent.

The latter can also lead to higher air pressure being pulled in from the west over South Africa, something which can result in typical heat wave conditions. Were these conditions making the 2015/16 summer season so extraordinary? Only time and research will provide answers to these questions in future.

Ocean surface temperatures

An important lesson that we can learn from this, is

to determine a forecast's skill at a specific point or across a region.

It is essential to take this skill into account when a forecast is analysed, because there may be regions where a forecast may indeed occur, but where the skill is so poor that the possibility of the forecast occurring can simply be attributed to chance.

Dry and hot weather conditions

The latest seasonal forecasts suggested that the remaining summer season would be dry and warm (until March 2016). In addition to these dry conditions that were forecast, there was a very strong indication, associated with a significant model skill, that maximum temperatures would be significantly higher than normal in January, February and March 2016. These drier and warmer conditions were expected to be out of the ordinary, in terms of the season and especially the midsummer period.

What made the 2015 early summer season exceptional, is that several extreme temperatures were measured.

The ongoing dry conditions, as well as the expectation for extremely hot conditions for the remainder of the summer season, may worsen the current dry conditions. It is strongly recommended that medium- and short-term weather forecasts should be monitored for early detection of the conditions that may exacerbate or alleviate the drought.

Prof Hannes Rautenbach is involved at the Laboratory for Atmospheric Studies (LAS), Meteorological Unit at the Department of Geography, Geoinformatics and Meteorology of the University of Pretoria. For more information, contact him on 082 480 6579 or hannes.rautenbach@up.ac.za.

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DOUBLE-SIEVE GRADING METHOD

of soya beans for the 2016/17 season

The Directorate Food Safety and Quality Assurance of the Department of Agriculture, Forestry and Fisheries (DAFF) has granted the soya bean industry an extension of the dispensation on the grading of soya beans for the 2016 season. This dispensation means that the grading of soya beans can be done according to the double-sieve grading method introduced during the 2015 season.

The dispensation is relevant to the new regulations for grading soya bean on a clean basis, as published by DAFF in June 2014. The double-sieve method allows for a more objective and scientific manner to grade soya beans. It is also faster, more accurate and less tedious for the grain grader, without compromising the position of either producers or agribusiness role-players in the value chain.

Amendment of inspection methods

The amendment of the inspection methods includes:

- A 1,8mm slotted sieve will be used in combination with the 4,75mm round-hole sieve for the determination of

foreign matter in soya beans.

- The number of sieve strokes must be increased from 20 to 30, and the prescribed 30 strokes must be completed within 30 to 35 seconds.
- All matter other than soya beans, loose seed coats and pods of soya beans as well as glass, coal, dung, sclerotinia and metal that pass through the 1,8mm slotted sieve during the sieving process is considered foreign matter.

Amendments to the grading table mean the maximum percentage foreign matter is increased from 4% to 5%. As a result of this, the maximum percentage for the combination of foreign matter and sclerotinia is increased from 6% to 7%.

Technical aspects of grading

Definitions

The 1,8mm slotted sieve, which is also used for the grading of wheat, sunflower seed and sorghum, will be used in combination with the 4,75mm round-hole sieve for the determination of foreign matter. The definition of the 1,8mm slotted sieve is:

A 1,8mm slotted sieve is a slotted sieve:

- With a flat bottom of metal sheet of 1mm thickness with apertures 12,7mm long and 1,8mm wide with rounded ends. The spacing between the slots in the same row must be 2,43mm wide and the spacing between the rows of slots must be 2mm wide. The slots must be alternately orientated with

a slot always opposite the solid

intersegment of the next row of slots.

- Of which the upper surface is smooth.
- With a round frame of suitable material with an inner diameter of between 300 and 310mm maximum and at least 50mm high.
- That fits onto a tray with a solid bottom and must be at least 20mm above the bottom of the tray.

The definition of foreign matter must also be amended to include the material that passes through the 1,8mm slotted sieve and the definition must read as follows:

Foreign matter means:

- All matter that passes through the 1,8mm slotted sieve during the sieving process.
- All matter that does not pass through the 1,8mm slotted sieve other than soya beans, glass, coal, manure, sclerotinia or metal, and loose seed coats of soya beans as well as pods.

Inspection methods

Amendment of inspection methods is necessary to reflect the amendments in the determination of foreign matter and soya beans, and pieces of soya beans that pass through the 4,75mm round-hole sieve. The number of strokes must be increased from 20 to 30 to be certain that all matter smaller than 1,8mm has the opportunity to pass through the sieve.

The percentage of other grain, sunflower seed, stones, sclerotinia and foreign matter in a consignment of soya beans



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Kort, Vinnige Groeiseisoenklas
Groep 4.4 en Groep 4.0

LS 6444R en LS 6240R

- *Wyd aanpasbaar
- *Uitstekende staanvermoë en uifers geskik vir nou rye
- *Goed aangepas vir droëland en besproeiing
- *Goeie peulhoogte vir 'n vinnige groeiklas
- *Uitstekende opbrengs potensiaal



Medium
Groeiseisoenklas
Groep 6.1

LS 6161R en LS 6261R

- *Smalblaar kultivars, goed aangepas vir droëland en besproeiing
- *Uitstekende staanvermoë
- *Wye aanpasbaarheid
- *Uitstekende opbrengs
- *Korter, regop groeiwyse

Groep 4.6 en Groep 4.8
Groeiseisoenklas

LS 6146R en LS 6248R

- *Wye aanpasbaarheid en goeie opbrengs vermoë
- *Goed aangepas in veral die koel en gematigde dele
- *Goeie staanvermoë en peulhoogte

Medium
Groeiseisoenklas
Groep 6.4

LS 6164R

- *Uitstekende agronomiese eienskappe
- *Baie goeie peulhoogte
- *Verkies gematigde tot warm gebiede

Groep 6.6
Groeiseisoenklas

LS 6466R

- *Baie goeie peulhoogte
- *Goed aangepas in gematigde en warm produksie gebiede

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shall be determined as follows:

- Obtain working samples of at least 200g from a representative sample of the consignment.
- Place the 1,8mm slotted sieve in the pan with the 4,75mm round-hole sieve on top. Place the sample on the 4,75mm round-hole sieve and screen the sample by moving the sieve 30 strokes away from and towards the operator of the sieve, in the same direction as the long axis of the slots of the 1,8mm sieve. Move the sieve, which rests on a table or other suitable smooth surface, 250mm to 460mm away from and towards the operator with each stroke. The prescribed 30 strokes must be completed within 30 to 35 seconds, provided that the screening process may also be performed in a container or an automatic sieving apparatus.
- Remove the foreign matter from both sieves by hand and add it to the foreign matter below the 1,8mm sieve in the pan, and determine the mass of the foreign matter. Remove all other grain, sunflower seed, stones and sclerotinia by hand from the working samples and determine the mass of the other grain, sunflower, seed, stones and sclerotinia separately.
- Express the respective masses thus determined as a percentage of the mass of the working sample concerned.
- Such percentage represents different percentages of other grain, sunflower seed, stones, sclerotinia and foreign matter in the consignment concerned.

Determining the percentages

The percentage of soya beans and pieces of soya beans which pass through the 4,75mm round-hole sieve shall be determined as follows:

- Determine the mass of the soya beans and pieces of soya beans that pass through the 4,75mm round-hole sieve and remain on top of the 1,8mm slotted sieve, which is free of other grain and sunflower seed, stones, sclerotinia and foreign matter have been removed, expressed as percentage of the mass of the working sample.

- Such percentage represents the percentage soya beans and pieces of soya beans in the consignment which passes through the 4,75mm round-hole sieve and not through a 1,8mm slotted sieve.

Amendments to the grading table mean the maximum percentage foreign matter is increased from 4% to 5%.

The percentage of defective soya beans shall be determined as follows:

- Obtain a working sample of at least 100g soya beans that remained on top of the 4,75mm round-hole sieve after the sieving action, which is free of other grain, sunflower seed, stones, sclerotinia and foreign matter, from the representative sample of the consignment.
- Sort the soya beans on the 4,75mm round-hole sieve so that the defective soya beans are retained.
- Determine the mass of the defective soya beans on the 4,75mm round-hole

sieve and express it as a percentage of the mass of the working sample concerned.

- Such percentage represents the percentage of defective soya beans in the consignment.

The percentage of soiled soya beans in a consignment of soya beans shall be determined as follows:

- Remove all soiled soya beans from the working sample obtained in Regulation 17(a) by hand and determine the mass thereof.
- Express the mass thus determined as a percentage of the mass of the working sample in Regulation 17(a) obtained.
- Such percentage represents the percentage of soiled soya beans in the consignment concerned.

Grading table

Adjustments to the grading table must also be done in the light of the additional material that passes through the 1,8mm slotted sieve that has become part of the foreign matter. The maximum percentage foreign matter is increased from 4% to 5%. As a result, the combination of foreign matter and sclerotinia is increased from 6% to 7%. The standards for the grading of soya beans are indicated in *Table 1*. 📌

Table 1: Standards for grades of soya beans.

Nature of deviation	Maximum % permissible deviation (m/m)
	Grade SB1
(a) Wet pods.	0,2%
(b) Foreign matter, including stones, other grain, sunflower seed and stones: Provided that such deviations are individually within the limits specified in items (c), (d) and (e).	5%
(c) Other grain.	0,5%
(d) Sunflower seed.	0,1%
(e) Stones.	1%
(f) Sclerotinia.	4%
(g) Soya beans and parts of soya beans above the 1,8mm slotted screen which pass through the 4,75mm round hole screen.	10%
(h) Defective soya beans on the 4,75mm round hole screen.	10%
(i) Soiled soya beans.	10%
(j) Deviations in (b) and (f) collectively: Provided that such deviations are individually within the limits of said items.	7%



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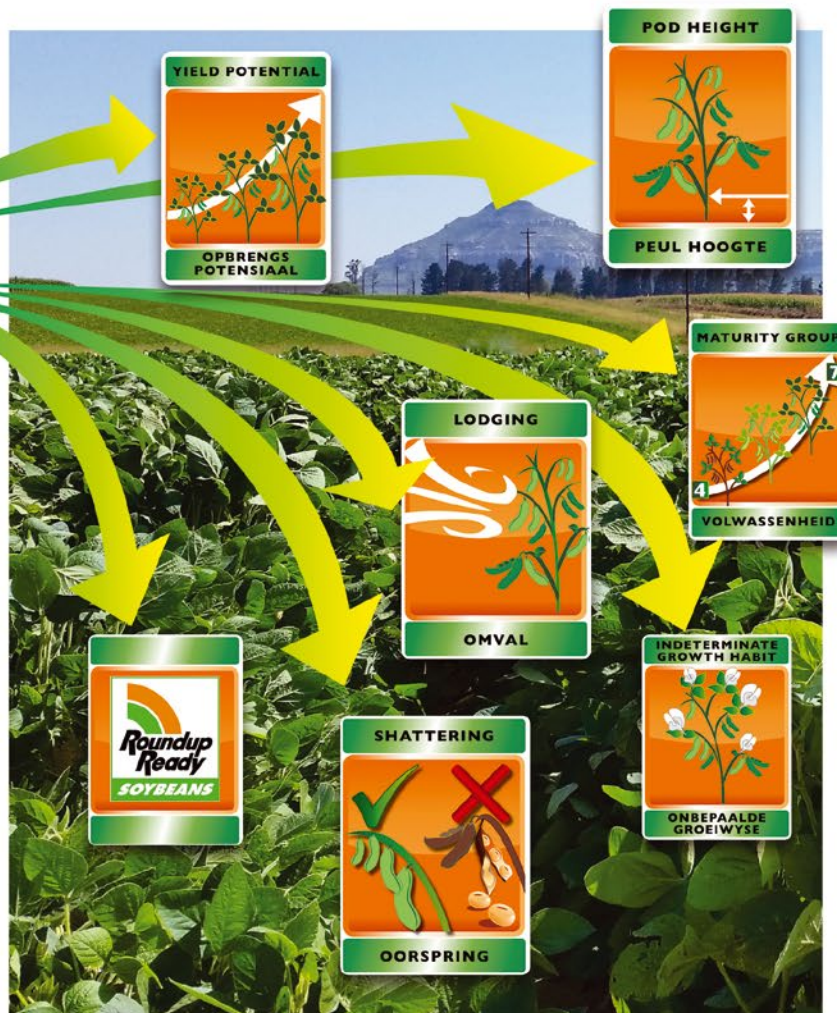
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