Key drivers that affect **sunflower seed quality**

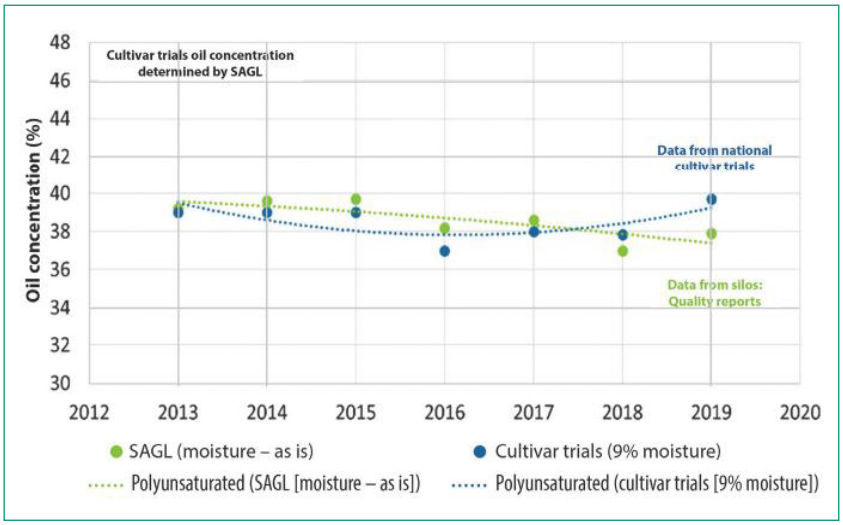
By Marion Delport, manager: data science, Bureau for Food and Agricultural Policy

Over the past seasons the drastic decline in sunflower seed oil content has had a major adverse effect on the industry. Whereas sunflower seed was typically delivered with an oil content of approximately 39% and higher, the oil content has declined significantly. This decline puts crushing margins and the overall competitiveness of the industry under pressure.

In light of this, the Bureau for Food and Agricultural Policy (BFAP) has undertaken a study to provide a deeper understanding of the key drivers that affect sunflower seed quality, the impact of lower oil content on the industry, and potential interventions to upgrade the value chain. The Oilseeds Advisory Committee and Oil and Protein Seeds Development Trust funded the study.

In South Africa, yields and oil yield (tons/ha) have been relatively stagnant over the past decade, managing to increase by an average annual growth rate of only 1% compared to maize yields that have increased by an average annual growth rate of 2,5% over the same period.

Figure 1: Sunflower seed oil concentration based on the cultivar trials (9% moisture level) and Southern African Grain Laboratory (as-is moisture level) results.



Simultaneously, the seed's oil content percentage has decreased by an average annual growth rate of 0,6%. The oil content of sunflower seed produced in South Africa is also significantly lower than that which is produced in Argentina or the Balkan countries.

Table 1: Comparison of high-oil-content cultivar performance in Argentina and South Africa. (Source: National cultivar trials in South Africa and Argentina, Corteva [2019] and ARC [2019])

Cultivar	Country	Yield (tons/ha)	Oil content (percentage, moisture – as is)
Cultivar 1 – commercially sold in Argentina and South Africa	Argentina	2,58	52,7%
	South Africa (average 2016 to 2019)	1,77	42,3%
Cultivar 2* in Argentina vs cultivar 3 in South Africa	Argentina	2,51	50,4%
	South Africa (average 2016 to 2019)	1,88	40%

** This cultivar is of South African origin and was moved to Argentina since it could not outperform cultivar 3, the leading Corteva cultivar, in terms of yield in South Africa.*

Cultivars with high oil content

Cultivar trial data from international seed breeders shows that the same high-oil-content cultivar planted in South Africa yields a lower oil content when it is planted under optimal conditions in Argentina (*Table 1*).

This research has clearly illustrated that seed yield and oil content are complex quantitative traits that are not only controlled by many genes, but are also highly influenced by environmental conditions. Both additive and non-additive genetic effects play an important role in the inheritance of seed yield and oil content.

There is some evidence that oil content levels can be increased by introducing more cultivars with high oil content (*Figure 1*). Currently, producers who plant sunflower have a choice of 199 different sunflower seed varieties; some 113 of

these varieties are classified as high-oil hybrids with the potential of achieving an oil content of more than 40%.

The average advertised oil content for South African cultivars is between 38 and 46%. An analysis of advertisements from seed companies supplying the Russian, Ukrainian, Hungarian and Argentinian markets indicated an advertised oil content in the range of 45 to 54%. Thus, the South African sunflower seed market may benefit from new imported cultivars. However, this must be tested first to establish their potential under South African climate and management conditions.

Focusing on oil content

Sunflower is a predominant cash crop in Argentina and the Balkan countries, while in South Africa it is a 'catch crop' that is planted after maize. Preference is not given to the timing of production such as optimal planting date, fertiliser applications, soil analysis or the pest, weed or disease programmes that are required for optimal production. *Table 2* lists the effects of some of these factors on yield and oil content.

To encourage producers to focus more on sunflower production, the return on investment must be higher than for maize, thus requiring a higher sunflower seed selling price. This price cannot be increased because the price of sunflower seed and oil must remain between import and export parity for South African sunflower seed to remain competitive in the global market.

Currently, there is little motivation for producers to increase oil content through targeted agronomic practices, because their primary focus is increasing yields for larger returns. One way to prevent sunflower seed oil content from decreasing further is to incentivise producers to focus on the oil content by buying higher-oil-content seed and planting sunflower earlier (closer to the optimal planting window).

A summary of various international and domestic quality-based pricing models highlighted two options for the sunflower industry:

- Oil-content-based price premium or oil-content-based grading (a common practice in Argentina and Balkan countries' pricing mechanisms).
- Back-payment structure by which the producer gets to share in high-oil-content advantages at crushing level.

A study of incentive systems

The BFAP study explored the principles of an incentive system, which rewards producers for adopting high-oil-content seed that maximises oil yield per hectare, rather than just yield per hectare. This is not a new concept and is a sunflower contracting norm in international markets.

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To accelerate producers' adoption of high-oil-content seed, an incentive structure that stimulates uptake would be important to consider, especially if there might be a perception (and theoretical expectation from a plant science and breeding perspective) of a negative correlation between yields and oil content. Therefore, at farm level, the incentive will compensate for a gross margin trade-off between producing 'high-yield, lower-oil-content seed' and 'low-yield, high-oil-content seed'.

In a pilot study conducted during the 2020 season, a sunflower seed crushing facility offered a 1,5% price premium for every 1% oil content above 38%. Producers who planted cultivar 1 (as mentioned in *Table 1*) were eligible to participate in this study. The stakeholders described the study as a success.

Of the sunflower seed delivered, the oil content was measured at 46 to 48%. Based on an average sunflower price of R5 887/ton, producers would have received price premiums of between R706 and R883/ton (that is 12 to 15%). On top of the improved price, producers who took part in the pilot study reported average yields of 2 tons/ha. Overall, the 1,5% premium accounts for a yield that is 0,3 tons/ha lower at the average oil content levels recorded in this study.

Oil content testing at silo level would be a key factor in implementing such an oil-content-based price premium, but is currently poorly defined with no standards or thresholds of oil content levels. Not all silo depots have calibrated equipment to measure oil content. The near-infrared reflectance testing methodology would be the analysis of choice at silos and crushing plants due to the speed of the test, the ease of testing and relative accuracy. However, making this technology available at all (or enough) silos would require significant additional investments.

A final thought

It comes down to producers' willingness to adopt new high-oil-content seed and predominant cash crop production practices (e.g. earlier planting dates), as well as the favourable environmental and climate factors mentioned in *Table 2*, to improve their ability to produce seed that exceeds the threshold of 38%, preferably in excess of 41%, oil content. Processors' ability to pay premiums that will sustainably stimulate high levels of high-oil-yielding seed production, while competing with crude oil imports, is also a factor.

For more information, phone the author on 083 731 9698 or 012 420 5770, or visit *www.bfap.co.za*.

Table 2: Factors that affect sunflower seed yield and oil content.

	Yield	Oil content
Late planting date	↓	↓
Plant population	<20'/ha ↓ >45'/ha ↓	
Temperature	↓	↓
Water stress	↓	↓