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OILSEEDS focus

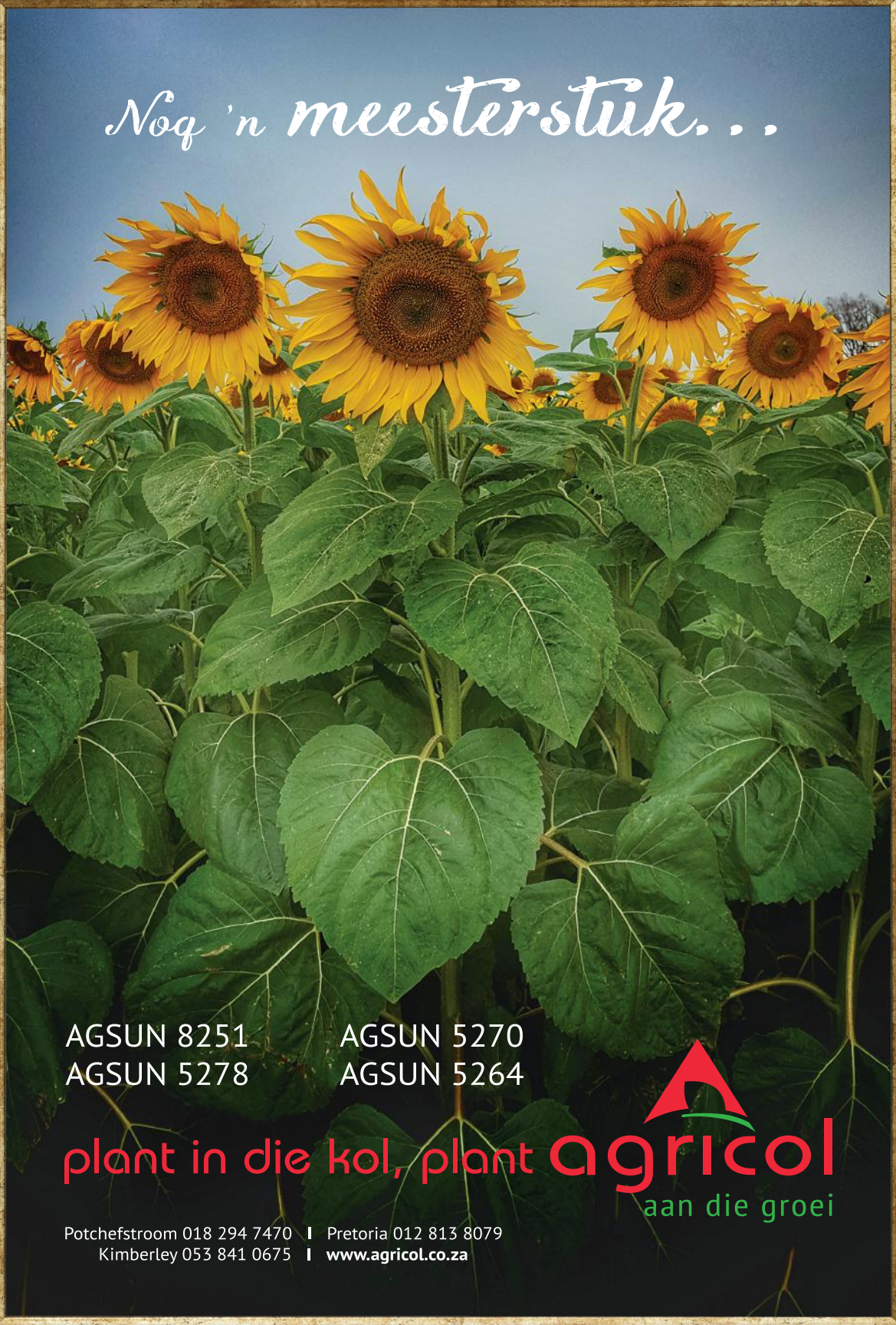
Protein Research Foundation • Oil & Protein Seeds Development Trust • Oilseeds Advisory Committee

Canola as a grazing crop

Satellites and crop estimates

Rate of nitrogen fertilisation

Developing farmer programmes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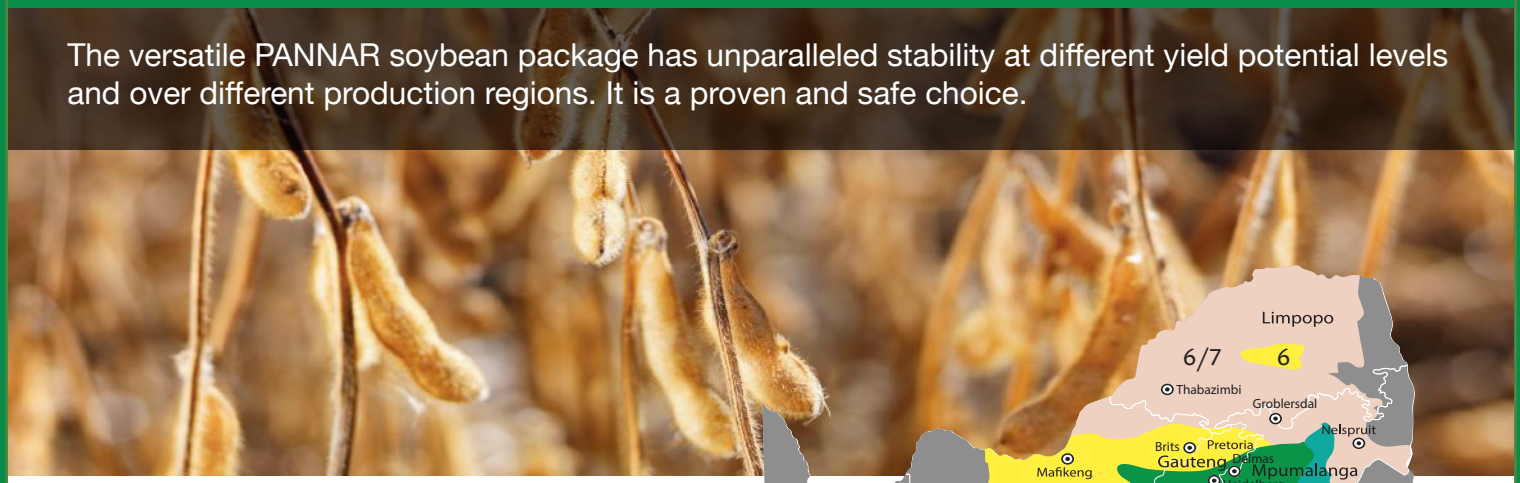
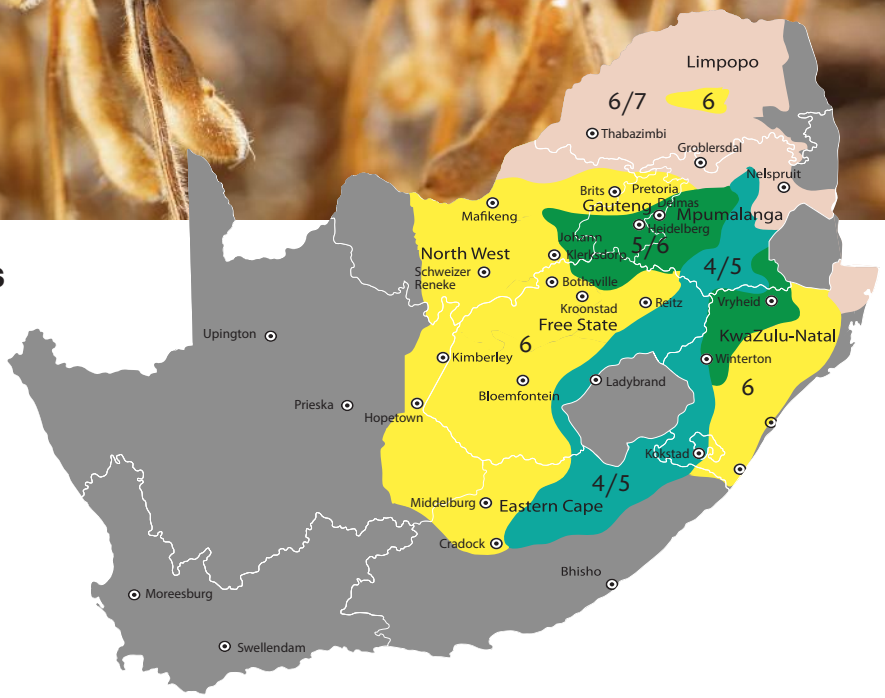


Soybean Production Regions

- Cool Region (MG 4/5)
- Temperate Regions (MG 5/6)
- Warm Regions (MG 6)
- Hot Regions (MG 6/7)

**MG = Maturity Group*

Map data courtesy of University of Pretoria



Pannar Soybean Package

Soybean cultivar recommendations for the different regions

Growth Class (MG)	Cool Regions	Eastern Temperate Regions	Dry Warm Regions	Hot Regions (Irrigation)
Early (4-5)	PAN 1454R*	PAN 1454R*		
Medium (5-6)	PAN 1532R PAN 1521R	PAN 1532R PAN 1521R	 PAN 1521R	PAN 1532R PAN 1521R
Late (6-7)	PAN 1614R PAN 1623R	PAN 1614R PAN 1623R	PAN 1614R PAN 1623R	

* *PAN 1454R should be limited as a smaller portion of the total package.*
PAN 1521R and PAN 1623R are two new cultivars with exceptional performance and are complemented by the stable cultivar, PAN 1614R.

Yield Probability (%)

2013/14, 2014/15 & 2015/16

COOL AREAS YIELD POTENTIAL (t/ha)								
Cultivar	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
PAN 1454R	**59**	55	50	45	40	36	32	29
PAN 1500R	**67**	**66**	**63**	**62**	**59**	56	53	51
PAN 1521R	49	57	**64**	**72**	**78**	**83**	**86**	**89**
PAN 1614R	32	35	39	43	48	52	57	**60**
PAN 1623R	**73**	**73**	**71**	**70**	**67**	**65**	**62**	**59**

TEMPERATE AREAS YIELD POTENTIAL (t/ha)								
Cultivar	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
PAN 1454R	18	18	18	19	20	21	23	24
PAN 1500R	47	44	42	40	37	36	34	33
PAN 1521R	**63**	**69**	**73**	**78**	**81**	**84**	**86**	**88**
PAN 1614R	**65**	**61**	**57**	53	49	44	40	37
PAN 1623R	**89**	**91**	**93**	**94**	**95**	**95**	**95**	**95**

WARM AREAS YIELD POTENTIAL (t/ha)								
Cultivar	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
PAN 1454R	55	51	46	40	35	31	28	25
PAN 1500R	46	41	34	29	23	20	17	16
PAN 1521R	**66**	**74**	**80**	**86**	**90**	**92**	**93**	**94**
PAN 1614R	**65**	**64**	**61**	**59**	56	53	49	47
PAN 1623R	**77**	**76**	**75**	**73**	**70**	**66**	**62**	58

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Innovating for food and nutrition security in South Africa

By Tony Esmeraldo, country leader: South Africa, DuPont

Sustainable protein is essential to our future. By 2050, the world population will reach 9,1 billion, creating further demand for protein as the population grows. Evolving customer trends, coupled with an increasing global population and a growing middle class, are placing an even greater demand on protein and subsequently the oilseed industry's need to drive productivity.

In line with these global trends, the oilseed industry in South Africa is experiencing an interesting shift and, to some extent, mirroring global trends. According to the Bureau for Food and Agricultural Policy (BFAP), there was an increase of animal protein in the food expenditure basket of the lower middle class, upper middle class and wealthy segments in South Africa, which drives an increase in the demand for animal feed.

Southern Africa is currently a small player in the global soya bean market and is emerging as one of the few possible new frontiers for expansion. This presents an attractive long-term growth opportunity in the oilseed market for local farmers and the entire value chain.

Lower than average yields

The continent, however, currently achieves lower than average yields. For instance, the average yield for soya beans in South Africa is 2,29t/ha (2016/17 season), up from 1,89t/ha in 2014. It is important that the industry avails improved seed to help farmers meet the demand and overcome the challenge of disease, insects and low yields.

With improved seed technologies and agronomic practices, South African farmers can achieve average yields similar to global players who enjoy more favourable growing environments. Private seed companies and government need to increase investments in research and in the protection of intellectual property.

The industry can adopt global technologies, but employ local environment-specific research and agronomic practices to help farmers – in this way helping them to better manage pests and crop diseases, climate volatility and soil fertility and to optimise yields by geography and improve crop productivity on every hectare.

The other big challenge faced by the industry is the high rate of grain retention for seed. This creates a challenge for private sector investment and limits access to technology. However, on the horizon is the End-Point-Royalty (EPR) system which will reward the owner of the intellectual property for their input into soya bean research. This will, without any doubt, stimulate the soya bean research environment in South Africa, and enable technologies that are being applied in North and South America to be employed here.

Benefits of the AYT process

Investments in research processes, including the Accelerated Yield Technology (AYT™) process, soya bean diseases, nurseries, innovative trait technologies and the ability to attract top-notch research talent, will pay off for farmers, the industry and ultimately the consumers in the long term.

Getting full access to global technologies is critical to future growth opportunities, success of farmers and the industry's value chain as a whole. The use of the AYT process pinpoints native trait genes for increased defensive trait protection and improved pest resistance packages tailored for specific geographies.

Context-specific markers to help optimise yields by geography, pinpointing native trait genes for increased disease resistance, and improved nematode and insect tolerance are being used widely in the rest of the world to drive genetic gain. These are expensive technologies, but, given the reward the EPR promises, we can expect technologies such as AYT to be deployed locally in future.

Broader range of cultivars

This will bring soya bean farmers a broad range of high yielding cultivars, ushering in an exciting new era in soya bean production in South Africa. Continuous innovation and deploying world-class technologies has become a requirement, not a choice. Research derived improvements are incremental in nature, and require long-term commitment to realise the benefits. The sooner the EPR system is implemented, the sooner the research engine can be up-scaled to realise these benefits.

Health-conscious consumers these days also expect foods with labels that say 0g trans-fat, and food manufacturers and restaurants are transitioning to oils that can meet this demand without sacrificing performance – or the taste that keeps their customers coming back.

The next frontier would be to consider the introduction of healthier high oleic soya beans into the South African market, which offers consumers nutritional benefits with broad applications. This will create more value for soya bean farmers, the supply chain as well as health-conscious consumers.

Investing in local research and new world-class technologies to enable farmers to maximise yield potential, agronomic traits and resistance to yield-robbing pests are the only way to drive growth and to address the challenges the industry is facing.

What to expect in 2018

Global grain and oilseeds stocks remain high, with world ending stocks of soya beans at 96,1 million tons compared to 94,9 million tons in the previous year. The South American climate is currently key and will play a critical role in crop condition moving into 2018.

Locally, the prospects for an exceptional crop of soya beans are looking good. October's intentions to plant 720 000 hectares of soya beans, which is an increase of 25% from the current season, bodes well for soya bean production in 2018. It will be the largest area in South Africa planted with soya beans yet.

Weather influence

Even with a yield reducing to a ten-year long-term average of 1,62 tons per hectare, we might still achieve a soya bean crop of 1,17 million tons. With sunflower at a ten-year long-term average of 1,23 tons per hectare, we could at least achieve a crop of 818 565 tons.

Weather will play a critical role in the success of crops, and prospects for summer rainfall are positive. The current drought in the Western Cape will persist into 2018, with dire consequences on agriculture in general. As a direct result of the drought, the socio-economic effect due to lack of employment will be felt long into next year, with the desperate requirement for winter rainfall to return to above normal.

The demand for animal feed and, consequently, proteins will be influenced by the current bird-flu epidemic. This epidemic has primarily affected the layer industry, with the Western Cape being the most adversely affected. Current estimates show a loss of at least three million layer hens. A change in weather patterns will hopefully curb the spread of the disease in 2018.

Oilseed prices

Large crop sizes are likely to keep a lid on oilseed prices, while the influence of the exchange rate's volatility will remain the norm. Between political instability, fiscal downgrades, dollar strength and emerging market movements, it will be a challenge to predict currency fluctuations in 2018.

December elections

We trust that the December elections for the leadership of the ANC will go smoothly and not be undone by violence or legal battles. This election will not only have a major influence on the 2019 general elections, but the future of our democracy and economy could be at stake.

Best wishes for a prosperous 2018.

Dr Erhard Briedenhann

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

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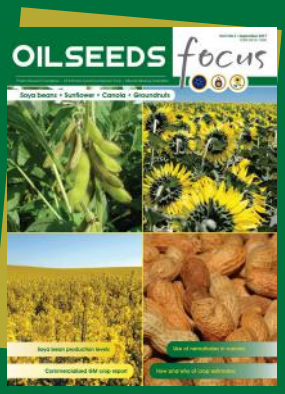

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NEWS

Soya bean appeal drives maize down

Brazil's maize production will drop by nearly five million tons, thanks to a drop in first-crop sowings to their lowest in at least 13 years, as low returns from the grain cause growers to plant soya beans instead.

Conab, the official Brazilian crop bureau, pegged maize output at 92,9 million tons, down from last season's 97,71 million tons. Its forecast for a reduction in area reflected in part an expectation of a continuation of a switch by Brazilian growers away from first-crop maize. This trend was being exacerbated by "low prices", the bureau said.

Soya beans had been the main beneficiary of the quest for alternative crops, Conab said, estimating sowings of the oilseed for 2017/18 at 34,47 to 35,21 million hectares – an increase of at least 555 000 hectares year-on-year.

Conab flagged, in soya beans, the "possibility of better profitability in relation to other crops", and forecast raised sowings "in practically all the main producing states". *– Agrimoney.com*

PRF elects new leaders

Andries Theron was recently elected as the new chairman of the Protein Research Foundation (PRF). Theron, a wheat farmer in the Swartland region, Western Cape, is an active member of several organised agriculture institutions, including Grain SA and Agri Western Cape.

He has served as vice-chairman of the PRF and originally joined the group to establish canola as a true cash crop. He follows in the footsteps of Gerhard Scholtemeijer, outgoing chairman.

Dr Erhard Briedenhann, CEO of MIDS, has been elected as vice-chairman of the PRF. Erhard is well-known in the industry and is involved in several industry organisations. *– Ursula Human, Oilseeds Focus*

Newly elected vice-chairman, Dr Erhard Briedenhann (left) and chairman, Andries Theron, of the Protein Research Foundation.

Grain production forecast second highest

The International Grains Council (IGC) raised its forecast in September for total grains production in 2017/18 to 2,069 billion tons, up from 2,049 billion tons in August, but down from 2,133 billion forecasted for 2016/17. Total consumption was raised to 2,096 billion tons from 2,089 billion tons.

"World total grains (wheat and coarse grains) production in 2017/18 is projected to be the second largest ever, at 2,069 billion tons," the IGC said. "This is 65 million tons below last season's record, largely because of a 50 million fall for maize, with about half of that linked to poorer anticipated results in the US. Following another upward revision, the global wheat crop is placed only a fraction under the previous year's peak." – *Sacota.co.za*

BASF acquires Bayer seed majority

As part of its planned acquisition of Monsanto, Bayer has agreed to divest significant portions of its seed and non-selective herbicide business to BASF in a US$7 billion all-cash deal.

This deal marks the entrance of Germany's BASF, the third largest player in the crop chemical industry, into the global seeds space – a sector that the group had previously avoided in favour of the development of beneficial plant traits that it would then license to outside seed developers.

However, the need by Bayer to satisfy regulatory concerns surrounding its $66 billion deal to acquire Monsanto has created a landscape where rivals have the rare opportunity to buy highly attractive assets that will give them wider exposure in the row crop value chain. – *Oilseedandgrain.com*

Ukraine sunflower crushers face closures

Ukraine's sunflower crushing industry faces closures and mergers due to a poor domestic harvest of the oilseed, Kernel Holding said, flagging "poor business conditions" ahead, depressed by weaker grain yields too.

The Ukrainian ports-to-farming group said that a disappointing sunflower crop in the country – the world's top grower – this year had raised the prospect of a further decline in crushing margins, already sapped by investment in increased capacity.

"Without a doubt, the current level of crushing margins is not sustainable," said Andriy Verevskyi, Kernel chairman. The company revealed that its own earnings before interest, tax, depreciation and amortisation (ebitda) in bulk sunflower oil output had already tumbled by 33% to $77m in the year to June.

This downturn predicts plant closures for Ukraine's smaller, independent crushers, which represent more than 50% of domestic capacity, said Kernel, the country's top-ranked processor. *– Agrimoney.com*

Sacota elects new chairman

The following directors were elected to the Sacota board during the AGM that took place on 12 October 2017: Konrad Keyser (Brisen Commodities), Brendon de Boer (Cargill South Africa), Cornelius Odendaal (Unigrain), Johan Steyn (Seaboard Overseas Limited) and Anton Wienand (ETG World).

Konrad Keyser and Brendon de Boer have respectively been elected as chairman and vice-chairman. We wish the new board all the best with the task ahead to expand Sacota's reach, influence and contribution to the Southern African agricultural industry. – *Sacota.co.za*

Cargill looks to triple its feed business

Cargill has taken full ownership of the Southern African based Provimi-branded premix and nutrition business from Astral Foods.

Cargill already owned 75% of the Provimi-branded operation as part of a joint venture with Astral Foods that kicked off in 2012. It has now acquired the remaining 25%.

Guillaume Smeets, managing director of Cargill Animal Nutrition for the Middle East and Africa (MEA), said Cargill was committed to developing its business in sub-Saharan Africa.

"Africa's population is predicted to more than double by 2050, and protein demand continues to increase in the region. Rapidly growing markets and increasing animal productivity make Africa, including sub-Saharan Africa, a strategic growth area for Cargill.

"We have already shown our commitment to this region through investing in a new premix and base mix facility in Pietermaritzburg. We went to great lengths to bring state-of-the-art technology into this facility, allowing us to take feed, and food safety, to the next level," he said. – *Food Navigator*

Centenary of agricultural science at UP celebrated

Throughout 2017, the Faculty of Natural and Agricultural Sciences at the University of Pretoria (UP) celebrated their 100th birthday. The centenary celebration of Agricultural Sciences at UP embrace the three founding departments in the former Faculty of Agricultural Sciences, namely Phytopathology, Soil Science and Livestock Breeding. The celebration recently reached its high point with a prestigious function held in Pretoria.

"A centenary celebration should not bring complacency; it gives us an opportunity to reflect on the past, take stock of the present and consider the future. We should formulate a vision for the future to reach our desired destination and set the foundation for the next 100 years of agriculture science at the university," said prof Cheryl de la Rey, vice-chancellor and principal of the Faculty of Natural and Agricultural Sciences at the recent centenary celebrations of the faculty. – *Marike Brits, AgriOrbit*

License exemptions to boost renewable energy

The Department of Energy has paved the way to enable smaller scale renewable energy projects to generate power not only for own use, but also for the benefit of industries such as the farming sector. Until recently, most independent power generation projects were required to be registered with and hold a license from the National Energy Regulator of South Africa (Nersa).

The Draft Licensing and Registration Exemption Notice, initially published on 2 December 2016 in terms of the *Electricity Regulation Act, 2006* (the Draft Exemptions), proposes an exemption from the licensing requirement for specific activities, for example, embedded generation if the installed capacity does not exceed 1MW. In terms of the Draft Exemptions, smaller scale projects (up to 1 MW) will be allowed to proceed unencumbered from the requirement for licensing. On 10 November 2017, the Department of Energy published the Licensing Exemption and Registration Notice in the *Government Gazette* (No. 41237). – *Press release*

AFMA Symposium feed role-players together

The annual Animal Feed Manufacturers Association (AFMA) Symposium held on 31 October 2017, hosted a record number of delegates. Approximately 400 delegates from international and local feed industries came together at the CSIR International Convention Centre. The theme of the symposium was 'Rising to the challenge' and equipped delegates with a spectrum of information that they will need to rise to the challenge of a changing feed industry landscape.

Speakers included Clem Sunter, internationally renowned scenario planner, Christo Joubert, manager of Agro Food Chains at the National Agricultural Marketing Council, Dr Hilde van Meirhaeghe, Vetworks Belgium, and Frans Waxenecker, development and innovation director at Biomin, Austria, to name but a few. – *Ursula Human, AgriOrbit*

From left are Christo Joubert, NAMC, Clem Sunter, international scenario planner, and Stephan Breytenbach, AFMA.

Management of soya bean nutrition

By Dr Fernando Salvagiotti: Crops, soils and water management, INTA EEA Oliveros, Santa Fe

Crop production is closely related to resource capture. The maximum grain production in a particular environment is determined by three defining factors: Radiation and CO_2 that crops can capture; the potential for generating yield that each genotype has; and the temperature regime (*Figure 1*).

The expression of potential production will be constrained by the limiting factors – water and nutrients. In dryland soya bean production systems, the yield gap due to limiting factors is a combination of nutrients and water deficits.

The magnitude of the response to fertiliser addition of those nutrients identified as deficient in the soil and/or those that are necessary for sustaining high yielding crops defines the 'nutritional gap'. The use of chemical fertilisers, the inclusion of cover crops, the addition of organic manure and the use of associated or symbiont microorganisms are tools that may contribute to reducing the nutritional gap.

Therefore, the reduction in this gap requires a thorough understanding of soil-plant relationships, including crop ecophysiology and nutrition, soil fertility and soil microbiology.

Essential nutrients have specific roles in plants. The deficiency of each nutrient will depend on soil characteristics and yield potential of the crop in each particular system. Fertilisation is an important tool for correcting these deficiencies, however, excessive chemical fertiliser application may have negative consequences for the environment.

For an efficient fertilisation practice, not only knowledge of fertiliser efficiency use is important, but also the relative importance of each nutrient in yield formation and the relative proportions needed for maximising yield. There are certain physiological aspects related to crop nutrition and yield.

Figure 1: Representative scheme between maximum attainable, feasible and actual yield as related to reducing, limiting and defining factors.

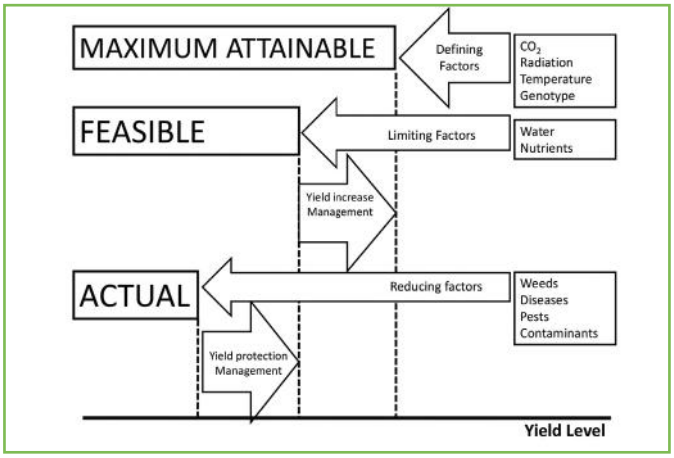


Figure 2: Relationship between N content and biomass of seed per unit of photosynthate produced in 24 cultivated species.

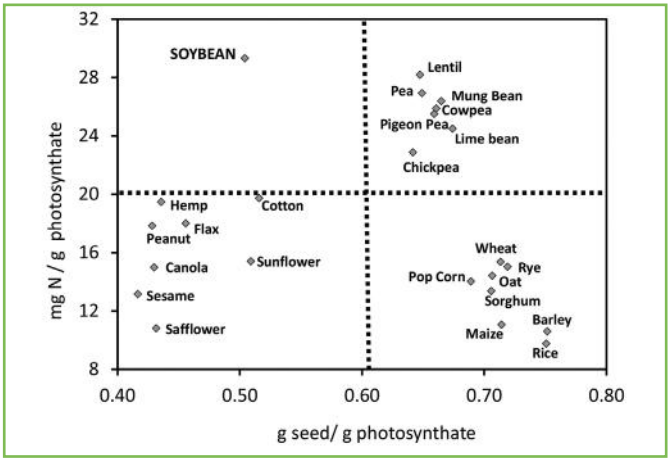


Figure 3: Relationship between N content in leaves and leaf photosynthesis in maize, rice and soya beans.

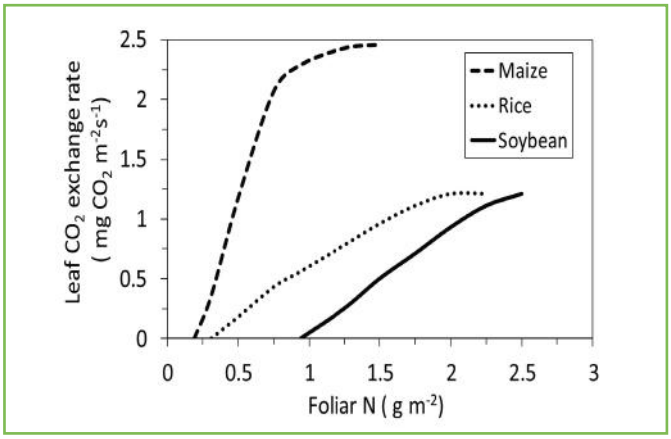
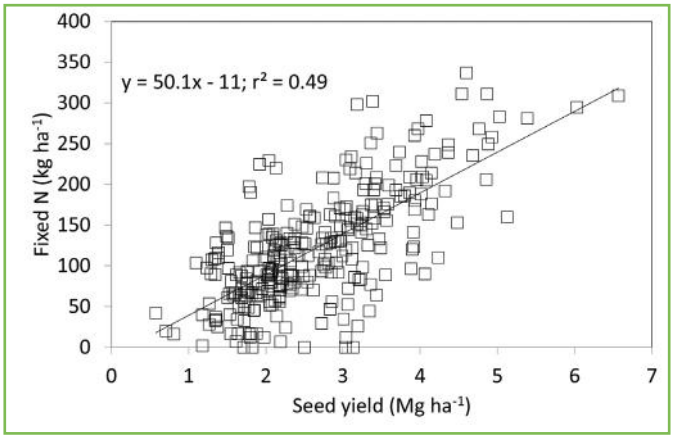


Figure 4: Relationship between seed yield and N derived from biological N fixation in soya beans.



Nitrogen the engine

Nitrogen (N) has two essential roles in plants: It is part of enzymatic systems in the cells, which are necessary for crop growth and development, and it is an essential constituent of reserve proteins. In the first case, N represents more than 60% in leaves as a component of ribulose bisphosphate carboxylase/oxygenase (Rubisco) and other enzymes involved in CO_2 assimilation.

Figure 2 depicts the distribution of several grain crops when considering the relationship between grain yield per unit of photosynthate (i.e. larger values are reached when the energetic value of the molecules that form the grain is low) and grain N content per unit of photosynthate (i.e. larger values in crops with greater protein content in grains).

Grains are grouped in the right-lower quadrant since starch (with low energy value) is the main constituent in the grain and they have relatively low protein content (less than 14%). In the left-lower quadrant are oil crops that accumulate molecules with high energetic value (mainly as oil), but with low protein content.

In the right-upper quadrant, leguminous crops with larger protein content than grains but also great accumulation of carbohydrates are grouped. Finally, soya bean is located in the left-upper section of the graph since it accumulates substances with high energetic value (more than 19% as oil) and high protein content (mostly above 38%).

This composition implies a large N demand, especially during the seed-filling period, when N mobilisation, mainly from leaves, begins at a high rate. N mobilisation would be a constraint for obtaining higher yield because the N pool in leaves accumulated as Rubisco will decrease. The positive relationship between N uptake and seed yield in soya beans may be explained by the fact that a greater part of N in leaves is in the photosynthetic system.

Figure 3 shows the relationship between foliar N in grams of N per unit leaf area (analogous of Rubisco content) and crop photosynthesis. Crops with C4 metabolism (e.g. maize) contrast with C3 crops (e.g. soya beans) because they have a larger N use efficiency and less N is required in leaves to get similar photosynthetic rates.

In line with these observations, increases in N uptake have been reported as a consequence of soya bean breeding. A rise was also observed in N content in seeds, but with a decline in protein content (N dilution effect). Soya bean breeding has achieved a crop with a larger capacity for assimilating more N during the seed-filling period (*Table 1*).

The basis for managing N in soya beans is the optimisation of the process of biological N fixation (BNF) from air. Crop management should optimise the contribution of this source, mainly through inoculation with highly effective rhizobium strains and using inoculants that ensure the number of bacteria in well conserved conditions.

The success of this practice will be achieved with crop and soil management practices that optimise the environment for the rhizobium-soya bean symbiosis. The amount of N fixed (kg/N) will depend not only on the proportion of N derived from BNF but also on the biomass production of the crop. In general, there is a strong association between growth, seed yield, N assimilation and BNF (*Figure 4*).

Results from experiments that evaluated N fertilisation in soya beans show erratic results, with a large proportion of cases with no response to N fertilisation. In general, a response to N fertilisation in soya beans has been

Table 1: Seed yield, grain quality and variables associated with N nutrition in old and modern soya bean cultivars.

Cultivar	Seed yield	Protein	Oil	N uptake in R4	N uptake R5-R7	Mobilized N	N in seeds	N total	ICN
	kg N ha^{-1}		%			kg N ha^{-1}			%
Old cultivars (´30s)	3000	37.6	19.1	110	14	95	104	120	91
Modern cultivars (´90s)	3775	35.7	21.4	113	39	100	131	143	91
	*	*	*	NS	*	NS	*	*	NS

* Significant differences at 5%; NS: not significant differences

observed when environmental conditions were not adequate for normal functioning of nodules. In Argentina, a response to N fertilisation was only observed in fields where soya beans were not planted before, and thus without a naturalised rhizobium population. After two years of inoculated soya beans, N fertilisation did not cause any increase in seed yield.

Another alternative in high-yielding soya beans is by locating fertiliser N below the area where nodules are present in order to avoid the negative effect of nitrates on BNF. Studies performed on soya bean crops that yielded above 5 000kg/ha showed increases of approximately 5% in seed yield when the crop received 180kgN/ha as fertiliser both on surface or locating the fertiliser (as a slow-release fertiliser) below the nodule area.

Phosphorus, potassium and sulphur

When planning nutrient management of phosphorus (P), potassium (K) or even sulphur (S) – nutrients that have medium to low mobility in the soil – it is important to not only take direct effects on the crop into account, but also residual effects for the crops in the sequence.

From a physiological viewpoint, P availability is relatively more important in early stages of crop growth when crop growth rates are high and the crop has a large P demand (which is accumulated as ribosomal RNA) in order to produce proteins that are necessary for this active growth.

In field experiments, the reduction in seed yield due to P deficiency was associated with a decline in seed numbers per unit area. This drop is a consequence of a reduction in growth, leaf area expansion and radiation capture in early reproductive stages (i.e. between R2 and R5) when seed numbers are determined. In general, the effect during seed-filling is relatively lower, and it is generally observed as a larger P mobilisation to the seeds accumulated as phytate.

High-yielding soya beans will have a high P uptake. However, a larger demand does not imply a rise in soil P calibrated thresholds. *Figure 5* shows that response to P fertilisation is high when soils have P contents below thresholds, but without relationships with the maximum seed yield per site.

Sulphur is closely related to N nutrition in soya beans, as was observed in several crops. Sulphur is the main component of enzymes involved in N uptake, N fixation and N assimilation in the plants. In addition, reserve protein in soya bean seeds are rich in sulphur-amino acids (methionine and cysteine), and thus a large demand is expected. Field experiments have shown increases both in seed numbers and individual weight. Even when S is more mobile than P, residual effects of S fertilisation have been reported, depending on soil type.

Cations (K, Ca and Mg)

Potassium has a central role in crop physiology since it is directly involved in regulating stomata movement, important for maintaining the hydric status of the crop and in solute transport across the phloem. As described for P, larger requirements are observed in early stages of the crop. Potassium mobilisation to seeds is low, and K is related to tissue strength.

Based on Table 2 values, it can be seen that the internal N requirement of soya beans is approximately 12, 19 and 2 times higher than the internal requirement of P, S and K, respectively.

Magnesium (Mg) is part of the chlorophyll molecule and intervenes in several physiological processes. Calcium (Ca) is mainly involved as a cell wall stabiliser. In general, a high Ca uptake may cause physiological disorders at the membrane level, and thus Ca uptake is regulated to prevent an increase above certain levels. A high Ca uptake has been observed in less differentiated tissues in the roots (close to the calyptra).

Figure 5: Response to P fertilisation as related to the maximum seed yield per site. Lines represent the average response in each soil P group.

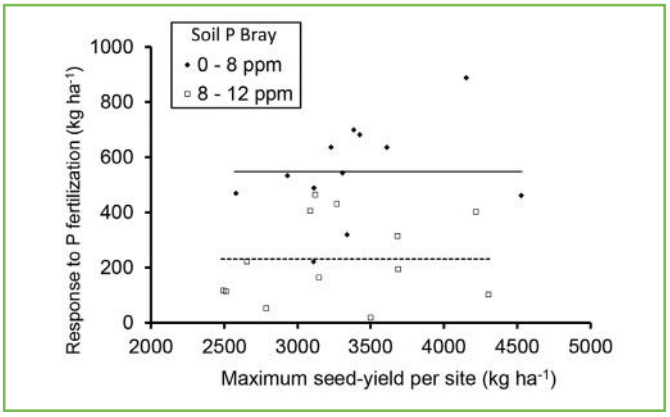


Figure 6: Relationship between seed yield (corrected to 13% moisture) and N uptake in aerial biomass.

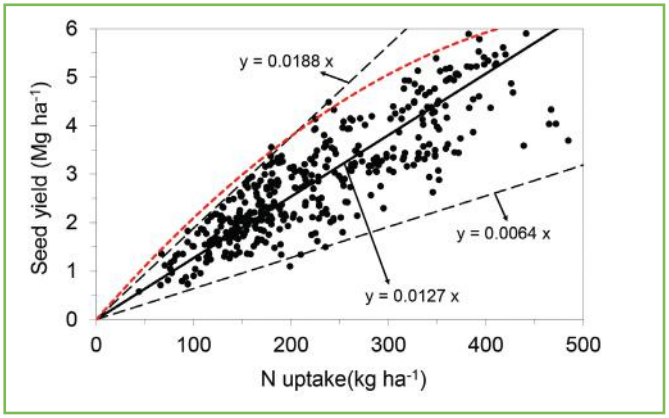


Table 2: Internal average requirement (AR), maximum dilution (MD), maximum accumulation (MA) and ranges of nutrient harvest index (HINu) of main macronutrients in soya beans.

Nutrient	AR	MD	MA	HINu
	kg nutrient / kg seed			%
N	79	53	156	53-76
P	6.5	3.8	10	35-75
S	4.1	2.1	7.8	40-59
K	36	23	48	27-44

The addition of Ca and Mg may have indirect effects via improving the proportion of these cations in the cation exchange capacity complex, affecting availability of other nutrients. In this situation, however, Ca and Mg rates are high and applied as amendment.

Micronutrients

Each micronutrient has particular roles in plant physiology, and contributes to increased yield and reduces the nutritional gap. The most studied micronutrients in agricultural systems have been molybdenum (Mo), boron (B), zinc (Zn) and manganese (Mn). Molybdenum is directly involved in N metabolism of the plant, and specifically in the BNF process since it is a constituent of the nitrogenase enzyme. Boron is related, among others, to processes such as the emission of pollen tubes in flowers. Then, addition of B is recommended during the flowering period.

Nutrient use efficiency

In grain crops such as soya beans, the agronomic use efficiency of a nutrient is generally expressed as kilogram of grain per unit of nutrient applied as fertiliser (i.e. agronomic efficiency, AE). This efficiency is the product of nutrient uptake efficiency (EUpt) and physiological use efficiency (EPhy).

Nutrient uptake efficiency can be estimated as the slope of the relationship between nutrient availability (soil or soil + fertiliser) and nutrient uptake. In general, these relationships are non-linear since nutrient uptake will be limited by the capacity of root cells to transport ions from soil to the internal part of the cells. This capacity is related to the presence of molecular transporters at the membrane level in the roots, which has a genetic control.

Analogously, the slope of the relationship between seed yield and nutrient uptake is the physiological nutrient efficiency. These relationships are also curvilinear, where a higher nutrient uptake is not accompanied by a proportional seed yield increase. These relationships are generally presented as an 'envelope' around the average fit. This envelope shows two processes: nutrient dilution and accumulation.

Identifying the nutrients that are deficient and defining a potential yield are important for reducing the nutritional gap.

Nutrient use efficiency will depend on the environmental conditions in which soya beans are growing. In *Figure 6*, even when an average fit can be defined, it can be seen as a non-linear trend when seed yield is increasing (i.e. there are no data points on the dilution curve for seed yield above 4mg/ha). The solid line is the average fit of the data with a slope of 0,0127mg seed per kg N. The dotted lines show the frontier line of maximum dilution (superior) and maximum accumulation (inferior) of N. The red dotted line shows the non-linear trend.

The internal nutrient requirement (the inverse of the slope of the relationship between nutrient uptake and seed yield) is important for planning crop and system nutrient management. *Table 2* shows internal nutrient requirements for the main macronutrients in soya beans, and also internal efficiencies of the dilution and accumulation lines. This knowledge may plan a more balanced nutrition of soya beans.

Based on *Table 2* values, it can be seen that the internal N requirement of soya beans is approximately 12, 19 and 2 times higher than the internal requirement of P, S and K, respectively. Likewise, the internal P requirement is 1,6 times larger than S.

Nutrient harvest index is another important variable for testing nutrient use efficiency, for knowing not only how much nutrient is exported from the system, but also how much nutrient is left with residues, and thus allowing for some insights of nutrient cycling in a sequence. The larger nutrient harvest indexes have been observed for N and P (*Table 2*).

Conclusions

Identifying the nutrients that are deficient and defining a potential yield are important for reducing the nutritional gap. In soya beans, the high N requirements should be primarily satisfied via the BNF process, and optimising crop management in order to maximise this contribution.

When planning fertilisation of low mobility nutrients, not only the effect on the crop but also residual effects of crops in the sequence should be considered. A deeper study is needed on the equilibrium between nutrients in order to optimise crop nutrition and minimise a negative impact on the environment.

References available from the author. For more information, email Dr Fernando Salvagiotti at salvagiotti.fernando@inta.gob.ar.

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Yield potential	Very high	Moderately high	Moderately high	High
Plant vigour	Excellent	Excellent	Excellent	Excellent
Days to maturity	82 - 85	80 - 87	80 - 87	90 - 97
Growth period	Early	Medium early	Medium early	Medium late
Plant height	Medium tall	Medium	Short	Medium tall
Shatter tolerance	Excellent	Good	Good	Excellent
Crop use	Grain, grazing	Grain, grazing	Grain, grazing	Grain, grazing
Sowing density (kg/ha)	Sow: 4 - 5 Plant: 3 - 4	Sow: 4 - 5 Plant: 3 - 4	Sow: 4 - 5 Plant: 3 - 4	Sow: 4 - 5 Plant: 3 - 4
Blackleg tolerance	Tolerant	Moderately tolerant	Moderately tolerant	Tolerant

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Canola is a valuable grazing crop

Article sourced from The Cattle Site

South African farmers are used to planting canola as a cash crop or a rotational crop to harvest the grain for canola oil. In the rest of the world it is a general practice to use it for grazing, silage, hay or in combination of grazing and a cash crop. It can be used to provide valuable grazing in the beginning and carry on to be a productive cash crop at the end of season.

Canola can be grazed when the canopy height is 15 to 20cm tall, but livestock should be removed when one third to half of the original forage remains.

Canola forage should not be grazed if the seed was treated with an insecticidal seed treatment. These seed treatments are systemic and can cause irritation when cattle consume the forage.

A slightly earlier planting date is advisable to allow for maximum forage growth prior to grazing, but adjustments to seeding rates are not necessary.

Adjust stocking rate

Stock the canola field when the canopy height is approximately 15 to 20cm. Generally, the most forage is available upon reaching the eight-leaf stage and canola grows vigorously at this stage.

Adjust the stocking rate so mostly new growth is consumed and remove cattle when only half of the original forage remains. Producers may use flash grazing, which means grazing the canola for a brief period of time, removing the cattle to allow re-growth, and then returning the cattle to the canola forage.

To better utilise the crop, graze canola with younger cattle rather than older cows. Smaller animals cause less physical damage to the canola plant.

No more than 75% of the animals' ration should be canola, with the other 25% consisting of a lower quality, high-fibre hay.

Since canola is relatively low in fibre, producers should exercise caution when introducing cattle to the forage and may want to consider a bloat preventer. Cattle should be full, near a source of fibre, and closely monitored when initially placed on canola pasture.

Making hay

Haying of canola should be done before it flowers. Being harvested before the crop goes into full pod stage, will make good feed for the winter. Mow with a roller mower conditioner to smash the stems as much as possible to help the stems dry enough.

Without this the feed may become moldy due to the crop's high moisture content. If the crop has to be left for a long period to dry, leaf material (which is better quality than the stalk and has higher palatability) will be lost when raking. Avoid raking if possible.

The plants take four to six days to dry to proper moisture levels (16 to 18% moisture content) for baling. In experiments in the United States (US), there were wide variations in yield (1 to 7t/ha), which could be due to difference in cultivars, growing conditions and rainfall.

Silage a good option

Silage might be a cheaper option than baling. Canola has a high moisture content of 75 to 80%. Consequently, seepage and effluent losses from the silage can be large. Wilting the crop to moisture levels of 60 to 65% (40% dry matter) will take time but crimping will hasten the drying process.

Ensiling the crop will reduce nitrate content by 30 to 70%, making the feed safe. The addition of bacterial silage inoculants may be beneficial when ensiling these crops, which are low in soluble carbohydrates.

Canola as a forage or silage crop should be treated similar to grain crops when cutting, chopping and packing. The one difference is that canola, with its hollow stems (full of moisture), takes about an extra day to dry down to the 60 to 65% moisture content level.

If baling silage, baling at drier than 45% dry matter may lead to poor packing and dry stalk ends. Baling too wet will result in poor foul smelling and low palatability silage due to the high protein contents. Some producers have had good results by filling the silage bunker with alternating layers of canola and grain crops cut for silage.

Higher yields in follow-up crops

It is a known fact that crop rotation with canola can lead to higher yields in follow-up crops such as maize, chicory, wheat and even grass-type pasture crops. Canola is a particularly suitable pasture and silage crop.

Early to medium-late canola types are on K2 Seed's product list. All cultivars are moderately tolerant against black stem.

Both Hyola 61 and Hyola 50 are suitable for grain and grazing. Both are conventional cultivars. Hyola 575 CL is a Clearfield® cultivar with high yield potential. Hyola 555 TT (Triazine®) exhibits outstanding plant vigour and takes approximately 80 to 87 days until flowering.

Rate and timing of nitrogen fertilisation for canola

By Albert Coetzee (Extract from an MSc thesis at the University of Stellenbosch)

Canola is increasingly becoming more popular as a crop in the Southern Cape and Swartland regions of South Africa due to its health benefits for consumers and various other benefits in crop rotation systems for producers.

Canola has a relatively low nitrogen use efficiency (NUE), and due to the rising input production cost of N fertilisation, refined N fertiliser guidelines are needed. This will not only enhance the yield of canola to satisfy the rising demand of consumers, but also to maximise profitability for producers.

Currently, the appropriateness of N fertiliser guidelines for canola in South Africa is questioned. These guidelines are adopted from international literature or from guidelines for wheat, and should be refined for the local environmental conditions.

The objective of this research project was to determine to optimal rate (kg N/ha) and time of N application for the Swartland (Altona and Langgewens) and the Southern Cape (Roodebloem). The effects of rate and distribution of N fertilisation on total soil mineral N, leaf area index (LAI), biomass production, agronomic N use efficiency (ANUE), water use efficiency (WUE), thousand kernel mass (TKM), grain yield and profitability were determined.

The average rainfall

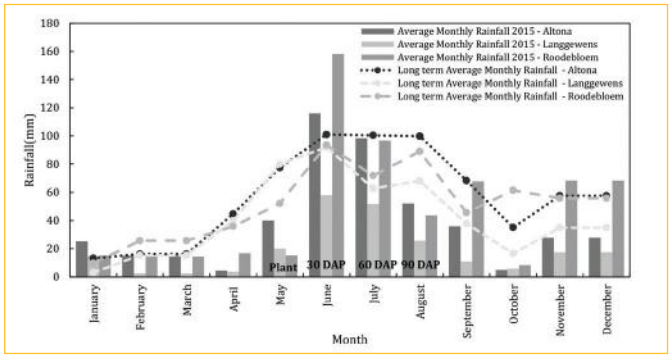
The 2015 season was characterised by dry conditions in the Swartland, with rainfall lower than the long-term average of most months. Roodebloem received higher than average rainfall during the leaf formation, stem elongation and flowering phases, while the rainfall during the remainder of the year was below the long-term average.

The average maximum daily temperatures in summer were generally similar or slightly lower than the long-term average daily maximum temperatures. The average minimum daily temperature was higher during August and September than the long-term average.

Soils of all sites were shallow (250 to 300mm) sandy loams with a high gravel content (>40%). The two Swartland sites were part of a crop rotation system where medics preceded canola the previous growing season, while wheat preceded canola at Roodebloem.

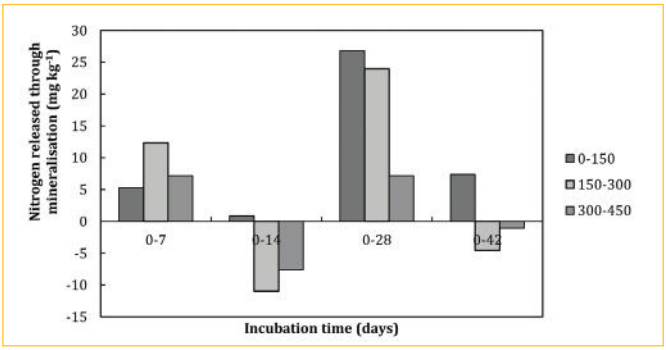
Total soil mineral N did not differ between treatments at Altona at 30, 60 or 90 days after planting (DAP), while at Langgewens the only difference in total soil mineral N was observed at 90 DAP. Nitrogen applied at a rate higher than 46kg N/ha, and at two intervals (30 and 60 DAP), resulted in a higher (P<0,05) total soil mineral N content. No differences (P>0,05) in LAI, biomass, ANUE, WUE, TKM or yield were observed between treatments at Altona and Langgewens.

Figure 1: Average long-term and monthly rainfall for 2015 for Altona, Roodebloem and Langgewens.



'Plant' indicates when the canola was planted, while 30, 60 and 90 DAP indicates the number of days after planting, when N fertiliser was applied.

Figure 2: Total soil mineral nitrogen released at soil depths of 0-150, 150-300 and 300-450 mm at Langgewens Research Farm after 7, 14, 28 and 42 days of incubation at 20°C and at 75% of field water capacity.



Higher biomass production

At Roodebloem, no differences in total soil mineral N were found between treatments. Although the LAI did not differ (P>0,05) between treatments, N fertilisation tended (P<0,1) to increase LAI at 30 DAP at Roodebloem. Treatments that received more than 70kg N/ha tended to have the highest LAI. There also was a trend (P<0,1) for higher biomass production at higher rates of N at 90 DAP at Roodebloem.

Figure 3: Summary of nitrogen fertiliser treatments applied at Altona, Langgewens and Roodebloem.

Experimental Unit	N-rate (kg ha^{-1})	At planting	30 DAP	60 DAP	90 DAP
0-0-0-0	0	0	0	0	0
20-0-0-0	20	20	0	0	0
20-40-0-0	60	20	40	0	0
20-20-20-0	60	20	20	20	0
20-13-13-13	60	20	13.3	13.3	13.3
20-70-0-0	90	20	70	0	0
20-35-35-0	90	20	35	35	0
20-23-23-23	90	20	23.3	23.3	23.3
20-100-0-0	120	20	100	0	0
20-50-50-0	120	20	50	50	0
20-33-33-33	120	20	33.3	33.3	33.3
20-130-0-0	150	20	130	0	0
20-65-65-0	150	20	65	65	0
20-43-43-43	150	20	43.3	43.3	43.3

The N fertiliser rate (kg/ha-1) is shown which was applied at different increments, viz, in order from left to right, fertiliser rate at planting (placed with seed) 30 days after planting (DAP), 60 DAP and 90 DAP.

Treatments that received more than 100kg N/ha at 30 DAP tended to have the highest (P<0,1) biomass production, with both treatments receiving the bulk of their total N rate at 30 DAP. Treatments that received more than 90kg N/ha, with applications of more than 23kg N/ha at 30 DAP, had the highest ANUE and WUE. At Roodebloem, treatments receiving 20kg/ha of N during planting, and a top dressing of more than 70kg N/ha at 30 DAP led to the highest yield.

No significant difference

These preliminary results indicated that in a low rainfall year, the application of additional N as a top dressing made no significant difference in yield in the Swartland. Due to the lower N mineralisation potential of Swartland soils, higher optimum levels of N are expected in normal and high rainfall years than in the Southern Cape.

The effect of treatments at Roodebloem might have been significant due to a combination of lower temperatures, sufficient soil moisture and high levels of N available during vegetative growth. Nevertheless, these results at Roodebloem indicate that treatments that received 20kg N/ha at planting and more than 50kg N/ha at 30 DAP led to the highest yield.

It can also be concluded from the results obtained in this study that the highest gross profit was realised by applying 0kg N/ha at the Swartland localities of Altona and Langgewens, in a year with poor rainfall distribution in a crop rotation system where canola was produced after medics. In the Southern Cape, applying N in excess of 70kg N/ha generated the highest gross income in a relatively normal rainfall distribution if compared to the long-term average of the area.

The hypotheses were as follows:

- H_1H_0: Increasing rates of N application will lead to increased yields to an optimum level.
- H_1H_1: Increasing rates of N application will not lead to increased yields.
- H_2H_0: Split application of N over more than one time of application will increase yield.
- H_2H_1: Split application of N over more than one time of application will not increase yield.

The H_1H_0 hypothesis was rejected at Altona and Langgewens as no differences in yield were found, while at Roodebloem, higher rates only increased yield up until 120kg N/ha, and, for this site, the H_1H_0 was accepted.

Recommendations from study

Split application of N over more than one time of application realised no difference in yield at Altona and Langgewens, and the H_2H_0 hypothesis was rejected at these localities. At Roodebloem, the H_2H_0 hypothesis is accepted as the highest yield was obtained at treatments where N was applied at planting and 30 days later.

With regard to the current study, it is recommended that it should be repeated in other years, before accurate general guidelines for N fertilisation of canola could be constructed. Lower than long-term average rainfall and higher temperatures may have influenced results, which is not typical of most other years. Future studies should also determine the total soil mineral N at harvest as well as the N content of the plants at harvest.

Canola is a good alternative to replace imported protein used in animal feed. Canola as cash crop in South Africa, and particularly the Southern Cape and Swartland regions, is a fairly young crop when compared to wheat or barley. Unpredictable establishment success and variable yields currently make farmers sceptical about canola cultivation.

Various agronomic factors and management practices that can lead to improved yield should therefore be researched. During the current study, only medics and wheat preceded canola.

Therefore, it is advised for further studies that the current trial be repeated with different preceding crops than only wheat and medics. The influence of the preceding crop on the availability of the residual N should then be incorporated in fertiliser guidelines.

Practices have changed

Current N fertiliser guidelines were developed in the 1960s. As can be expected, various management practices have since changed, including the adoption of minimum tillage and other conservation agriculture practices.

Minimum tillage supports organic matter accumulation in the topsoil, which in turn may lead to more plant available N in the topsoil. This implies that different N rates may be needed as additional application than what is currently prescribed. Regardless of these, guidelines are still based on outdated management strategies.

It is further recommended for crop modelling to be implemented to navigate the way forward and refine the recommendation rates by running the model for various scenarios and climatic conditions, to account for variation in temperatures, rainfall and mineralisation potential of soils.

Herbicides, reduced nodulation and N-fixation in soya beans – the case for atrazine herbicide

By Prof Charlie Reinhardt

Nitrogen (N) is an immensely important element for the survival and productivity of all forms of life on earth. Due to the critical role of N in agricultural productivity, the N-fixing bacteria (rhizobia), which have a unique symbiotic (mutually beneficial) relationship with legume plants, have attained special positions in the field of agriculture as plant growth promoters.

When legume-rhizobia interaction is healthy and active, as measured by good nodulation on the root system, application of additional nitrogen is not necessary. Nodules that are actively fixing atmospheric nitrogen are coloured pink or red inside.

Soil bacteria in the *Rhizobium* group invade the roots of legume plants and form nodules on roots to fix atmospheric nitrogen into ammonia, which enters directly into the root system of host plants. This unique interaction and process allow the plants to grow in the absence of additional N sources.

Nodules on soya bean roots. Soil bacteria in the Rhizobium group invade the roots of legume plants and form nodules on roots to fix atmospheric nitrogen into ammonia.

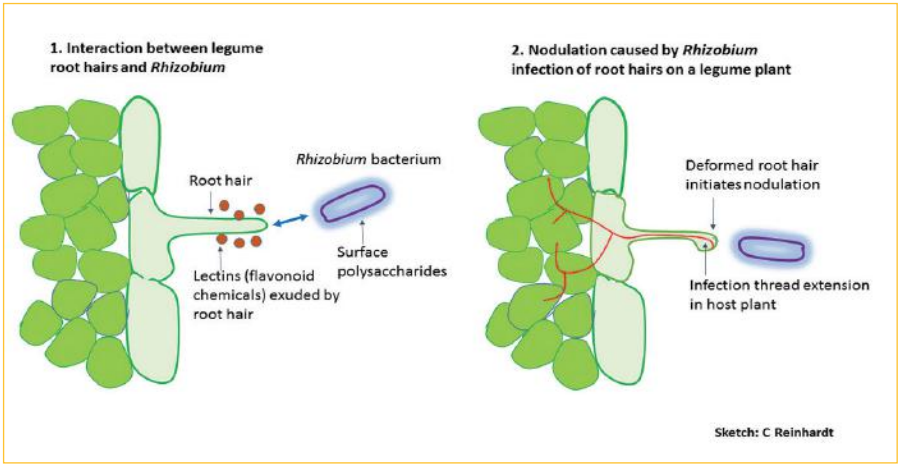
Symbiotic relationship

Soya bean plants have the ability to form a symbiotic relationship with specific *Bradyrhizobium* races (e.g. *Bradyrhizobium japonicum*) that cause the formation of nodules (small swellings) on the root system and is the location for N-fixation.

Because both soya bean and *Bradyrhizobium* species are not indigenous to South Africa, the standard practice is to ensure that soya bean-specific rhizobia are available in the immediate vicinity of the developing soya bean seedling, and explains why inoculation is advised with each planting of the crop (Botha *et al.*, 2004). Certain factors can reduce the formation of nodules, and, hence, the ability of legume plants to acquire N (ammonium) through fixation of N present as a gas in the atmosphere. Factors that are well known for limiting nodulation and N-fixation include:

- Elevated levels of nitrogen in the soil.
- Very wet conditions early in the season or extremely dry soil conditions.
- Fungi causing root disease or iron deficiency chlorosis (IDC) may negatively influence nodulation.
- Host plants that are under severe stress from physical (abiotic) and/or biological (biotic) factors.
- Limited nodulation may occur in fields in which soya beans are grown for the first time (various abiotic and biotic factors can be involved).

Figure 1: *Rhizobium* infection of legume root hairs.



Abiotic plant stressors

Herbicides represent one type of abiotic plant stressors, which can, according to certain international scientific literature sources, under specific conditions, inhibit rhizobia and cause poor nodulation and N-fixation in a variety of legume crops.

Atrazine is one such herbicide. Based on information emanating from time to time from certain quarters in South Africa, this herbicide is associated with poor rhizobia nodulation on soya bean. Information such as this perhaps could have originated from, for example, a year 2000-study report on soya bean production in South Africa, which has as one of its recommendations the following statement: "Atrazine had a negative effect on the functioning of *Rhizobium*" (translated from Afrikaans).

The risk with such an unqualified statement is that it might be used out of context. If the full findings of the particular study are scrutinised, it would reveal that the effect of atrazine on *Rhizobium* was not direct but indirect, through atrazine first having injured the atrazine-sensitive soya bean plant.

Atrazine is a selective herbicide that kills mainly broadleaf (dicotyledonous) weeds in crops belonging to the grass family, e.g. maize and sugarcane. Its toxic action in atrazine-sensitive plants is highly specific in that it inhibits the light reaction of the photosynthesis process. This life process does not occur in *Rhizobium* bacteria. Therefore, they should be immune from direct damage by atrazine.

The same argument applies to other herbicides in the s-triazine group, e.g. terbuthylazine. Research by Cardina *et al.* (1986) revealed that atrazine inhibited photosynthesis of the inherently atrazine-sensitive legume host plant to such an extent that insufficient energy-rich photosynthate (carbohydrates) reached the nodules, with a consequent reduction in N-fixation.

Harmful dosages

Similar results were reported by Shankar *et al.* (2012) for the herbicides atrazine, 2,4-D and glyphosate. *Rhizobium* nodulation was affected negatively only at herbicides dosages that were harmful to the host plant.

Van Rensburg and Strijdom (1984) basically came to the same conclusion after assessment of the toxicity of thirteen herbicides registered in South Africa against *Rhizobium* strains used in legume inoculants for lucerne, clover, soya beans, groundnuts and lupins.

In this *in vitro* (laboratory) study, the authors highlighted the non-toxic effects observed for atrazine, and stated: "The lack of toxicity of atrazine to rhizobia implied that its application to maize, following a legume crop, would not adversely affect the *Rhizobium* population present in the soil." At present, I am not aware of any research done locally or internationally since 1984 that contradicts this finding.

Unlikely in the field

Other possible sources of disinformation on herbicides being directly responsible for reduced N-fixation could be fuelled by findings from various international laboratory (*in vitro*) studies making use of impractical herbicide concentrations, i.e. much higher concentrations than those recommended for field use.

Several international studies have concluded that the negative effects of various herbicides on rhizobia and N-fixation, which are observed under laboratory conditions, are unlikely to occur in the field, provided the directions for herbicide use are closely followed (Kunelius, 1974; Duke *et al.*, 2012).

Contradiction in expert opinions and scientific research findings will continue to present obstacles on the way to get to the 'real truth'; in fact, this reality is common to all spheres of scientific endeavour. This then begs the question: How real is the supposed threat of herbicides having a negative effect on N-fixation, and what are the origins and reliability of such information?

The overwhelming evidence provided by scientific literature points to atrazine, at least, not posing risks for direct inhibition of *Rhizobium* bacteria and N-fixation, in particular when this herbicide is correctly and responsibly used. Any other factor that would sensitise the crop to herbicides could adversely affect *Rhizobium* bacteria and N-fixation indirectly (secondary effect) through the primary effect of weakening of the host plant.

References available from the author at email dr.charlie.reinhardt@gmail.com.

Strategies for management of herbicide-resistant weeds are well documented and frequently communicated on the South African Herbicide Resistance Initiative (SAHRI) website: *www.up.ac.za/sahri*. Prof Reinhardt is project leader at SAHRI, which is based in the Department of Plant Production and Soil Science, University of Pretoria (UP), dean of Villa Academy, extraordinary professor of weed science, UP, and extraordinary professor at the Department of Agronomy, Stellenbosch University (SU). References are available from the author on 083 442 3427 or email: dr.charlie.reinhardt@gmail.com.

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High alert warning against plant pests

By Dr Gerhard Verdoorn

With an unprecedented outbreak of African armyworm in canola and wheat in the Western Cape, fears were triggered that an outbreak of plant pests may explode in the forthcoming growth season. In other parts of South Africa, reports of large numbers of moths caught in pheromone traps indicate a challenging season ahead for farmers.

South African farmers managed to beat the fall armyworm to a large extent during the previous summer, but it is likely that this invasive pest may emerge again in summer rainfall areas as well as in the Western Cape. Reports of the tomato leaf miner add to the problems farmers will be facing during the growth season.

CropLife South Africa urges producers to invest in scientific monitoring tools, such as pheromone traps, and to start pest vigilance programmes in all crops. Pests are likely to become bolder due to extreme climatic conditions and it is likely that pest outbreaks will also become more extreme due to climate change.

Early detection and prevention

Early detection of plant pests should become standard practice for all farmers to ensure that pests are effectively controlled before they inflict serious damage to crops. It is well known that larvae reaching their adult stages are very difficult, if not impossible, to control even with toxic insecticides.

Detecting pest invasions early gives farmers the opportunity to bring such pests effectively under control in an environmentally compatible

and cost-effective manner. Many maize farmers learnt these lessons last season when the fall armyworm invaded critically important maize areas in South Africa.

Pheromone traps for Lepidoptera and other pests are commercially available from CropLife South Africa members as well as South African Bioproducts Organisation members. Farmers should consult their CropLife South Africa accredited agents for pheromone traps and use them as early warning mechanisms against pest outbreaks.

Registered pesticides available

CropLife South Africa is working closely with the registrar of the *Fertilisers, farm feeds, agricultural remedies and stock remedies Act, 1947* (Act 36 of 1947) to find solutions to the pest problems that farmers are facing.

Farmers are advised to only use registered pesticides and to refrain from using products off-label, which means using it for purposes or in manners other than what the labels indicate. No registration holder will assume responsibility for product failure or crop damage if pesticides are not used strictly according to label instructions. Should non-registered pesticides be available for a particular situation, the industry will work closely with the registrar to lodge and process emergency registration applications.

Pests to be on the lookout for include African bollworm on all crops including vegetable crops, African armyworm, fall armyworm, false armyworm, tomato leaf miner, oriental fruit fly, stalk borer, thrips and whitefly.

Farmers need to report any suspected outbreak of fall armyworm to their closest agriculture officials or send a picture via WhatsApp to CropLife South Africa on 082 446 8946. CropLife South Africa will report any confirmed fall armyworm infestations to the relevant authorities at the Department of Agriculture, Forestry and Fisheries.

Information about registered pesticides is available on the CropLife South Africa AgriIntel Database: *www.agri-intel.com.* A simple registration process will grant free access to the website for easy interrogation on the AgriIntel system.

For more information, contact Tom Mabesa, CropLife SA CEO on 087 980 5163 or tom@avcasa.co.za, or Dr Gerhard Verdoorn, CropLife SA consultant on 082 446 8946 or nesher@tiscali.co.za.

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Science For A Better Life

02/2017

Recent advances in canola meal utilisation **in swine nutrition**

By G Mejicanos and N Sanjayan, University of Manitoba, Canada, IH Kim, Dankook University in South Korea and CM Nyachoti, University of Manitoba, Canada (Article from the Journal of Animal Science and Technology, 2016)

Canola meal (CM) can be used as a cost-effective protein substitute for other protein sources such as soya bean meal (SBM) in pig diets. Depending on its relative nutritive value and cost, it is economical to replace soya bean meal partially or fully with CM. The literature contains enough evidence that CM has been used for more than forty years in swine diets.

Starter pig diets

It appears that the majority of the studies on CM use in starter pig diets were mainly focused on growth performance. In the past, it was suggested that complete or partial replacement of soya bean meal with CM had negative effects on pig performance. It was also documented that increasing inclusion of CM linearly reduced average daily gain (ADG) and average daily feed intake (ADFI) in weaned pigs.

In a preference trial, weaned pigs were offered a choice between a SBM based control diet and CM at 5-20% inclusion level. Results indicated that pigs preferred to eat the SBM based control diet more than any of the diets containing CM. There was also a significant reduction in the amount of feed consumed when the CM inclusion level was increased from 5 to 20%.

The possible reason for the low intake of a diet containing CM by starter pigs may be the influence of glucosinolate (GSL) break-down products on thyroid function and the reduced palatability due to the presence of GSL and their break-down products.

Recent findings, however, are contrary to the results of past research. For instance, a recent study reported that either solvent-extracted canola meal (SECM) or expeller-pressed canola meal (EPCM) at 150g/kg inclusion level combined with crude glycerol can partially replace SBM and wheat in weaned pig diets.

Canola meal offers an alternative in swine diets as it is a cost-effective protein source. (Photograph: www.animalsciencepublications.org)

Growth performance

In a study by Landero, 0, 50, 100, 150 and 200g SECM/kg, in replacement for SBM, was fed to weaned pigs. It was found that from 0 to 28 days on trial, increasing inclusion of SECM up to 20% did not affect body weight gain, feed intake and feed efficiency, although increasing inclusion of CM reduced linearly the apparent total tract digestibility (ATTD) of energy, dry matter (DM), crude protein (CP) and quadratically the dietary energy (DE) content of the diets.

Landero *et al.* conducted another experiment to determine the effect of feeding increasing levels of EPCM up to 200g/kg diet to weaned pigs. They found no significant differences in growth performance although there were linear reductions in ATTD of DM, energy and CP.

In a more recent study, Sanjayan *et al.* demonstrated that SECM from *B. napus* black and *B. juncea* yellow can be included in the weaned pig diets at up to 25% without adverse effect on the growth performance (*Table 1*). In another study, Mejicanos evaluated high levels of inclusion of parent and dehulled *B. napus* and *B. juncea* CM replacing SBM at 15% level and found increased growth performance when using Fine 2 dehulled CM.

There were two possible explanations proposed for the improved performance of weaned pigs at high CM inclusion. Firstly, diets in the past were formulated mainly

Table 1: Effect of dietary canola meal inclusion and canola meal type on nursery pig performance[a].

Item	Control	*B. juncea* yellow		*B. napus* black	
	0%	20%	25%	20%	25%
ADG, g/d	400	385	390	395	391
ADFI, g/d	617	607	620	622	618
G:F	0,63	0,64	0,63	0,64	0,63

[a]Piglets were fed canola meal containing diets in two phases for 28 days.

based on CP and DE and not on standard ileal digestible amino acids (SID AA) or NE.

Zijlstra and Payne suggested that formulating diets with byproducts as alternative feedstuffs would minimise the risk associated with reductions in growth performance if the NE and SID AA systems were used. The second reason is that recent cultivars of CM have comparatively low amounts of GSL compared to old cultivars.

Grower, finisher pig diets

Previous studies reported that CM can be used to replace only up to 50% of the supplemental protein from SBM in grower pigs. However, replacement of 75% or complete replacement of SBM by CM significantly reduced the growth performance. Sauer *et al.* indicated that lower DE and lysine contents in CM compared to SBM and the effect of GSL on feed intake and metabolic process might be the possible reasons for the low performance in grower pigs.

Thacker suggested that good performance could be achieved in grower pigs if CM supplies only one half of the supplementary protein in the diet. In a review on CM, Schöne *et al.* suggested that growing pigs can tolerate a maximum level of 2µmol/g of GSL in the diet. But the total GSL content of Canadian CM is around 7,2µmol/g, which implies a maximum level of 33% CM in a growing pig diet.

Studies to determine the digestibility of nutrients of CM have been conducted. For instance, Bell *et al.* (1998) reported that *B. napus* black and *B. juncea* yellow had similar digestible protein and energy in finisher pigs. An experiment using toasted and non-toasted black and yellow seeded *B. napus* and yellow *B. juncea* in grower pigs suggested that DE and NE content of *B. napus* yellow seeded is higher than that of conventional *B. napus* black and *B. juncea*.

The Canadian National Research Council indicates NE value for SECM from black *B. napus* to be NE for yellow seeded *B. napus* averaged 2 102kcal/kg, while values for yellow *B. juncea* averaged 2 340kcal/kg. The SID AA of SECM and EPCM in grower pigs has been reported by several studies. In the mentioned studies, EPCM had greater digestible AA compared to SECM.

Carcass characteristics

Previous studies also indicated that CM can be included in pig diets without affecting growth performance and carcass characteristics of the finisher pigs. A performance study was conducted in grower pigs with a decreasing amount of expeller extracted CM (22,5%, 15%, 7,5% and 0%) to validate the performance and carcass characteristics.

Increasing the inclusion level of expeller extracted CM did not affect carcass characteristics, such as back fat thickness, loin depth, jowl fat and fatty acid profile; ADG, however, was reduced by 3g/day per 1% inclusion of EPCM. Zanotto *et al.* fed 20%, 40%, 60% and 80% of CM in replacement of soya bean meal to growing finishing pigs and found a quadratic treatment effect on the weight gain.

These authors found that a substitution level of 40% soya bean meal yields a high weight gain and a heavier carcass, although it had greater back fat depth. Busboom *et al.* found that canola feeding not only increased the proportion of unsaturated fatty acid in adipose tissue and muscle tissue, but it also did not affect the carcass characteristics.

Studies have shown that average sow performance and piglet weight were not affected by different levels of canola meal in the rations given during the research.

Sow diets

Spratt and Leeson evaluated the effects of inclusion of raw, ground, full fat canola on sow milk composition and piglet growth using *B. napus* (cultivar Tower) at levels from 5 to 25% commencing on 109 days of gestation and continuing until 21 days postpartum. They found that sow performance was not affected using 5 and 10% canola seed level, but at 15% a decrease in daily weight gain was observed, resulting in the loss of weight

on sows from 7-21 days postpartum; milk was not affected.

More recently, King *et al.* evaluated the effect of diets containing up to 20% of SECM on sow performance. Results indicated that average sow performance and piglet weight were not affected by the different levels of CM in the diets.

In another study, Clowes *et al.* evaluated phase-feeding protein to gestating sows over three parities. The study used CM at a rate of up to 8,1% and did not find an effect on maternal growth, piglet birth weight, litter growth in lactation, wean-to-breeding interval or subsequent litter size.

Quiniou *et al.* studied the effects of feeding 10% of low-glucosinolate rapeseed meal (*B. napus*) during gestation and lactation, over three reproductive cycles, on the performance of hyper-prolific sows and their litters and found no differences when compared to diets containing no rapeseed meal. In their study, sows farrowed 43,6 and 43,8 piglets over three reproductive cycles, respectively.

Determination of SID AA of new cultivars of canola is very important in order to formulate the diet efficiently, thereby helping to achieve predictable growth performance in pigs.

Piglet weight at birth or weaning survival and litter weight gain were not affected by dietary inclusion of CM. Plasma thyroxin levels of sows and piglets indicated that thyroid function was not altered by inclusion of canola of less than 2µol/g of GSL. The use of diets containing 10% of CM on gestation and lactation of hyper-prolific sows over three parities did not affect sow longevity and reproductive and litter performance.

Conclusion

CM offers an alternative in swine diet as it is a cost-effective protein source. This literature review provides information about the nutritive value of CM and recent techniques (i.e. development of new canola cultivars, dehulling of CM, and supplementation of feed enzymes and fermentation) that have been used to improve the nutritive value of CM and overcome the limitations encountered by the swine industry and its use as feedstuff.

Determination of SID AA of new cultivars of canola is very important in order to formulate the diet efficiently, thereby helping to achieve predictable growth performance in pigs. Furthermore, enzyme supplementation to cereal based diets has yielded inconsistent results.

References available from the authors.

Oilseed focus moves to the south

By Dr Dirk Strydom, Grain SA

In early November 2017, international soya bean prices showed good gains, which led to a slight upward trend despite expectations that world soya bean stock levels could increase sharply in the 2018/19 season.

Some of the reasons for the higher prices, include the declining yield in the United States (US) and expectations that the United States Department of Agriculture (USDA) could revise US production to a slightly lower number as harvesting progresses. The completion of soya bean harvesting might also be hindered by expected rain in the eastern parts of the US soya bean belt.

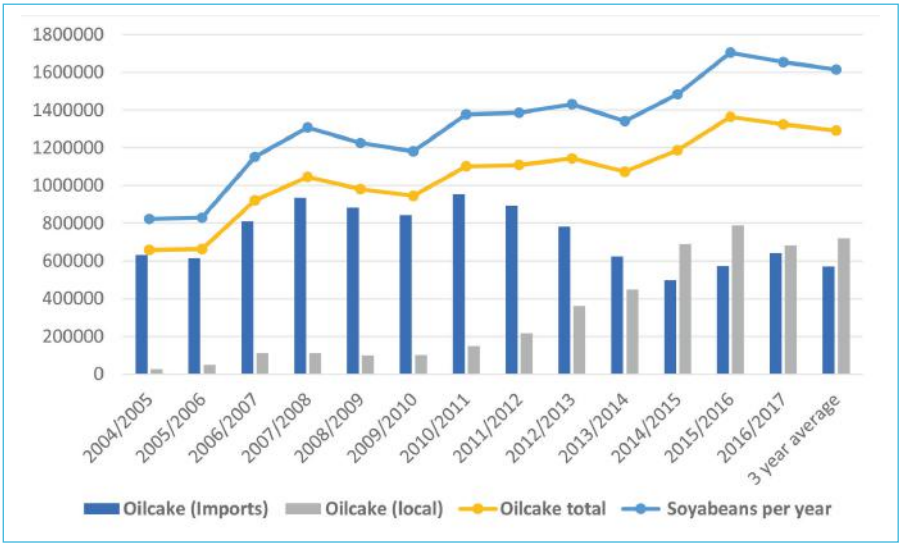
Another factor that influences international soya bean prices, is the weather and production uncertainties in South America. Favoured by good rainfall, the planting of soya beans in Brazil has gained some momentum, but various forecasts show that the central parts of the country might experience below normal rainfall in November, which will be the third consecutive month.

International market prices

Soya bean exports from Brazil during October was only slightly lower than last year's exports, but cumulative exports for the year reached record levels at the beginning of November. Harvesting in the US is nearing completion, and the focus for the coming months will mostly be on the South American production prospects, which would determine the movement of prices within the international market.

International sunflower seed prices are under pressure and traded at a discount to other oilseeds, such as rapeseed and soya beans, despite the smaller crops in the Commonwealth of Independent States (CIS) countries. The higher than expected production in the European Union (EU) and the poor world import demand, are keeping international prices under pressure.

Figure 1: Soya bean oilcake imports and local production. (Source: Sars, Sagis)



The combined setback in sunflower seed crushing in Ukraine and Russia, is likely to be moderated by the reduced import demand from the EU and Turkey, which absorbed more than 70% of sunflower seed exports last season. The international export prices of sunflower seeds hovered near recent lows – with the Black Sea prices still unusually low.

Everyone in the local market is looking forward to a new planting season and, according to the new planting intentions published in October 2017, the expectation is that there will be an increase in production of soya beans. As stated by the Crop Estimates Committee (CEC), there will be an increase of 25,4% in terms of hectares.

Table 1: Supply and demand for current marketing season.

	2016/17	2017/18
Opening stock	89 128	84 792
Supply	985 880	1 315 370
Demand	990 216	1 140 700
Ending stock	84 792	259 462
Months stock	1	2,8

Accommodate the increase

The question on everyone's lips is whether the market will be able to accommodate the expected increase. In the current marketing season, the National Agricultural Marketing Council (NAMC) expects a 259 462 ton carry-over soya bean stock. This raises a few concerns. It is, however, important to look at the season in a holistic way, which would include the production and products from soya beans.

This season was a season of records – records that included not only a yield of 2,29 tons/ha, but also the second biggest area of production with 573 950ha. This was far above market expectations. In terms of the demand side of soya beans, there was an increase year-on-year of 150 484 tons.

However, there was still a decrease in total animal feed consumption from 11,7 million to 11,3 million tons within South Africa. This was mainly attributed to the

drought conditions of the previous year and farmers building new commercial herds. The outbreak of avian influenza (bird flu) also contributed to the decrease, since a large number of infections occurred.

Keep in mind that birds (more specifically layers) are the largest single consumer of soya bean feed products. The demand for soya beans thus increased because soya bean product imports were replaced and more local soya beans were processed. This happened even though some of the processing plants experienced difficulties.

Figure 1 indicates the amount of soya bean oilcake produced in South Africa as well as the imports of oilcake. The average soya bean oilcake consumption over the past three years was 1,3 million tons. Of this, 720 000 tons were locally produced and 580 000 tons were imported.

Imports are decreasing

When analysing *Figure 1*, it becomes clear that imports are decreasing because local feed manufacturers are starting to utilise more local production. As soon as there is a total replacement of imported oilcake, many hectares can be added to local production to satisfy demand. According to the Bureau for Food and Agricultural Policy (BFAP), if the country runs at an 80% processing capacity level, there is a soya bean market space of 1,4 million tons available in terms of dedicated soya bean processing capacity.

In respect of the new season's supply and demand figures, three scenarios are calculated in *Table 2*: Scenario 1 is the lowest average yields of the last five years, scenario 2 the average yield of the last five years and scenario 3 the highest yield of the last five years.

Table 2: Supply and demand scenarios for the new planting season.

Marketing year	2018/19**	2018/19**	2018/19**
	Scenario 1	Scenario 2	Scenario 3
Area planted (x1 000ha)	720	720	720
Yield (ton/ha)	1,48	1,75	2,3
Commercial supply			
Opening stocks (1 March)	259	259	259
Commercial deliveries	1 035,6	1 230	1 626
Imports	0	0	0
Total commercial supply	**1 294,6**	**1 489**	**1 885**
Commercial demand			
Commercial consumption			
Food	25	25	25
Feed (Full-fat soya)	120	120	120
*Crushed for oil and oilcake	**1 050**	**1 250**	**1 640**
Total	1 195	1 395	1 785
Other consumption			
Total	9	9	9
Total SA soya bean demand	1 204	1 404	1 794
Exports	4	4	4
Total commercial demand	1 208	**1 408**	**1 798**
Carry-out (28 February)	87	**81**	**87**

The demand is used to balance the supply and demand to levels of more or less 80 000 tons ending stock, which was the last three-year year norm. Prices were also traded at import parity levels. The need for soya bean processing under the different scenarios are the following: Scenario 1 – 1 050 000 tons; scenario 2 – 1 250 000 tons; and scenario 3 – 1 640 000 tons, which means even at scenario 2 there is still room for oilcake imports.

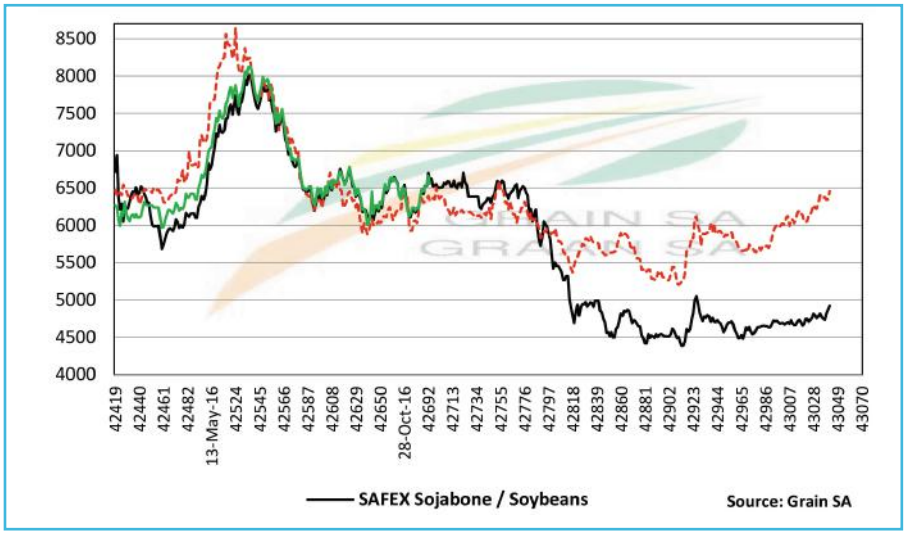
Other factors to keep in mind this coming season are crushing margins, the exchange rate and local prices. Currently, crushing margins are positive as shown in *Figure 2*. This will also motivate local processors to crush more and will assist the competitiveness of local soya bean oilcake against imported oilcake.

With regard to the exchange rate, a lot of uncertainty still exists in the market following the mini budget speech, with slow economic growth still a major threat. There is yet again the possibility of a credit downgrade, and with the ruling party election in December, the exchange rate (as seen before) will be very sensitive to political changes in South Africa. In short this means that the exchange rate will be highly volatile.

Local soya bean prices are far lower than the derived prices, mainly due to expected ending stock levels. Local prices are likely to trade closer to derived prices in the new season, but this depends on local consumption and oilcake imports. The NAMC also expects some soya bean exports, which will assist with ending stock levels.

In production terms, local soya bean prices are still favourable compared to maize, with a current price ratio of 2,3. In South Africa, once the price ratio drops below two, producers start to revert to maize production. Thus, soya bean production is still more profitable, given current prices and assuming that average yields will realise.

Figure 2: Prices of derived soya bean delivered in Randfontein.



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Soya bean crush complex – the right product at the right time

By Raphael N Karuaihe

South Africa's soya bean product has been a great success story over the last ten years, with a ramp up in production reaching 1,3 million tons in the current season. At the same time, South Africa's soya bean crushing capacity has also seen a significant increase.

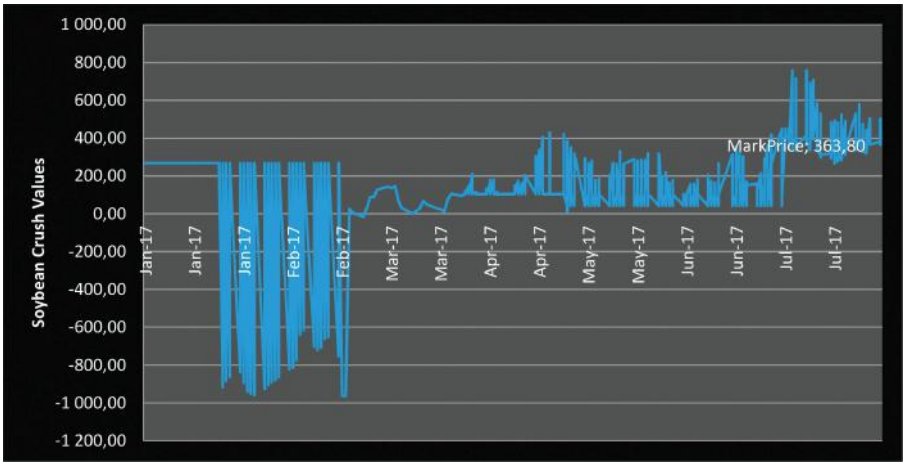
For this reason, soya bean crushers and commodity traders have expressed significant interest in the ability to trade the entire crush complex. This crush complex includes local soya beans and then relies on CME meal and oil as a proxy for global prices.

The complex is a key component in the soya bean market in what is known as the 'crush' spread. Soya beans are processed into two products, namely soya bean meal and soya bean oil. The crush spread is the difference between the combined value of the products and the value of the soya beans.

Measure of profit margin

It is a measure of profit margin for the soya bean processor. The soya bean processor will be interested in the crush spread as part of its hedging strategy, and the speculator will look at the crush spread for trading opportunities.

Figure 1: A time series of the soya crush margin since inception in January 2017.



Although we have the individual contracts listed, the challenge today has been the initial margin efficiency to wrap all three as a single product in the desired ratios. For example, when crushing 100 tons of beans, this will result in 74 tons of meal and 17 tons oil, with 9 tons as wastage.

A crush spread can thus be calculated as the price of soya bean meal (R/t) multiplied by 74%, plus the price of soya bean oil (R/t) multiplied by 17%, less the price of soya beans (R/t). The current clearing solution could not allow for this. So, this necessitated the introduction of a separate contract, namely the Soya Bean Crush complex, which will then trade the complex wrapped up as a single product.

Accessible hedging tool

The JSE Soya Bean Crush complex is an easily accessible hedging tool for the crusher while traders are also able to participate in the movements of this crush complex. This product is not unique to the JSE as globally the CME Group is offering this not only for their local soya beans, but also linking with Dalian Commodity Exchange in China.

In *Figure 1*, a time series of the crush margin since inception in January this year is indicated. The series clearly underscores the need for a price risk management tool such as this one. A spread margin above zero means that the processor is running a profitable operation.

About the author

Raphael joined the JSE at the beginning of 2012 as manager of commodities. Since 1 July 2017, Raphael has been appointed head of commodities where he oversees agricultural and non-agricultural commodities within the Capital Markets Division of the JSE.

Raphael spent many years in the financial services industry where he had advised institutional clients on retirement planning, investments and risk management. He holds a doctorate in agricultural economics from Washington State University.

Raphael N Karuaihe.

Better crop estimates with satellites and remote sensing

By Wiltrud Durand and Fanie Ferreira

Remote sensing is the art and science of recording, measuring and analysing information about a phenomenon from a distance. In order to study large areas of the Earth's surface, geographers use devices known as remote sensors. These sensors are mounted on platforms, such as helicopters, aeroplanes and satellites, that make it possible for the sensors to observe the Earth's surface from above.

The sensors record the reflected or emitted energy digitally, and in the case of satellites this data is transmitted to a ground receiving station. Data from satellites is then converted from digital numbers into satellite imagery, using advanced image processing algorithms so that it can be used by scientists to extract information.

A brief overview

Satellite images recorded by Earth observation satellites have several bands (electromagnetic wavelengths) that are sensitive to and collects information on vegetation stage and condition, which can be associated with chlorophyll content or plant health.

The light reflected by the leaves of a crop depends on the amount and various types of leaf pigments. Measuring the difference in reflected light at various wavelengths of the electromagnetic (EM) spectrum makes it possible to distinguish vegetation from soil, green and senescent vegetation, and different crop types.

In South Africa, three sources of satellite imagery are utilised as part of the process to generate information for the Crop Estimates Committee (CEC) in the Department of Agriculture, Forestry and Fisheries (DAFF). These satellites have different levels of detail (pixel resolution) as well as frequency of recording imagery, and are selected according to their capabilities for a specific purpose.

SPOT 6 and SPOT 7 have a resolution of 1,5m and is used to map agricultural field boundaries. Landsat 8, with a resolution of 30m, and Sentinel 2A, with a 20m resolution, are used in combination within the cropping season to perform a grain crop type classification.

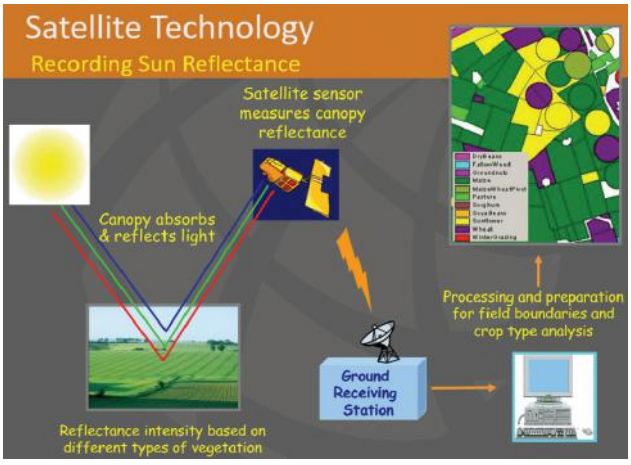


Figure 1: The processes involved in determining field boundaries and crop type analyses.

Field crop boundaries

The DAFF national field crop boundary layer contains a polygon for each individual commercial agricultural field in South Africa, with an attribute of the area in hectare for each field. Fields that are irrigated by means of a centre pivot are also labelled accordingly while small-scale farming fields are grouped together as clusters of cultivation.

The field boundary layer was initially mapped from SPOT 5 satellite imagery at a 2,5m resolution for the entire South Africa at a scale of 1:10 000. The process included strict control measures to ensure a consistent and accurate layer, with fields labelled as centre pivot, rainfed, horticulture (fruit orchards), old fields and small-scale farming.

Fields in all nine provinces of South Africa were mapped, delineating approximately 800 000 cultivated fields, and represents a total of approximately 14 000 000 hectares. These fields have an average size of almost 40ha, with significant variation according to regional landscapes – some fields are even larger than 100ha (*Figure 2*).

The field boundaries are updated annually from the recently launched SPOT 6 and SPOT 7 satellites, featuring a resolution of 1,5m, with the

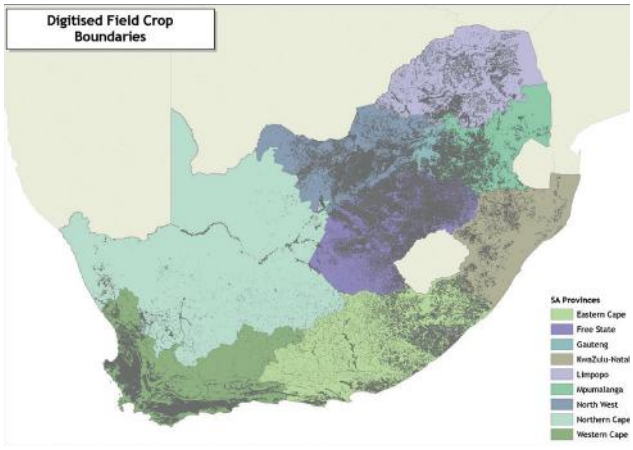


Figure 2: Digitised field crop boundaries for all nine provinces.

focus on irrigated fields such as centre pivots. The field boundary layer is used as a statistical sampling framework for the PICES (Producer Independent Crop Estimate System) survey, which identifies crop types on selected fields in South Africa to calculate provincial statistics.

The approach to map and use field boundaries as the frame for the surveys has reduced the area to be surveyed for area estimates by almost a third when compared to the original farm level area frame.

Crop type classification

The aim of the crop type classification is to identify the specific grain crop that is cultivated on each individual field in the summer grain provinces of Mpumalanga, Free State and North West. Summer grain crops are cultivated from September to April, and therefore regular cloud free satellite imagery is required during the growth season to track the crop growth phenology.

The most appropriate satellites to provide regular imagery are Sentinel 2 (two satellites in a constellation) at 20m resolution with a 5-day recording interval, and Landsat 8 at 30m resolution with a 16-day recording interval.

Information from the PICES survey is used to calibrate satellite imagery to perform the crop type classification. This step involves linking each individual crop type to a specific spectral reflectance value, which is used by the classification algorithm to assign a crop type to each field.

Grain crops that are classified during this process include maize, sunflower, soya bean, groundnuts, dry beans and pastures. This information can then be summarised for a defined region or known administrative boundaries, such as districts, and displayed graphically (*Figure 3*).

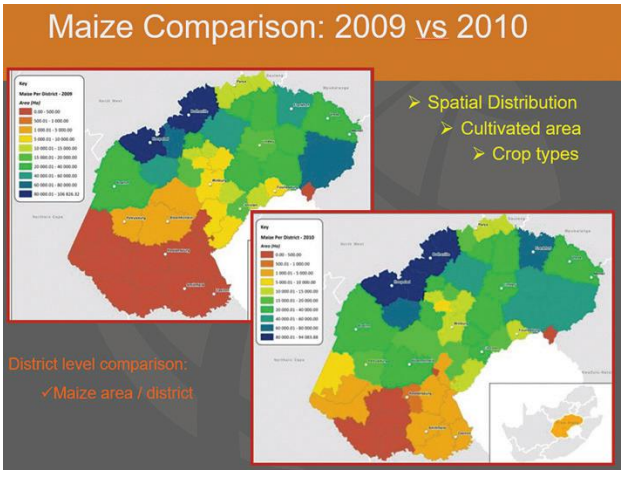


Figure 3: District level maize crop comparison.

Crop type information enables decision-makers and agronomists to understand where a crop of interest is cultivated, and this can also be summarised to district level and compared to previous seasons to identify changes in the cultivated area of a specific crop.

Crop type classifications can also assist in understanding different farm management systems, such as irrigation, double cropping and crop rotation practices. The continuous monthly processing of imagery enables the tracking of progress during the harvesting period and allows the calculation of the area harvested each month.

The use of satellites and remote sensing for agricultural purposes is an exciting and new field of research, where the focus is placed on developing operational automated systems with high accuracy and timely outputs. Due to its well-developed crop estimates system that captures high quality data, South Africa is in collaboration with international research organisations and at the forefront in the development of these monitoring systems.

For more information, contact Fanie Ferreira at Fanie.Ferreira@geoterraimage.com.

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Sizing accuracy on sizers – how to get it right

By Carel Hauptfleisch, Agrisort Technologies

Agricultural producers who have to transport their produce, often struggle with weighbridges not performing accurately. Errors of 5-10g (and even more) are common. But what causes this? Most factors are mechanical in nature, but the control system can also play a part.

Cup linkage design

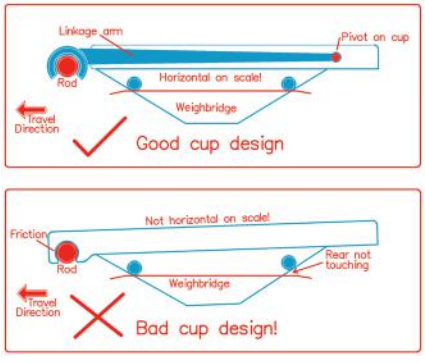
Certain cup designs are simply bad. Inspect your cups closely. What you need is for the cup to somehow be pushed along the track, instead of dragged by the rod. This is typically done by having linkage arms on the side of the cup, connecting the rear of the cup to the rod in front, or by having the cup sit loosely inside a frame.

If the cup is simply hanging on the rod from its front end, friction on the rod causes it to carry a small percentage of the weight in an uncontrolled manner, causing significant errors.

Cup orientation on scale

It is important for the cup to be completely flat on the weighbridge as it passes by. Bad linkage design can often cause the cup to be tilted forward, so that some of the weigh points are hanging in the air, with predictably disastrous effects on results.

Figure 1: A good cup design will ensure accuracy in measurements.



Cup weigh points

A good cup is designed so that both the front and rear end of the cup move onto the scale simultaneously. This is typically achieved by having a 3-point system (one weigh point in the middle front and two in the back), or by having two sets of staggered weigh points whereby the front points are narrower than the rear. The advantage of this is that the entire cup is on the scale for a longer period, giving the system more time to weigh the cup.

Weighbridge alignment

The area where the cup transfers from the track onto the weighing area needs to be aligned so that the cup does not bang against the weighbridge, but gently transfers onto it. A good idea is to place your finger in the cup as it moves over the bridge. You want a relatively smooth ride. If it is bad, you will feel an ugly bump as it goes across.

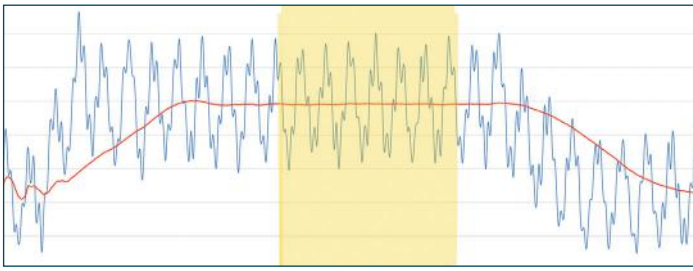
Lubrication

A well-designed cup can give accurate results without much fuss. If the system is calibrated, you will always get a good result. A bad cup design can still give accurate results if you do some basic maintenance. The weighing area, especially where the cups are sliding, should be lubricated daily. The rods where the cups are hanging should also be lubricated from time to time using silicone spray. Regularly check the cup orientation by watching from the side to make sure the cups remain perfectly horizontal during their travel.

Mechanical integrity

Make sure your loadcell and weighbridge are properly fastened and that the weighbridge is completely isolated. It should not be touching any adjacent hardware and should not have any debris. Clean gently, as the loadcells are sensitive devices.

Figure 2: Displayed loadcell readings.



Filter design

The raw readings the machine receives from the loadcell are rather noisy (blue line in *Figure 2*). The machine needs to apply some clever filtering techniques to tease a good 'Table Mountain' signal out of the mess (red line in *Figure 2*). Good control systems have digital filters providing excellent characteristics. One way to know if you have a digital filter or not is to answer this question: Does your machine have any loadcell adjustments that require a screwdriver? If so, your machine likely has analogue (old) filters and will not work as accurately.

Conclusion

A good machine will give accurate results within 1-2g of the true value, all the time. A bad machine or cup design will always take a lot of care to give reasonable results, and, even then, accuracy will never be much better than 3-5g. Use this information to choose wisely when you buy a new machine, and if you already have a 'bad' machine, inquire over your retrofit and upgrade options. Perhaps your old machine does not have to remain as inaccurate.

For more information, phone Carel Hauptfleisch on 021 981 7062 or visit *www.AgriSort.com*.

A practical guide to land reform

By Ursula Human

Many farmers want to get involved in land reform projects, but might not know where to start. "Land reform is often seen as a government 'stand-alone' programme or term, yet the private sector has contributed immensely to the goals set for land reform," says Elton Greeve of Agri-Dev Consulting.

Producers who have become involved in BEE partnerships on their farms have experienced exceptional success, according to Greeve, who worked for the Department of Rural Development and Land Reform (DRDLR) as chief director of strategic land reform interventions for 20 years. He has overseen several land reform projects that have achieved great success.

Significant results

"If I had to name just a few producers whose partnerships have seen significant results, it would be Solms Delta in the wine industry, Hoogland Estate in the fruit industry, both in the Western Cape, Westcliffe in the sugar cane industry in KwaZulu-Natal, and Dabchick Wildlife Reserve in Limpopo – all of which are part of the DRDLR's Strengthening of Relative Rights Programme. The Grasslands Development Trust in the Eastern Cape is also a good example of how a shared dairy has benefited both parties in the partnership," says Greeve.

But what are the options for farmers who want to participate in the land reform process by entering a black economic empowerment (BEE) partnership, and how can they get started? To assist farmers with the steps involved in establishing a successful 50/50 BEE partnership in the agricultural industry, *Oilseeds Focus* consulted with Greeve to come up with a practical 'how to' guide.

Although these are only the basic steps involved in initiating such a project, it does clarify the initial phase of the process and can assist farmers in deciding whether to get involved or not.

The following guide attempts to simplify the steps involved in the two major ways producers can go about establishing a land reform project. Although these are only the basic steps involved in initiating such a project, it does clarify the initial phase of the process and can assist farmers in deciding whether to get involved or not.

The first stage

If a producer wants to contribute to land reform, the first decision will be whether to sell the farm outright to the state for their land reform programme or whether to enter a partnership. If a producer wants to sell land, it could be sold to the DRDLR for redistribution via their land reform programme.

If a partnership is preferred, the producer will need to choose whether to approach the land reform programme through the state or private sector via a financier. This is the first major step and determines which of the following steps will be necessary to make the project a success.

STEP 1: Choose between state and private sector

Choosing whether to approach a partnership project for land reform

through the state or privately might well be the biggest decision the producer can make. Both options have their advantages and disadvantages and farmers need to weigh the pros and cons to suit their needs (*Table 1*). The biggest advantage one gets through proceeding through the state is the grant funding made available to purchase land for a 50/50 partnership. The greatest disadvantage, however, is that the process flow takes quite long.

Table 1: Departmental programme vs private financing.

Department of Land Reform programme		Private financier	
Pros	**Cons**	**Pros**	**Cons**
Grant funding	Land belongs to the state, entity thus cannot build equity on the land	Land belongs to the entity and can build equity, or used for additional development/ production loans	Interest rate offered by the financier may not be sustainable for the project/entity
Long process flow	Difficult to obtain post transaction financial support, due to the lack of surety	Process flow is short	Term period for the repayment will determine the sustainability of the project

A major part of formalising the partnership is to give clarity as to the business structure and model.

The shorter process flow involved in a private sector initiative is the greatest plus when choosing this option. However, there are also cons which include interest rates from the financier that may or may not be sustainable in the long run. Fortunately, there are ways to deal with each option's pros and cons in order to establish an approach that suits the needs of the producer and partners.

A high interest rate, for instance, might deter farmers who want to approach the project privately, but financiers such as Afgri has options available to adapt interest rates according to the level of BEE participation involved in the project.

STEP 2: Follow state or private procedures

State – land reform programme: If a farmer opts for the state route via the land reform programme, a request is sent to the Department of Rural Development and Land Reform, either via the Proactive Land Acquisition Strategy, for outright sale of land, or the Strengthening of Relative Rights of Those Working the Land Programme, to enter a 50/50 partnership. Further steps for the state option then follow the department's internal processes.

Private sector initiative: If a farmer opts for a private sector initiative, an application is made to a financier such as Afgri or the Land Bank. This application is accompanied by a business case study which includes a production plan and a financial report. A projection report might also be included as well as the empowerment venture to be entered into. The process then follows the internal processes of the specific financier.

"No matter how you approach a land reform partnership, the main point of such an activity should always be to improve the socio-economic conditions of farm workers and other previously disadvantaged members in the agricultural sector.

STEP 3: Formalising the partnership model

The third step, whether you have chosen the state or private option, for BEE partnerships is to formalise the model that will be used to facilitate the project. The business plan for a BEE partnership is essential and should clarify the model that will be used to facilitate the partnership.

A major part of formalising the partnership is to give clarity as to the business structure and model. Information should include details of how profit shares will work as well as other aspects of the project such as roles and responsibilities. It should also include details on training that will be provided, particularly in terms of business management on the farm or enterprise.

Models for partnerships depend greatly on the type of enterprise of a farm and the type of commodity that is produced on the farm. Models can be tailormade to suit the project and its partners.

The steps ahead

"These are only the basic steps involved in initiating a land reform project," explains Greeve. "A lot more detail and time goes into a final project that achieves the goals it has set out.

"Farmers also need to know that they do not have to complete all of the steps mentioned above by themselves. There are expert consultants such as Agri-Dev Consulting that offer a service to assist farmers in undertaking these processes. Hence, farmers can get a consultant not only for advisory services, but also to assist with applications and other admin involved in establishing a land reform project.

"No matter how you approach a land reform partnership, the main point of such an activity should always be to improve the socio-economic conditions of farm workers and other previously disadvantaged members in the agricultural sector. Most importantly, it creates the opportunity for shared growth in the sector," Greeve concludes.

For more information, contact Elton Greeve on 073 891 7637 or elton@agri-dev.co.za.

Grain SA Farmer Development Programme

By Jane McPherson, programme manager: Farmer Development, Grain SA

"Good farmers, who take seriously their duties as stewards of creation and of their land's inheritors, contribute to the welfare of society in more ways than society usually acknowledges, or even knows. These farmers produce valuable goods, of course; but they also conserve soil, they conserve water, they conserve wildlife, they conserve open space, they conserve scenery." – Wendell Berry

While South Africa has world-class intensive grain farmers, there are also large numbers of smaller grain producers farming on land that may belong to them, be leased, shared, may have been their family's land for generations or only recently come under ownership through restitution or redistribution programmes, who are not using their land optimally.

The Grain SA Farmer Development Programme (FDP) aims to support developing farmers to harvest the highest possible yield from the land they are farming, using a combination of approaches to achieve this goal. The FDP is sponsored by numerous different trusts and industry partners, which include the Maize Trust, the Oil and Protein Seeds Development Trust (OPDT), the Winter Cereal Trust (WCT), Monsanto, Pannar, Pioneer, Sasol Base Chemicals, Afgri and Grain SA.

The FDP is implemented by the Grain SA office in Bloemfontein, Free State, and field offices spread across the country: Paarl (Western Cape); Kokstad, Dundee and Louwsburg (KwaZulu-Natal); Maclear and Mthatha (Eastern Cape); Nelspruit (Mpumalanga); Lichtenburg (North West) and Ladybrand (Free State). Each office serves a large number of farmers.

Study groups

The FDP model is to form study groups consisting of developing farmers. These study groups are mentored by experienced farmers and mentors are supervised by coordinators located at regional offices. Hundreds of developing farmers and farm workers are trained each year.

This in-field mentoring is supported by an array of different types of training, including:

- Production (introduction to each crop, basic production, advanced production and marketing).
- Production under irrigation (introduction).
- Maintenance (tractors and farm implements, high-application tractor maintenance, basic engine repair and tractor maintenance Parts 1 and 2).
- Management (mechanisation management, centre pivot management, resource assessment and farm planning, farm management for profits, business ethics and contractors).
- Skills development (safe use of workshop tools and farm equipment, workshop skills; development course, workshop skills; welding, workshop skills; spray painting, workshops skills; power tools, workshop skills; hand

tools, practical skills; soil potential and areas determination, practical skills; planter calibration, maintenance and setting of implements, practical skills).

The study groups are effective platforms for gaining and sharing knowledge, and even experienced farmers remain members of the groups, sharing their knowledge and experience. It is a strong indication of the efficacy of the groups that successful farmers remain members, with the intention of both guiding group members and acquiring new information.

One of the most effective methods of capacitating farmers is by planting demonstration trials. Most offices have between five and seven demonstration crops planted annually. The demonstration trials provide farmers with real-time examples of the progress (or lack thereof) of their own crops, from land preparation and planting to weed, pest and fungus control, to harvesting and storage or marketing.

Farmers are taken by surprise to find that some demonstration crops do not go exactly according to plan, but such deviations are valuable learning experiences for developing farmers nonetheless.

Farmers' days

In each region, five farmers' days are held every year. The farmers' days provide an opportunity to view the demonstration sites and to exchange information with other farmers and stakeholders who get invited to these days, such as input supply companies and sector stakeholders. The information to which farmers are exposed at farmers' days are invaluable for subsistence and small-scale developing farmers.

Farmers' days are also organised in more commercialised (i.e. less deep rural) areas where trials have been planted by input companies or by the Agricultural Research Council (ARC) and other industry stakeholders, and even by established commercial farmers in some cases. These days are planned specifically for developing farmers.

In order to prepare farmers for the day when they will no longer be receiving support, we need to facilitate the development of a support system for them that comprises other farmers, input providers, industry representatives and stakeholders, and state entities. Each group has its own unique benefits and challenges and grouping the farmers this way allows the FDP to identify and address challenges unique to each group.

Individual farm visits are made to the most promising farmers during the growth season, in an effort to provide one-on-one intensive support to ensure the best possible quality and quantity of crop. The main aim of this activity is to provide one year of intensive, one-on-one support to outstanding candidates who have come out of the study group system, in terms of production planning, management, making financial applications, reporting etc.

Table 1: Programme statistics.

	Total
Subsistence farmers	7 742
Smallholder farmers	544
Potential commercial farmers	266
New-era commercial farmers	75
Access to arable land	140 266
Study groups	167
Study group members	8 832
Jobs fund farmers	3 014
Advanced farmers	119
REID farmers funded	109
RECAP farmers funded	16
Training courses to date this year	27
Attendees	363
Farmers' days	41
Demonstration trials	41

Commercial farmers

After the year is completed, they should be able to manage as commercial farmers with occasional telephonic advice from their mentors. Each year a new group of farmers is identified and supported in this manner. As soon as the producer is farming each hectare to commercial standards of yield and produces more than 250 tons a year, they are fast-tracked into the commercial sector and 'handed over' to the commercial growers in the particular area. This process has greatly contributed to the rapid growth in numbers of black commercial farmers.

The Rural Enterprise and Industrial Development (REID) initiative of the Department of Rural Development and Land Reform (DRDLR) is also supporting advanced farmers in partnership with Grain SA. The mandate of REID is, *inter alia*, to facilitate the development of rural enterprise and industries, and 109 developing farmers are receiving funding and support through this programme.

The same department is implementing a Recapitalisation and Development Programme (RADP) which focuses on human capacity development, infrastructure development and operational inputs for properties in distress and newly acquired through the land reform redistribution, restitution and other programmes since 1994 – as well as other agricultural properties in distress acquired without grant funding. The FDP is currently partnering with the department on 16 farms in the Free State in this programme.

For subsistence farmers, there is a project known as 'From subsistence to abundance'. This project is a partnership between the jobs fund of the National Treasury, Grain SA, Monsanto, Syngenta, Kynoch and the Sasol Trust. In the 2016/17 season, 3 023 farmers have planted 4 300ha under this project.

Food security

The purpose of this programme is to improve the household food security of subsistence farmers and stimulate production in deep rural areas. The increased production by these farmers has led to many opportunities in the value chain (livestock feeding, milling etc.).

Each year, coordinators identify outstanding members in each group to be nominated for the Farmer of the Year Competition per category. The prizes are awarded in October at a day of celebration following the end of the harvest season. There are four different categories, viz. subsistence (under 10ha), smallholder (10 to 100ha), potential commercial (over 100ha) and new-era commercial (producing in excess of 250 tons).

The FDP also has a monthly magazine, the *Pula/Imvula*, which contains articles on various seasonal topics and supports the theme of current farmers' days and other developing farmer activities. A total of 18 137 magazines are distributed monthly in seven languages: English, Afrikaans, Sesotho, Setswana, isiXhosa, Sesotho sa Leboa and isiZulu. Each quarter, the OPDT contributes relevant articles to the magazine.

Contact Jane McPherson at jane@grainsa.co.za for more information.

Investing globally in the food and agricultural value chain

By Chris Potgieter, Old Mutual head of private client securities, treasury and fiduciary

The food and agricultural value chain has a massive economic, social and environmental footprint. This US$5 trillion industry represents 10% of global consumer spending, 40% of employment and accounts for 70% of fresh water consumption.

The value chain covers production inputs from farmland to logistics, and ultimately also comprises the wholesale and retail of produced goods. *Figure 1* provides an overview of the typical players and investment characteristics of each category in the value chain.

Apart from the obvious players, this value chain also comprises a wide range of speciality companies focusing on specific areas within the chain to increase productivity and quality and to reduce waste. Technology and the precise application thereof are playing an ever-increasing role in the food and agribusiness value chain.

An early example of cost-effective precision in farming was John Deere. They equipped their tractors and other mobile machines with global positioning system (GPS) sensors so that they could be located to within a few centimetres anywhere on earth. Such technology applications and targeted biological research are set for significant growth in the coming decades.

Investment opportunity

Since 2004, global investments in the food and agribusiness sector have grown more than threefold. Previously unavailable opportunities to invest in farmland and emerging markets are now readily accessible. Food and agribusiness companies on average have demonstrated higher total returns to shareholders (TRS) than many other sectors.

Certain sub-sectors such as United States (US) farmland have delivered even more impressive risk-adjusted returns over similar and even longer periods of time, while offering a significant diversification benefit to portfolios due to the low correlation of farmland to other asset classes. Assets such as commercial farmland, which were historically privately held and not available as listed equities, are now more accessible to investors.

Figure 1: Characteristics of the food and agricultural value chain.

	INPUTS e.g. equipment, seeds , fertiliser, pesticides,	FARMLAND	COMMODITIES AND TRADING	STORAGE /TRANSPORT /PROCESSING/ PACKAGING	WHOLESALE/RETAIL
OWNERSHIP	Mostly public companies, some private companies	Mostly private owner-operators. Some public/private funds	Public and private companies	Public and private companies	Mostly public companies
EXAMPLES OF KEY PLAYERS	John Deere, Monsanto Yara, Mosaic, Bayer, Omnia	Family ownership, Listed REITS e.g. Farmland Partners	Bunge, Archer Daniels Midland, Amaggi, Raizen, Grainvest	Cargill, JBS, Tyson Foods, Richardson, Mondi	General Mills, Kraft, BRF, Nestle, Pioneer Foods, Tiger Brands
INVESTMENT RETURN PROFILES	Some cyclical	Stable (if diversified)	Highly cyclical	Some cyclical	Stable (if diversified)

In the coming decades, farmers will need to find ways to cope with more climate shocks while roughly doubling the amount of food they produce.

Over the next few decades, the world's population will continue to grow, driven by developing markets coupled with increasing income per capita that will translate into higher caloric intake, i.e. more people with more money will want to consume richer food items such as meat (protein).

On the other hand, the world is facing a growing shortage of food supply that is primarily due to a decline in arable land and a water shortage, driven by overuse and climate change. Other factors, such as the reduction of waste throughout the food and agribusiness value chain and the application of smart technologies to improve productivity, present opportunities to address some of this shortfall of food supply versus demand.

Supply and demand trends

Two hundred years ago, a British scholar, Thomas Malthus, convinced English nobility that civilisation had surpassed the earth's carrying capacity and that famine was imminent. Since this first prediction

of the world having a limited capacity to support its growing population, there have been many episodes of recurring concerns that the world has exceeded its carrying capacity.

However, Malthus underestimated mankind's ability to adapt and invent new solutions to solve the issue of resource constraints versus population growth. Global transportation, for example, allowed abundant harvests in one part of the world to satisfy the shortfalls in other parts of the world. Additionally, the industrial application of nitrogen introduced commercial fertiliser that massively increased the productivity of land.

Although significant productivity improvements over the past 50 years have enabled abundant food supply in certain parts of the world, feeding the global population has re-emerged as a critical issue due to the combination of increasing demand and increasing supply constraints.

Figure 2: Declining arable land supply and rising food demand.
(Source: UN Food and Admin Org)

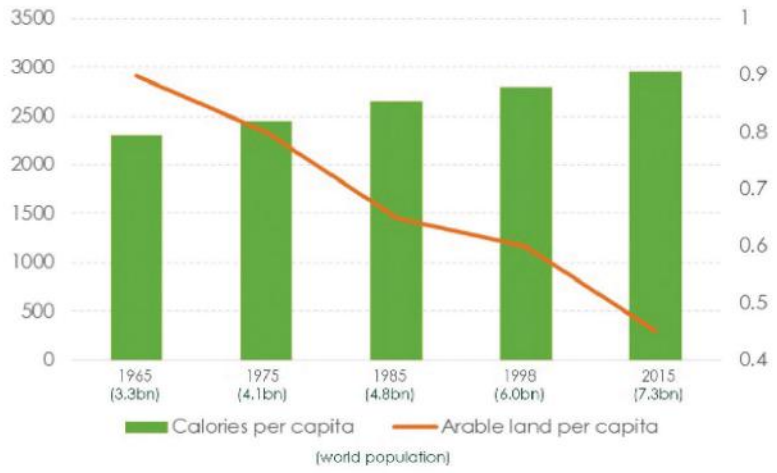
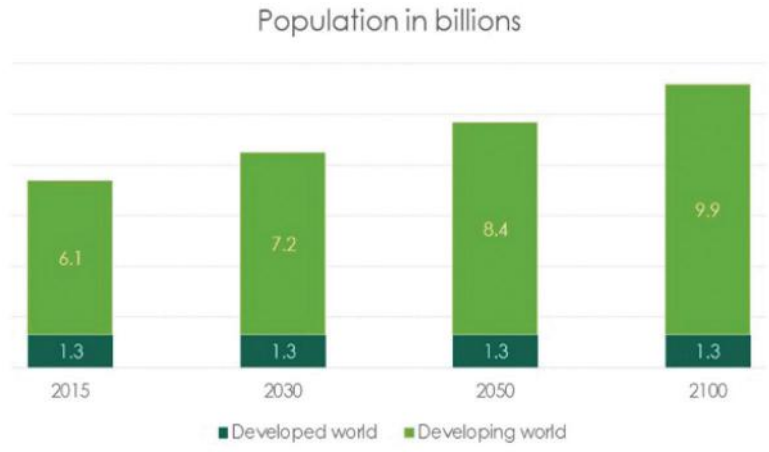


Figure 3: Growing world population fuelled by emerging economies.
(Source: UN Report: World Population Prospects, 2015 revision)



Increase in demand

- In 1960, the world population was three billion. In the last 57 years more than four billion people have been added to the planet and today between 800 million and 1 billion people are starving.
- Population growth in developing countries is equivalent to adding the entire current US population every four to five years. If this trend continues, the world population will expand to 8,5 billion people by 2030 and swell to 10 billion by 2050.
- Gross domestic product (GDP) per capita is increasing rapidly in developing countries. This trend supports a growing demand for higher caloric intake and protein. If current trends continue, by 2050, caloric demand will increase by 70% and crop demand for human consumption and animal feed will increase by at least 100%. Protein consumption is set for continued growth in excess of non-protein consumption.

Increasing supply constraints

- Globally, over 20% of arable land is already degraded and new land added is almost always of a lower quality than land that is lost. Increasing urbanisation is also removing arable land from production.
- The trend towards non-genetically modified, organic produce and local and free-range farming in developed countries requires more land and resources per calorie to produce than traditional commercial methods.
- The typical US diet requires two acres (2,5 acres = 1 hectare = 10 000 square meters) of farmland per person. If current trends continue, in 40 years there will be 0,3 acres of farmland available per person globally.
- Agriculture currently accounts for 70% of fresh water demand. It is estimated that by 2030, 40% of fresh water demand is unlikely to be met, meaning that harvests will come under increasing pressure.
- Rising demand is depleting global crop inventories, with the global grain surplus having steadily declined from 120 days of consumption in 1985 to 90 days currently. The trend remains negative despite significant yield improvements.
- The average age of a typical US farmer is 59 years and there is a shortage of skills in agriculture reflected globally.

Helping farmers cope with climate

Climate change is already having a much greater effect on harvests. In 2010, Russia and the Ukraine experienced excessive heat waves, fires and serious droughts, causing wheat production in these countries to drop by 33% and 17% respectively. Cold and rainy weather in Canada resulted in a 14% decline in

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harvest while excessive rain in Australia diminished production by 9%.

China – the largest wheat producer and consumer in the world – experienced a drought in its main wheat-growing eastern region. With the current El Niño effect impacting South Africa's agricultural industry, certain areas of the country have been declared disaster zones as crop failure, livestock mortality and unemployment rise.

Producers and food companies that embrace more stringent environmental and social standards, organic-certification requirements and traceability standards should be able to better position themselves in the face of evolving regulation, and continue to grow to take advantage of this trend.

In the coming decades, farmers will need to find ways to cope with more climate shocks while roughly doubling the amount of food they produce. Furthermore, they will need to accomplish this feat in a way that is sustainable for both the environment and their bottom line. This will require revolutionary innovation in all areas impacting farming.

Producing more protein

By 2020, emerging economies are expected to deliver more than half of global GDP growth, and over half the world's urban population will reside in these countries. Not only is the demand for food in emerging markets expected to rise significantly due to population and income growth, but these regions are also likely to adopt a more developed world diet, i.e. they are likely to consume more calories, protein and processed foods.

A projected surge in demand for protein in emerging markets, especially pork in China, would create opportunities for companies to grow in core production and supporting industries such as breeding, animal-health testing, feed and vaccines. Beef and other livestock production in Argentina and Brazil, for example, is expected to grow strongly to meet global demand.

Making feed conversion more efficient so that animals produce more meat without necessarily consuming more feed could be profitable for companies with unique intellectual property in additives such as probiotics, enzymes and acidifiers.

Shifting consumer preferences

In addition to greater demand for protein, there is a trend towards healthier diets. Consumers are becoming increasingly health conscious and place greater importance on environmental sustainability. While this is most notable in developed countries, this trend is gaining momentum in emerging markets and in response governments are tightening food production standards.

As a result, demand is rising for healthier functional foods (those that offer benefits beyond basic nutrition, such as lowering cholesterol), and for traceable and certified foods that are guaranteed to meet a certain level of safety and environmental or corporate social responsibility.

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A war on waste

Reducing waste in the agricultural value chain will also be a key factor to mitigate against the substantial shortfall between food production and demand. It is estimated that post-harvest waste amounts to 30% of production in developing countries, mostly due to poor engineering and agricultural practices, inadequate infrastructure and poor storage facilities. Improved logistics, such as cold storage and transport, will be required to reduce this wastage and increase accessibility to food.

Furthermore, it is estimated that over 30% of food produced in the developed world goes to waste on retail shelves and in consumer homes. This waste can be ascribed to many factors such as strict sell-by dates, buy-one-get-one-free offers and consumers' demand for cosmetically perfect food.

In these developed markets, there are opportunities for innovation in extending food shelf life and in packaging to reduce waste downstream. Agricultural, logistical, processing and packaging technologies that raise productivity and reduce waste will become increasingly important.

New farmland

Bringing new farmland into production in South America, Africa and Eastern Europe will also be critical in avoiding a catastrophic shortfall in food supply should current trends continue. Current farmland productivity, however, needs to be protected and enhanced and, in this regard, US farmland remains important for global food production.

Only slightly behind China, the US is the world's second-largest producer of grains and oilseeds and the world's largest exporter. Given that the average age of the US farmer is 59 and there is demand from farmers for both expansion capital and risk diversification, an increasing proportion of US farmland is becoming investable through land-lease schemes.

Acquired farmland is held as direct investment by private funds such as sovereign wealth funds, pension funds and individual investors through pooled funds (e.g. LandFund Partners) or REIT structures (e.g. Farmland Partners). These mechanisms for attracting private capital to farmland will become ever more important for the preservation and growth of farmland globally.

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Events Calendar

For more information on any of these events, contact Ursula Human on 064 890 6942 (during office hours) or email ursula@plaasmedia.co.za.

DECEMBER 2017

3 – 6	International Conference on Global Food Security, Cape Town, South Africa
4	Fruitnet Forum Middle East, Dubai World Trade Centre, Dubai
5 – 7	9th International Perishables Expo Middle East (WOP DUBAI 2017), Dubai World Trade Centre, Dubai

JANUARY 2018

18	VinPro Information Day, Cape Town International Convention Centre (CTICC), Cape Town
18 – 20	International Conference on Food and Agriculture Technologies (ICFAT 2018), Jejusi, South Korea

FEBRUARY 2018

7 – 9	Fruit Logistica 2018, ExpoCenter City, Berlin, Germany
14 – 16	16th African Fine Coffee Conference and Exhibition, Kampala Serena Hotel, Uganda
27 – 28	E-Agri East Africa Summit, Hilton Hotel, Nairobi, Kenya
27 – 28	Agri Logistics East Africa Summit, Hilton Hotel, Nairobi, Kenya

MARCH 2018

5 – 7	11th World Congress on Plant Biotechnology and Agriculture 2018, Paris, France
8 – 10	21st Euro-Global Summit on Food and Beverages 2018, Berlin, Germany
19 – 21	Global Berry Congress 2018, World Trade Center, Rotterdam, Netherlands
23 – 24	Giant Pumpkin Festival, Heidelberg, Western Cape, South Africa

APRIL 2018

12 – 14	Agritech Expo Zambia, GART Research Centre, Chisamba, Zambia
27 – 29	South African Cheese Festival, Sandringham, Stellenbosch

MAY 2018

15 – 18	Nampo Harvest Day, Bothaville, South Africa
31 – 3 June	Robertson Wacky Wine Weekend, corner Voortrekker and Reitz Street, Robertson Wine Valley

JUNE 2018

7 – 8	2018 Agbiz Congress, Boardwalk International Convention Centre, Port Elizabeth, Eastern Cape