The impact of key drivers on sunflower seed quality

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Over the past seasons, the drastic decline in sunflower seed oil content has had an adverse impact on the industry. The industry norm was typically the delivery of sunflower seed with an oil content of approximately 39% and higher; however, the oil content has dropped significantly, putting crushing margins and the overall competitiveness of the industry under pressure.

In light of this, the Bureau for Food and Agricultural Policy (BFAP) undertook a study, funded by the Oilseeds Advisory Committee (OAC) and the Oil and Protein Seeds Development Trust (OPDT), to provide a deeper understanding of the key drivers affecting sunflower seed quality, the impact of varying (lower) oil content on the industry, and potential interventions towards an upgraded state of the value chain.

Minimal average annual growth

In South Africa, yields (per hectare) and oil yield (t/ha) have been relatively stagnant over the past decade, managing to increase by an average annual growth of only 1% compared to maize yields, which have increased by an average annual growth of 2,5% over the same period. Simultaneously, the oil content (%) of the seed has decreased by an average of -0,6% annually.

The oil content of sunflower seed produced in South Africa is also significantly lower than what is produced in Argentina or the Balkan countries. Furthermore, cultivar trial data from international seed breeders shows that the same high oil content cultivar planted in South Africa yields a lower oil content than if planted under optimal conditions in Argentina (*Table 1*).

This research clearly illustrated that seed yield and oil content are complex, and that 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 a vital role in the inheritance of seed yield and oil content. There is

Figure 1: Sunflower seed oil concentration (%) results based on the cultivar trials for 2013 to 2019 (9% moisture level), and South African Grain Laboratories (SAGL) for 2013 to 2019 (as-is moisture levels).

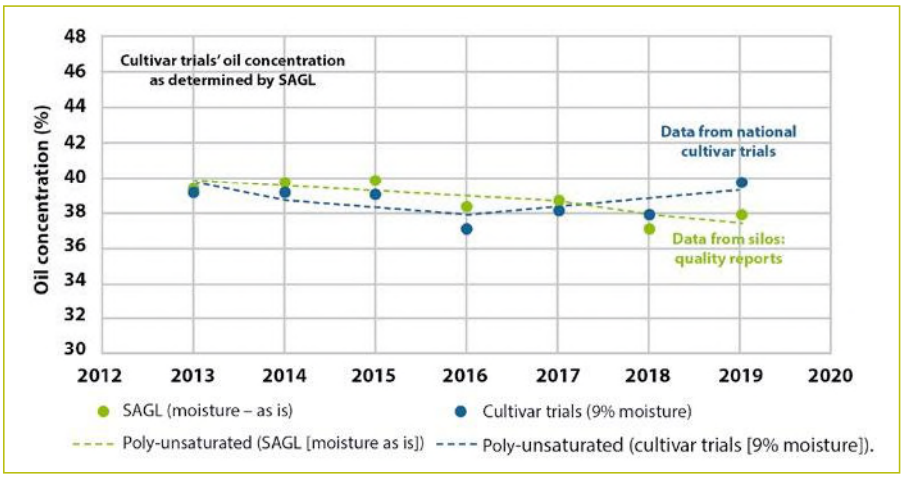

Table 1: A comparison of the performance high oil content cultivars in Argentina and South Africa. (Source: National cultivar trials in South Africa and Argentina, Corteva [2019] and ARC [2019])

Cultivar	Country	Yield (t/ha)	Oil content (%, moisture – as is)
Cultivar 1: Commercially sold in Argentina and South Africa	Argentina	2,58	52,7
	South Africa (avg 2016 to 2019)	1,77	42,3
Cultivar 2[1] in Argentina vs Cultivar 3 in South Africa	Argentina	2,51	50,4
	South Africa (avg 2016 to 2019)	1,88	40

[1]Cultivar is of South African origin but was moved to Argentina since it could not outperform Cultivar 3, the winning Corteva cultivar in terms of yield in South Africa.

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

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

some evidence that oil content levels can be increased by introducing more high oil yielding cultivars (*Figure 1*).

Currently, producers planting sunflower have a choice of 199 different seed varieties. Of these, 113 are classified as high-oil hybrids with the potential of achieving an oil content higher 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 might benefit from new imported cultivars. This must, however, first be tested to establish its potential under South African climatic and management conditions.

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

Focussing on high yield cultivars

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

Currently, there is little motivation for producers to increase oil content (through targeted agronomic practices), therefore 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, namely an oil content-based price premium or oil content based grading (a common practice in Argentina and the Balkan countries' pricing mechanisms), and a back-payment structure whereby the farmer gets to share in high-quality driven (high oil content) advantages at crushing level.

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

To speed up the adoption of high oil content seed by producers, an incentive structure that stimulates uptake would be an important factor to consider, especially if there could 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'.

Pilot study yields results

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 that planted Cultivar 1 (as mentioned in *Table 1*) were eligible to participate in this study.

The stakeholders described the pilot as a success because:

- Of the sunflower seed delivered, 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 to R883/ton (that is 12 to 15%).
- On top of the improved price, producers that took part in the pilot reported average yields of 2t/ha.

Overall, the 1,5% premium accounts for a 0,3t/ha lower yield 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, and is currently poorly defined with no standards or thresholds of oil content levels – and not all silo depots have calibrated oil content measurement equipment.

The near-infrared reflectance (NIR) testing methodology would be an analysis of choice at both silo level and crushing plants due to the speed of the test, the ease of testing, and relative accuracy. However, to make this technology available at all (or enough), silos would require significant additional investments by silo owners.

Carte blanche for producers

Overall, it comes down to the producers' willingness to adopt new high oil content seed and predominant cash crop production practices (such as earlier planting dates), as well as favourable environmental and climatic factors.

This is to improve their ability to produce seed that exceeds the threshold of 38%, preferably in excess of a 41% oil content, as well as the wherewithal of processors to pay premiums that will sustainably stimulate high levels of high oil yielding seed production, while competing with crude oil imports.

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