Southern African Sunflower Crop

Quality Report
2018/2019 season

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South African

Commercial sunflower quality for the 2018/2019 Season

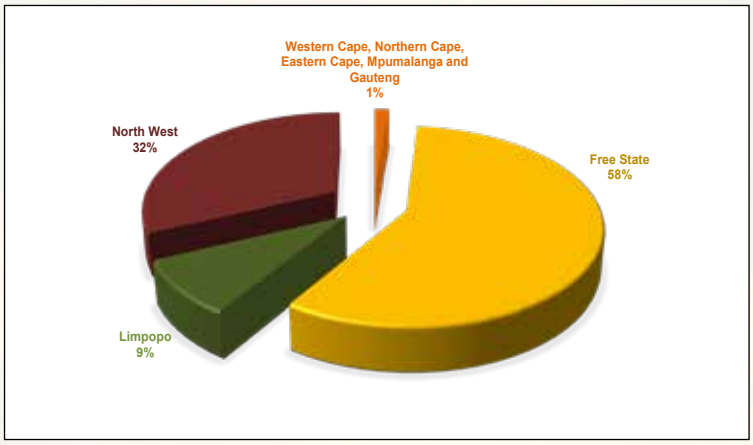
Acknowledgements
With gratitude to:

- ***The Oil & Protein Seed Development Trust for its financial support in conducting this survey.***
- *Agbiz Grain and its members for their cooperation in providing the samples to make this survey possible.*
- *The Crop Estimates Committee (CEC) of the Department of Agriculture, Forestry and Fisheries (DAFF/DALRRD) for providing production related figures.*
- *South African Grain Information Service (SAGIS) for providing supply and demand figures relating to sunflower.*
- *The Bureau for Food and Agricultural Policy (BFAP) for providing research based market analysis.*
- *Precision Oil Laboratories for providing Fatty Acid Profile analyses.*

Introduction

The final commercial sunflower crop figure of the 2018/19 season as overseen by the National Crop Estimates Liaison Committee (CELC) is 678 000 tons, a decrease of 2 940 tons or -0.43% compared to the final crop estimate figure. The crop decreased by 21.3% (184 000 tons) year on year. The major sunflower-producing provinces, namely the Free State and North West, contributed 89.6% of the total crop.

Graph 1: Contribution of the provinces to the production of the 2018/19 sunflower crop



Figures provided by the CEC.

During the harvesting season, a representative sample of each delivery of sunflower seed at the various grain intake points, was taken according to the prescribed grading regulations. The sampling procedure for the samples used in this survey is described on page 36. One hundred and seventy six (176) composite sunflower samples, representing the different production regions, were analysed for quality. The samples were graded, milled and analysed for moisture, crude protein, crude fat, crude fibre and ash content. Twenty samples, randomly selected to represent the different production regions, were submitted to Precision Oil Laboratories for fatty acid profile analyses.

This is the seventh annual sunflower crop quality survey performed by The Southern African Grain Laboratory NPC (SAGL). SAGL was established in 1997 on request of the Grain Industry. SAGL is an ISO 17025 accredited testing laboratory and participates in a number of proficiency testing schemes, both nationally and internationally, as part of our ongoing quality assurance procedures to demonstrate technical competency and international comparability.

The goal of this crop quality survey is the compilation of a detailed database, accumulating quality data collected over several seasons on the national commercial sunflower crop, which is essential in assisting with decision making processes. The data reveal general tendencies and highlight quality differences in the commercial sunflower seed produced in different production regions nationally.

The results of this survey are available on the SAGL website (www.sagl.co.za). Hard copy reports are distributed to all the Directly Affected Groups and interested parties. The report is also available for download in a PDF format from the website.

In addition to the quality information, production figures (obtained from the Crop Estimates Committee (CEC)) relating to hectares planted, tons produced and yields obtained on a national as well as provincial basis, over an eleven season period, are provided in this report. SAGIS (South African Grain Information Service) supply and demand information is provided in table and graph format. Import and export figures over several seasons as well as information on the manufacture, import and export of oil seeds products, are also included.

The report of the Evaluation of sunflower cultivars 2018/19 season conducted by the ARC-Grain Crops in collaboration with Agricol, Pannar, Pioneer, Syngenta, Sensako and Link Seed is included in totality and as received, in this report. The national grading regulations as published in Government Notice NO. 45 of 22 January 2016 are also provided.

Production

World sunflower seed production for the 2018/19 season stands at 52.3 million metric tons with the Ukraine and Russia contributing 53.6% to this total. The forecasted figure for the 2019/20 season is 54.4 million metric tons.

Please see Table 1 for the world sunflower seed supply and disappearance figures.

Table 1: World Sunflower Seed Supply and Disappearance (October through September)

Season	2014/15	2015/16	2016/17	2017/18	2018/19 (Revised)	2019/20 (Forecast)
Area Harvested (1 000 Ha)	***24 708***	***25 242***	***26 964***	***26 885***	***27 265***	***27 521***
Yield (MT/Ha)	***1.67***	***1.70***	***1.86***	***1.83***	***1.92***	***1.98***
Production (1 000 MT)						
Argentina	3 000	2 830	3 300	3 400	3 730	3 400
European Union	9 006	7 769	8 641	10 058	9 484	9 465
China	2 380	2 698	2 750	2 580	2 550	2 500
Russia	9 000	9 700	11 600	11 000	12 756	14 600
Ukraine	10 250	12 100	15 100	13 400	15 250	15 750
United States	1 005	1 329	1 203	970	959	881
South Africa	736	755	874	862	681	800
Turkey	1 350	1 350	1 470	1 700	1 530	1 690
Other	4 607	4 386	5 130	5 086	5 353	5 354
TOTAL	***41 334***	***42 914***	***50 068***	***49 056***	***52 290***	***54 440***
Import (1 000 MT)						
Turkey	523	436	611	721	1 051	950
European Union	275	577	632	520	549	610
Other	1 078	1 100	1 396	1 322	1 397	1 674
TOTAL	***1 876***	***2 113***	***2 639***	***2 563***	***2 997***	***3 234***
Export (1 000 MT)						
Argentina	63	302	74	58	149	95
United States	126	107	99	89	87	80
Russia	61	105	362	103	337	600
Ukraine	123	171	261	50	119	120
Other	1 462	1 467	1 804	2 234	2 496	2 189
TOTAL	***1 835***	***2 152***	***2 600***	***2 534***	***3 188***	***3 084***
Oilseed crushed	***36 581***	***38 177***	***44 845***	***44 663***	***47 218***	***49 568***

National Sunflower Association website www.sunflowernsa.com, Table updated January 13, 2020;
Source: Oil World & USDA.

Sunflower seed production is very suitable for South African climatic conditions as sunflower plants are drought tolerant. The deep root system of a sunflower enables the plant to perform better than other crops during dry seasons. Planting sunflowers is also advantageous when rainfall occurs late in the season, due to the late planting window relative to that of maize.

The area utilized for sunflower production decreased by 14.3% to 515 350 ha, compared to the 601 500 ha

of the previous season. Late rainfall resulted in not all intended sunflower area being planted. This season's area planted is the lowest since the 2012/13 season. The national yield average decreased by almost 8% to 1.32 t/ha, slightly higher than the previous three- and five-year average of 1.28 t/ha.

According to The Bureau for Food and Agricultural Policy (BFAP) Baseline, Agricultural Outlook 2019 – 2028, fairly consistent yield growth is expected over the coming decade (assuming stable rainfall and continuously improving cultivars), with quicker gains for sunflower seed and white maize, compared to the other major summer crops. The removal of more marginal areas supports this greater average yield gains. The total area planted to sunflower seed and white maize is however expected to decline.

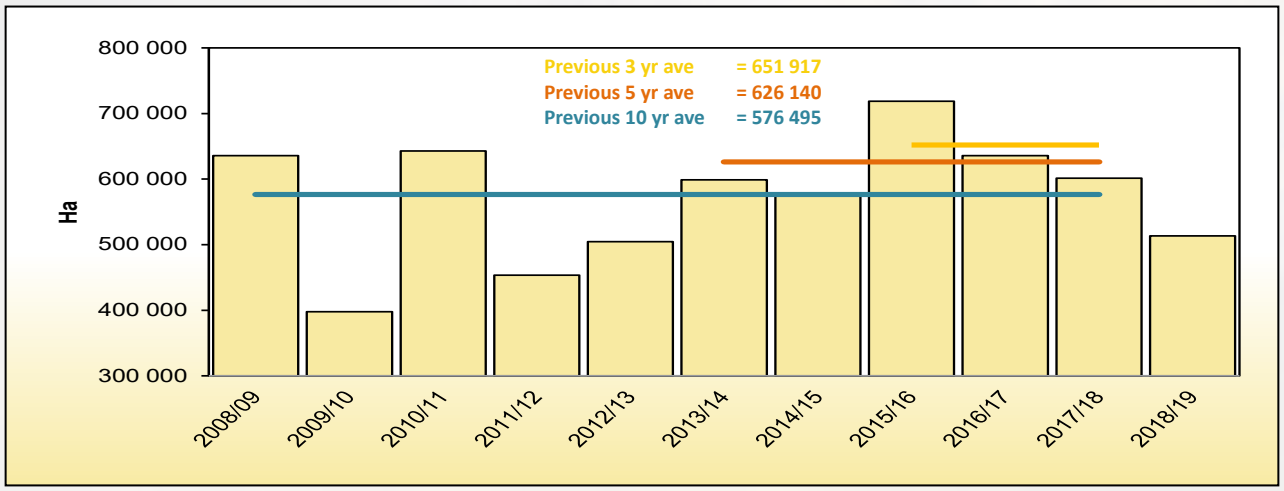
Please see Table 2 for an overview of sunflower production under dry land conditions versus irrigation in the 2018/19 season, compared to the 2017/18 season. Graphs 2 to 4 provide national figures with regards to hectares planted, tons produced and yields obtained over the last 11 seasons and Graphs 5 to 10 similar figures for the major sunflower producing provinces, namely the Free State and North West as well as Limpopo.

Table 2: Sunflower production overview over two seasons

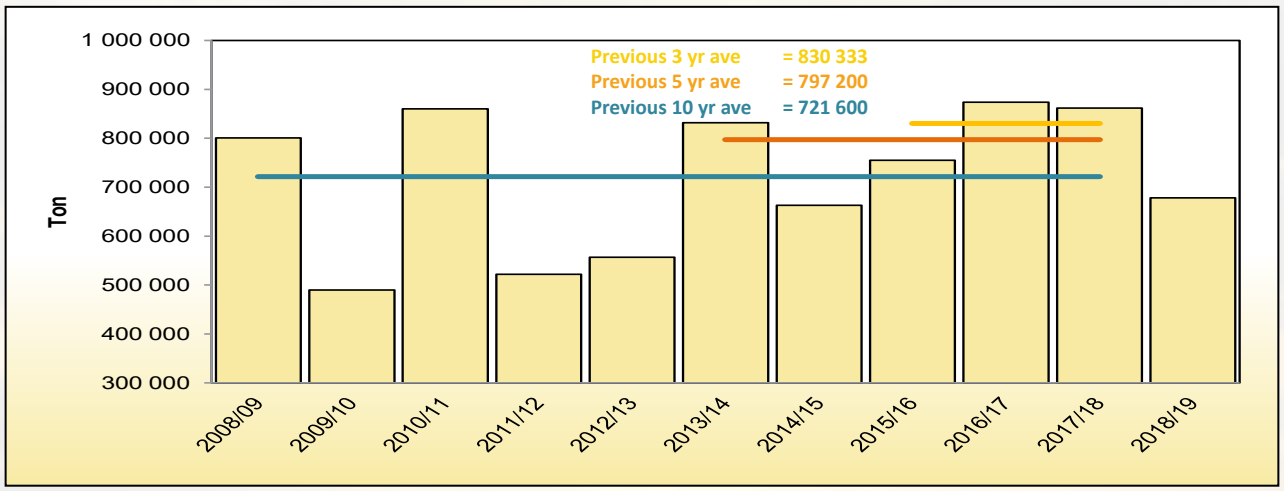
Province	Type of production	2018/19			2017/18		
		Hectares planted, ha	Production, tons	Yield, t/ha	Hectares planted, ha	Production, tons	Yield, t/ha
Western Cape	Dryland	-	-	-	100	100	-
	Irrigation	-	-	-	-	-	-
	Total	-	-	-	100	100	-
Northern Cape	Dryland	-	-	-	-	-	-
	Irrigation	950	1 140	1.20	1 600	1 920	1.20
	Total	950	1 140	1.20	1 600	1 920	1.20
Free State	Dryland	265 500	382 050	1.44	312 200	486 000	1.56
	Irrigation	4 500	9 450	2.10	1 800	4 000	2.22
	Total	270 000	391 500	1.45	314 000	490 000	1.56
Eastern Cape	Dryland	100	260	2.60	-	-	-
	Irrigation	-	-	-	-	-	-
	Total	100	260	2.60	-	-	-
KwaZulu-Natal	Dryland	-	-	-	-	-	-
	Irrigation	-	-	-	-	-	-
	Total	-	-	-	-	-	-
Mpumalanga	Dryland	4 500	4 500	1.00	2 300	2 180	0.95
	Irrigation	-	-	-	-	-	-
	Total	4 500	4 500	1.00	2 300	2 180	0.95
Limpopo	Dryland	60 000	58 800	0.98	44 500	34 750	0.78
	Irrigation	1 000	2 200	2.20	500	1 250	2.50
	Total	61 000	61 000	1.00	45 000	36 000	0.80
Gauteng	Dryland	3 550	3 300	0.93	5 050	4 500	0.89
	Irrigation	250	500	2.00	450	1 100	2.44
	Total	3 800	3 800	1.00	5 500	5 600	1.02
North West	Dryland	174 100	214 000	1.23	231 900	323 950	1.40
	Irrigation	900	1 800	2.00	1 100	2 250	2.05
	Total	175 000	215 800	1.23	233 000	326 200	1.40
RSA	Dryland	507 750	662 910	1.31	596 050	851 480	1.43
	Irrigation	7 600	15 090	1.99	5 450	10 520	1.93
	Total	515 350	678 000	1.32	601 500	862 000	1.43

Figures provided by the CEC.

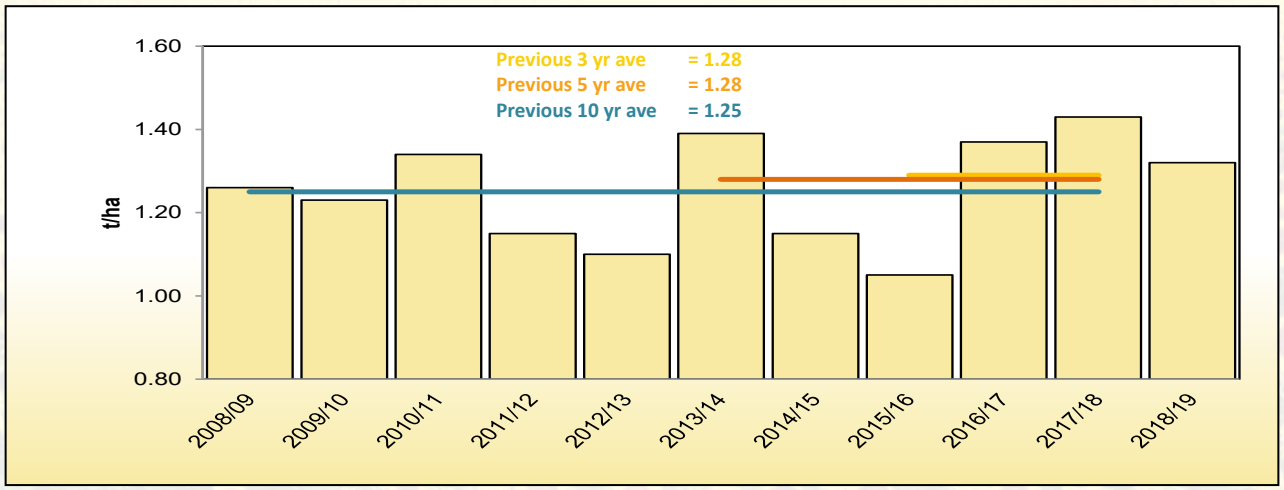
Graph 2: Total RSA area utilised for sunflower production from 2008/09 to 2018/19



Graph 3: Sunflower production in RSA from 2008/09 to 2018/19

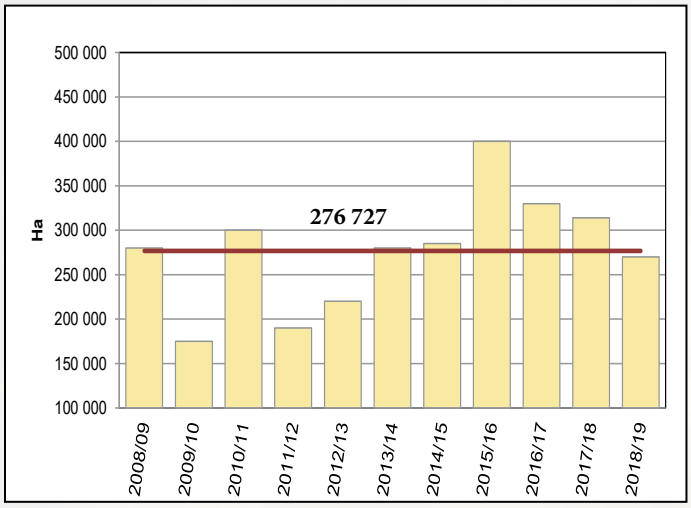


Graph 4: RSA Sunflower yield from 2008/09 to 2018/19

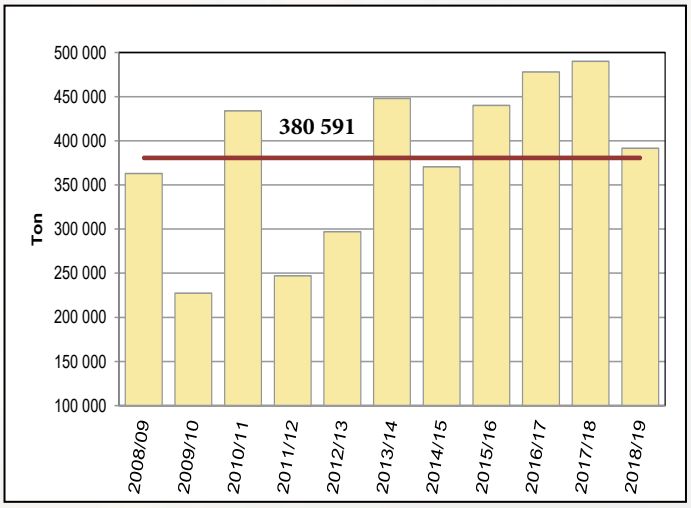


Figures provided by the CEC.

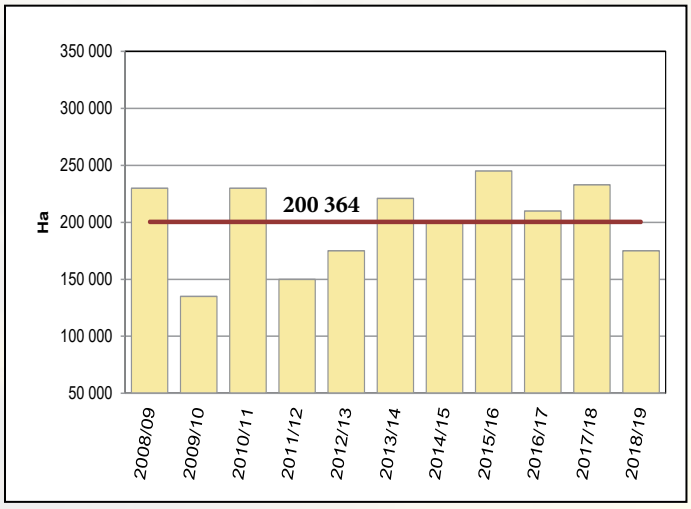
Graph 5: Area utilised for sunflower production in the Free State since 2008/09



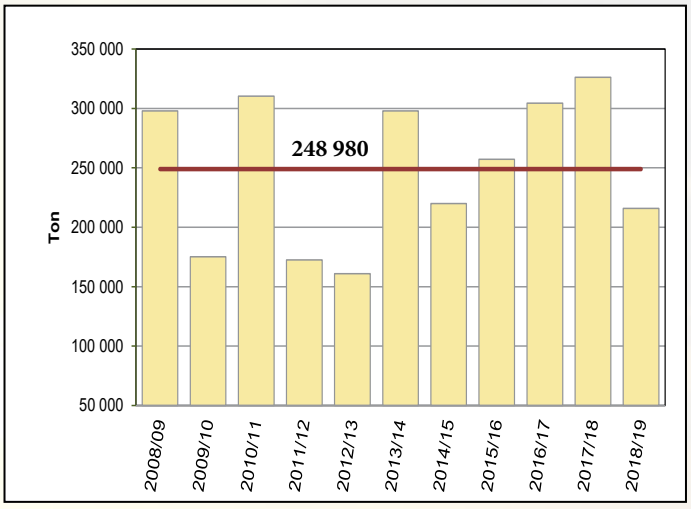
Graph 6: Sunflower production in the Free State since 2008/09



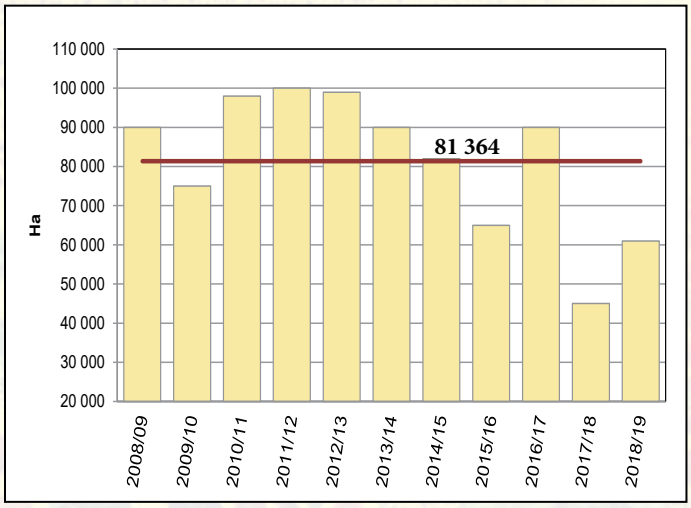
Graph 7: Area utilised for sunflower production in North West since 2008/09



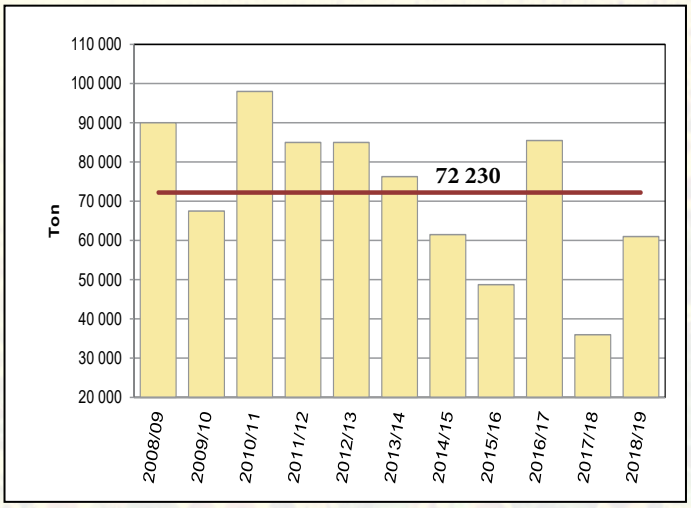
Graph 8: Sunflower production in North West since 2008/09



Graph 9: Area utilised for sunflower production in Limpopo since 2008/09



Graph 10: Sunflower production in Limpopo since 2008/09



Figures provided by the CEC.

Supply and Demand

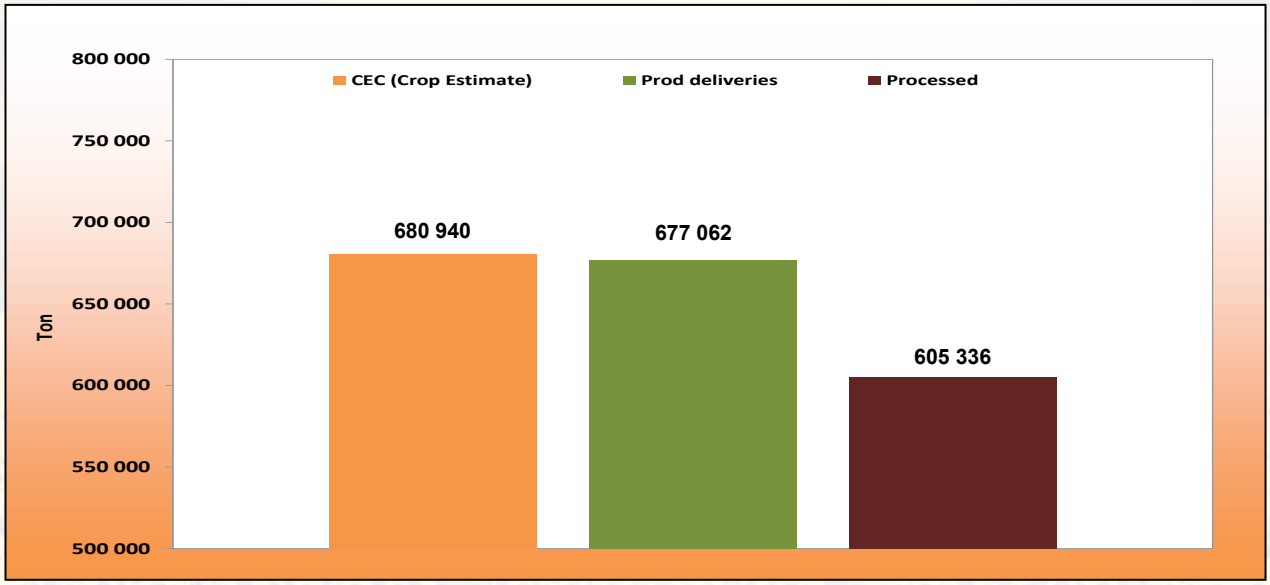
The sunflower seed marketing season dates from March to February. According to SAGIS supply and demand figures for the 2019/20 marketing season to date (March 2019 to January 2020), opening stock declined by more than 22% compared to the previous marketing season, but still exceeds the 10-year average by 16% (16 721 tons).

To date, 457 tons of sunflower and sunflower seed products have been imported compared to the 1 324 and 554 tons of the previous two seasons respectively. The 10-year import average is 39 648 tons. Of the 605 336 tons of sunflower seeds processed so far, only 1 353 tons (0.2%) was used for human consumption and 5 138 tons (0.8%) for animal feed. The vast majority of sunflower seed is crushed to produce oil and oilcake. The amount of sunflower seeds crushed to date is almost 33% less than in the previous season and almost 21% less than the 10-year average of 756 674 tons.

According to *BFAP Baseline*, vegetable oil consumption is slowing relative to the past decade, but is still expected to increase by 38% up to 2028, relative to a 2016-2018 base period. Since 2008, sunflower oil consumption increased by 63%. The projected increase of 41% in sunflower oil consumption over the next decade, although slower than the past decade, remains significant.

Exports to date amount to 526 tons, compared to the 515 tons of the 2018/19 season. Globally, Russia, followed by Argentina and the Ukraine were the largest exporters of sunflower seeds during 2018/19. The United States was only the fourth largest exporter during this season. The Ukraine (6 million metric tons) and Russia (2.8 million metric tons) accounted for 76% of total sunflower oil exports worldwide in the corresponding period *(National Sunflower Association website www.sunflowernsa.com, Table updated January 13, 2020; Source: Oil World & USDA).*

Graph 11: Sunflower supply and demand overview for the current marketing season (Mar 2019 - Feb 2020)



Information provided by SAGIS.

SAGIS South African Grain Information Service
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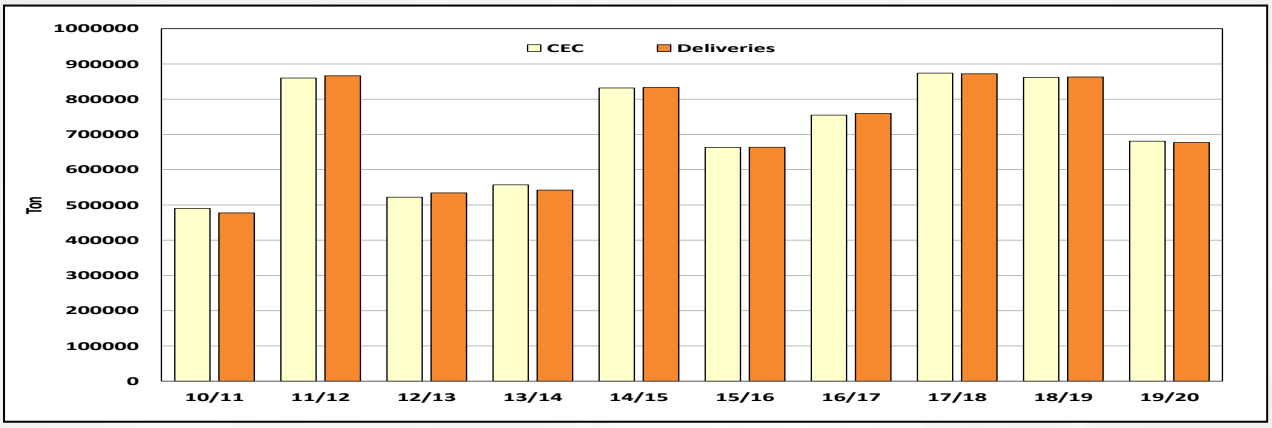
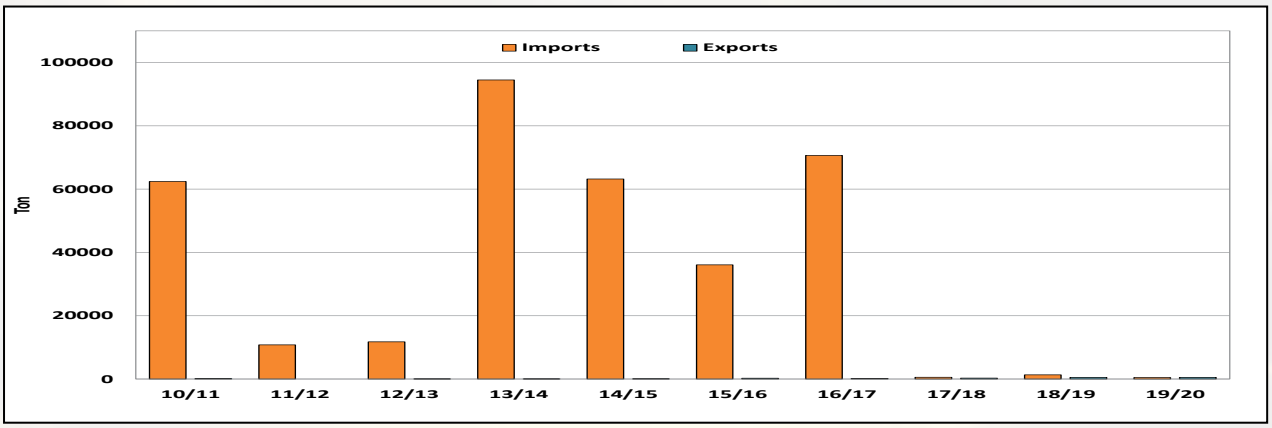
SUNFLOWERSEED: SUPPLY AND DEMAND TABLE BASED ON SAGIS' INFO (TON)																		Publication date: 2020-02-25	
	Season (Mar - Feb)																	Current Season Mar-Jan	10 Year average
	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	2009/10-2018/19
																		***	
																		11	
CEC (Crop Estimate)	928 800	642 600	648 000	620 000	520 000	300 000	872 000	801 000	490 000	860 000	522 000	557 000	832 000	663 000	755 000	874 000	862 000	680 940	721 600
SUPPLY																			
Opening stock (1 Mar)	109 600	189 400	41 300	69 900	40 700	90 400	64 700	164 300	157 200	18 800	109 000	81 302	47 116	92 927	45 867	163 086	154 841	120 165	103 444
Prod deliveries	901 200	617 200	652 900	612 700	524 900	310 100	846 600	806 900	477 300	866 300	534 251	542 165	833 165	663 669	759 614	872 171	863 184	677 062	721 872
Imports	1 700	18 800	300	5 900	3 100	8 900	25 600	45 300	62 400	10 800	11 737	94 475	63 180	36 064	70 643	554	1 324	457	39 648
Surplus	0	0	0	3 800	2 300	1 500	4 100	700	2 000	3 800	5 485	4 689	5 948	9 897	4 268	12 173	6 863	5 197	5 582
Total Supply	**1 012 500**	**825 400**	**694 500**	**692 300**	**571 000**	**410 900**	**941 000**	**1 017 200**	**698 900**	**899 700**	**660 473**	**722 631**	**949 409**	**802 557**	**880 392**	**1 047 984**	**1 026 212**	**802 881**	**870 546**
DEMAND																			
Processed	748 900	762 300	616 900	644 300	472 300	339 500	685 300	847 200	671 500	782 200	572 519	666 551	847 682	747 808	707 327	885 039	900 045	605 336	762 787
-human	100	1 300	700	1 300	1 200	2 100	2 400	1 900	1 600	1 300	904	1 162	467	1 003	1 192	1 487	1 609	1 353	1 262
-animal feed	2 100	1 800	3 200	2 600	3 100	3 500	3 400	3 300	3 100	2 900	3 022	2 777	2 893	8 995	10 665	5 737	5 114	5 138	4 850
-crush (oil and oilcake)	746 700	759 200	613 000	640 400	468 000	333 900	679 500	842 000	666 800	778 000	568 593	662 612	844 322	737 810	695 470	877 815	893 322	598 845	756 674
Withdrawn by producers	16 000	8 000	2 700	1 500	2 000	1 900	4 900	5 700	1 700	3 500	2 521	2 524	1 068	1 157	605	442	519	736	1 974
Released to end-consumers	2 900	1 900	2 400	2 700	3 500	3 000	2 800	4 800	4 100	3 700	3 154	2 923	2 799	2 936	2 867	2 592	1 764	945	3 164
Seed for planting purposes	3 000	1 600	1 300	2 200	1 200	1 800	3 300	2 700	1 700	2 500	2 700	2 903	3 804	2 824	3 474	3 026	3 582	2 423	2 921
Net receipts(-)/disp(+)	2 900	500	-2 000	900	1 500	0	1 000	-400	1 000	-1 200	-1 716	606	1 081	1 709	2 828	1 770	- 378	1 243	530
Deficit	3 900	9 600	3 100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Exports	45 500	200	200	0	100	0	79 400	0	100	0	27	8	48	256	205	274	515	526	143
Total Demand	**823 100**	**784 100**	**624 600**	**651 600**	**480 600**	**346 200**	**776 700**	**860 000**	**680 100**	**790 700**	**579 205**	**675 515**	**856 482**	**756 690**	**717 306**	**893 143**	**906 047**	**611 209**	**771 519**
Ending Stock (28 Feb)	**189 400**	**41 300**	**69 900**	**40 700**	**90 400**	**64 700**	**164 300**	**157 200**	**18 800**	**109 000**	**81 268**	**47 116**	**92 927**	**45 867**	**163 086**	**154 841**	**120 165**	**191 672**	**99 027**
- processed p/month	62 400	63 500	51 400	53 700	39 400	28 300	57 100	70 600	65 000	65 200	47 700	55 546	70 640	62 317	58 944	73 753	75 004	55 031	62 680
- months' stock	3.0	0.7	1.4	0.8	2.3	2.3	2.9	2.2	0.3	1.7	1.7	0.8	1.3	0.7	2.8	2.1	1.6	3.5	1.4

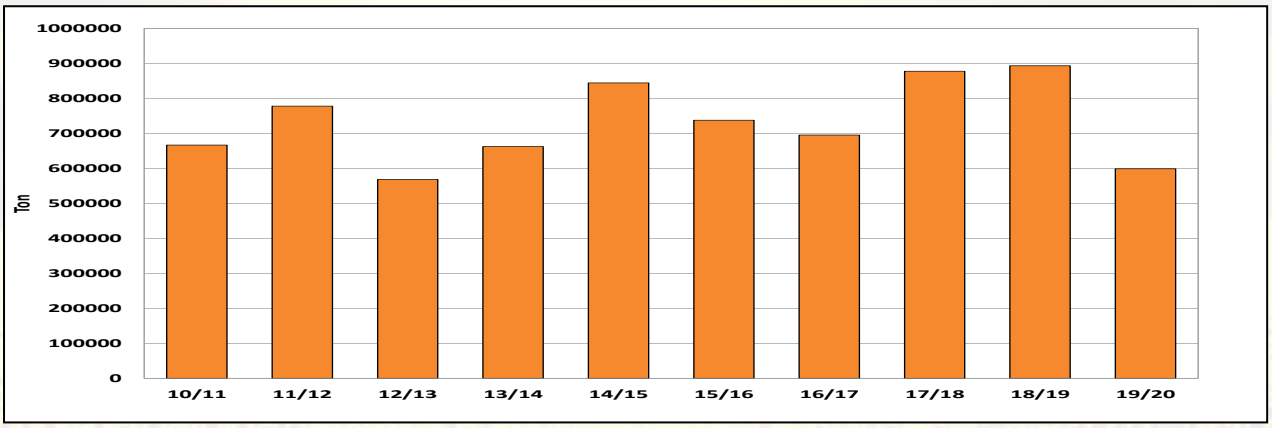
Graph 12: Sunflower: CEC Estimate vs SAGIS deliveries over 10 marketing seasons



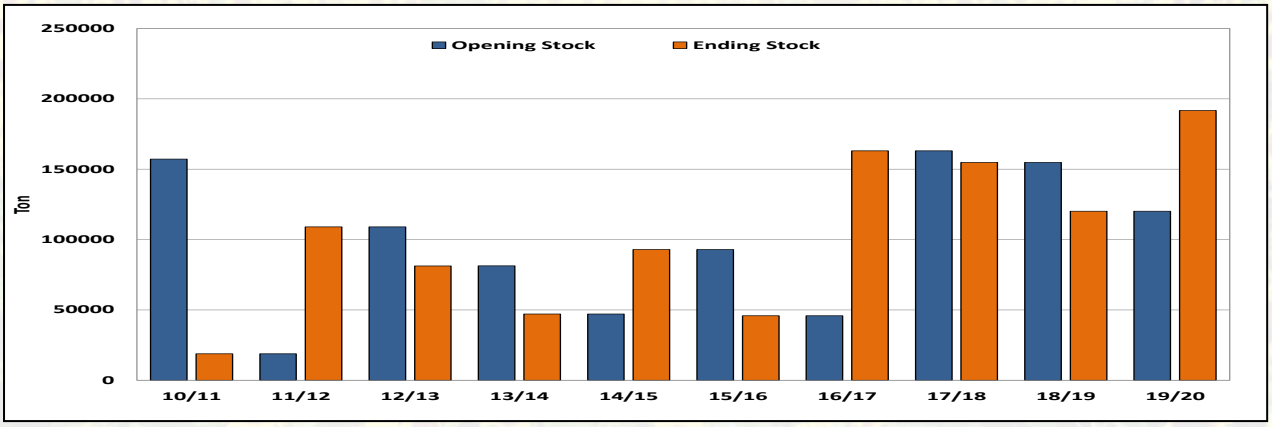
Graph 13: Sunflower: Imports and Exports over 10 marketing seasons



Graph 14: Sunflower: Crushed over 10 marketing seasons



Graph 15: Sunflower: Opening and closing stock over 10 marketing seasons



Information provided by SAGIS.

Season	WHOLE SUNFLOWER: IMPORTS FOR RSA PER COUNTRY											
	Argentina	Botswana	Bulgaria	China	Egypt	Malawi	Mozambique	Romania	Ukraine	United Kingdom	Zambia	Total
2014/15	42	4 764	0	0	0	574	0	57 800	0	0	0	63 180
2015/16	80	4 518	0	0	0	663	0	30 531	0	0	272	36 064
2016/17	42	1 424	38 434	0	0	686	0	30 015	19	23	0	70 643
2017/18	21	0	0	18	44	429	19	0	0	23	0	554
2018/19	65	381	0	0	23	855	0	0	0	0	0	1 324
2019/20	44	0	0	0	23	390	0	0	0	0	0	457

Season	SUNFLOWER: IMPORTS PER HARBOUR					
	Harbours					
	East London	Durban	Cape	Port Elizabeth	Richards Bay	Total
2005/06	0	18	0	0	0	18
2006/07	0	0	0	0	0	0
2007/08	0	19	0	0	0	19
2008/09	0	0	0	0	0	0
2009/10	0	66 547	0	0	0	66 547
2010/11	0	50 209	0	0	0	50 209
2011/12	0	0	0	0	0	0
2012/13	0	0	0	0	0	0
2013/14	0	92 832	0	0	0	92 832
2014/15	0	57 842	0	0	0	57 842
2015/16	0	30 611	0	0	0	30 611
2016/17	0	68 533	0	0	0	68 533
2017/18	0	44	62	0	0	106
2018/19	0	88	0	0	0	88
2019/20*	0	67	0	0	0	67

* Progressive March 2019 - January 2020
Note: Includes Imports for RSA and Other Countries

Season	WHOLE SUNFLOWER: RSA EXPORTS PER COUNTRY					
	Australia	Botswana	Namibia	Swaziland	Zimbabwe	Total
2014/15	22	0	0	26	0	48
2015/16	0	10	158	88	0	256
2016/17	0	40	48	107	10	205
2017/18	0	23	136	115	0	274
2018/19	0	10	360	145	0	515
2019/20	0	78	308	140	0	526

Season	SUNFLOWER: EXPORTS PER HARBOUR					
	Harbours					
	East London	Durban	Cape	Port Elizabeth	Richards Bay	Total
2005/06	0	113	0	0	0	113
2006/07	0	0	0	0	0	0
2007/08	0	0	0	0	0	0
2008/09	34 870	44 555	0	0	0	79 425
2009/10	0	0	0	0	0	0
2010/11	0	0	0	0	0	0
2011/12	0	0	0	0	0	0
2012/13	0	0	0	0	0	0
2013/14	0	0	0	0	0	0
2014/15	0	22	0	0	0	22
2015/16	0	0	0	0	0	0
2016/17	0	0	0	0	0	0
2017/18	0	0	0	0	0	0
2018/19	0	0	0	0	0	0
2019/20*	0	0	0	0	0	0

* Progressive March 2019 - January 2020
All figures are reported in Tons

SAGIS South African Grain Information Service NPC
Suid Afrikaanse Graaninligtingsdiens NWM
Reg no. 1997/019186/08

	OIL SEEDS PRODUCTS PER MONTH MANUFACTURED													
	Marketing year Mar 2017 - Feb 2018 Progressive: 12 Months	**Marketing year Mar 2018 - Feb 2019** Progressive: 12 Months	**Mar 2019** Manufactured Tons	**Apr 2019** Manufactured Tons	**May 2019** Manufactured Tons	**Jun 2019** Manufactured Tons	**Jul 2019** Manufactured Tons	**Aug 2019** Manufactured Tons	**Sep 2019** Manufactured Tons	**Oct 2019** Manufactured Tons	**Nov 2019** Manufactured Tons	**Dec 2019** Manufactured Tons	**Jan 2020** Manufactured Tons	**Market-ing year Mar 2019 - Feb 2020** Progressive: 11 Months
Palm Oil and Derivatives	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oil	**152 434**	**180 325**	17 522	16 559	13 321	15 928	16 906	23 250	19 651	18 919	23 489	15 098	19 856	**200 499**
Sunflower Oil	**319 052**	**315 406**	12 506	5 329	11 476	24 545	26 173	25 047	28 379	25 257	24 697	13 445	17 203	**214 057**
Cottonseed Oil	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Coconut Oil/ Ground-nut Oil/ Canola Oil/ Corn (Maize) Oil/ Blends or mix-es of Oils which includes one of the above Oils/ Bio-diesel	**55 278**	**51 780**	4 086	4 462	3 356	4 678	4 435	4 319	3 908	4 598	4 204	2 889	3 572	**44 507**
Cottonseed Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Sunflower Oilcake	**369 122**	**379 395**	17 514	3 482	12 975	28 881	31 266	30 030	33 095	28 510	28 215	16 258	21 151	**251 377**
Coconut Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Palmnut Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oilcake/ Canola Oilcake	**722 794**	**847 062**	81 686	75 491	60 356	79 407	85 410	106 222	89 139	88 409	106 000	69 781	93 141	**935 042**
Soybean Flours and Meals/ Textured Vegetable Protein	**35 121**	**38 779**	2 941	3 489	3 437	3 161	2 885	3 445	3 885	3 630	4 889	2 158	2 572	**36 492**
Soybean Fullfat	**155 345**	**224 233**	19 263	17 873	21 981	19 089	18 738	17 159	15 184	15 365	13 824	11 694	12 659	**182 829**
Peanut Butter and Paste	**30 422**	**29 734**	2 665	2 105	2 660	2 581	2 100	2 319	2 687	2 931	2 660	1 621	1 537	**25 866**
Total	**1 839 568**	**2 066 714**	**158 183**	**128 790**	**129 562**	**178 270**	**187 913**	**211 791**	**195 928**	**187 619**	**207 978**	**132 944**	**171 691**	**1 890 669**

SAGIS South African Grain Information Service NPC
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	OIL SEEDS PRODUCTS PER MONTH IMPORTED													
	Marketing year Mar 2017 - Feb 2018 Progressive: 12 Months	**Marketing year Mar 2018 - Feb 2019** Progressive: 12 Months	**Mar 2019** Manufactured Tons	**Apr 2019** Manufactured Tons	**May 2019** Manufactured Tons	**Jun 2019** Manufactured Tons	**Jul 2019** Manufactured Tons	**Aug 2019** Manufactured Tons	**Sep 2019** Manufactured Tons	**Oct 2018** Manufactured Tons	**Nov 2019** Manufactured Tons	**Dec 2019** Manufactured Tons	**Jan 2020** Manufactured Tons	**Market-ing year Mar 2019 - Feb 20209** Progressive: 11 Months
Palm Oil and Derivatives	**323 198**	**536 957**	49 142	41 794	55 480	34 659	71 525	36 970	44 494	56 057	26 541	31 091	45 032	**492 785**
Soybean Oil	**50 123**	**116 828**	4 496	1 997	3 000	7 999	14 950	8 750	9 000	11 500	7 000	2 500	12 748	**83 940**
Sunflower Oil	**81 034**	**143 635**	10 956	32 884	18 066	26 956	13 500	17 095	24 500	24 748	15 135	17 054	27 061	**227 955**
Cottonseed Oil	**1 995**	**3 250**	0	2 500	0	0	0	0	2 013	0	0	0	0	**4 513**
Coconut Oil/ Ground-nut Oil/ Canola Oil/ Corn (Maize) Oil/ Blends or mix-es of Oils which includes one of the above Oils/ Bio-diesel	**4 789**	**12 641**	740	631	433	1 156	1 249	1 033	1 155	759	1 175	603	579	**9 513**
Cottonseed Oilcake	**167**	**0**	34	0	0	0	0	297	297	0	0	0	0	**628**
Sunflower Oilcake	**24 166**	**48 777**	24 985	14 527	26 988	0	14 737	0	7 885	0	7 167	0	8 749	**105 038**
Coconut Oilcake		**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Palmnut Oilcake		**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oilcake/ Canola Oilcake	**438 555**	**358 850**	6 408	38 510	70 380	47 027	36 026	40 169	32 456	31 863	39 407	39 556	36 225	**418 027**
Soybean Flours and Meals/ Textured Vegetable Protein		**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Fullfat		**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Peanut Butter and Paste	**1 320**	**1 035**	95	295	176	102	78	31	15	87	73	242	112	**1 306**
Total	**925 347**	**1 221 973**	**96 856**	**133 138**	**174 523**	**117 899**	**152 065**	**104 345**	**121 815**	**125 014**	**96 498**	**91 046**	**130 506**	**1 343 705**

SAGIS South African Grain Information Service NPC
Suid Afrikaanse Graaninligtingsdiens NWM
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	OIL SEEDS PRODUCTS PER MONTH EXPORTED													
	Marketing year Mar 2017 - Feb 2018 Progressive: 12 Months	**Marketing year Mar 2018 - Feb 2019** Progressive: 12 Months	**Mar 2019** Manufactured Tons	**Apr 2019** Manufactured Tons	**May 2019** Manufactured Tons	**Jun 2019** Manufactured Tons	**Jul 2019** Manufactured Tons	**Aug 2019** Manufactured Tons	**Sep 2018** Manufactured Tons	**Oct 2019** Manufactured Tons	**Nov 2018** Manufactured Tons	**Dec 2019** Manufactured Tons	**Jan 2020** Manufactured Tons	**Marketing year Mar 2019 - Feb 2020** Progressive: 11 Months
Palm Oil and Derivatives	**23 661**	**15 771**	1 027	1 174	1 928	1 082	2 811	1 203	1 323	1 463	1 181	849	1 110	**15 151**
Soybean Oil	**33 775**	**29 459**	1 676	1 622	2 125	994	2 956	1 767	430	697	319	556	471	**13 613**
Sunflower Oil	**2 151**	**2 169**	307	263	394	210	92	124	206	52	327	549	245	**2 769**
Cottonseed Oil	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Coconut Oil/ Groundnut Oil/ Canola Oil/ Corn (Maize) Oil/ Blends or mixes of Oils which includes one of the above Oils/ Biodiesel	**2 308**	**977**	30	54	136	32	37	31	107	5	133	102	96	**763**
Cottonseed Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Sunflower Oilcake	**2 343**	**3 464**	571	593	602	678	135	34	69	0	64	113	80	**2 939**
Coconut Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Palmnut Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oilcake/ Canola Oilcake	**13 141**	**11 420**	1 398	491	1 017	812	739	1 270	734	696	1 046	810	890	**9 903**
Soybean Flours and Meals/ Textured Vegetable Protein		**1 802**	264	372	365	277	671	431	304	709	373	274	0	**4 040**
Soybean Fullfat	**4 904**	**7 120**	448	462	332	102	200	302	408	161	171	0	0	**2 586**
Peanut Butter and Paste	**345**	**821**	35	51	30	7	23	18	20	19	19	21	20	**263**
Total	**82 628**	**73 003**	**5 756**	**5 082**	**6 929**	**4 194**	**7 664**	**5 180**	**3 601**	**3 802**	**3 633**	**3 274**	**2 912**	**52 027**

RSA Production Regions

The RSA is divided into 9 provinces as illustrated in Figure 1.

Figure 1: RSA Provinces

Regional map with gratitude to SiQ.

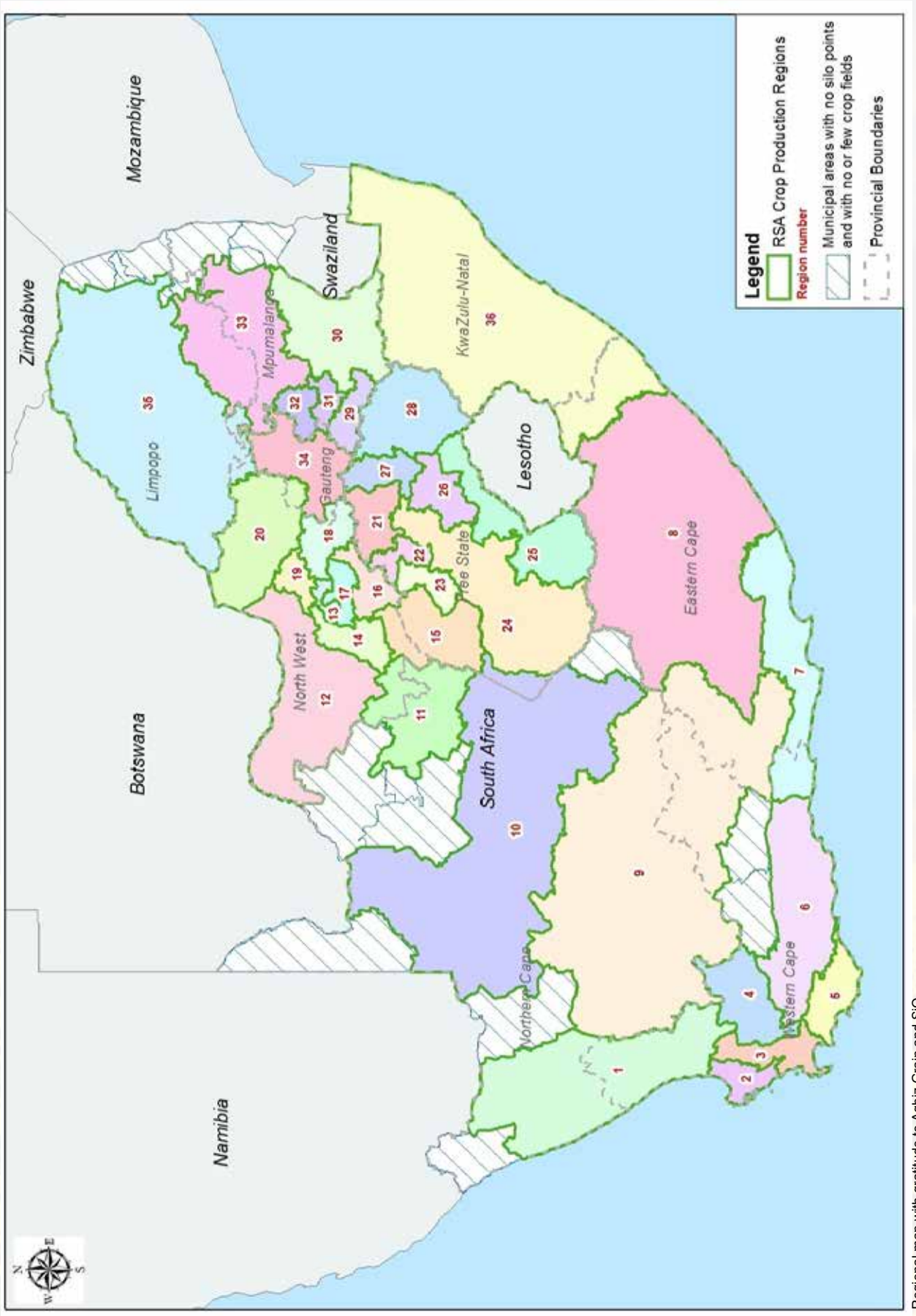
The 9 provinces are divided into 36 grain production regions.

The regions are distributed as follows:
Region 1: Namakwaland
Regions 2 to 4: Swartland
Regions 5 and 6: Rûens
Regions 7 and 8: Eastern Cape
Region 9: Karoo
Region 10: Griqualand West
Region 11: Vaalharts
Regions 12 to 20: North West
Regions 21 to 28: Free State
Regions 29 to 33: Mpumalanga
Region 34: Gauteng
Region 35: Limpopo
Region 36: KwaZulu-Natal

Please see the Crop Production Regions map on the next page.

The production regions from which sunflower samples have been received for the crop quality survey of the 2018/19 production season, are named and described on pages 15 to 17. All the silo/intake stands as well as the type of storage structure, situated in a particular region, are provided.

Figure 2: RSA Crop Production Regions



Regional map with gratitude to Agbiz Grain and SIQ.

Grain Production Regions

Silo/Intake stands per region indicating type of storage structure

Region 12: North West Western Region			
NWK	Blaauwbank (Bins)	NWK	Mareetsane (Bins)
NWK	Bührmannsdrif (Bins)	Suidwes	Kameel (Bins)
NWK	Kameel (Bins)	Suidwes	Vryburg (Bins)

Region 13: North West Central Region (Sannieshof)			
NWK	Biesiesvlei (Bins)	NWK	Oppaslaagte (Bins)
NWK	Bossies (Bins)	NWK	Sannieshof (Bins)
NWK	Gerdau (Bins)		

Region 14: North West Southern Region			
NWK	Barberspan (Bins)	NWK	Taaibospan (Bins)
NWK	Delareyville (Bins)	Suidwes	Amalia (Bins)
NWK	Excelsior (Bins)	Suidwes	Hallatshope (Bins)
NWK	Geysdorp (Bins)	Suidwes	Migdol (Bins)
NWK	Migdol (Bins)	Suidwes	Schweizer-Reneke (Bins)
NWK	Nooitgedacht (Bins)		

Region 15: North West South-Eastern Region			
Suidwes	Bloemhof (Bins)	Suidwes	Kingswood (Bins)
Suidwes	Christiana (Bins)	Suidwes	Kruising (Bunkers)
Suidwes	Hertzogville (Bins)	Suidwes	Poppieland (Bunkers)
Suidwes	Hoopstad (Bins)		

Region 16: North West Central-Eastern Region			
Senwes	Klerksdorp (Bins)	Suidwes Landbou	Makwassie (Bins)
Senwes	Regina (Bins)	Suidwes Landbou	Strydpoort (Bins)
Suidwes Landbou	Bamboesspruit (Bins)	Suidwes Landbou	Wolmaranstad (Bins)
Suidwes Landbou	Leeudoringstad (Bins)		

Region 17: North West Central-Northern Region (Ottosdal)			
NWK	Boschpoort (Bags/Bins/Bulk)	NWK	Vermaas (Bins)
NWK	Kleinharts (Bins)	Senwes	Hartbeesfontein (Bins)
NWK	Ottosdal (Bins)	Senwes	Melliodora (Bins)
NWK	Rostrataville (Bins)	Senwes	Werda (Bins)

Region 18: North West Central Region (Ventersdorp)			
NWK	Bodenstein (Bins)	Senwes	Makokskraal (Bins)
NWK	Coligny (Bins)	Senwes	Potchefstroom (Bins)
Senwes	Buckingham (Bins)	Senwes	Ventersdorp (Bins)
Senwes	Enselspruit (Bins)		

Region 19: North West Central Region (Lichtenburg)			
Afgri	Lichtenburg (Bunkers)	NWK	Lottie Halte (Bins)
NWK	Grootpan (Bins)	NWK	Lusthof (Bins)
NWK	Halfpad (Bins)	NWK	Lichtenburg Silo 3 (Bins)
NWK	Hibernia (Bins)	NWK	Lichtenburg Silo 5 (Bins)

Grain Production Regions

Silo/Intake stands per region indicating type of storage structure

Region 20: North West Eastern Region			
Afgri	Battery (Bins)	NWK	Koster (Bins)
Afgri	Brits (Bins)	NWK	Swartruggens (Bins)
NWK	Boons (Bins)	NWK	Syferbult (Bins)
NWK	Derby (Bins)		

Region 21: Free State North-Western Region (Viljoenskroon)			
Senwes	Attie (Bins)	Senwes	Vierfontein (Bins)
Senwes	Groenebloem (Bins)	Senwes	Viljoenskroon (Bins)
Senwes	Heuningspruit (Bins)	Senwes	Vredefort (Bins)
Senwes	Koppies (Bins)	Senwes	Weiveld (Bins)
Senwes	Rooiwal (Bins)		

Region 22: Free State North-Western Region (Bothaville)			
Senwes	Allanrigde (Bins)	Senwes	Schoonspruit (Bins)
Senwes	Bothaville (Bins)	Senwes	Schuttesdraai (Bins)
Senwes	Mirage (Bins)	Suidwes	Misgunst (Bunkers)
Senwes	Odendaalsrus (Bins)		

Region 23: Free State North-Western Region (Bultfontein)			
Senwes	Bultfontein (Bins)	Senwes	Tierfontein (Bins)
Senwes	Losdoorns (Bins)	Senwes	Wesselsbron (Bins)
Senwes	Protespan (Bins)	Senwes	Willemsrus (Bins)

Region 24: Free State Central Region			
Senwes	Bloemfontein (Bins)	Senwes	Petrusburg (Bins)
Senwes	Brandfort (Bins)	Senwes	Theunissen (Bins)
Senwes	De Brug (Bins)	Senwes	Van Tonder (Bins)
Senwes	Geneva (Bins)	Senwes	Welgeleë (Bins)
Senwes	Hennenman (Bins)	Senwes	Winburg (Bins)
Senwes	Kroonstad (Bins)		

Region 25: Free State South-Western Region			
Afgri	Bethlehem (Bins)	OVK	Marseilles (Bins)
Afgri	Slabberts (Bins)	OVK	Modderpoort (Bins)
OVK	Clocolan (Bins)	OVK	Tweespruit (Bins)
OVK	Ficksburg (Bins)	OVK	Westminster (Bins)
OVK	Fouriesburg (Bins)		

Region 26: Free State South-Eastern Region			
Afgri	Kaallaagte (Bins)	Afgri	Monte Video (Bins)
Afgri	Libertas (Bins)	Afgri	Senekal (Bins)
Afgri	Marquard (Bins)	Senwes	Arlington (Bins)
Afgri	Meets (Bins)	Senwes	Steynsrus (Bins)

Grain Production Regions

Silo/Intake stands per region indicating type of storage structure

Region 27: Free State Northern Region			
Senwes	Gottenburg (Bins)	Senwes	Mooigeleë (Bins)
Senwes	Heilbron (Bins)	Senwes	Wolwehoek (Bins)
Senwes	Hoogte Grainlink (Bins)	VKB	Petrus Steyn (Bins)

Region 28: Free State Eastern Region			
Afgri	Afrikaskop (Bins/Bunkers)	VKB	Jim Fouché (Bins)
Afgri	Eeram (Bins)	VKB	Memel (Bins)
Afgri	Harrismith (Bins)	VKB	Reitz (Bins)
Afgri	Kransfontein (Bins/Bunkers)	VKB	Tweeling (Bins)
VKB	Ascent (Bins)	VKB	Villiers (Bins/Bulk)
VKB	Cornelia (Bins)	VKB	Vrede (Bins)
VKB	Daniëlsrus (Bins)	VKB	Warden (Bins)
VKB	Frankfort (Bins)	VKB	Windfield (Bins)

Region 29: Mpumalanga Southern Region			
Afgri	Balfour (Bins)	Afgri	Leeuspruit (Bins)
Afgri	Greylingstad (Bins)	Afgri	Platrand (Bins)
Afgri	Grootvlei (Bins)	Afgri	Standerton (Bins)
Afgri	Harvard (Bins)	Afgri	Val (Bins)
Afgri	Holmdene (Bins)		

Region 33: Mpumalanga Northern Region			
Afgri	Arnot (Bins)	Afgri	Middelburg (Bins)
Afgri	Driefontein (Bins)	Afgri	Pan (Bins)
Afgri	Lydenburg (Bins)	Afgri	Stoffberg (Bins)
Afgri	Marble Hall (Bins)	Afgri	Wonderfontein (Bins)

Region 34: Gauteng Region			
Afgri	Bloekomspruit (Bins)	Afgri	Nigel (Bins)
Afgri	Bronkhorstspruit (Bins)	Afgri	Pretoria Wes (Bins)
Afgri	Glenroy (Bins)	Afgri	Vogelvallei (Bunkers)
Afgri	Goeie Hoek (Bins)	Senwes	Middelvlei (Bins)
Afgri	Kaalfontein (Bins)	Senwes	Oberholzer (Bins)
Afgri	Kliprivier (Bunkers)	Senwes	Raathsvlei (Bins)
Afgri	Meyerton (Bunkers)		

Region 35: Limpopo Region			
Afgri	Northam (Bins)	VKB	Nylstroom (Modimolle) (Bins)
VKB	Alma (Bins)	VKB	Potgietersrus (Mokopane) (Bins)
VKB	Lehau (Bins)	VKB	Roedtan (Bins)
VKB	Naboomspruit (Mookgophong) (Bins)	VKB	Settlers (Bins)
VKB	Nutfield (Bins)	VKB	Warmbad (Bela-Bela) (Bins)

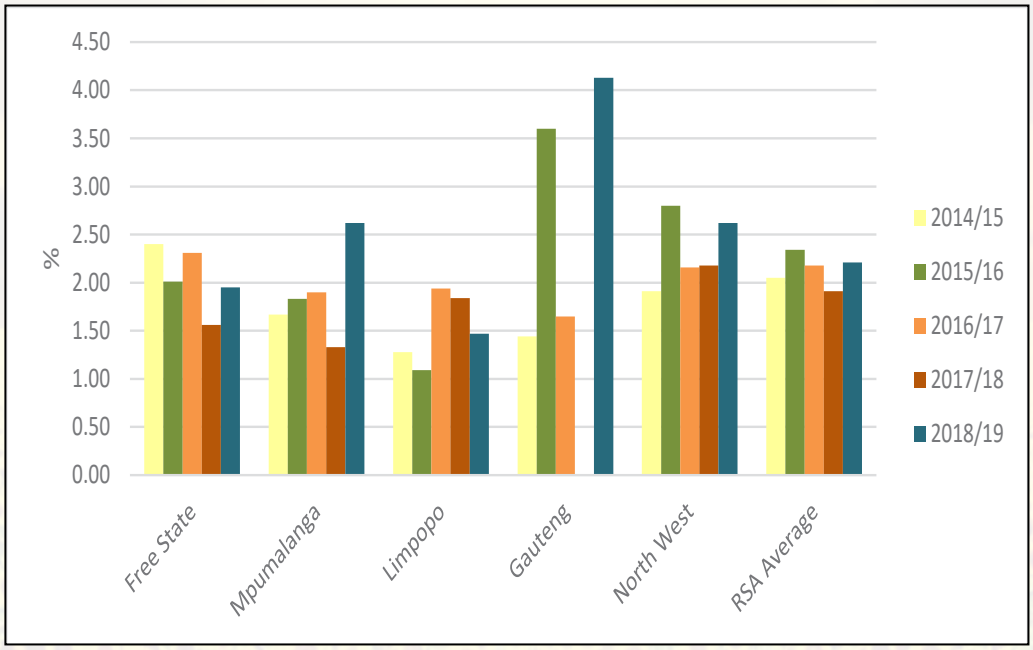
Sunflower Crop Quality 2018/19 – Summary of results

Seventy-six percent (133) of the 176 samples analysed for the purpose of this survey were graded as Grade FH1, with 43 of the samples downgraded to COSF (Class Other Sunflower Seed). The percentage of FH1 samples decreased compared to the 81% of the previous season. In the 2016/17 season, this percentage was 85%.

- Twenty-one of the samples were downgraded as a result of the percentage of either the screenings or the collective deviations or a combination of both exceeding the maximum permissible deviations of 4% and 6% respectively.
- Four samples were downgraded as a result of both the presence of sclerotia produced by the fungus *Sclerotinia sclerotiorum* and the collective deviations exceeding the maximum permissible deviations, namely 4% and 6% respectively.
- Four samples were downgraded as a result of the presence of poisonous seeds *(Datura spp.)* exceeding the maximum permissible number, namely 1 per 1000 g.
- Three samples were downgraded due to the presence of a musty odour.
- The remaining eleven samples were downgraded as a result of a combination of one or more of the following deviations exceeding the maximum permissible deviation: percentage screenings, percentage foreign matter, percentage collective deviations as well as the presence of poisonous seeds *(Datura spp.)* or an undesired odour.

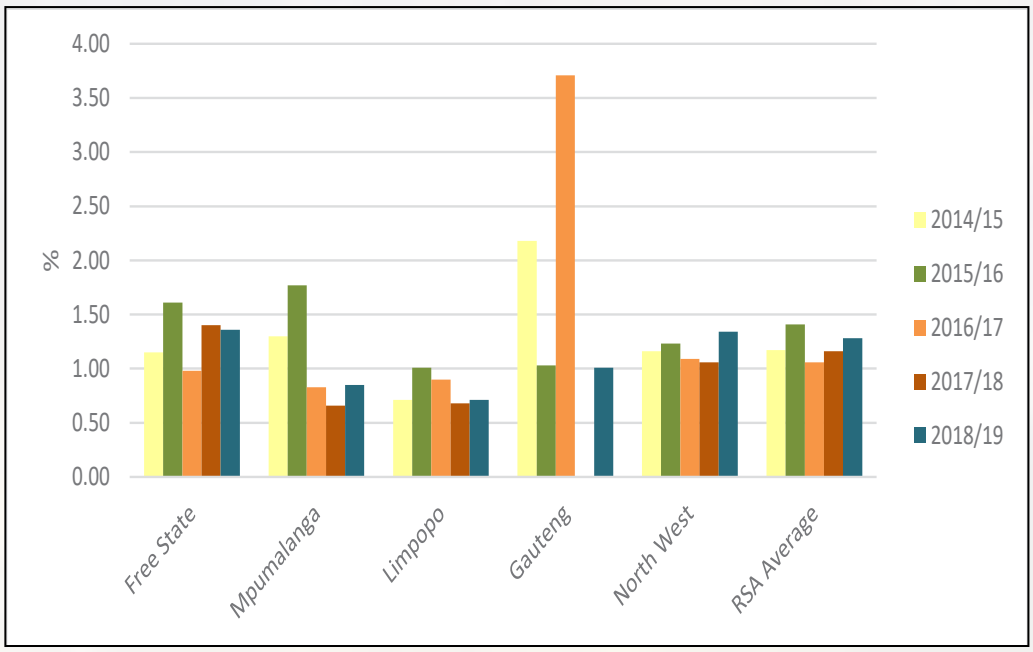
Gauteng province (3 samples) reported the highest weighted average percentage screenings namely 4.13%, followed by North West (N = 58) and Mpumalanga (N = 8) provinces both with 2.62%. Limpopo (12 samples) reported the lowest average percentage screenings of 1.47%. The weighted national average was 2.21% compared to the 1.91% of the previous season.

Graph 16: Average percentage screenings per province over five seasons



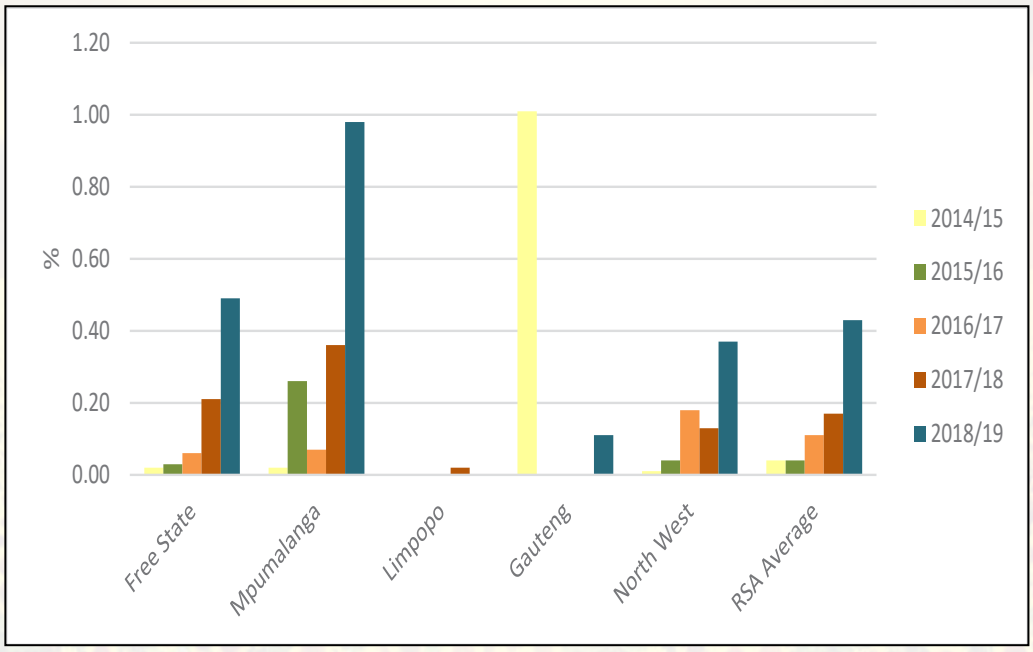
The highest weighted average percentage foreign matter (1.36%) was reported on the 95 samples from the Free State. North West followed closely with an average of 1.34%. The lowest percentages were found in Mpumalanga and Limpopo with 0.85% and 0.71% respectively. The South African average was 1.28% compared to the 1.16% and 1.06% of the previous two seasons. Please see Graph 17.

Graph 17: Average percentage foreign matter per province over five seasons



The number of samples received for this survey that contained sclerotia from the fungus *Sclerotinia sclerotiorum*, increased from 78 samples (44%) in the previous season, to 90 samples (51%) this season. Sixty-one of these samples originated in the Free State province, 25 in North West and two each in Mpumalanga and Gauteng. Four of these samples (one from North West, two from the Free State and one from Mpumalanga) exceeded the maximum permissible deviation of 4%. Weighted average levels ranged from 0% in Limpopo to 0.98% in Mpumalanga. The Free State's weighted average was 0.49%. The national average of 0.43%, is the second highest since the 0.53% of the 2013/2014 season. Last season's average was 0.17%.

Graph 18: Average percentage sclerotia per province over five seasons

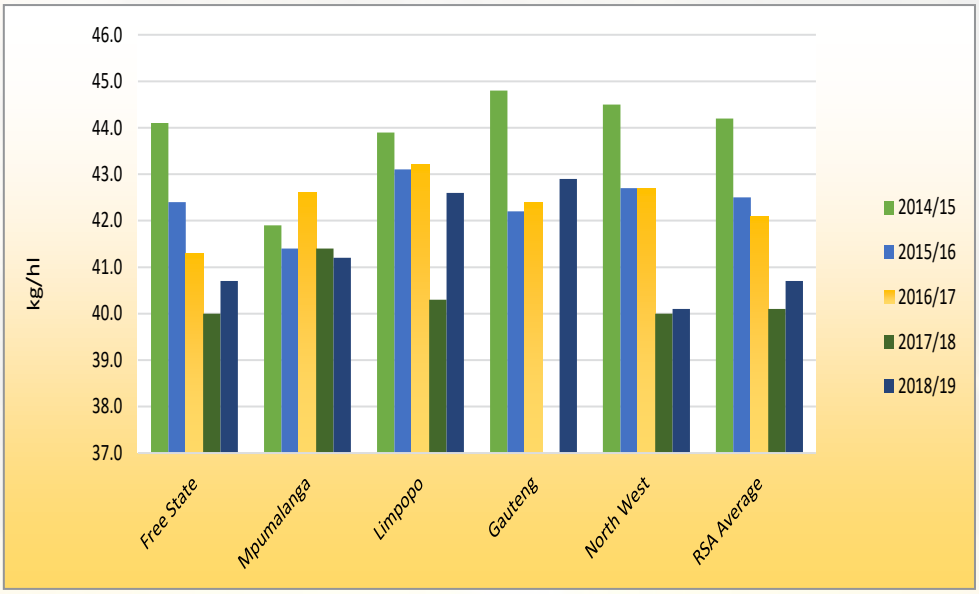


Test weight does not form part of the grading regulations for sunflower seed in South Africa. An approximation of the test weight of South African sunflower seed is provided in Table 3 for information purposes. The standard working procedure of the Kern 222 instrument, as described in ISO 7971-3:2009, was followed. The g/1 L filling mass of the sunflower seed samples was determined and divided by two. The test weight was then extrapolated by means of the following formulas obtained from the Test Weight Conversion Chart for Sunflower Seed, Oil of the Canadian Grain Commission: $y = 0.1936x + 2.2775$ (138 to 182 g/0.5 L) and $y = 0.1943x + 2.1665$ (183 to 227 g/0.5 L). Please also see Graph 19 for a comparison of the test weight per province over the last five seasons.

Table 3: Approximation of test weight per province over three seasons									
Province	Test weight, kg/hl								
	2018/19 Season			2017/18 Season			2016/17 Season		
	Weighted average	Range	No. of samples	Weighted average	Range	No. of samples	Weighted average	Range	No. of samples
Free State (Regions 21 - 28)	40.7	33.1 - 46.8	95	40.0	34.9 - 45.7	64	41.3	34.2 - 45.1	76
Mpumalanga (Regions 29 - 33)	41.2	39.8 - 42.8	8	41.4	35.0 - 42.2	8	42.6	35.0 - 42.2	10
Limpopo (Region 35)	42.6	37.8 - 45.4	12	40.3	38.5 - 43.1	5	43.2	40.4 - 45.5	11
Gauteng (Region 34)	42.9	42.5 - 43.6	3	-	-	-	42.4	41.2 - 43.7	3
North West (Region 12 - 20)	40.1	30.9 - 46.5	58	40.0	33.2 - 45.9	*98	42.7	39.1 - 45.1	76
RSA	***40.7***	***30.9 - 46.8***	***176***	***40.1***	***33.2 - 45.9***	***175***	***42.1***	***34.2 - 45.5***	***176***

**One sample with an outlier value was not taken into account for calculation purposes.*

Graph 19: Comparison of the test weight per province over five seasons



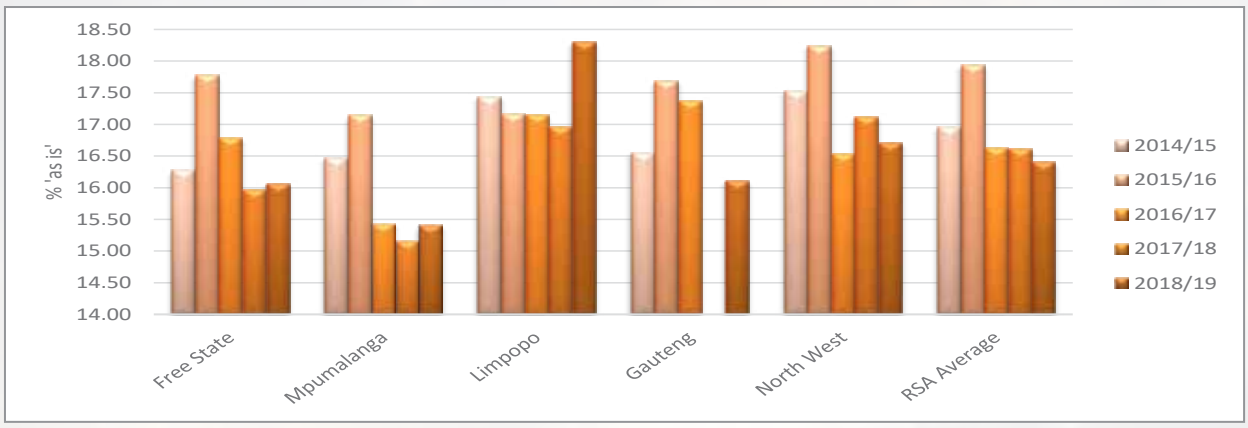
The nutritional component analyses, namely crude protein, -fat, -fibre and ash are reported as % (g/100 g) on an 'as received' or 'as is' basis.

The weighted average crude protein content this season was 16.40%, compared to the 16.61% of the previous season. Limpopo had the highest weighted average crude protein content of 18.30% and Mpumalanga the lowest with 15.41%. Mpumalanga has consistently reported the lowest average protein content since commencement of this survey in the 2012/13 season. North West's crude protein content averaged 16.71% and that of the Free State 16.06%. The weighted average crude fat percentage of 37.9% was almost one percent higher than last season's 37.0%, but still the second lowest of the last six seasons. Limpopo had the highest weighted average crude fat content of 39.0%, closely followed by Gauteng with 38.9%. The lowest average fat content was the 37.6% of the North West province. North West also reported the lowest average in the previous two seasons.

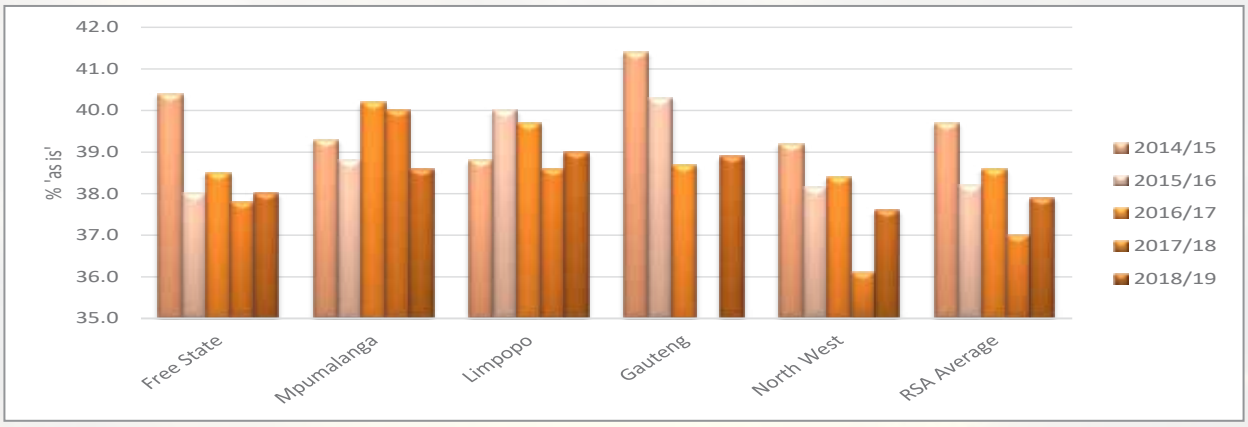
The weighted average percentage crude fibre was the highest of the last seven seasons at 22.4% (21.9% in 2017/18). Average values varied between 20.2% in Limpopo to 23.0% in North West. The weighted average ash content was 2.60%, slightly lower than the 2.69% of the previous season. The provincial averages ranged from 2.37% in Mpumalanga to 2.64% in the Free State.

Graphs 20 to 23 on page 21 provide comparisons between provinces and over seasons for the nutritional components discussed above.

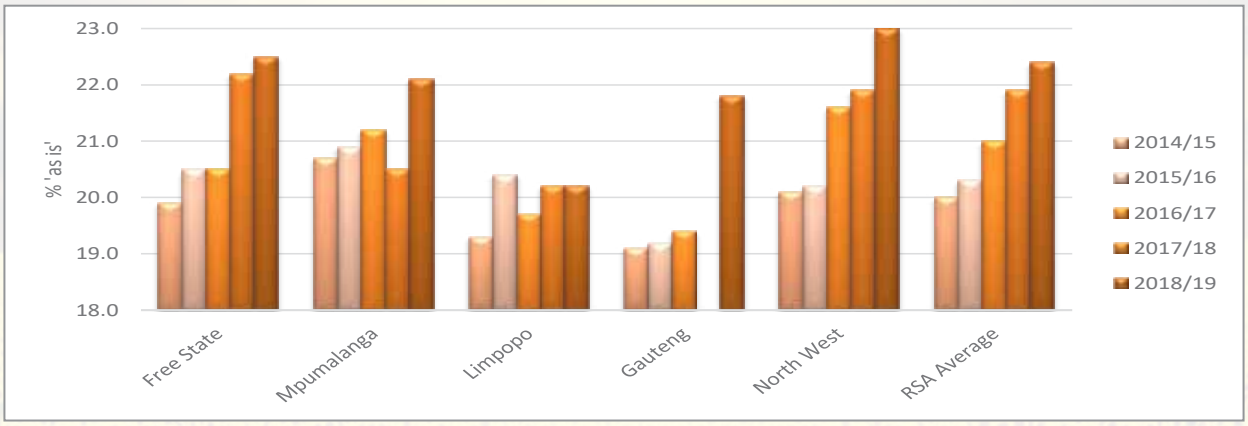
Graph 20: Average crude protein content per province over five seasons



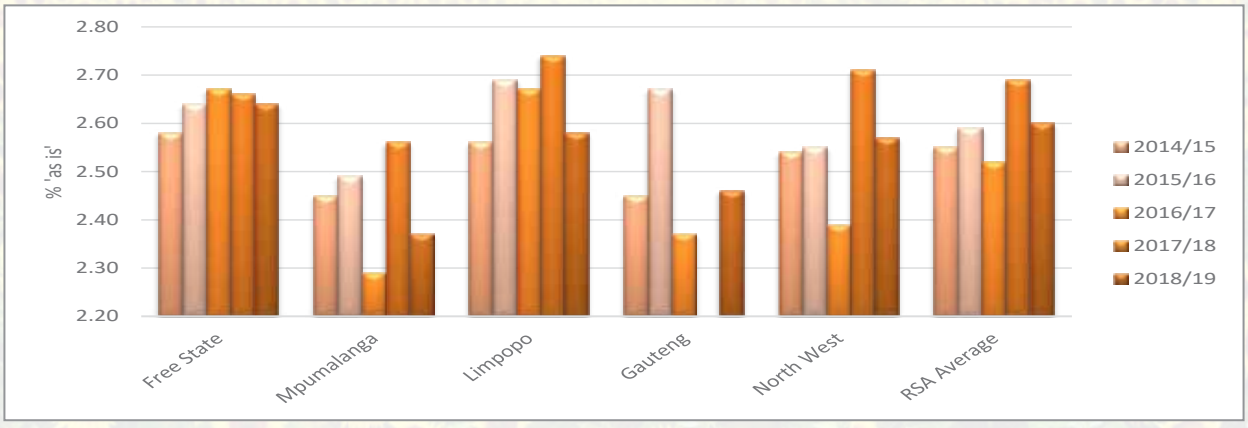
Graph 21: Average crude fat content per province over five seasons



Graph 22: Average crude fibre content per province over five seasons



Graph 23: Average ash content per province over five seasons



Please see a comparison of the moisture, crude protein and crude fat results between the crop survey and ARC Grain Crops sunflower cultivar trials' samples in Table 4.

Table 4: Comparison between the moisture, crude protein and crude fat results of the sunflower crop quality and ARC cultivar trial samples of the 2018/19 season

Analysis	Moisture, % (17hr, 103°C)	Crude Protein, % (as is)	Crude Fat, % (as is)
Sunflower Crop Quality Survey results			
Average	**4.7**	**16.40**	**37.9**
Minimum	2.9	12.41	28.5
Maximum	7.7	20.02	45.2
Standard deviation	0.60	1.49	2.51
No. of samples	*176*	*176*	*176*
ARC Grains Crops Cultivar trial sample results			
Average	**4.8**	**16.44**	**43.6**
Minimum	3.0	10.10	34.4
Maximum	6.0	25.37	55.4
Standard deviation	0.63	3.65	4.49
No. of samples	*144*	*144*	*144*
% Difference between crop and cultivar samples	***-0.1***	***0.0***	***-5.7***

See Table 5 on page 23 for a summary of the RSA Sunflower Crop Quality averages of the 2018/19 season compared to those of the 2017/18 season.

Please also see pages 24 to 30 for the average sunflower quality per region.

Table 5: South African Sunflower Crop Quality Averages 2018/19 vs 2017/18						
Class and Grade Sunflower	**2018/19**			**2017/18**		
	FH1	**COSF**	**Average**	**FH1**	**COSF**	**Average**
Grading:						
1. Damaged sunflower seed, %	0.09	0.34	0.15	0.32	0.25	0.31
2. Screenings, %	1.61	4.04	2.21	1.52	3.58	1.91
3. Sclerotia, %	0.19	1.15	0.43	0.14	0.29	0.17
4. Foreign Matter, %	1.01	2.11	1.28	0.97	1.94	1.16
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.82	7.30	3.92	2.63	5.81	3.23
Musty, sour, khaki bush or other undesired smell	No	No	No	No	No	No
Substance present that renders the seed unsuitable for human or animal consumption or for processing into or utilization thereof as food or feed	No	No	No	No	No	No
Poisonous seeds (*Crotalaria sp., Datura sp., Ricinis communis*)	0	2	1	0	6	1
Poisonous seeds (*Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.*)	0	0	0	0	1	0
Number of samples	***133***	***43***	***176***	***143***	***33***	***176***
Nutritional analysis:						
Moisture, % (5 hr, 105 °C)	4.7	4.6	4.7	4.9	4.8	4.9
Crude Protein, % (as is)	16.59	15.80	16.40	16.62	16.58	16.61
Crude Fat, % (as is)	38.0	37.8	37.9	36.9	37.2	37.0
Crude Fibre, % (as is)	22.3	23.1	22.4	21.9	22.0	21.9
Ash, % (as is)	2.60	2.59	2.60	2.68	2.71	2.69
Number of samples	***133***	***43***	***176***	***143***	***33***	***176***

SOUTH AFRICAN
REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(12) North-West Western Region				(13) North-West Central Region (Sannieshof)				(14) North-West Southern Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.00	0.00	0.00	0.00	0.96	0.00	3.58	1.57	0.15	0.00	1.40	0.38
2. Screenings, %	1.48	0.14	2.66	1.02	2.77	0.94	5.08	1.27	2.14	0.52	3.66	1.18
3. Sclerotia, %	0.00	0.00	0.00	0.00	0.03	0.00	0.20	0.07	0.19	0.00	0.80	0.28
4. Foreign Matter, %	1.13	0.24	2.12	0.90	1.06	0.74	1.60	0.28	0.91	0.42	1.44	0.30
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.61	0.54	4.78	1.87	3.86	2.14	6.68	1.39	3.23	1.38	5.00	1.19
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0	1	0	4	1.41	1	0	10	3.63
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0	0	0	0	0	0	0	0	0
Number of samples	***5***				***8***				***14***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.8	4.2	5.8	0.63	5.0	4.2	7.2	1.01	4.8	4.3	5.2	0.24
Crude Protein, % (as is)	17.72	16.55	19.51	1.23	16.61	15.99	17.15	0.39	16.39	14.73	18.30	0.95
Crude Fat, % (as is)	37.3	34.7	39.8	2.19	38.2	35.3	41.7	2.06	36.8	33.2	41.9	2.71
Crude Fibre, % (as is)	23.3	20.8	24.7	1.51	23.9	20.9	26.4	2.19	23.3	20.5	26.9	1.83
Ash, % (as is)	2.67	2.53	2.91	0.15	2.59	2.43	2.87	0.14	2.53	2.29	2.75	0.13
Number of samples	***5***				***8***				***14***			

SOUTH AFRICAN
REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(15) North-West South-Eastern Region				(16) North-West Central Eastern Region				(17) North-West Central Northern Region (Ottosdal)			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.15	0.00	0.30	0.21	0.03	0.00	0.24	0.08	0.07	0.00	0.24	0.10
2. Screenings, %	1.03	0.46	1.60	0.81	2.53	0.66	6.34	2.15	2.34	0.65	4.52	1.27
3. Sclerotia, %	0.45	0.26	0.64	0.27	0.47	0.00	3.06	0.99	1.14	0.00	6.00	2.16
4. Foreign Matter, %	0.60	0.20	1.00	0.57	2.51	0.46	6.72	2.08	1.22	0.24	2.68	0.79
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.08	1.30	2.86	1.10	5.52	1.26	13.06	4.02	4.71	1.86	6.89	1.84
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0	0	0	0	0	0	0	0	0
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0	0	0	0	0	0	0	0	0
Number of samples	***2***				***9***				***9***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.8	4.7	4.8	0.07	4.6	4.1	5.7	0.53	5.2	3.9	7.7	1.21
Crude Protein, % (as is)	17.67	17.41	17.92	0.36	17.18	15.32	19.85	1.38	15.94	14.96	16.86	0.57
Crude Fat, % (as is)	35.7	34.4	37.0	1.84	36.9	33.7	38.6	1.98	38.5	36.8	41.7	1.57
Crude Fibre, % (as is)	22.8	22.0	23.5	1.06	22.5	21.2	24.8	1.25	22.9	20.6	25.6	1.61
Ash, % (as is)	2.51	2.50	2.52	0.01	2.61	2.46	3.03	0.17	2.48	2.29	2.75	0.17
Number of samples	***2***				***9***				***9***			

SOUTH AFRICAN
REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(18) North-West Central Region (Ventersdorp)				(19) North-West Central Region (Lichtenburg)				(20) North-West Eastern Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.10	0.00	0.24	0.12	0.16	0.00	0.36	0.18	0.69	0.00	2.76	1.38
2. Screenings, %	5.87	1.76	14.62	6.07	3.93	2.36	5.30	1.48	2.80	1.00	5.00	1.70
3. Sclerotia, %	0.18	0.00	0.36	0.20	0.73	0.20	1.20	0.50	0.00	0.00	0.00	0.00
4. Foreign Matter, %	2.90	0.70	6.96	2.91	0.55	0.44	0.74	0.16	0.72	0.36	0.86	0.24
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	8.94	2.86	21.58	8.80	5.21	3.00	7.24	2.13	3.52	1.36	5.80	1.86
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0	0	0	0	0	13	0	50	25.00
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0	0	0	0	0	0	0	0	0
Number of samples	***4***				***3***				***4***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.9	4.2	5.6	0.58	4.9	4.3	5.3	0.53	4.3	2.9	4.8	0.90
Crude Protein, % (as is)	17.49	14.20	20.02	2.75	16.68	16.15	17.08	0.48	16.22	14.07	18.54	1.94
Crude Fat, % (as is)	35.8	28.5	40.2	5.46	39.4	38.8	40.4	0.90	39.8	38.5	43.2	2.29
Crude Fibre, % (as is)	24.8	22.4	28.3	2.51	21.3	20.6	22.0	0.70	20.2	18.9	20.9	0.93
Ash, % (as is)	2.81	2.58	3.06	0.21	2.55	2.36	2.70	0.17	2.46	2.26	2.75	0.21
Number of samples	***4***				***3***				***4***			

SOUTH AFRICAN
REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(21) Free State North-Western Region (Viljoenskroon)				(22) Free State North-Western Region (Bothaville)				(23) Free State North-Western Region (Bultfontein)			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.03	0.00	0.24	0.08	0.11	0.00	0.54	0.24	0.10	0.00	0.32	0.12
2. Screenings, %	1.22	0.28	2.32	0.62	1.71	0.82	3.92	1.29	2.10	1.28	3.76	0.66
3. Sclerotia, %	0.17	0.00	0.54	0.17	0.14	0.00	0.28	0.14	0.03	0.00	0.26	0.07
4. Foreign Matter, %	1.19	0.12	2.94	0.90	1.28	0.24	2.60	1.00	2.08	0.38	16.88	3.97
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.58	0.98	4.03	0.89	3.13	1.39	6.80	2.12	4.21	2.40	19.10	4.05
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0	2	0	10	4.47	0	0	0	0
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0	0	0	0	0	0	0	0	0
Number of samples	***20***				***5***				***16***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.9	4.0	5.8	0.43	5.3	5.1	5.5	0.19	4.9	4.2	6.0	0.50
Crude Protein, % (as is)	16.90	15.30	17.94	0.76	17.92	17.03	18.57	0.70	17.58	16.83	18.64	0.53
Crude Fat, % (as is)	38.2	36.2	40.4	1.17	35.3	33.5	36.8	1.18	36.3	31.9	40.6	2.32
Crude Fibre, % (as is)	22.0	19.2	24.8	1.43	22.3	20.9	24.9	1.57	22.3	20.1	24.5	1.37
Ash, % (as is)	2.69	2.52	2.84	0.09	2.73	2.56	3.00	0.18	2.65	2.34	2.91	0.14
Number of samples	***20***				***5***				***16***			

SOUTH AFRICAN
REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(24) Free State Central Region				(25) Free State South-Western Region				(26) Free State South-Eastern Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.08	0.00	0.36	0.13	0.11	0.00	0.54	0.18	0.28	0.00	1.10	0.36
2. Screenings, %	1.97	0.30	3.80	1.12	2.62	0.22	4.80	1.50	2.22	0.18	7.20	1.90
3. Sclerotia, %	0.24	0.00	1.50	0.42	1.72	0.00	4.82	1.58	0.61	0.00	1.84	0.46
4. Foreign Matter, %	1.75	0.22	4.68	1.38	0.83	0.38	1.44	0.38	1.03	0.16	2.84	0.73
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	3.96	0.78	7.20	1.86	5.17	1.02	7.52	2.28	3.86	0.82	9.10	2.39
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	1	0	5	1.58	0	0	0	0	0	0	8	1.94
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0	0	0	0	0	0	0	0	0
Number of samples	***19***				***11***				***17***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.6	3.7	5.3	0.46	4.6	3.8	5.4	0.57	4.5	4.1	5.3	0.34
Crude Protein, % (as is)	15.81	13.46	17.90	1.11	14.21	12.41	15.11	0.87	14.82	13.16	16.72	0.86
Crude Fat, % (as is)	38.0	30.1	42.3	3.10	39.5	34.2	41.8	2.17	38.2	34.3	41.8	1.98
Crude Fibre, % (as is)	23.4	20.1	28.6	1.86	22.0	19.9	24.9	1.45	22.9	20.6	27.6	1.90
Ash, % (as is)	2.53	2.13	2.84	0.16	2.64	2.29	2.91	0.18	2.63	2.45	2.88	0.12
Number of samples	***19***				***11***				***17***			

SOUTH AFRICAN
REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(27) Free State Northern Region				(28) Free State Eastern Region				(29) Mpumalanga Southern Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.24	0.12	0.36	0.12	0.15	0.00	0.36	0.18	0.00	0.00	0.00	0.00
2. Screenings, %	4.40	2.40	7.20	2.50	0.39	0.20	0.66	0.20	1.78	1.24	3.30	1.01
3. Sclerotia, %	2.51	1.26	3.76	1.25	0.06	0.00	0.22	0.11	0.00	0.00	0.00	0.00
4. Foreign Matter, %	1.00	0.86	1.14	0.14	0.78	0.48	1.26	0.35	1.00	0.76	1.22	0.22
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	7.91	4.52	12.10	3.85	1.23	0.76	1.92	0.56	2.78	2.06	4.44	1.12
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0	0	0	0	0	0	0	0	0
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0	0	0	0	0	0	0	0	0
Number of samples	***3***				***4***				***4***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	3.6	3.5	3.8	0.15	4.4	3.8	5.0	0.49	4.9	3.9	5.3	0.67
Crude Protein, % (as is)	14.60	14.11	14.87	0.43	16.07	14.67	19.20	2.14	16.17	14.53	17.72	1.36
Crude Fat, % (as is)	39.4	38.6	41.0	1.36	40.6	37.8	44.7	3.00	36.3	35.2	36.9	0.77
Crude Fibre, % (as is)	23.4	23.3	23.4	0.06	20.4	18.3	22.3	1.72	22.9	20.9	23.5	1.30
Ash, % (as is)	2.63	2.54	2.69	0.08	2.74	2.44	3.07	0.27	2.41	2.16	2.59	0.21
Number of samples	***3***				***4***				***4***			

SOUTH AFRICAN
REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(33) Mpumalanga Northern Region				(34) Gauteng Region				(35) Limpopo Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.11	0.00	0.24	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Screenings, %	3.46	2.36	4.70	0.97	4.13	1.88	6.02	2.09	1.47	0.36	2.74	0.72
3. Sclerotia, %	1.96	0.00	4.22	2.27	0.11	0.00	0.24	0.12	0.00	0.00	0.00	0.00
4. Foreign Matter, %	0.70	0.54	0.88	0.14	1.01	0.52	1.60	0.55	0.71	0.22	1.68	0.42
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	6.11	3.88	7.84	1.87	5.26	2.90	7.62	2.36	2.17	0.64	3.48	0.90
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0	0	0	0	0	0	0	0	0
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0	0	0	0	0	0	0	0	0
Number of samples	***4***				***3***				***12***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.0	3.6	4.2	0.29	4.2	3.7	4.8	0.56	4.6	3.6	5.8	0.52
Crude Protein, % (as is)	14.64	14.10	15.17	0.44	16.11	15.80	16.69	0.50	18.30	16.55	19.53	0.87
Crude Fat, % (as is)	40.9	39.4	43.1	1.61	38.9	38.4	39.2	0.44	39.0	35.1	45.2	2.72
Crude Fibre, % (as is)	21.2	20.0	22.8	1.30	21.8	20.7	22.8	1.05	20.2	15.3	23.4	2.08
Ash, % (as is)	2.33	2.13	2.50	0.19	2.46	2.30	2.61	0.16	2.58	2.39	3.22	0.24
Number of samples	***4***				***3***				***12***			

Fatty acid Profile

Fatty acid profiles are the most important tool for identification of authenticity of vegetable fats and oils. All types of oil have their own specific fatty acid profile which is unique to that product. Fatty acids are typically esterified to a glycerol backbone to form triglycerides (also called fats or oils). Fatty acids are either described as saturated or unsaturated, with saturated fatty acids being solid at room temperature and unsaturated fatty acids being liquid at room temperature. Unsaturated fatty acids are further subdivided into mono-unsaturated (one double bond in the carbon chain) or poly-unsaturated (more than one double bond in the carbon chain). The unique fatty acid profile of each product/crop is a combination of saturated, mono-unsaturated and poly-unsaturated oils and is specific to that type of oil.

Fatty acid profiles of every crop, however, are subject to variation. The variation or typical pattern of fatty acids in a specific oil not only influences the stability and physical properties of the oil but also aids in distinguishing one type of oil from another. Variation of fatty acids within the same product depend on climate, latitude, soil type, cultivar, rainfall as well as seasonal variation. These variations should be included when ranges for identification of authenticity are determined.

It is imperative to include ranges wherein fatty acids vary, in order to successfully validate the authenticity of a specific vegetable oil. Building of a database requires gathering of information over different seasons, areas and cultivars in order to give a true reflection of the ranges wherein fatty acids can differ. Precision Oil Laboratories was consulted by a large seed oil producer in South Africa to determine if an unexpected variation of one of the fatty acids in a sunflower seed batch was acceptable. After extraction of the sunflower oil, it was rejected by a food processing company, indicating that one of the fatty acids was not within their specification. Currently, no national updated database for fatty acid composition of sunflower oil is available. In the absence of a national database, Codex Alimentarius was consulted, but did not accommodate the range of the specific fatty acid in question. After a literature search, the American database proved that wide ranges for the specific fatty acid were acceptable since specific factors, including drought, could lead to the fatty acid having increased acceptable ranges. The seed containing the fatty acid which was out of range, was from a particularly dry season's production which explained the wide range. If a national database was kept and maintained, time and money lost by the industry as a result of rejected batches could have been avoided.

It is important that South Africa, as a sunflower seed producing country, develop and maintain a national fatty acid profile database to the benefit of the Oil Seed Industry. Annual analysis of crop and cultivar samples will ensure that the natural variation caused by different cultivars as well as the influence of climate and locality are included in the database values. Seasonal variations will also be addressed. Recording all variation applicable to the crops in the database will enable the annual review of the specified ranges.

Precision Oil Laboratories was subcontracted to perform fatty acid profile analyses on 20 composite crop samples representing different production regions as well as 20 cultivar samples from different localities. Please refer to Tables 6, 7 and 8 on pages 33 to 35 for the results.

The following fatty acid were included in the profile analysis:

C14:0	Myristic acid
C16:0	Palmitic acid
C16:1	Palmitoleic acid
C17:0	Margaric acid
C17:1	Glinkgolic acid
C18:0	Stearic acid
C18:1 t	trans Oleic acid
C18:1 c	cis Oleic acid
C18:2 t	trans Linoleic acid
C18:2 c	cis Linoleic acid
C18:3n6	n6 Linolenic acid

C18:3n3	n3 Linolenic acid
C20:0	Arachidic acid
C20:1	Eicosenoic acid
C20:2	Eicosadienoic acid
C21:0	Heneicosanoic acid
C22:0	Behenic acid
C22:1	Erucic acid
C24:0	Lignoceric acid
C24:1	Nervonic acid

Some samples contained trace amounts of C18:3n5.

The samples gathered for the purpose of the annual national sunflower crop survey can be further utilized for future research to the benefit of industry by including the following analyses and results to the newly created database:

- ## Sterol and Tocopherol

The problem of adulteration of food is not new and methods of detecting it have been described as far back as 1820. Adulteration in the oilseed industry is a reality and blends are often made intentionally in order to increase the profit margin of the oil by blending it with a lower cost oil.

Although Fatty acid profile is the most important test for adulteration of oil, it can be circumvented. The standard ranges laid down for the fatty acids of pure oils are very wide in order to accommodate natural variation. When blends are made, the natural variations of the constituent oils are superimposed. This causes the problem of checking the identity of oil samples to become more complex. It is possible to blend a number of oils to make it look like a pure oil with respect to the standard ranges of the fatty acid composition.

Fatty acid profile alone is not sufficient information for discrimination when blends of oils are involved. The inclusion of tocopherol and sterols patterns in a data basis of oils have been proven to not only discriminate between authentic and adulterated oils, but that it can also be used to determine which oils are present in a blend and what proportions were blended.

- ## Free Fatty Acids

The free fatty acid value of oil is an indicator of hydrolytic deterioration. The free fatty acid value is an important quality parameter for oilseeds and is directly correlated with effective drying of the seeds as well as storage temperatures. High free fatty acid values lead to significant oil losses during refining of the oil. Factors aggravating hydrolytic deterioration are moisture, heat and enzymatic activity. If seeds are not dried properly, the free fatty acid value increases. It is important to update the National database with the free fatty acid value for seed oils. This will ensure that correlations can be made between free fatty acid value and harvesting conditions, as well as free fatty acids and storage temperatures. The information gathered will assist in lowering of free fatty acid values and prevent oil losses.

References:

Accum, F., 1820. “A Treatise on Adulteration of Food and Culinary Poisons”, Longman, Hurst, Rees, Orme and Row, London.
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Rossell, J.B., Measurement of rancidity. IN: J.C. and Hamilton R.J. (Eds), Rancidity in Foods. Blackie Academic and Professional, Glasgow, pp22-53.
Van Niekerk, P.J., 1990. Determination of the component oils of edible oil blends. University of Pretoria.

The Fatty acid Profile information was supplied by Dr. Mathilda Mostert from Precision Oil Laboratories.

Table 6: Fatty acid profile results of a selection of crop quality samples from the 2018/19 season

Province	Region	g Fatty acids/100 g Fatty Acids																			
		C14:0	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1 t	C18:1 c	C18:2 t	C18:2 c	C18:3n6	C18:3n3	C20:0	C20:1	C20.2	C21:0	C22:0	C22:1	C24:0	C24:1
North West	12	ND	5.67	ND	ND	ND	6.72	ND	16.95	ND	68.3	ND	< LOQ	0.55	< LOQ	ND	ND	1.02	ND	< LOQ	ND
	13	ND	5.47	ND	ND	ND	7.68	ND	16.17	ND	68.7	ND	< LOQ	0.60	< LOQ	ND	ND	0.94	ND	< LOQ	ND
	14	ND	5.48	ND	ND	ND	7.73	ND	15.67	ND	68.8	ND	< LOQ	0.56	< LOQ	ND	ND	1.02	ND	< LOQ	ND
	16	ND	5.44	ND	ND	ND	7.20	ND	15.25	ND	70.0	ND	< LOQ	0.57	< LOQ	ND	ND	1.01	ND	< LOQ	ND
	17	ND	5.65	ND	ND	ND	7.16	ND	16.56	ND	68.2	ND	< LOQ	0.61	< LOQ	ND	ND	1.05	ND	< LOQ	ND
	18	ND	5.00	ND	ND	ND	8.36	ND	16.43	ND	68.2	ND	< LOQ	0.61	< LOQ	ND	ND	0.99	ND	< LOQ	ND
	19	ND	5.61	ND	ND	ND	7.46	ND	16.93	ND	67.8	ND	< LOQ	0.58	< LOQ	ND	ND	1.09	ND	< LOQ	ND
	20	ND	5.78	ND	ND	ND	4.95	ND	20.41	ND	66.6	ND	< LOQ	0.46	< LOQ	ND	ND	0.95	ND	< LOQ	ND
	Min	-	*5.00*	-	-	-	*4.95*	-	*15.25*	-	*66.6*	-	-	*0.46*	-	-	-	*0.94*	-	-	-
	Max	-	*5.78*	-	-	-	*8.36*	-	*20.41*	-	*70.0*	-	-	*0.61*	-	-	-	*1.09*	-	-	-
	N	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*
Free State	21	ND	5.32	ND	ND	ND	6.85	ND	17.32	ND	68.0	ND	< LOQ	0.55	< LOQ	ND	ND	0.95	ND	0.30	ND
	22	ND	5.53	ND	ND	ND	6.97	ND	16.67	ND	68.5	ND	< LOQ	0.56	< LOQ	ND	ND	0.98	ND	< LOQ	ND
	23	ND	5.68	ND	ND	ND	6.89	ND	15.55	ND	69.8	ND	< LOQ	0.60	< LOQ	ND	ND	1.03	ND	< LOQ	ND
	24	ND	5.29	ND	ND	ND	6.63	ND	16.95	ND	69.0	ND	< LOQ	0.53	< LOQ	ND	ND	0.92	ND	< LOQ	ND
	25	ND	5.75	ND	ND	ND	5.84	ND	16.56	ND	69.8	ND	< LOQ	0.53	< LOQ	ND	ND	1.01	ND	< LOQ	ND
	26	ND	5.68	ND	ND	ND	5.62	ND	19.48	ND	67.1	ND	< LOQ	0.48	< LOQ	ND	ND	1.02	ND	< LOQ	ND
	27	ND	5.29	ND	ND	ND	5.32	ND	17.70	ND	69.6	ND	< LOQ	0.51	< LOQ	ND	ND	0.97	ND	< LOQ	ND
	28	ND	5.19	ND	ND	ND	6.63	ND	21.08	ND	64.6	ND	< LOQ	0.55	< LOQ	ND	ND	1.08	ND	< LOQ	ND
	Min	-	*5.19*	-	-	-	*5.32*	-	*15.55*	-	*64.6*	-	-	*0.48*	-	-	-	*0.92*	-	-	-
	Max	-	*5.75*	-	-	-	*6.97*	-	*21.08*	-	*69.8*	-	-	*0.60*	-	-	-	*1.08*	-	*0.30*	-
	N	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*
Mpumalanga	29	ND	5.60	ND	ND	ND	5.47	ND	26.76	ND	59.8	ND	< LOQ	0.51	< LOQ	ND	ND	1.11	ND	< LOQ	ND
	33	ND	5.50	ND	ND	ND	6.38	ND	17.64	ND	68.4	ND	< LOQ	0.53	< LOQ	ND	ND	1.02	ND	< LOQ	ND
	Min	-	*5.50*	-	-	-	*5.47*	-	*17.64*	-	*59.8*	-	-	*0.51*	-	-	-	*1.02*	-	-	-
	Max	-	*5.60*	-	-	-	*6.38*	-	*26.76*	-	*68.4*	-	-	*0.53*	-	-	-	*1.11*	-	-	-
	N	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Gauteng	34	ND	5.60	ND	ND	ND	5.09	ND	18.11	ND	68.9	ND	< LOQ	0.47	< LOQ	ND	ND	1.00	ND	< LOQ	ND
Limpopo	35	ND	5.37	ND	ND	ND	6.67	ND	21.67	ND	63.8	ND	ND	0.50	< LOQ	ND	ND	0.94	ND	< LOQ	ND
RSA	*Min*	-	*5.00*	-	-	-	*4.95*	-	*15.25*	-	*59.82*	-	-	*0.46*	-	-	-	*0.92*	-	-	-
	Max	-	*5.78*	-	-	-	*8.36*	-	*26.76*	-	*69.99*	-	-	*0.61*	-	-	-	*1.11*	-	*0.30*	-
	N	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*

Note:
Limit of detection (LOD) = 0.09 g Fatty acid/100 g Fatty acids.
Limit of quantitation (LOQ) = 0.28 g Fatty acid/100 g Fatty acids.
Values below the limit of quantitation cannot be accurately quantified.
ND = Not detected

Table 7: Fatty acid profile results of a selection of cultivar samples from the 2018/19 season

Province	Locality	Region	Cultivar	g Fatty acids/100 g Fatty Acids																			
				C14:0	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1 t	C18:1 c	C18:2 t	C18:2 c	C18:3n6	C18:3n3	C20:0	C20:1	C20.2	C21:0	C22:0	C22:1	C24:0	C24:1
North West	Potchefstroom 1	18	AGSUN 5106 CLP	ND	6.02	ND	ND	ND	4.28	ND	26.64	ND	61.3	ND	ND	0.402	< LOQ	ND	ND	0.73	ND	< LOQ	ND
			AGSUN 8251	ND	5.82	ND	ND	ND	4.64	ND	27.77	ND	59.7	ND	ND	0.403	< LOQ	ND	ND	0.77	ND	< LOQ	ND
			P 65 LL14	ND	6.29	ND	ND	ND	3.89	ND	23.60	ND	64.3	ND	ND	0.402	< LOQ	ND	ND	0.80	ND	0.283	ND
			PAN 7158 HO	ND	5.52	ND	ND	ND	6.99	ND	16.72	ND	68.7	ND	< LOQ	0.57	< LOQ	ND	ND	1.00	ND	< LOQ	ND
			SY 3975 CLOH	ND	3.76	< LOQ	ND	ND	3.68	ND	82.3	ND	7.62	ND	ND	0.402	0.296	ND	ND	1.43	ND	0.44	ND
		Min		-	*3.76*	-	-	-	*3.68*	-	*16.72*	-	*7.62*	-	-	*0.402*	-	-	-	*0.73*	-	*0.283*	-
		Max		-	*6.29*	-	-	-	*6.99*	-	*82.3*	-	*68.7*	-	-	*0.57*	*0.296*	-	-	*1.43*	-	*0.44*	-
		N		*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
	Potchefstroom 3	18	AGSUN 5106 CLP	ND	5.75	ND	ND	ND	6.31	ND	24.53	ND	61.2	ND	ND	0.52	< LOQ	ND	ND	0.91	ND	< LOQ	ND
			AGSUN 8251	ND	5.37	ND	ND	ND	6.71	ND	25.14	ND	60.9	ND	ND	0.50	< LOQ	ND	ND	0.85	ND	< LOQ	ND
			P 65 LL14	ND	6.10	ND	ND	ND	5.45	ND	21.10	ND	66.1	ND	ND	0.50	< LOQ	ND	ND	ND	ND	0.28	ND
			PAN 7158 HO	ND	3.42	ND	ND	ND	3.95	ND	82.3	ND	7.93	ND	ND	0.415	0.303	ND	ND	1.29	ND	0.41	ND
			SY 3975 CLOH	ND	3.65	ND	ND	ND	5.14	ND	84.7	ND	3.336	ND	ND	0.53	0.301	ND	ND	1.79	ND	0.43	ND
		Min		-	*3.42*	-	-	-	*3.95*	-	*21.10*	-	*3.336*	-	-	*0.415*	*0.301*	-	-	*0.85*	-	*0.28*	-
		Max		-	*6.10*	-	-	-	*6.71*	-	*84.7*	-	*66.1*	-	-	*0.53*	*0.303*	-	-	*1.79*	-	*0.43*	-
		N		*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
	Potchefstroom 4	18	AGSUN 5106 CLP	ND	5.15	ND	ND	ND	6.90	ND	16.46	ND	69.4	ND	< LOQ	0.54	< LOQ	ND	ND	0.86	ND	0.30	ND
			AGSUN 8251	ND	5.16	ND	ND	ND	7.97	ND	14.98	ND	69.9	ND	< LOQ	0.59	< LOQ	ND	ND	0.92	ND	< LOQ	ND
			P 65 LL14	ND	5.64	ND	ND	ND	5.55	ND	14.29	ND	72.7	ND	< LOQ	0.48	< LOQ	ND	ND	0.89	ND	< LOQ	ND
			PAN 7158 HO	ND	2.80	ND	ND	ND	4.17	ND	82.2	ND	8.32	ND	< LOQ	0.405	< LOQ	ND	ND	1.34	ND	0.38	ND
			SY 3975 CLOH	ND	2.68	ND	ND	ND	5.55	ND	82.9	ND	6.00	ND	ND	0.50	< LOQ	ND	ND	1.77	ND	0.41	ND
		Min		-	*2.68*	-	-	-	*4.17*	-	*14.29*	-	*6.00*	-	-	*0.405*	-	-	-	*0.86*	-	*0.30*	-
		Max		-	*5.64*	-	-	-	*7.97*	-	*82.9*	-	*72.7*	-	-	*0.59*	-	-	-	*1.77*	-	*0.41*	-
		N		*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
	Boskop 3	18	AGSUN 5106 CLP	ND	4.79	ND	ND	ND	7.04	ND	18.93	ND	67.0	ND	ND	0.56	< LOQ	ND	ND	1.10	ND	< LOQ	ND
			AGSUN 8251	ND	4.66	ND	ND	ND	6.89	ND	19.88	ND	66.6	ND	ND	0.53	< LOQ	ND	ND	0.99	ND	< LOQ	ND
			P 65 LL14	ND	4.99	ND	ND	ND	5.55	ND	17.69	ND	69.8	ND	< LOQ	0.51	< LOQ	ND	ND	0.95	ND	< LOQ	ND
			PAN 7158 HO	ND	2.82	ND	ND	ND	4.37	ND	79.4	ND	11.07	ND	ND	0.40	< LOQ	ND	ND	1.23	ND	0.33	ND
			SY 3975 CLOH	ND	2.73	ND	ND	ND	5.54	ND	81.5	ND	7.39	ND	< LOQ	0.49	< LOQ	ND	ND	1.63	ND	0.39	ND
		Min		-	*2.73*	-	-	-	*4.37*	-	*17.69*	-	*7.39*	-	-	*0.40*	-	-	-	*0.95*	-	*0.33*	-
		Max		-	*4.99*	-	-	-	*7.04*	-	*81.5*	-	*69.8*	-	-	*0.56*	-	-	-	*1.63*	-	*0.39*	-
		N		*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
	Min			-	*2.68*	-	-	-	*3.68*	-	*14.29*	-	*3.336*	-	-	*0.402*	*0.296*	-	-	*0.73*	-	*0.283*	-
	Max			-	*6.29*	-	-	-	*7.97*	-	*84.7*	-	*72.7*	-	-	*0.59*	*0.303*	-	-	*1.79*	-	*0.44*	-
	N			*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*
RSA	Min			-	*2.68*	-	-	-	*3.68*	-	*14.29*	-	*3.336*	-	-	*0.402*	*0.296*	-	-	*0.73*	-	*0.283*	-
	Max			-	*6.29*	-	-	-	*7.97*	-	*84.7*	-	*72.7*	-	-	*0.59*	*0.303*	-	-	*1.79*	-	*0.44*	-
	N			*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*

Note:
Limit of detection (LOD) = 0.09 g Fatty acid/100 g Fatty acids.
Limit of quantitation (LOQ) = 0.28 g Fatty acid/100 g Fatty acids.
Values below the limit of quantitation cannot be accurately quantified.
ND = Not detected

Table 8: Fatty acid profile results per cultivar - 2018/19 season

Province	Region	Cultivar	g Fatty acids/100 g Fatty Acids																		
			C14:0	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1 t	C18:1 c	C18:2 t	C18:2 c	C18:3n6	C18:3n3	C20:0	C20:1	C20.2	C21:0	C22:0	C22:1	C24:0	C24:1
North West	18	AGSUN 5106 CLP	ND	6.02	ND	ND	ND	4.28	ND	26.64	ND	61.3	ND	ND	0.402	< LOQ	ND	ND	0.73	ND	< LOQ	ND
			ND	5.75	ND	ND	ND	6.31	ND	24.53	ND	61.2	ND	ND	0.52	< LOQ	ND	ND	0.91	ND	< LOQ	ND
			ND	5.15	ND	ND	ND	6.90	ND	16.46	ND	69.4	ND	< LOQ	0.54	< LOQ	ND	ND	0.86	ND	0.30	ND
			ND	4.79	ND	ND	ND	7.04	ND	18.93	ND	67.0	ND	ND	0.56	< LOQ	ND	ND	1.10	ND	< LOQ	ND
	Min		-	*4.79*	-	-	-	*4.28*	-	*16.46*	-	*61.2*	-	-	*0.402*	-	-	-	*0.73*	-	-	-
	Max		-	*6.02*	-	-	-	*7.04*	-	*26.64*	-	*69.4*	-	-	*0.56*	-	-	-	*1.10*	-	*0.30*	-
	N		*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
	18	AGSUN 8251	ND	5.82	ND	ND	ND	4.64	ND	27.77	ND	59.7	ND	ND	0.403	< LOQ	ND	ND	0.77	ND	< LOQ	ND
			ND	5.37	ND	ND	ND	6.71	ND	25.14	ND	60.9	ND	ND	0.50	< LOQ	ND	ND	0.85	ND	< LOQ	ND
			ND	5.16	ND	ND	ND	7.97	ND	14.98	ND	69.9	ND	< LOQ	0.59	< LOQ	ND	ND	0.92	ND	< LOQ	ND
			ND	4.66	ND	ND	ND	6.89	ND	19.88	ND	66.6	ND	ND	0.53	< LOQ	ND	ND	0.99	ND	< LOQ	ND
	Min		-	*4.66*	-	-	-	*4.64*	-	*14.98*	-	*59.7*	-	-	*0.403*	-	-	-	*0.77*	-	-	-
	Max		-	*5.82*	-	-	-	*7.97*	-	*27.77*	-	*69.9*	-	-	*0.59*	-	-	-	*0.99*	-	-	-
	N		*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
	18	P 65 LL14	ND	6.29	ND	ND	ND	3.89	ND	23.60	ND	64.3	ND	ND	0.402	< LOQ	ND	ND	0.80	ND	0.283	ND
			ND	6.10	ND	ND	ND	5.45	ND	21.10	ND	66.1	ND	ND	0.50	< LOQ	ND	ND	ND	ND	0.28	ND
			ND	5.64	ND	ND	ND	5.55	ND	14.29	ND	72.7	ND	< LOQ	0.48	< LOQ	ND	ND	0.89	ND	< LOQ	ND
			ND	4.99	ND	ND	ND	5.55	ND	17.69	ND	69.8	ND	< LOQ	0.51	< LOQ	ND	ND	0.95	ND	< LOQ	ND
	Min		-	*4.99*	-	-	-	*3.89*	-	*14.29*	-	*64.3*	-	-	*0.402*	-	-	-	*0.80*	-	*0.283*	-
	Max		-	*6.29*	-	-	-	*5.55*	-	*23.60*	-	*72.7*	-	-	*0.51*	-	-	-	*0.95*	-	*0.28*	-
	N		*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
	18	PAN 7158 HO	ND	5.52	ND	ND	ND	6.99	ND	16.72	ND	68.7	ND	< LOQ	0.57	< LOQ	ND	ND	1.00	ND	< LOQ	ND
			ND	3.42	ND	ND	ND	3.95	ND	82.3	ND	7.93	ND	ND	0.415	0.303	ND	ND	1.29	ND	0.41	ND
			ND	2.80	ND	ND	ND	4.17	ND	82.2	ND	8.32	ND	< LOQ	0.405	< LOQ	ND	ND	1.34	ND	0.38	ND
			ND	2.82	ND	ND	ND	4.37	ND	79.4	ND	11.07	ND	ND	0.40	< LOQ	ND	ND	1.23	ND	0.33	ND
	Min		-	*2.80*	-	-	-	*3.95*	-	*16.72*	-	*7.93*	-	-	*0.405*	-	-	-	*1.00*	-	*0.33*	-
	Max		-	*5.52*	-	-	-	*6.99*	-	*82.3*	-	*68.7*	-	-	*0.57*	*0.303*	-	-	*1.34*	-	*0.41*	-
	N		*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
	18	SY 3975 CLOH	ND	3.76	< LOQ	ND	ND	3.68	ND	82.3	ND	7.62	ND	ND	0.402	0.296	ND	ND	1.43	ND	0.44	ND
			ND	3.65	ND	ND	ND	5.14	ND	84.7	ND	3.336	ND	ND	0.53	0.301	ND	ND	1.79	ND	0.43	ND
			ND	2.68	ND	ND	ND	5.55	ND	82.9	ND	6.00	ND	ND	0.50	< LOQ	ND	ND	1.77	ND	0.41	ND
			ND	2.73	ND	ND	ND	5.54	ND	81.5	ND	7.39	ND	< LOQ	0.49	< LOQ	ND	ND	1.63	ND	0.39	ND
	Min		-	*2.68*	-	-	-	*3.68*	-	*81.49*	-	*3.336*	-	-	*0.402*	*0.296*	-	-	*1.43*	-	*0.39*	-
	Max		-	*3.76*	-	-	-	*5.55*	-	*84.7*	-	*7.62*	-	-	*0.53*	*0.301*	-	-	*1.79*	-	*0.44*	-
	N		*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
RSA	Min		-	*2.68*	-	-	-	*3.68*	-	*14.29*	-	*3.336*	-	-	*0.402*	*0.296*	-	-	*0.73*	-	*0.283*	-
	Max		-	*6.29*	-	-	-	*7.97*	-	*84.7*	-	*72.7*	-	-	*0.59*	*0.303*	-	-	*1.79*	-	*0.44*	-
	N		*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*

Note:
Limit of detection (LOD) = 0.09 g Fatty acid/100 g Fatty acids.
Limit of quantitation (LOQ) = 0.28 g Fatty acid/100 g Fatty acids.
Values below the limit of quantitation cannot be accurately quantified.
ND = Not detected

Methods

SAMPLING PROCEDURE:

A working group determined the procedure to be followed to ensure that the crop quality samples sent to the SAGL by the various grain silo owners, were representative of the total crop.

Each delivery was sampled as per the grading regulations for grading purposes.

After grading, the grading samples were placed in separate containers according to class and grade, per silo bin at each silo.

After 80% of the expected harvest had been received, the content of each container was divided with a multi slot divider in order to obtain a 3 kg sample.

If there were more than one container per class and grade per silo bin, the combined contents of the containers were mixed thoroughly before dividing it with a multi slot divider to obtain the required 3 kg sample.

The samples were marked clearly with the name of the depot, the bin/bag/bunker number(s) represented by each individual sample as well as the class and grade and were then forwarded to the SAGL.

GRADING:

Full grading was done in accordance with the Regulations relating to the Grading, Packing and Marking of Sunflower Seed intended for sale in the Republic of South Africa (Government Notice NO. 45 of 22 January 2016).

See pages 70 to 77 of this report.

TEST WEIGHT:

Test weight provides a measure of the bulk density of grain and oilseeds.

Test weight does not form part of the grading regulations for sunflower seed in South Africa. An approximation of the test weight of South African sunflower seed is provided in this report for information purposes. The standard working procedure of the Kern 222 instrument, as described in ISO 7971-3:2009, was followed. The g/1 L filling mass of the sunflower seed samples was determined and divided by two. The test weight was then extrapolated by means of the following formulas obtained from the Test Weight Conversion Chart for Sunflower Seed, Oil of the Canadian Grain Commission: $y = 0.1936x + 2.2775$ (138 to 182 g/0.5 L) and $y = 0.1943x + 2.1665$ (183 to 227 g/0.5 L).

NUTRITIONAL ANALYSIS:

Milling

Prior to the chemical analyses, the sunflower seed samples were milled on a Retch ZM 200 mill fitted with a 1.0 mm screen.

Moisture

The moisture content of the samples was determined as a loss in weight when dried in an oven at 105 °C for 5 hours according to AgriLASA method 2.1, latest edition.

Crude Protein

The Dumas combustion analysis technique was used to determine the crude protein content, according to AACCI method 46-30.01, latest edition.

This method prescribes a generic combustion method for the determination of crude protein. Combustion at high temperature in pure oxygen sets nitrogen free, which is measured by thermal conductivity detection. The total nitrogen content of the sample is determined and converted to equivalent protein by multiplication with a factor of 6.25 to obtain the crude protein content.

Crude Fat

In-House method 024 was used for the determination of the crude fat in the samples. After sample preparation the fat is extracted by petroleum ether with the aid of the Soxhlet extraction apparatus, followed by the removal of the solvent by evaporation and weighing the dried residue thus obtained. The residue is expressed as % crude fat.

Crude Fibre

In-House method 020 was used for the determination of the crude fibre in the samples. Crude fibre is the loss on ignition of the dried residue remaining after digestion of the sample with 1.25% Sulphuric acid (H_2SO_4) and 1.25% Sodium hydroxide (NaOH) solutions under specific conditions.

Ash

Ash is defined as the quantity of mineral matter which remains as incombustible residue of the tested substance, after application of the described working method. In-house method No. 011, based on AACCI method 08-03.01, was used for the determination. The samples were incinerated at 600 ± 15 °C in a muffle furnace for 2 hours.

PRECISION OIL LABORATORIES' FATTY ACID PROFILE METHODS:

Fat Extraction

In-House method POL 019 was used for the extraction of the crude fat from the samples. After sample preparation the fat is extracted by petroleum ether under reflux, followed by the removal of the solvent by evaporation. The residue obtained from the fat extraction is used for preparation of methyl esters for determination of the fatty acid profile.

Fatty Acid Profile

In-House method POL 015 was used for determination of the fatty acid composition. Extracted fat is converted to methyl esters using an alkali catalyzed method. Methyl esters are injected into a Gas Chromatograph and an external fatty acid methyl ester standard is used to identify peaks based on retention times. The fatty acid composition is expressed as a total fatty acid content of 100% with different fatty acids representing a percentage of the total fatty acids.

sanas
South African National Accreditation System

CERTIFICATE OF ACCREDITATION

In terms of section 22(2) (b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:-

SOUTHERN AFRICAN GRAIN LABORATORY NPC

Co. Reg. No.: 1997/018518/08

Facility Accreditation Number: **T0116**

is a South African National Accreditation System accredited facility provided that all conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying schedule of accreditation, Annexure "A", bearing the above accreditation number for

CHEMICAL AND PHYSICAL ANALYSIS

The facility is accredited in accordance with the recognised International Standard

ISO/IEC 17025:2017

The accreditation demonstrates technical competency for a defined scope and the operation of a quality management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the relevant accreditation symbol to issue facility reports and/or certificates

Mr R Josias
Chief Executive Officer

Effective Date: 01 November 2019
Certificate Expires: 31 October 2024

ANNEXURE A

SCHEDULE OF ACCREDITATION

Facility Number: **T0116**

Permanent Address of Laboratory:

Southern African Grain Laboratory NPC
Agri-Hub Office Park - Grain Building
477 Witherite Road
The Willows
Pretoria
0040

Technical Signatories:

Ms	J Nortje (All Methods excl. In-house method 029)
Ms	M Bothma (All Chemical Methods)
Ms	M Hammes (All Chemical Methods)
Ms	A de Jager (Nutrients & Contaminants Methods)
Ms	W Louw (In-house Methods 001, 002, 003, 010 & 026)
Ms	D Moleke (Rheological Methods)
Ms	I Terblanche (Rheological Methods)
Mrs	H Meyer (All Chemical, Nutrients and Contaminants & Grading Methods)
Ms	J Kruger (All Chemical Methods)
Ms	M Motlanthe (In-house Methods 001, 003 & 026)
Mr	B van Der Linde (Grading)
Ms	M Ramare (All Chemical Methods Excl. In-House Method 012 and SOP MC23)
Ms	Z Skhosana (In-house Method 026)
Ms	T de Beer (Rheological Methods)

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Nominated Representative:

Mrs H Meyer

Issue No.: 29
Date of Issue: 14 October 2019
Expiry Date: 31 October 2024

Material or Products Tested	Type of Tests / Properties Measured, Range of Measurement	Standard Specifications, Techniques / Equipment Used
CHEMICAL		
Ground Barley	Moisture (Oven Method)	Analytical EBC Method 3.2, latest Edition (2 hour; 130^{0}C)
Cereal and cereal products specifically-wheat, rice, (hulled paddy), barley, millet, rye, and oats as grain, semolina and flour	Moisture (Oven Method)	ICC Std No.110/1, Latest Edition (90 min; 130˚C) (2 hour; 130˚C)
Flour, semolina, bread, all kind of grains and cereal products and food products (except those that are sugar coated)	Moisture (Oven Method)	AACCI 44-15.02, Latest Edition (1 hour; 130˚C) (72 hour; 103˚C)

are sugar coated)		(72 hour; 103˚C)
Maize Grits	Moisture (Oven Method)	Analytical EBC Method 6.2.2, latest edition (4 hours, 130^{0}C)
Animal feed, Plant tissue and Sunflower (Milled)	Moisture (Oven Method)	AgriLASA 2.1, Latest Edition (5 hours, 105^{0}C)
All flours, cereal grains, oilseeds and animal feeds	Nitrogen and protein (Combustion method - Dumas)	AACCI 46-30.01, Latest Edition
Cereal based food stuff	Dietary fibres (Total)	In-house method 012
Food stuff and feeds	Carbohydrates (by difference) (calculation) Energy value (calculation) Total digestible nutritional value (calculation)	SOP MC 23
Food Stuff and feeds	Determination of Ash	In-house method 011
Wheat Kernels	Moisture (Oven Method)	Government Gazette Wheat Regulation, Latest Edition (72 hour, 103˚C)
Flours of grains e.g. barley, oats, triticale, maize, rye, sorghum and wheat; oilseeds like soybeans and sunflower, feeds and mixed feeds and foodstuffs	Crude fat (Ether extraction by Soxhlet)	In-house method 024
Meal and flour of wheat, rye, barley, other grains, starch containing and malted products	Falling number	ICC Std 107/1, Latest Edition
NUTRIENTS AND CONTAMINANTS		
Vitamin fortified food and feed products and fortification mixes grain based	Vitamin A as all trans Retinol (Saponification) (HPLC)	In-house method 001
	Thiamine Mononitrate (HPLC) Riboflavin (HPLC) Nicotinamide (HPLC) Pyridoxine Hydrochloride (HPLC)	In-house method 002
	Folic Acid (HPLC)	In-house method 003
Grain based food and feed products (fortified and unfortified) and fortification mixes	Total Sodium (Na) Total Iron (Fe) Total Zinc (Zn)	In-house method 010
Yeast and Bread	Vitamin D_2 (HPLC)	In-House method 029

Food and feed	Multi-Mycotoxin: -Aflatoxin G_1, B_1, G_2, B_2 and total -Deoxynivalenol (DON), 15-ADON -Fumonisin B_1, B_2, B_3 -Ochratoxin A -T2, HT-2 - Zearalenone	In-house method 026
GRADING		
Maize	Defective kernels (White maize/ yellow maize)	Government Gazette Maize Regulation, Latest Edition
Cereal as grains (Wheat, barley, rye and oats)	Hectolitre mass (Kern222)	ISO 7971-3, Latest edition
Wheat	Screenings	Government Gazette Wheat Grading Regulation, Latest Edition
RHEOLOGICAL		
Wheat flour	Alveograph (Rheological properties)	ICC Std.121, Latest Edition
Flours	Farinograph (Rheological properties)	AACCI 54.02, Latest Edition (Rheological behaviour of flour Farinograph: Constant Flour Weight procedure)
Hard, soft and durum wheat (flour and whole wheat flour)	Mixograph (Rheological properties)	Industry accepted method 020 (Based on AACCI 54-40.02, Latest Edition Mixograph Method)

Original Date of Accreditation: 01 November 1999

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

Accreditation Manager

Report

Evaluation of sunflower cultivars: 2018/2019 season

ARC-Grain Crops Institute in collaboration with the following seed companies: Agricol, Pannar, Pioneer, Syngenta, Sensako and Link Seed

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INTRODUCTION

Optimisation of crop production requires, among a number of inputs, the selection of a well performing cultivar. Sunflower cultivar trials, which are done since the nineteen seventies in South Africa, have the aim to enable farmers to optimise sunflower production through sound cultivar selection.

In this project, commercially available cultivars are evaluated in order to predict their future yield performances and to assess their seed composition. This project is the only unbiased effort in South Africa that strives to evaluate important cultivars in the main areas of production. The information generated in these field trials on grain yield and seed quality is not only available to farmers but to all interested parties.

MATERIALS AND METHODS

This project was conducted during the 2018/2019 season with the voluntary collaboration of Agricol, Pannar, Pioneer, Syngenta, Sensako and Linkseed. Seed companies entered 24 cultivars for evaluation (Table 1) and supplied seed to the ARC-GC which planned the field trials with randomised complete-block design layouts with three replicates. Germination tests, according to ISTA rules, were done on the supplied seed by a service provider (Senwes Grainlink). Seed germination from all cultivars exceeded the 80% requirement (Table 1). Seed from cultivars were packed according to trial plans and send to co-operators before the onset of the growing season.

Twelve of the 24 cultivars were Clearfield types on which the use of the post emergence broad leaf weed controlling herbicide mixture, imazapyr + imazamox (Euro-Lightning®), is possible. In the field trials these cultivars were treated in the same way as the regular cultivars and received no Euro-Lightning®. Two hybrids (PAN 7158 HO & SY3975CLHO) of the 24 was high oleic acid.

Each collaborating seed company had to conduct at least one trial for each cultivar entry. Agricol was supplied with seed for 9 trials, Pannar with 6, Pioneer with 5 and Syngenta with 2, Linkseed with 2 and Sensako with 1. Five trials were planted by the ARC-GC with different planting dates. Trial sites were selected by collaborators and the co-workers involved are listed in Table 2.

three trials of Pannar not planted or not harvested due to bad trial quality, two trials of Pioneer were not planted or planted and not harvested, one trial of Syngenta not planted, two trials of Linkseed not planted or not correctly done, two trials were not successful due to late planting and sclerotinia, bird damage, replanting not harvested or even not planted. Six trials were not statistically successful and were not included in the results. Planting dates, amount of fertiliser applied, soil analyses and other agronomic details from some successful field trials are reported in Table 3. Grain yields were recorded on these trials while the period from planting to 50% flowering was recorded on four trials at Potchefstroom and three trials at Boskop with different planting dates and one trial at Ventersdorp, Coligny, Lichtenburg, Viljoenskroon, and Kroonstad.

Yield data and seed samples were send by collaborators to ARC-GC for analyses. Seed from selected trials sent to SAGL for oil and protein content analyses. Yield data from 15 field trials were subjected to analyses of variance. The regression line technique as described by Loubser and Grimbeek (1984) was used to calculate yield probabilities for cultivars at different yield potentials from the 15 trials.

Yield probabilities were also calculated for 18 cultivars that were evaluated in 27 trials during 2017/2018 and 2018/2019.

RESULTS

Days from planting to flowering

The mean number of days from planting to 50% flowering of cultivars (Table 4) ranged from 67 (PAN 7102 CLP, P 64 LL 23, AGSUN 5270 & SY Arizona) to 72 days AGSUN 5103. Calculated across cultivars and planting dates, the period from planting to flowering was 69 days.

Oil and protein concentration

The moisture free oil and protein concentrations of seed from six trial localities, as analysed by the Southern African Grain Laboratory NPC, are shown in Tables 5 and 6 respectively. The oil analyses were done with a Soxhlet apparatus while the protein analyses were done according to the Dumas method.

The moisture free oil content for cultivars at the various localities varied from 40.65 to 51.53% with an overall mean of 43.63%.

The highest mean oil concentration among localities was at Potchefstroom (planting date 18 October 2018) with 46.13%. The locality with the lowest mean oil content of 38.52% was Boskopl planting date was December 22, 2018. The highest oil concentration among cultivars and calculated across localities, was SY 3970 CL at 51.53% followed by LG 5710 at 48.54% and SyArizona at 48.43%.

The average protein content varied from 15.03 to 19.15% among cultivars at the different localities. Among localities, Boskop planted in December 22, 2018 had the highest and Potchefstroom planted in October 18, 2018 the lowest protein content of 22.32 and 12.10% respectively. Calculated across localities, SY 3975 CLOH had the highest protein content (19.15 %) followed by LG 5678 CLP (19.03) while PAN 7080 the lowest (15.03%).

Seed yield

The mean seed yield of cultivars at the respective localities is presented in Table 7. The highest locality mean yield of 3.27 t ha^{-1} was obtained at Boskop2 planted on 22 December 2018 and the lowest of 1.15 t ha^{-1}, at Kroonstad planted on 21th January 2019.

The five best performing cultivars, in terms of average yield calculated over localities, were PAN 7080, PAN7156CLP, PAN 7102CLP, AGSUN 5270, AGSUN 8251 and P 65LL14. The overall mean yield for 2018/19 was 2.23 t ha^{-1}, 7 % lower than the mean yield of 2017/18.

Two high oleic cultivar (PAN 7158 HO & SY 3975 CLOH) was entered for evaluation in 2018/2019. Twelve Clearfield and Clearfield Plus cultivars, AGSUN 5101 CLP, AGSUN 5102 CLP, AGSUN 5103 CLP, AGSUN 5106 CLP, LG 5678 CLP, P 65 LC 17, PAN 7102 CLP, PAN 7156 CLP, PAN 7160 CLP, P 65LP 54, SY 3975 CLOH and SY 3970 CL were entered. Five of these cultivars namely PAN7156 CLP, PAN 7102 CLP, PAN 7160 CLP, P 65 LC 17 and AGSUN 5106 CLP have yields higher than the overall mean yield of all cultivars.

Oil yield

Oil yield per unit area is the product of grain yield and seed oil content and presented in Table 8.

The oil yield for cultivars at the seven localities varied from 0.98 to 1.26 t ha^{-1} with an overall mean of 1.10 t ha^{-1}. The locality with the highest mean oil yield was Boskop

planted in December 22, 2018 at 1.26 t ha^{-1}. P 65 LL 02 has the highest oil yield of 1.26 t ha^{-1} followed by Sy Arizona with 1.24 t ha^{-1}

Parameters calculated from the analysis of variance

The trial mean yield, standard error of the trial mean and other parameters, calculated for each locality, are shown in Table 9. These parameters are presented for the evaluation of individual trials.

Regression line coordinates at different yield targets

Regression line coordinates at different yield targets, the overall mean yield, the intercept and slope from the regression line and yield stability (D-parameter) are shown in Table 10. The coordinate values of a particular cultivar are estimates of the mean expected yield at corresponding yield potentials. These values take the cultivar X environment interaction into account but not the yield stability. These values are accordingly not reliable for cultivar selection. Individual cultivar regression lines for 2018/19 are shown in Figure 1 and for the 18 cultivars evaluated in 2017/18 and 2018/19 in Figure 2.

The yield stability of cultivars varied up to 21 fold among cultivars (Table 10). Cultivars which had exceptionally high stabilities (D-parameter ≤ 0.05) were, P 65 LL02, LG 5678 CLP, AGSUN 5102 CLP, AGSUN 5270, AGSUN 5106 CLP, PAN 7100, P 65LP54, AGSUN 5103 CLP, SY 3975 CLOH and PAN 7158HO

Yield probability

The yield probability of a cultivar, is the probability of exceeding the mean yield of all cultivars, at a particular yield potential. The yield probabilities of all 24 cultivars for 2018/19 are shown in Table 11. It takes account of both the cultivar X environment interaction and the yield stability and is therefore a reliable measure for cultivar choice. Yield probabilities higher than or equal to 60% in Table 11 indicates which cultivars would be sensible choices at the various yield potentials.

The yield probabilities of 18 cultivars evaluated in 27 trials in 2017/18 and 2018/19, and yield probabilities for the 12 cultivars evaluated in 40 trials are shown in Tables 12 and 13 respectively. Tables 11, 12 and 13 should be used jointly for cultivar selection.

Acknowledgements

Funding from the Oil and Protein Seed Development Trust and the participation of Agricol, Pannar, Pioneer, Syngenta, Like seed, Sensako and University of the Free State gratefully acknowledged.

References

LOUBSER, H.L. & GRIMBEEK, C.L., 1984. Cultivarevaluasie: ‘n vergelyking tussen verskillende tegnieke. In: Notule van vergadering gehou deur die ondersoekkomitee na cultivarprogramme by die NIGG te Potchefstroom.

Table 1: **Cultivars evaluated, seed germinated rate and supplier's company 2018/19**

Cultivar's Name	Germinated (%)			Company
	Normal	Abnormal	Dormant/dead	
AGSUN 5101 CLP	97	2	1	Agricol
AGSUN 5102 CLP	92	0	8	
AGSUN 5103 CLP	100	0	0	
AGSUN 5106 CLP	99	0	1	
AGSUN 5270	98	1	1	
AGSUN 5273	96	2	2	
AGSUN 5278	96	3	1	
AGSUN 8251	98	1	1	
LG 5678 CLP	94	1	5	Link Seed
LG 5710	93	3	4	
P 64 LL 23	80	1	19	Pioneer
P 65 LL 02	96	3	1	
P 65 LL14	97	2	1	
P 65 LP 54	98	1	1	
P 65 LC 17	98	1	1	
PAN 7080	97	3	0	Pannar
PAN 7100	92	5	3	
PAN 7102 CLP	100	0	0	
PAN 7156 CLP	96	2	2	
PAN 7158 HO	94	4	2	
PAN 7160 CLP	93	3	4	
SY 3970 CL	99	0	1	Syngenta
SY 3975 CLOH	93	4	3	
SY Arizona	94	2	4	

Table 2: Collaborating company, trial localities and responsible co-workers 2018/19

Company	Localities	Planting dates	Co-workers	E-mail address of co-worker
Agricol	Boskop 1 Boskop 2 Boskop 3 Ventersdorp Lichtenburg Wolmaranstad Vilioenskroon Coligny Delareyville	13/11/2018 12/12/2018 08/01/2019 31/01/2019 01/12/2018 05/02/2019 14/01/2019 30/01/2019 05/02/2019	J Swanepoel	Jouberts@agricol.co.za
ARC-GCI	Potchefstroom	18/10/2018 09/11/2018 28/11/2018 29/01/2018 10/01/2019	W Makgoga & J Erasmus	Makgogamw@arc.agric.za Erasmusj@arc.agric.za
PANNAR	Kroonstad Senekal Reitz Wesselsbron Bethlehem	10/12/2018 Not planted 05/12/2018 Not planted 22/11/2018	A Pretorius	abre.pretorius@pannar.co.za
Sensako	Kroonstad	21/01/2019	Janine Wessels	janinewessels@yahoo.com
Link seed	Viljoenskroon	05/01/2019	Werner Viljoen	Werner.viljoen@linkseed.co.za
Syngenta	Marquard	11/01/2019	Roean Wessels	roean.wessels@sensako.co.za
Pioneer	Potchefstroom Derby Lichtenburg Putfontein Delmas	Not planted 04/01/2019 09/01/2019 07/01/2019 29/10/2018	P Fourie	philip.fourie@pioneer.com

Table 3:Trial site information 2018/19

Locality	Planting date	Plant population	Soil classification	Top soil analysis (mg kg^{-1}) pH (KCl)	P	K	Ca	Mg	Fertiliser applied (Kg ha^{-1})	Row width (cm)	Weed control and insecticides	Nett plot size (m^2)
Boskop 1	13/11/2018	40 000		-	-	-	-	-	-	91	Alanex and Karate	11.83
Boskop 2	12/12/2018	40 000	-	-	-	-	-	-	-	91	Alanex and Karate	11.83
Boskop 3	08/01/2019	40 000	-	-	-	-	-	-	-	91	Alanex and Karate-	11.83
Ventersdorp	31/01/2019	40 000	-	-	-	-	-	-	-	91	Mechanical weeding	11.83
Lichtenburg	01/12/2018	40 000	-	-	-	-	-	-	-	91	Mechanical weeding -	11.83
Wolmaranstad	05/02/2019	40 000	-	-	-	-	-	-	-	91	Mechanical weeding	11.83
Vilioenskroon	14/01/2019	40 000	-	-	-	-	-	-	-	91	Mechanical weeding	11.83
Coligny	30/01/2019	40 000	-	-	-	-	-	-	-	91	Mechanical weeding	11.83
Delareyville	05/02/2019	40 000	-	-	-	-	-	-	-	91	Mechanical weeding	11.83
Potchefstroom	18/10/2018	38 000		6,91	49	345	1150	560	N:120,P:8.3.K:4.1	90	Metagen Gold and Gramaxome	14.40
Potchefstroom	09/11/2018	38 000		6,47	39	373	1050	513	N:80,P:8.3.K:4.1	90	Metagen Gold and Gramaxome	14.40
Potchefstroom	29/11/2018	38 000		6,47	39	373	1050	513	N:80,P:8.3.K:4.1	90	Metagen Gold and Gramaxome	4.40
Potchefstroom	10/01/2019	38 000		6,58	54	255	1060	608	N:160,P:8.3.K:4.1	90	Metagen Gold and Gramaxome	14.40
Kroonstad	10/12/2018	40 000	-	-	-	-	-	-	-	-	-	13.65
Senekal	Not planted	40 000	-	-	-	-	-	-	-	-	-	13.65
Reitz	05/12/2018	40 000	-	-	-	-	-	-	-	-	-	13.65
Wesselsbron	Not planted	40 000	-	-	-	-	-	-	-	-	-	13.65
Bethlehem	22/11/2018	40 000	-		-	-	-	-	-		-	13.65
Kroonstad	10/12/2018		-	6.05	25	190	598	174	-	-	-	
Viljoenskroon	05/01/2019	40 000	-	-	-	-	-	-	-	-	-	10.92
Marquard	10/01/2019	45 000	-	-	-	-	-	-	Hifert,9:1:0(30), 160kg. Boron, 2.5	91	Baseline 960 and Racer and Karate	12.74
Potchefstroom	Not planted	40 000	-	-	-	-	-	-	-	-		13.65
Derby	04/01/2019	40 000	-	-	-	-	-	-	-	-	-	13.65
Lichtenburg	09/01/2019	40 000	-	-	-	-	-	-	-	-	-	13.65
Putfontein	07/01/2019	40 000	-	-	-	-	-	-	-	-	-	13.65
Delmas	29/10/2018	40 000	-	-	-	-	-	-	-	-	-	13.65

Table 4: Number of days from planting to 50 percent flowering of cultivars at selected localities and planting dates 2018/2019

Cultivar	Boskop 13/11/2018	Boskop 22/12/2018	Boskop 08/01//2019	Lichtenburg 05/01/2019	Coligny 30/01/2019	Viljoenskroon 14/01/2019	Ventersdorp 31/01/2019	Kroonstad 21/01/2019	Potchefstroom 18/10/2018	Potchefstroom 09/11/2018	Potchefstroom 29/11/2018	Potchefstroom 10/01/2019	Mean
AGSUN 5101 CLP	67	67	68	71	70	76	69	70	78	73	68	76	71
AGSUN 5102 CLP	66	68	68	72	72	77	68	69	79	72	65	76	71
AGSUN 5103 CLP	68	68	67	71	72	76	68	72	81	71	69	76	72
AGSUN 5106 CLP	67	69	67	71	71	76	69	70	83	66	70	76	71
AGSUN 5270	62	66	62	65	69	72	63	66	72	71	66	70	67
AGSUN 5273	65	68	68	68	70	74	67	68	78	67	67	72	69
AGSUN 5278	66	67	66	69	71	74	67	69	78	66	67	75	70
AGSUN 8251	68	68	66	71	71	73	68	70	80	71	67	75	71
LG 5678 CLP	65	69	68	72	73	77	67	68	77	68	68	76	71
LG 5710	66	67	64	70	68	72	67	68	76	70	66	70	69
P 64 LL 23	63	61	62	64	67	72	65	67	71	70	67	72	67
P 65 LL02	64	68	66	70	67	76	63	70	79	66	68	75	69
P 65 LL14	68	67	66	73	70	73	68	67	73	66	69	72	69
P 65 LP 54	64	65	65	70	69	75	67	69	72	71	66	73	69
P 65 LC 17	63	64	64	69	68	74	67	68	71	71	67	75	68
PAN 7080	65	67	67	70	68	73	66	67	72	71	66	74	69
PAN 7100	64	67	67	71	70	76	67	68	73	72	67	70	69
PAN 7102 CLP	62	63	64	71	66	65	66	68	71	66	65	72	67
PAN 7156 CLP	64	63	67	71	68	76	67	70	72	68	66	76	69
PAN 7158 HO	64	67	67	72	70	74	69	72	81	70	68	76	71
PAN 7160 CLP	65	63	67	70	67	73	67	71	76	71	66	76	69
SY 3970 CL	67	68	68	72	68	74	66	67	80	68	69	75	70
SY 3975 CLOH	68	70	70	72	70	76	66	70	71	71	69	75	71
SY Arizona	63	65	63	70	65	71	67	67	71	72	65	70	67
Mean	65	66	66	70	69	74	67	69	76	70	67	74	69

Table 5: The moisture free seed oil concentration (%) of cultivars at selected localities 2018/2019

Cultivar	Vilioenskroon 14/01/19	Boskop 22/12/2018	Lichtenburg 05/01/2019	Potchefstroom 18/10/2018	Potchefstroom 09/11/2018	Potchefstroom 10/01/2019	Mean
AGSUN5101CLP	37,60	36,90	40,40	44,20	43,20	41,60	40,65
AGSUN5102CLP	36,90	37,20	41,80	44,20	44,00	44,60	41,45
AGSUN5103CLP	37,30	34,60	41,00	42,90	45,50	43,70	40,83
AGSUN5106CLP	38,20	35,90	41,40	43,90	40,70	44,80	40,82
AGSUN5270	43,20	37,40	44,80	46,30	46,70	47,10	44,25
AGSUN5273	39,70	37,10	43,00	42,60	41,00	44,80	41,37
AGSUN5278	38,70	38,80	42,70	44,10	42,50	43,40	41,70
AGSUN8251	37,80	36,10	42,00	42,50	44,00	42,90	40,88
LG5678CLP	43,10	43,70	47,00	50,90	48,00	51,90	47,43
LG5710	45,60	41,70	49,60	50,60	53,00	50,20	48,45
P64LL23	45,50	39,00	45,70	47,70	48,20	47,20	45,55
P65LL02	46,90	39,80	48,20	47,60	49,50	50,10	47,02
P65LL14	43,80	39,50	45,90	48,20	47,60	48,30	45,55
P65LP54	38,30	34,40	42,30	42,20	42,30	45,30	40,80
P65LC17	39,00	37,30	44,50	44,30	43,00	43,70	41,97
PAN7080	38,10	35,80	43,70	44,20	44,30	43,60	41,62
PAN7100	41,40	38,50	45,50	49,10	46,80	46,50	44,63
PAN7102CLP	38,20	36,20	44,90	44,00	44,60	39,20	41,18
PAN7156CLP	39,00	34,60	43,80	44,00	44,10	39,30	40,80
PAN7158HO	36,10	37,90	41,70	44,20	44,50	40,60	40,83
PAN7160CLP	41,60	37,70	43,50	44,80	47,70	38,60	42,32
SY3970CL	49,70	47,20	52,80	52,50	55,40	51,60	51,53
SY3975CLOH	44,10	43,00	49,20	52,00	49,60	43,90	46,97
SYArizona	46,60	44,20	49,80	50,20	49,70	50,10	48,43
mean	41,10	38,52	44,80	46,13	46,08	45,13	43,63

Table 6: The moisture free seed protein concentration (%) of cultivars at selected localities 2018/2019

Cultivar	Vilioenskroon 14/01/19	Boskop 22/12/2018	Lichtenburg 05/01/2019	Potchefstroom 18/10/2018	Potchefstroom 09/11/2018	Potchefstroom 10/01/2019	Mean
AGSUN5101CLP	20,47	22,64	16,97	5	17,33	13,76	17,15
AGSUN5102CLP	20,66	23,04	16,47	11,47	15,11	13,81	16,76
AGSUN5103CLP	19,80	25,37	16,89	12,50	13,24	13,40	16,86
AGSUN5106CLP	20,10	22,82	16,82	11,34	14,83	13,11	16,50
AGSUN5270	18,38	23,80	17,11	12,97	15,39	15,07	17,12
AGSUN5273	18,84	23,41	17,68	16,88	16,61	14,48	17,98
AGSUN5278	19,40	22,83	16,41	11,34	14,67	14,11	16,46
AGSUN8251	19,56	21,69	16,06	12,37	14,66	14,39	16,45
LG5678CLP	21,20	24,02	18,82	14,07	18,29	17,81	19,03
LG5710	20,97	23,05	18,51	13,31	13,74	16,82	17,73
P64LL23	17,11	21,09	16,57	11,41	14,19	16,06	16,07
P65LL02	17,40	21,81	16,41	13,21	12,68	13,85	15,89
P65LL14	17,48	21,43	15,60	11,12	13,09	13,62	15,39
P65LP54	17,68	23,13	15,70	11,65	12,65	13,41	15,70
P65LC17	18,03	21,50	15,71	11,22	13,80	13,40	15,61
PAN7080	18,36	22,51	14,05	10,10	12,86	12,29	15,03
PAN7100	18,28	20,01	13,97	11,69	15,80	14,23	15,66
PAN7102CLP	19,22	21,42	15,19	11,93	12,58	14,42	15,79
PAN7156CLP	17,59	21,54	13,93	10,74	12,74	17,21	15,62
PAN7158HO	17,21	21,11	13,27	12,78	14,14	13,99	15,42
PAN7160CLP	17,49	22,64	13,26	10,59	13,90	16,42	15,71
SY3970CL	18,48	20,82	13,75	11,96	15,71	14,99	15,95
SY3975CLOH	21,81	24,18	17,20	13,70	19,00	19,00	19,15
SYArizona	18,31	19,79	15,73	10,43	16,29	12,94	15,58
mean	18,91	22,32	15,92	12,10	14,72	14,69	16,44

Table 7: Mean seed yield (t ha^{-1}) of cultivars at each locality 2018/2019

Cultivars	Boskop1 13/11/18	Boskop 22/12/18	Boskop3 08/01/19	Coligny 30/01/19	Delareyvill 05/02/19	Kroonatad 21/01/19	Kroonstad 10/12/18	Lichtenburg 05/01/19	Potchefstroom 09/11/18	Potchefstroom 10/01/19	Potchefstroom 18/10/18	Ventersdorp 31/01/19	Viljoenskroon 14/01/19	Wolmaranstand 05/02/19	Mean
AGSUN5101CLP	2,64	3,42	2,90	1,34	1,89	0,93	2,18	2,43	2,02	2,60	1,48	1,88	2,69	2,11	2,18
AGSUN5102CLP	2,80	3,13	2,41	1,50	1,98	1,30	1,50	2,80	2,29	2,57	1,62	1,66	2,50	2,17	2,16
AGSUN5103CLP	3,25	3,20	2,51	1,54	2,17	0,84	1,79	2,78	2,16	2,49	1,55	1,85	2,85	2,12	2,22
AGSUN5106CLP	3,56	3,48	2,82	1,26	1,96	1,12	1,51	2,83	2,37	2,17	1,48	1,75	2,90	2,37	2,26
AGSUN5270	3,40	3,41	2,99	1,46	2,33	1,31	2,17	3,03	2,18	2,57	1,83	1,66	2,89	2,24	2,39
AGSUN5273	2,37	3,16	2,32	0,99	2,15	0,92	1,53	2,52	2,12	2,80	1,44	1,79	2,76	2,06	2,07
AGSUN5278	2,68	3,00	2,67	1,14	1,71	1,16	1,17	2,65	1,80	2,60	1,70	2,01	2,46	2,12	2,06
AGSUN8251	3,28	3,54	2,64	1,41	2,04	1,37	2,49	2,68	2,29	2,29	1,86	2,00	2,97	2,33	2,37
LG5678CLP	3,05	2,72	2,48	1,10	1,86	1,05	1,70	2,20	2,19	2,53	1,84	1,47	2,57	2,03	2,06
LG5710	3,39	3,38	2,87	1,19	1,93	1,03	1,82	2,23	2,35	2,33	1,99	1,75	2,15	2,04	2,18
P64LL23	2,91	3,14	2,50	1,36	1,65	1,43	2,32	2,63	3,11	2,62	2,14	1,67	2,61	2,26	2,31
P65LL02	3,37	3,34	2,80	1,20	2,16	1,11	2,00	2,50	2,61	2,75	2,06	1,59	2,93	2,44	2,35
P65LL14	3,24	3,76	2,46	1,36	2,49	1,18	1,87	3,08	2,12	2,57	1,93	1,79	2,83	2,29	2,36
P65LP54	2,72	3,27	2,58	1,17	1,85	1,10	1,51	2,81	2,65	2,28	1,94	1,86	2,69	2,57	2,21
P65LC17	3,45	2,85	3,03	1,52	2,05	0,89	1,91	2,97	2,22	2,27	2,11	1,90	2,54	2,50	2,30
PAN7080	2,95	3,77	2,70	1,25	2,54	1,18	2,12	2,76	2,84	2,46	2,00	1,58	3,09	2,89	2,44
PAN7100	2,99	3,12	2,21	1,54	1,90	1,41	1,83	2,58	2,16	2,48	1,74	1,74	2,87	2,27	2,20
PAN7102CLP	3,60	3,54	2,40	1,47	2,43	1,25	2,37	2,62	2,48	2,41	2,04	2,05	2,88	2,44	2,43
PAN7156CLP	2,86	3,48	2,71	1,58	2,12	1,27	1,77	3,12	2,80	2,90	2,10	1,95	3,02	2,41	2,44
PAN7158HO	2,65	3,35	2,41	1,00	1,85	1,26	1,63	2,51	2,82	2,30	1,77	1,49	2,72	2,20	2,14
PAN7160CLP	3,51	3,34	2,98	1,44	2,02	1,04	1,70	2,61	2,42	2,65	2,04	1,59	3,06	2,16	2,33
SY3970CL	3,25	3,18	1,98	1,23	1,35	0,99	1,37	2,54	2,56	1,99	1,60	1,16	2,58	1,93	1,98
SY3975CLOH	2,59	2,64	2,07	1,01	1,73	1,19	1,58	2,72	1,56	2,22	1,56	1,21	2,35	1,90	1,88
SYArizona	3,22	3,31	2,54	1,02	1,69	1,17	1,86	2,50	3,20	1,96	2,14	1,81	2,31	2,05	2,20
mean	3,07	3,27	2,58	1,30	1,99	1,15	1,82	2,67	2,39	2,45	1,83	1,72	2,72	2,25	2,23
CV%	14,9	11,6	15,2	19,5	20,2	18,7	22,8	10,5	17,3	10,9	14,8	19,3	13,3	11,5	

Table 8: Oil yield (t ha^{-1}) of cultivars at selected localities 2018/2019

Cultivar	Vilioenskroon 14/01/19	Boskop 22/12/2018	Lichtenburg 05/01/2019	Potchefstroom 18/10/2018	Potchefstroom 09/11/2018	Potchefstroom 10/01/2019	Mean
AGSUN5101CLP	1,01	1,26	0,98	0,65	0,87	1,08	0,98
AGSUN5102CLP	0,92	1,16	1,17	0,72	1,01	1,15	1,02
AGSUN5103CLP	1,06	1,11	1,14	0,66	0,98	1,09	1,01
AGSUN5106CLP	1,11	1,25	1,17	0,65	0,96	0,97	1,02
AGSUN5270	1,25	1,28	1,36	0,85	1,02	1,21	1,16
AGSUN5273	1,10	1,17	1,08	0,61	0,87	1,25	1,01
AGSUN5278	0,95	1,16	1,13	0,75	0,77	1,13	0,98
AGSUN8251	1,12	1,28	1,13	0,79	1,01	0,98	1,05
LG5678CLP	1,11	1,19	1,03	0,94	1,05	1,31	1,11
LG5710	0,98	1,41	1,11	1,01	1,25	1,17	1,15
P64LL23	1,19	1,22	1,20	1,02	1,50	1,24	1,23
P65LL02	1,37	1,33	1,21	0,98	1,29	1,38	1,26
P65LL14	1,24	1,49	1,41	0,93	1,01	1,24	1,22
P65LP54	1,03	1,12	1,19	0,82	1,12	1,03	1,05
P65LC17	0,99	1,06	1,32	0,93	0,95	0,99	1,04
PAN7080	1,18	1,35	1,21	0,88	1,26	1,07	1,16
PAN7100	1,19	1,20	1,17	0,85	1,01	1,15	1,10
PAN7102CLP	1,10	1,28	1,18	0,90	1,11	0,94	1,08
PAN7156CLP	1,18	1,20	1,37	0,92	1,23	1,14	1,17
PAN7158HO	0,98	1,27	1,05	0,78	1,25	0,93	1,04
PAN7160CLP	1,27	1,26	1,14	0,91	1,15	1,02	1,13
SY3970CL	1,28	1,50	1,34	0,84	1,42	1,03	1,23
SY3975CLOH	1,04	1,14	1,34	0,81	0,77	0,97	1,01
SYArizona	1,08	1,46	1,25	1,07	1,59	0,98	1,24
mean	1,12	1,26	1,20	0,84	1,10	1,11	1,10

Table 9: Parameters calculated from the analysis of variance for yield data at each locality

Locality	Mean (t ha^{-1})	SE	CV (%)	GCV	t	SE(t)	tn
Bethlehem 22/11/18	0,81	0,17	36,00	17,80	0,20	0,14	0,43
Boskop1 13/11/18	3,09	0,24	13,50	7,80	0,25	0,14	0,50
Boskop2 2/12/18	3,27	0,22	11,60	5,40	0,18	0,13	0,40
Boskop3 08/01/19	2,58	0,23	15,20	6,50	0,15	0,13	0,35
Coligny 30/01/19	1,30	0,15	19,50	9,60	0,19	0,14	0,41
Delareyvill 05/02/19	1,97	0,21	18,40	10,20	0,24	0,14	0,49
Derby 04/01/19	1,37	0,28	34,80	24,80	0,34	0,13	0,61
Kroonatad 21/01/19	1,15	0,12	18,70	9,30	0,20	0,14	0,43
Kroonstad10/12/18	1,83	0,19	18,20	16,20	0,44	0,13	0,70
Lichtenburg 05/01/19	2,69	0,14	8,90	7,30	0,40	0,13	0,67
Lichtenburg 09/01/19	1,09	0,18	28,40	21,00	0,35	0,13	0,62
Marquard 11/01/19	1,99	0,27	23,50	10,70	0,17	0,13	0,38
Potchefstroom 09/11/18	2,39	0,24	17,30	12,70	0,35	0,13	0,62
Potchefstroom 10/01/19	2,45	0,15	10,90	7,30	0,31	0,14	0,57
Potchefstroom 18/10/18	1,83	0,16	14,80	9,30	0,28	0,14	0,54
Potchefstroom 28/11/18	2,03	0,25	21,20	13,30	0,28	0,14	0,54
Putfontein 07/01/19	1,79	0,30	29,00	1,40	0,00	0,12	0,00
Reitz 05/12/18	1,94	0,31	27,50	6,00	0,05	0,13	0,14
Ventersdorp31/01/19	1,72	0,19	19,30	7,20	0,12	0,13	0,29
Viljoenskroon 14/01/19	2,72	0,21	13,30	4,90	0,12	0,13	0,29
Wolmaranstand 05/02/19	2,25	0,15	11,50	7,50	0,30	0,14	0,56

Table 10: Regression line coordinates at different yield potentials 2018/19

Cultivar	Yield potential (t ha^{-1})						Mean (t ha^{-1})	Intercept	Slope	D-parameter
	1	1.5	2	2.5	3	3.5				
AGSUN5101CLP	0,98	1,47	1,96	2,45	2,94	3,43	2,18	0,00	0,98	0,071
AGSUN5102CLP	1,08	1,53	1,97	2,42	2,86	3,31	2,16	0,19	0,89	0,025
AGSUN5103CLP	0,93	1,46	1,98	2,51	3,03	3,56	2,22	-0,12	1,05	0,034
AGSUN5106CLP	0,75	1,36	1,97	2,58	3,19	3,80	2,26	-0,47	1,22	0,038
AGSUN5270	1,09	1,62	2,14	2,67	3,19	3,72	2,39	0,04	1,05	0,035
AGSUN5273	0,85	1,34	1,83	2,32	2,81	3,30	2,07	-0,13	0,98	0,072
AGSUN5278	0,93	1,39	1,85	2,31	2,77	3,23	2,06	0,01	0,92	0,075
AGSUN8251	1,20	1,68	2,15	2,63	3,10	3,58	2,37	0,25	0,95	0,044
LG5678CLP	0,94	1,40	1,86	2,32	2,78	3,24	2,06	0,02	0,92	0,028
LG5710	0,92	1,44	1,95	2,47	2,98	3,50	2,18	-0,11	1,03	0,065
P64LL23	1,28	1,70	2,12	2,54	2,96	3,38	2,31	0,44	0,84	0,079
P65LL02	0,99	1,54	2,09	2,64	3,19	3,74	2,35	-0,11	1,10	0,023
P65LL14	1,00	1,55	2,10	2,65	3,20	3,75	2,36	-0,10	1,10	0,045
P65LP54	0,99	1,49	1,98	2,48	2,97	3,47	2,21	0,00	0,99	0,043
P65LC17	1,11	1,60	2,08	2,57	3,05	3,54	2,30	0,14	0,97	0,077
PAN7080	1,08	1,63	2,18	2,73	3,28	3,83	2,44	-0,02	1,10	0,068
PAN7100	1,17	1,59	2,01	2,43	2,85	3,27	2,20	0,33	0,84	0,022
PAN7102CLP	1,23	1,72	2,21	2,70	3,19	3,68	2,43	0,25	0,98	0,050
PAN7156CLP	1,21	1,71	2,20	2,70	3,19	3,69	2,44	0,22	0,99	0,037
PAN7158HO	0,91	1,42	1,92	2,43	2,93	3,44	2,14	-0,10	1,01	0,046
PAN7160CLP	0,91	1,49	2,06	2,64	3,21	3,79	2,33	-0,24	1,15	0,032
SY3970CL	0,61	1,17	1,72	2,28	2,83	3,39	1,98	-0,50	1,11	0,071
SY3975CLOH	0,85	1,27	1,68	2,10	2,51	2,93	1,88	0,02	0,83	0,050
SYArizona	0,97	1,47	1,97	2,47	2,97	3,47	2,20	-0,03	1,00	0,118

Table 11: Yield probability (%) of cultivars for 2018/19 at different yield potentials

Cultivar	Yield potential (t ha^{-1})					
	1	**1.5**	**2**	**2.5**	**3**	**3.5**
AGSUN5101CLP	47	46	44	43	42	41
AGSUN5102CLP	67	57	43	31	21	15
AGSUN5103CLP	37	42	46	52	56	61
AGSUN5106CLP	14	25	44	65	81	90
AGSUN5270	66	72	76	81	82	84
AGSUN5273	32	29	27	26	26	26
AGSUN5278	41	36	30	25	22	20
AGSUN8251	79	79	75	72	67	63
LG5678CLP	38	29	21	15	11	9
LG5710	39	41	43	46	47	50
P64LL23	80	74	66	55	45	36
P65LL02	48	60	72	81	88	91
P65LL14	50	59	67	75	81	84
P65LP54	48	48	46	46	45	45
P65LC17	63	63	61	60	57	55
PAN7080	60	68	75	80	84	86
PAN7100	84	71	53	33	18	9
PAN7102CLP	81	82	82	80	78	75
PAN7156CLP	82	84	84	84	82	80
PAN7158HO	36	37	36	38	38	41
PAN7160CLP	33	48	63	77	86	92
SY3970CL	10	13	16	21	28	36
SY3975CLOH	28	17	8	4	2	2
SYArizona	47	47	47	47	47	47

Table 12: Yield probability (%) of cultivars 2017/2018 and 2018/2019 at different yield potentials

Cultivar	Yield potential (t ha^{-1})					
	1	1.5	2	2.5	3	3.5
AGSUN5101CLP	33	32	32	32	32	33
AGSUN5102CLP	53	41	27	18	11	7
AGSUN5103CLP	25	34	44	56	66	76
AGSUN5106CLP	37	45	52	61	67	74
AGSUN5270	72	75	75	77	77	78
AGSUN5273	36	30	23	18	13	11
AGSUN5278	55	45	33	24	16	11
AGSUN8251	69	65	61	55	50	45
P65LL02	61	68	72	78	81	84
P65LL14	58	60	61	63	64	65
P65LP54	37	40	42	46	48	52
PAN7080	44	53	62	71	78	83
PAN7100	62	60	58	56	54	52
PAN7102CLP	77	76	73	70	67	63
PAN7156CLP	78	76	73	70	65	61
PAN7158HO	45	43	41	39	38	37
PAN7160CLP	50	57	65	72	78	82
SY3970CL	19	18	16	16	16	17

Table 13: Yield probability (%) of cultivars for three years' data 2016/17 to 2018/2019 at different yield potentials

Cultivar	Yield potential (t ha^{-1})					
	1	1.5	2	2.5	3	3.5
AGSUN5270	62	62	61	61	59	59
AGSUN5273	23	25	27	30	33	36
AGSUN5278	59	47	32	21	12	7
AGSUN8251	65	62	56	52	46	41
P65LL02	48	50	52	54	56	57
P65LL14	42	43	45	47	48	50
P65LP54	52	48	43	39	34	31
PAN7080	26	35	45	58	68	77
PAN7100	47	50	53	57	60	63
PAN7102CLP	57	60	64	67	70	73
PAN7156CLP	73	70	64	60	53	48
PAN7160CLP	50	57	63	70	75	80

Sclerotinia head rot rating: *(University of the Free State)*

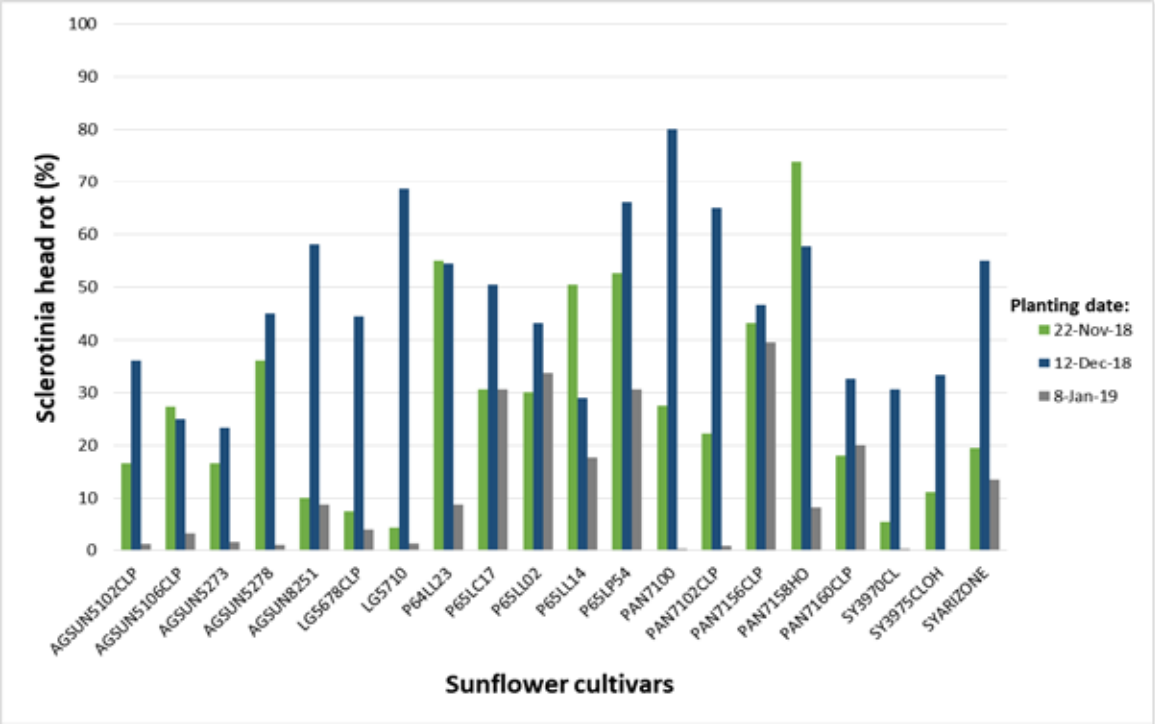


Figure 1: Sclerotinia head rot rating (%) for twenty sunflower hybrids planted at different planting dates during 2018-19 growing season in Delmas

Twenty sunflower cultivars were planted on the 22 November 2018, 12 December 2018 and 8 January 2019 in Delmas, Mpumalanga figure 1. The sunflowers were artificially inoculated with *S. sclerotiorum* at flowering growth stage and Sclerotinia ratings were conducted. The second planting yielded the most Sclerotinia head rot, 47.24%, while the last planting yielded the lowest level of Sclerotinia, 11.31%. The first planting produced an average of 27.93% Sclerotinia head rot. The above results were based on one rating. Future trials will include multiple ratings throughout the season. Conducted in partnership with a local industry member.

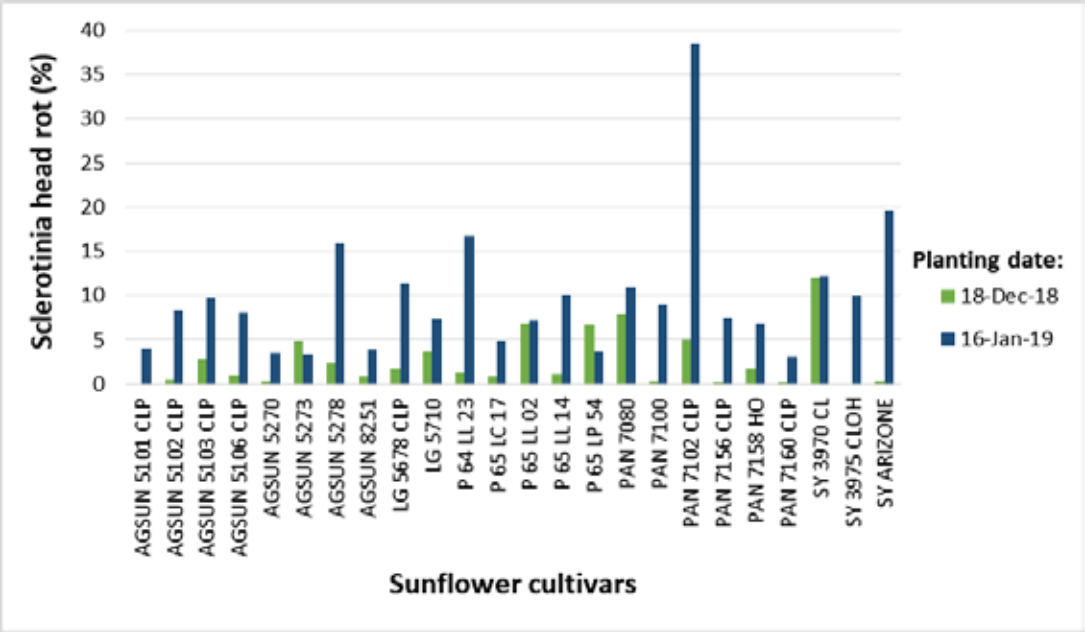
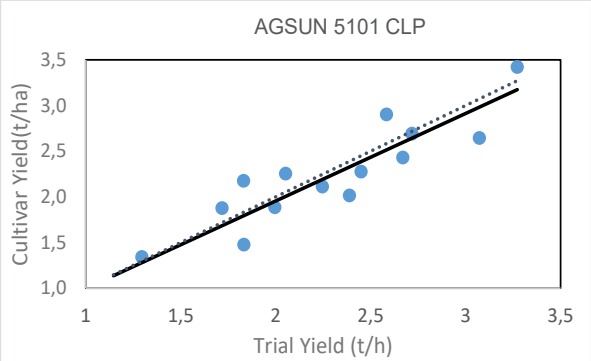


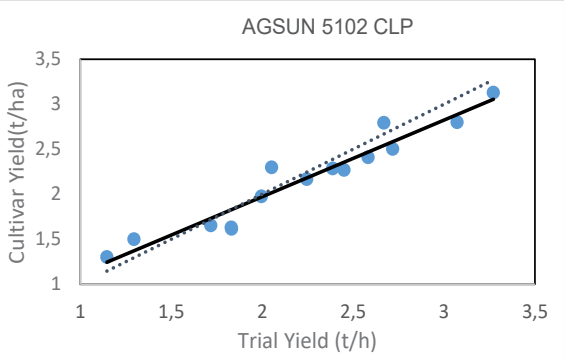
Figure 2: Sclerotinia head rot rating (%) for twenty-four sunflower hybrids planted at two planting dates during 2018-19 growing season in Clocolan

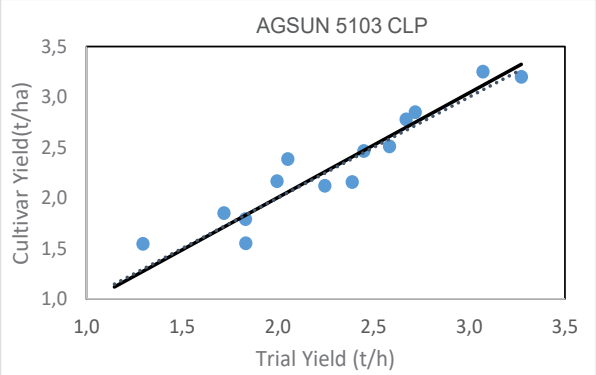
Twenty-four sunflower cultivars were planted on the 18 December 2018 and 16 January 2019 in Clocolan, Free State **figure 2**. The sunflowers were naturally infected with *S. sclerotiorum* and Sclerotinia ratings were conducted. The second planting yielded an average of 10% severity, while the first planting produced almost 3% severity. The above results were based on one rating. Future trials will include multiple ratings throughout the season. Conducted in partnership with a local producer.

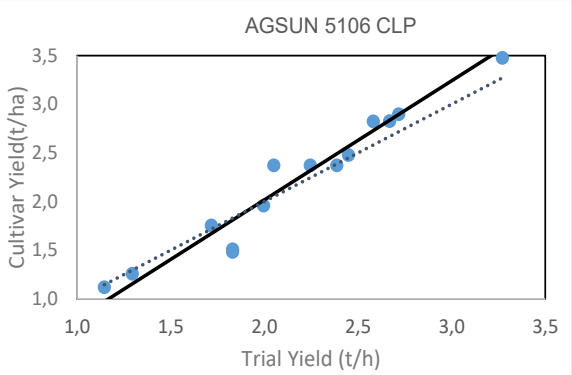
For additional information relating to the Sclerotinia head rot rating kindly, contact
Ms. Marlese Meiring mcbester6@gmail.com
Ms. Lisa A. Rothmann CoetzeeLA@ufs.ac.za
University of the Free State

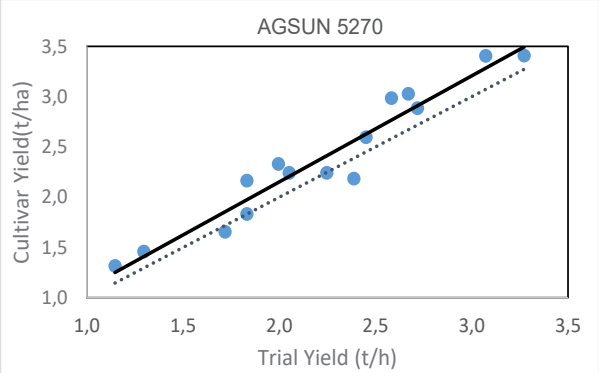
Figure 3: Regression lines for cultivars 2018/2018

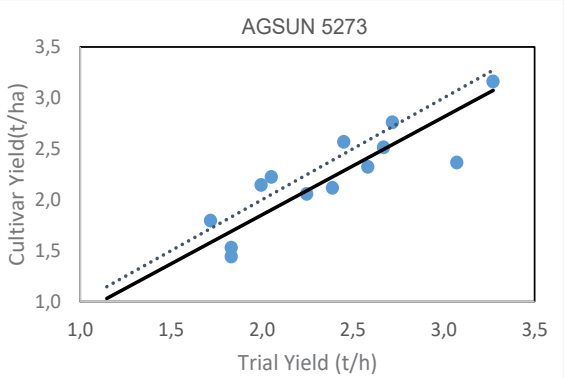


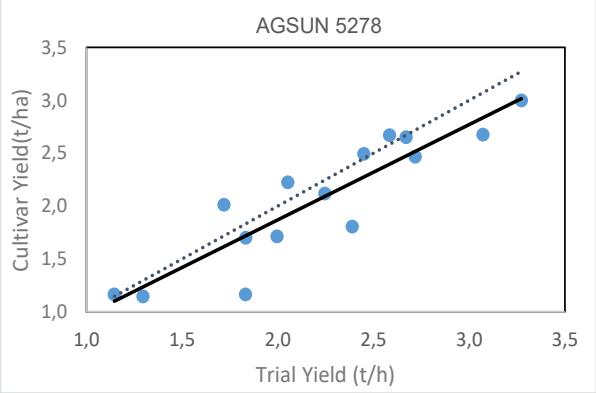


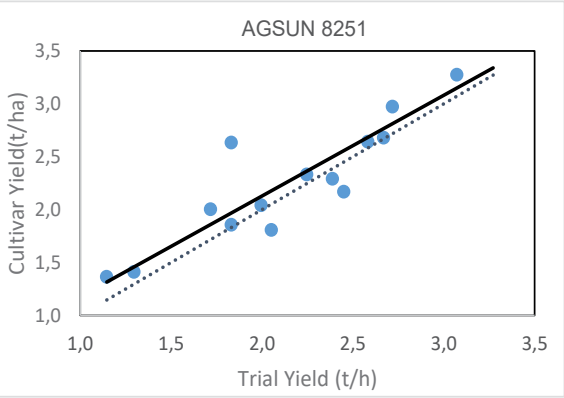


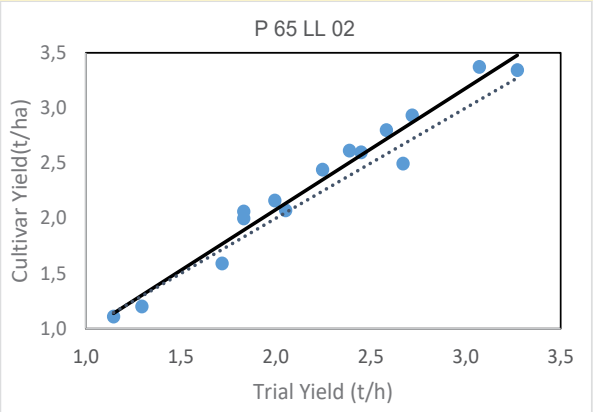


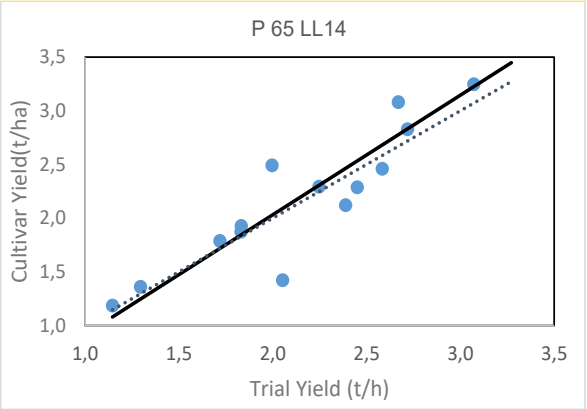


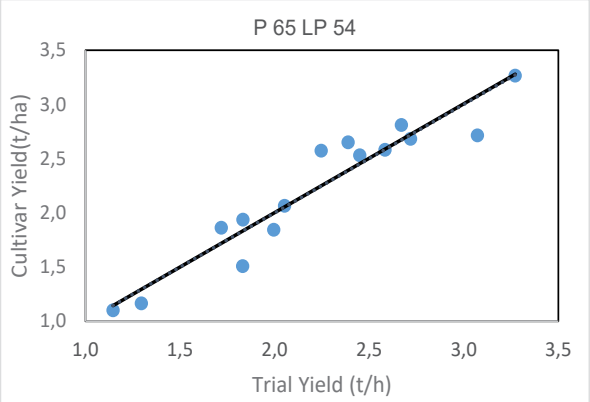


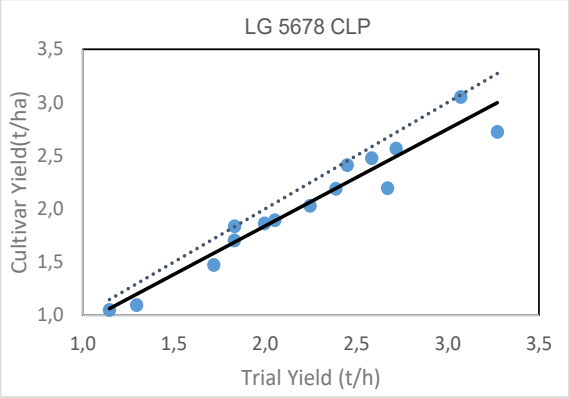


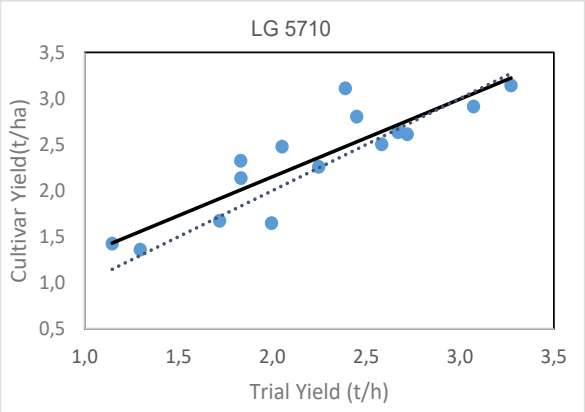


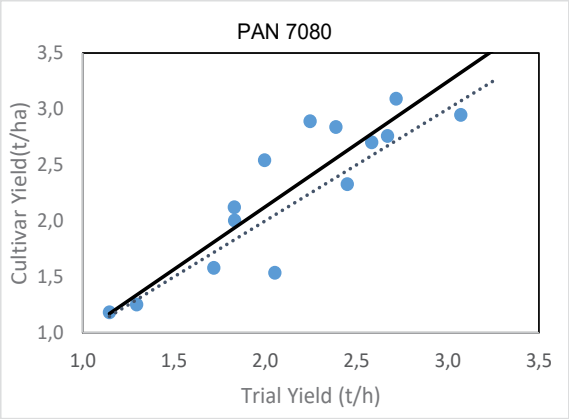

P 65 LL 02
Cultivar Yield(t/ha)
Trial Yield (t/h)

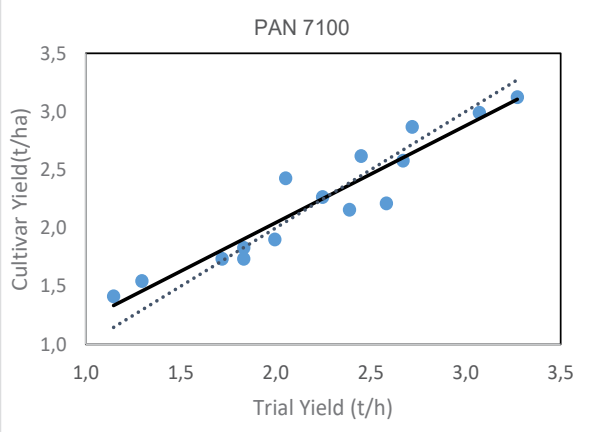

P 65 LL14
Cultivar Yield(t/ha)
Trial Yield (t/h)


P 65 LP 54
Cultivar Yield(t/ha)
Trial Yield (t/h)


LG 5678 CLP
Cultivar Yield(t/ha)
Trial Yield (t/h)


LG 5710
Cultivar Yield(t/ha)
Trial Yield (t/h)


PAN 7080
Cultivar Yield(t/ha)
Trial Yield (t/h)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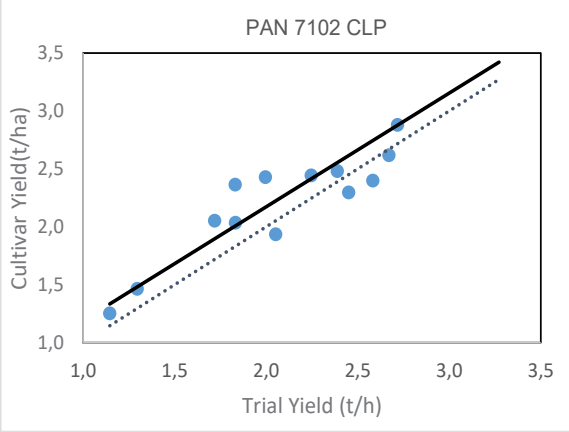
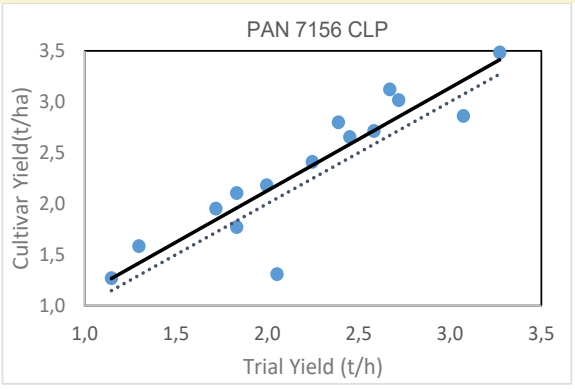
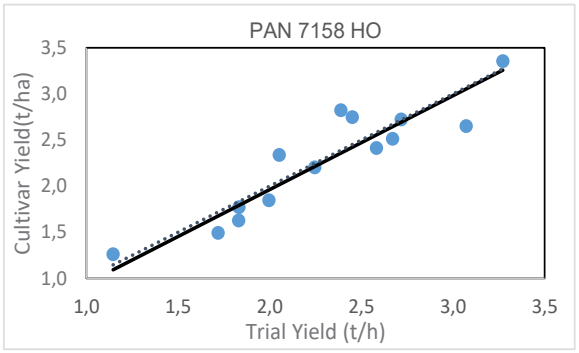
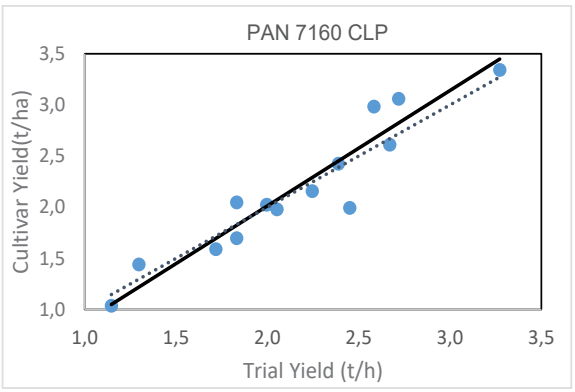
Cultivar Yield(t/ha)
Trial Yield (t/h)


PAN 7102 CLP
Cultivar Yield(t/ha)
Trial Yield (t/h)


PAN 7156 CLP
Cultivar Yield(t/ha)
Trial Yield (t/h)


PAN 7158 HO
Cultivar Yield(t/ha)
Trial Yield (t/h)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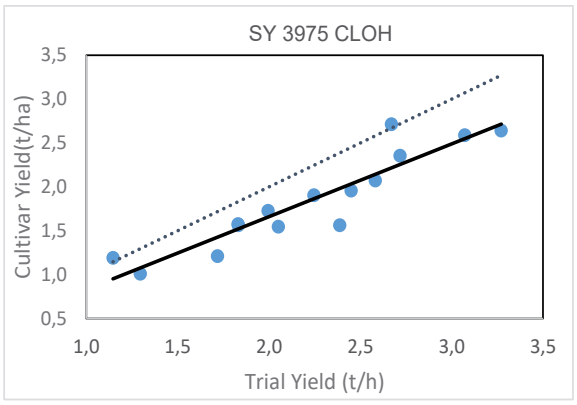
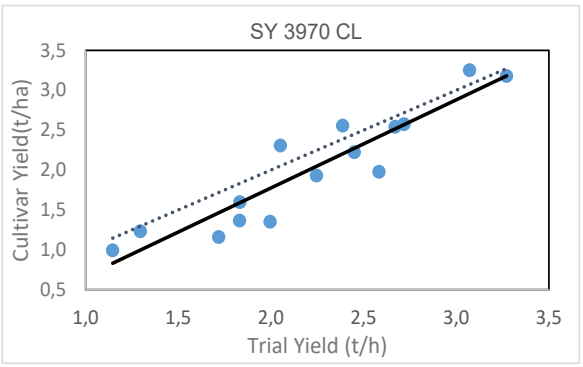
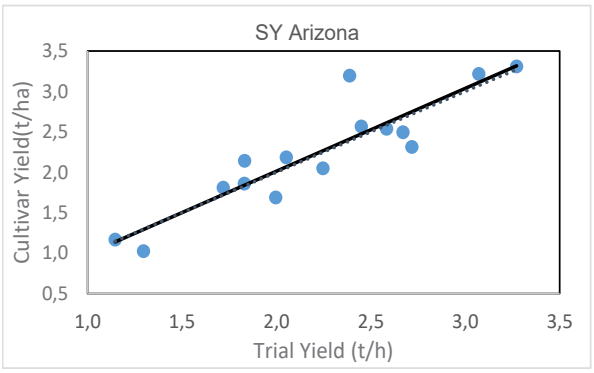
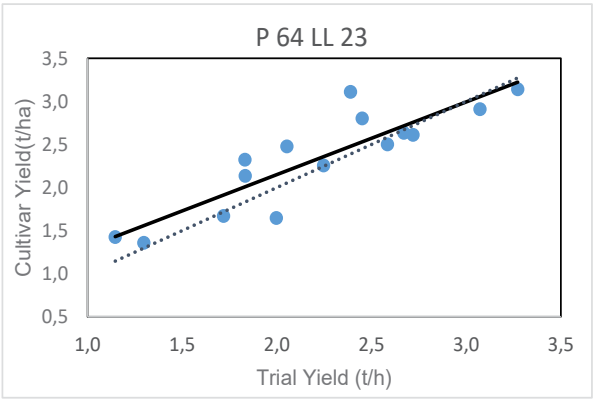
Cultivar Yield(t/ha)
Trial Yield (t/h)


SY 3975 CLOH
Cultivar Yield(t/ha)
Trial Yield (t/h)


SY 3970 CL
Cultivar Yield(t/ha)
Trial Yield (t/h)


SY Arizona
Cultivar Yield(t/ha)
Trial Yield (t/h)


P 64 LL 23
Cultivar Yield(t/ha)
Trial Yield (t/h)

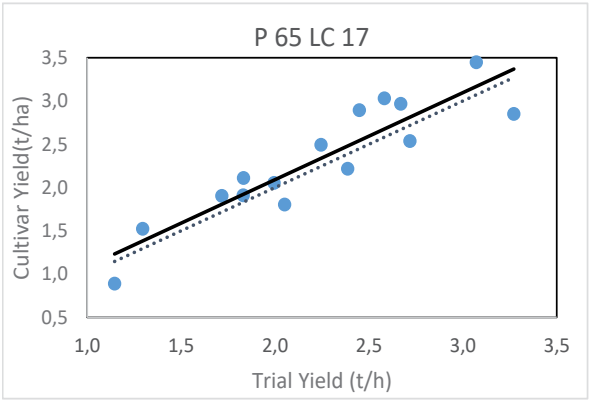
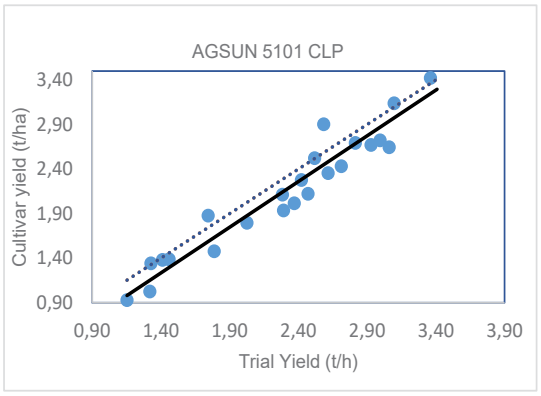
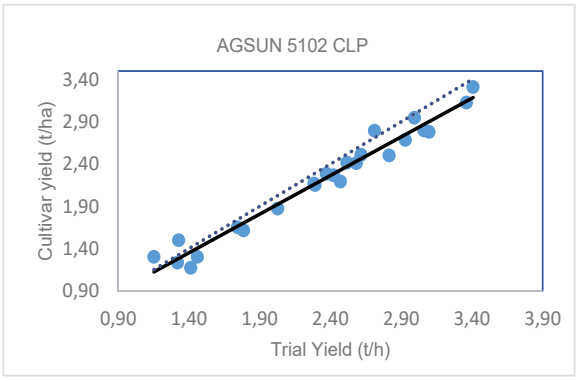
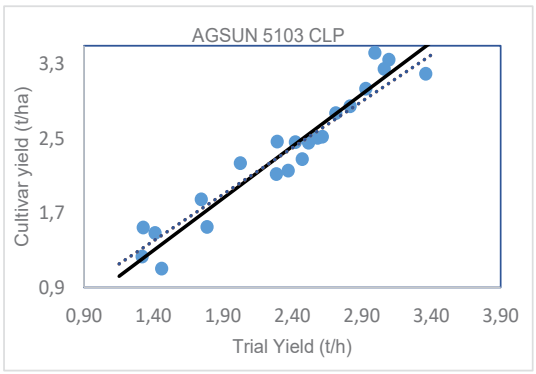
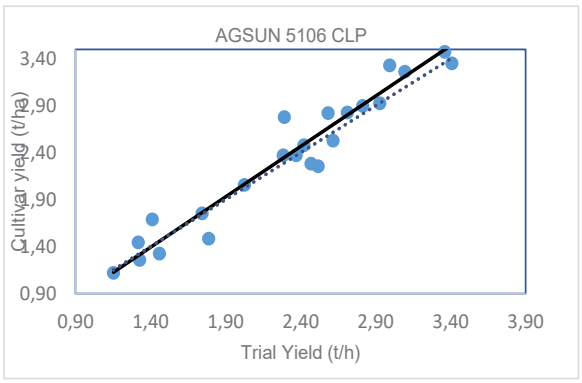

P 65 LC 17
Cultivar Yield(t/ha)
Trial Yield (t/h)

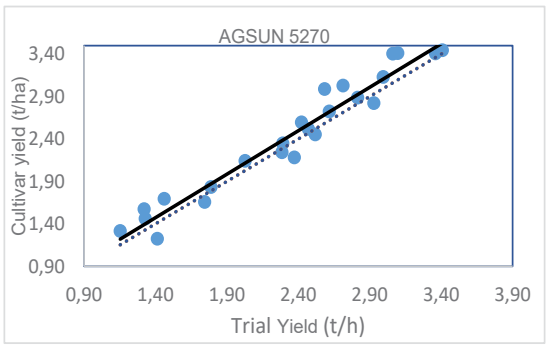
Figure 4: Regression lines for cultivars 2017/2018 and 2018/2019

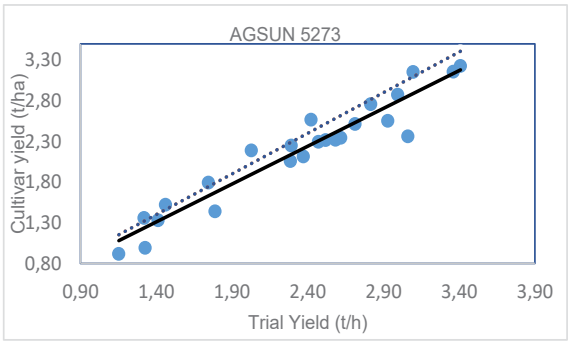


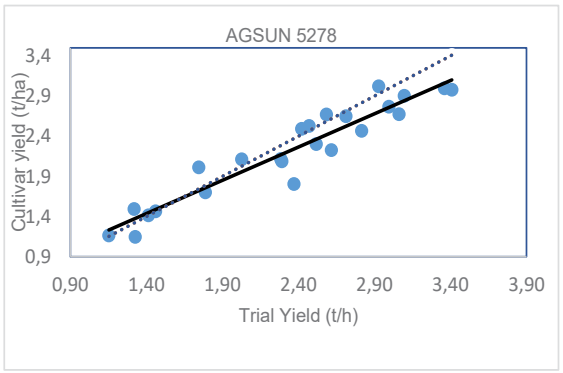


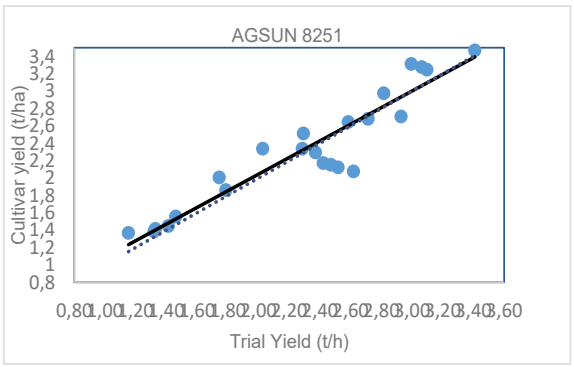


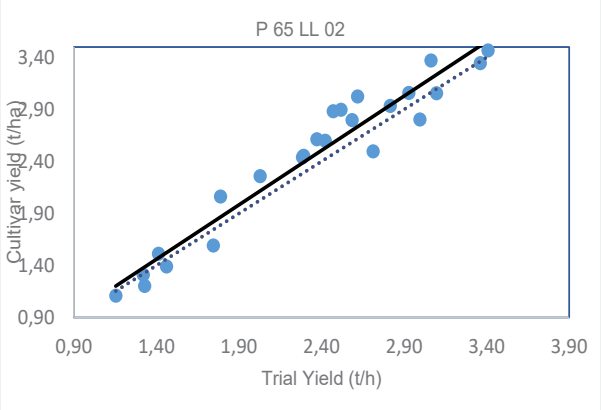


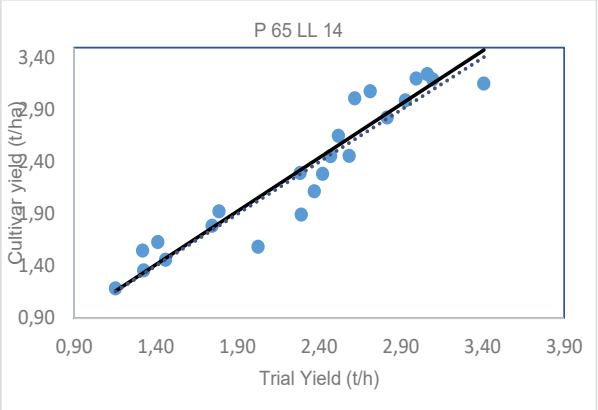


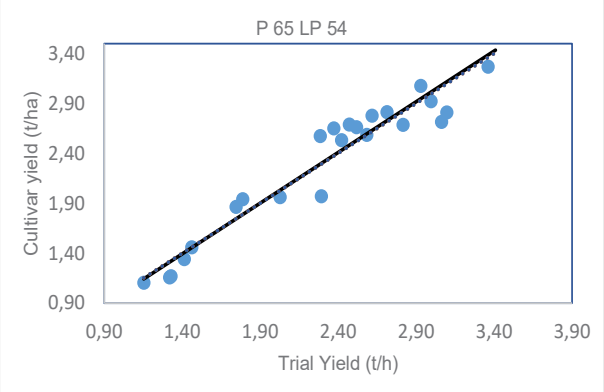


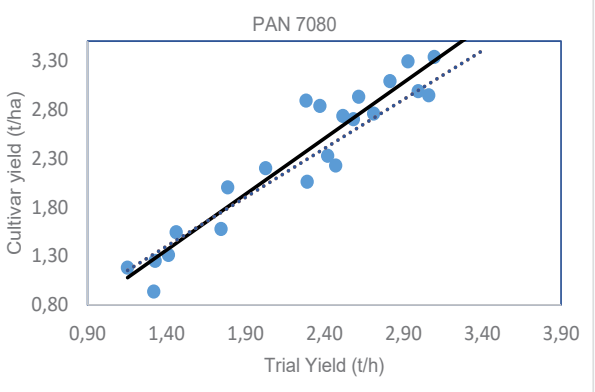


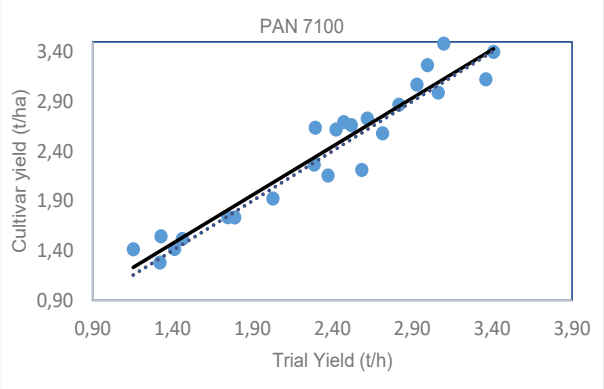


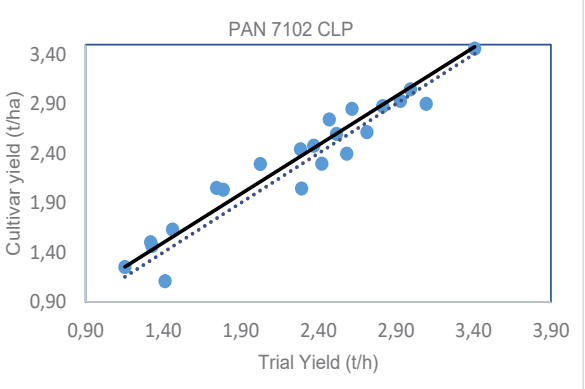

P 65 LL 02
Cultivar yield (t/ha)
Trial Yield (t/h)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90

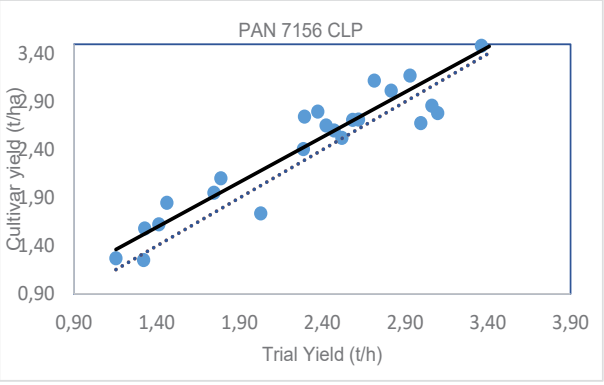

P 65 LL 14
Cultivar yield (t/ha)
Trial Yield (t/h)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90

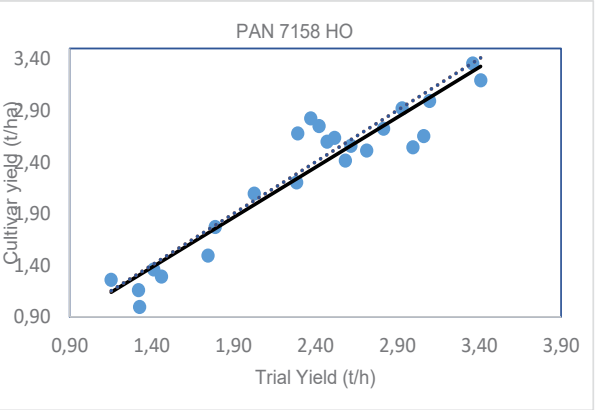

P 65 LP 54
Cultivar yield (t/ha)
Trial Yield (t/h)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90


PAN 7080
Cultivar yield (t/ha)
Trial Yield (t/h)
3,30
2,80
2,30
1,80
1,30
0,80
0,90
1,40
1,90
2,40
2,90
3,40
3,90

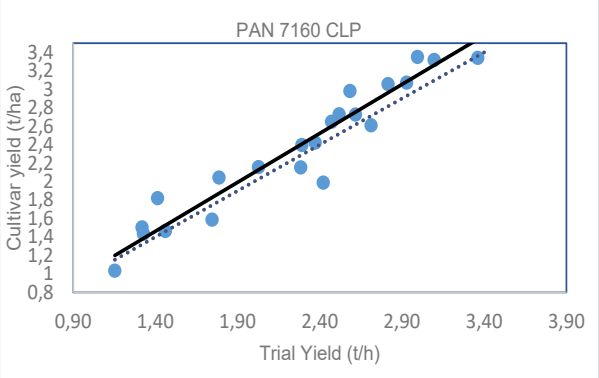

PAN 7100
Cultivar yield (t/ha)
Trial Yield (t/h)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90

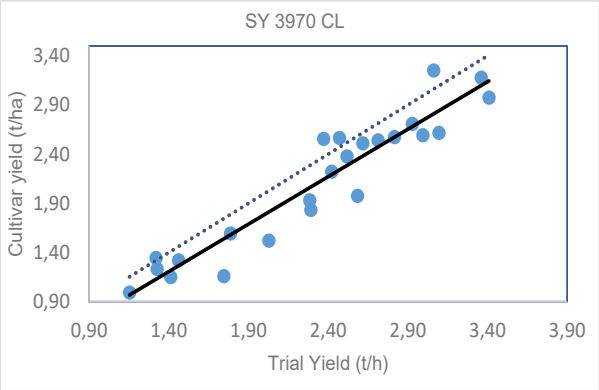

PAN 7102 CLP
Cultivar yield (t/ha)
Trial Yield (t/h)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90


PAN 7156 CLP
Cultivar yield (t/ha)
Trial Yield (t/h)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90


PAN 7158 HO
Cultivar yield (t/ha)
Trial Yield (t/h)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90

25


PAN 7160 CLP
Cultivar yield (t/ha)
3,4
3,2
3
2,8
2,6
2,4
2,2
2
1,8
1,6
1,4
1,2
1
0,8
0,90
1,40
1,90
2,40
2,90
3,40
3,90
Trial Yield (t/h)


SY 3970 CL
Cultivar yield (t/ha)
3,40
2,90
2,40
1,90
1,40
0,90
0,90
1,40
1,90
2,40
2,90
3,40
3,90
Trial Yield (t/h)

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DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES

NO. 45 **22 JANUARY 2016**

AGRICULTURAL PRODUCT STANDARDS ACT, 1990
(ACT No.119 OF 1990)

REGULATIONS RELATING TO THE GRADING, PACKING AND MARKING OF SUNFLOWER SEED INTENDED FOR SALE IN THE REPUBLIC OF SOUTH AFRICA

The Minister of Agriculture, Forestry and Fisheries under section 15 of the Agricultural Product Standards Act 119 of 1990, has

(a) made the regulations in the Schedule;

(b) determined that the said regulations shall come into operation on the date of publication thereof; and

(c) read together with section 3(1) of the said Act, repealed the Regulations published by Government Notice No. R 477 of 20 June 2014.

SCHEDULE

Definitions

1. In these regulations any word or expression to which a meaning has been assigned in the Act, shall have that meaning and, unless the context otherwise indicates--

"animal filth" means dead rodents, dead birds and dung;

"bag" means a bag manufactured from--

(a) jute or phormium or a mixture of jute and phormium; or

(b) polypropylene that compiles with SANS specification CKS632 1246: 2012;

"bulk container" means any vehicle or container in which bulk sunflower seed is transported or stored;

"consignment" means--

(a) a quantity of sunflower seed of the same class, which belongs to the same owner, delivered at any one time under the same consignment note, delivery note or receipt note, or delivered by the same vehicle or bulk container, or loaded from the same bulk storage structure or from a ship's hold; or

(b) in the case where a quantity referred to in paragraph (a), is subdivided into a grade, each such quality of such grade.

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"container" means a bag or a bulk container;

"damaged sunflower seed" means sunflower seed or portion thereof which is visibly discoloured as a result of external heat or heating due to internal fermentation;

"foreign matter" means--

(a) loose and empty shells above the sieve that occur in the consignment concerned; and

(b) all matter other than sunflower seed and the achene of sunflower seed above the standard sieve. Coal, dung, glass and metal shall not be present in the consignment at all.

"insect" means any live grain insect that is injurious to stored sunflower seed as well as other grain, irrespective of the stage of development of that insect;

"poisonous seeds" mean seeds or part of seeds of plant species that in terms of the Foodstuffs Cosmetics and Disinfectants Act 64 of 1972, may represent a hazard to human or animal health when consumed, including seeds of *Argemone mexicana L, Convolvulus spp., Crotalaria spp., Datura spp., Ipomoea spp., Lolium temulentum, Ricinus communis or Xanthium spp;*

"sclerotia" means hard masses of fungal tissue produced by fungus *Sclerotinia sclerotiorum*. The sclerotia vary in size and form and consist of a dark black exterior, a white interior and a rough surface texture;

"screenings" means all material that passes through a standard sieve;

"standard sieve" means a slotted sieve--

(a) with a flat bottom of metal sheet of 1,0 mm thickness with apertures 12.7 mm long and 1.8 mm wide with rounded ends (±0.03 mm). The spacing between the slots in the same row must be 2.43 mm wide and the spacing between the rows of slots must be 2.0 mm wide. The slots must be alternately oriented with a slot always opposite the solid inter segment of the next row of slots;

(b) of which the upper surface of the sieve is smooth;

(c) with a round frame of suitable material with an inner diameter of at least 300 mm and at least 50 mm high; and

(d) that fits onto a tray with a solid bottom and must be at least 20 mm above bottom of the tray.

"sunflower seed" means the seed of the plant species of *Helianthus annuus (L); and*

"the Act" means the Agricultural Product Standards Act 119 of 1990.

Restrictions on sale of sunflower seed

2. (1) No person shall sell sunflower seed in the Republic of South Africa--

(a) unless the sunflower seed are sold according to the classes set out in regulation 3;

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(b) unless the sunflower seed comply with the standards for the classes concerned set out in regulation 4;

(c) unless the sunflower seed, where applicable, comply with the grades of sunflower seed and the standards for grades set out in regulation 5 and 6 respectively;

(d) unless the sunflower seed are packed in accordance with the packing requirements set out in regulation 7;

(e) unless the container or sale documents, as the case may be, are marked in accordance with the marking requirements set out in regulation 8; and

(f) if such sunflower seed contains a substance that renders it unfit for human or animal consumption or for processing into or utilisation thereof as food or feed.

(2) The Executive Officer may grant written exemption, entirely or partially, to any person on such conditions as he or she may deem necessary, from the provisions of sub-regulation (1): Provided that such exemption is done in terms of section 3(1) (c) of the Act.

PART I

QUALITY STANDARDS

Classes of sunflower seed

3. Sunflower seed shall be classified as--

(a) Class FH;

(b) Class FS; and

(c) Class Other Sunflower Seed.

Standards for classes of sunflower seed

4. (1) A consignment of sunflower seed shall --

(a) be free from a musty, sour, khaki bush or other undesired odour;

(b) be free from any substance that renders it unsuitable for human or animal consumption or for processing into or utilisation as food or feed;

(c) not contain more poisonous seeds than permitted in terms of the Foodstuffs, Cosmetics and Disinfectants Act 54 of 1972;

(d) shall be free from stones, glass, metal, coal or dung;

(e) with the exception of Class Other Sunflower seed, be free from insects;

(f) with the exception of Class Other Sunflower seed, have a moisture content of not more than 10 percent; and

(g) be free from animal filth.

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(2) A consignment of sunflower seed shall be classified as --

(a) Class FH if it--

(i) consist of at least 80 percent (m/m) sunflower seed of a cultivar with a high oil content; and

(ii) complies with the standard for Grade 1 set out in regulation 6.

(b) Class FS if it--

(i) consist of at least 80 percent (m/m) sunflower seed of a cultivar with a low oil content; and

(ii) complies with the standards for Grade 1 set out in regulation 6.

(c) Class Other Sunflower Seed if it does not comply with the requirements for Class FH or Class FS.

Grades for sunflower seed

5. (1) There is only one grade for the Classes FH and FS Sunflower Seed, namely Grade 1.

(2) No grades are determined for Class Other Sunflower seed.

Standards for grades of sunflower seed

6. A consignment of Grade 1 sunflower seed shall be graded as Grade 1 if the nature of deviation, specified in column 1 of Table 1 of the Annexure, in that consignment does not exceed the percentage specified in column 2 of the said table opposite the deviation concerned.

PART II

PACKING AND MARKING REQUIREMENTS

Packing requirements

7. Sunflower seed of different classes and grades shall be packed in different containers or stored separately.

Marking requirements

8. Every container or the accompanying sale documents of a sunflower seed shall be marked or endorsed with the class and, where applicable, the grade of the sunflower seed.

PART III

SAMPLING

Obtaining a sample

9. (1) A representative sample of a consignment of sunflower seed shall--

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(a) in the case of sunflower seed delivered in bags and subject to regulation 10, be obtained by sampling at least 10 percent of the bags, chosen from that consignment at random, with a bag probe: Provided that at least 25 bags in a consignment shall be sampled and where a consignment consists of less than 25 bags, all the bags in that consignment shall be sampled; and

(b) in the case of sunflower seed delivered in bulk and subject to regulation 10, be obtained by sampling that consignment throughout the whole depth of the layer, in at least six different places, chosen at random in that bulk quantity, with a bulk sampling apparatus.

(2) The collective sample obtained in sub-regulation (1) (a) or (b) shall--

(a) have a total mass of at least 5 kg; and

(b) be thoroughly mixed by means of dividing before further examination.

(3) If it is suspected that the sample referred to in sub regulation (1)(a) is not representative of that consignment, an additional five percent of the remaining bags, chosen from that consignment at random, shall be emptied into a suitable bulk container and sampled in the manner contemplated in sub regulation(1)(b).

(4) If it is suspected that the sample referred to in sub-regulation (1) (b) is not representative of that consignment, an additional representative sample shall be obtained by using an alternative sampling pattern, apparatus or method.

(5) A sample taken in terms of these regulations shall be deemed to be representative of the consignment from which it was taken.

Sampling if contents differ

10. (1) If, after an examination of the sunflower seed taken from different bags in a consignment in terms of regulation 9(1), it appears that the contents of those bags differ substantially--

(a) the bags concerned shall be separated from each other;

(b) all the bags in the consignment concerned shall be sampled in order to do such separation; and

(c) each group of bags with similar contents in that consignment shall for the purpose of these regulations be deemed to be separate consignment.

(2) If, after the discharge of a consignment of sunflower seed in bulk has commenced, it is suspected that the consignment could be of a class or grade other than that determined by means of the initial sampling, the discharge shall immediately be stopped and that part of the consignment remaining in the bulk container, as well as the sunflower seed already in the collecting tray, shall be sampled anew with a bulk sampling apparatus or by catching at least 20 samples at regular intervals throughout the whole off loading period with a suitable container from the stream of sunflower seed that is flowing in bulk.

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Working sample

11. (1) A working sample of sunflower seed shall be obtained by dividing the representative sample of the consignment according to the latest revision of the ICC (International Association for Science and Technology) 101/1 method.

PART IV

INSPECTION METHODS

Determination of undesired odour, harmful substances, poisonous seeds, stones, glass, metal, coal, dung, insect and animal filth

12. A consignment or sample of a consignment shall be assessed sensorially or chemically analysed in order to determine whether it--

(a) has a musty, sour, khaki bush or other undesired odour;

(b) contains a substance that renders it unsuitable for human or animal consumption or processing into or utilization thereof as food or feed;

(c) contains poisonous seeds;

(d) contains stones, glass, metal, coal or dung;

(e) contains any insects; and

(f) contains animal filth.

Determination of moisture content

13. The moisture content of a consignment of sunflower seed may be determined according to any suitable method: Provided that the result thus obtained is in accordance with the maximum permissible deviation for a class 1 moisture meter as detailed in ISO 7700/2, based upon result of the 3 hour, 103°C oven dried method [the latest revision of the AACCI ("American Association of Cereal Chemists International") Method 44-15].

Determination of percentage screenings

14. The percentage screenings in a consignment of sunflower seed is determined as follows:

(a) Obtain a working sample of at least 50g from a representative sample of the consignment.

(b) Place the sample on a standard sieve; screen the sample by moving the sieve 50 strokes to and fro, alternately away from and towards the operator of the sieve, in the same direction as the long axes of the slots of the sieve. Move the sieve, which rests on a table or other suitable smooth surface, 250 mm to 460 mm away from and towards the operator with each stroke. The prescribed 50 strokes must be completed within 50 to 60 seconds: Provided that the screening process may also be performed in some or other container or an automatic sieving apparatus.

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(c) Determine the mass of the material that has passed through the sieve and express it that as a percentage of the mass of the working sample.

(d) Such percentage represents the percentage screenings in the consignment.

Determination of percentage foreign matter

15. The percentage foreign matter in a consignment of sunflower seed shall be determined as follows:

(a) Obtain a working sample of at least 20g of a screened sample.

(b) Remove all foreign matter by hand and determine the mass thereof.

(c) Express the mass thus determined as a percentage of the mass of the working sample.

(d) Such a percentage represents the percentage foreign matter in the consignment.

Determination of percentage sclerotia

16. The percentage sclerotia in a consignment of sunflower seed is determined as follows:

(a) Remove all sclerotia in the working sample in 15(a) obtained by hand and determine the mass thereof.

(b) Express the mass thus determined as a percentage of the working sample in regulation 15(a) obtained.

(c) Such a percentage represents the percentage sclerotia in the consignment.

Determination of percentage sunflower seed of another class

17. The percentage sunflower seed of another class in a consignment of sunflower seed shall be determined as follows:

(a) Obtain a working sample of at least 20g from a screened sample free of foreign matter and sclerotia.

(b) Remove all sunflower seeds of another class from the working sample by hand and determine the mass thereof.

(c) Express the mass thus determined as a percentage of the working sample.

(d) Such a percentage represents the percentage sunflower seed of another class in the consignment.

Determination of the percentage damaged sunflower seed

18. The percentage damaged sunflower seed in a consignment of sunflower seed, shall be determined as follows:

(a) Obtain a working sample of at least 20 g from a screened sample free of foreign matter and sclerotia.

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(b) Shell the seed in the working sample by hand or with a machine so that nucleus portions thereof are retained.

(c) Remove all damaged sunflower seed from the quantity thus shelled and determine the mass thereof.

(d) Express the mass thus determined as a percentage of the working sample.

(e) Such a percentage represents the percentage damaged sunflower seed in the consignment.

PART V

MASS DETERMINATION

19. The mass of sunflower seed shall be determined by deducting the actual percentage sclerotia, screenings and foreign matter found during the inspection process from the total mass of the consignment: Provided that the weighing instruments used for the determination of mass shall comply with the requirements of SANS 1649:2001 published in terms of the Trade Metrology Act 77 of 1973 for the specific class of instrument.

PART VI

OFFENCE AND PENALTIES

20. Any person who contravenes or fails to comply with any provision of these regulations shall be guilty of an offence and upon conviction be liable to a fine or imprisonment in terms of section 11 of the Act.

ANNEXURE

TABLE 1

STANDARDS FOR GRADES OF SUNFLOWER SEED

DEVIATIONS		**Maximum permissible deviations**	
		Class FH	**Class FS**
		Grade1	
1.	Damaged sunflower seed	10%	
2.	Screenings	4%	
3.	Sclerotia	4%	
4.	Foreign Matter	4%	
5.	Deviation in 2,3 and 4 collectively: Provided that such deviations are individually within the limits of said items.	6%