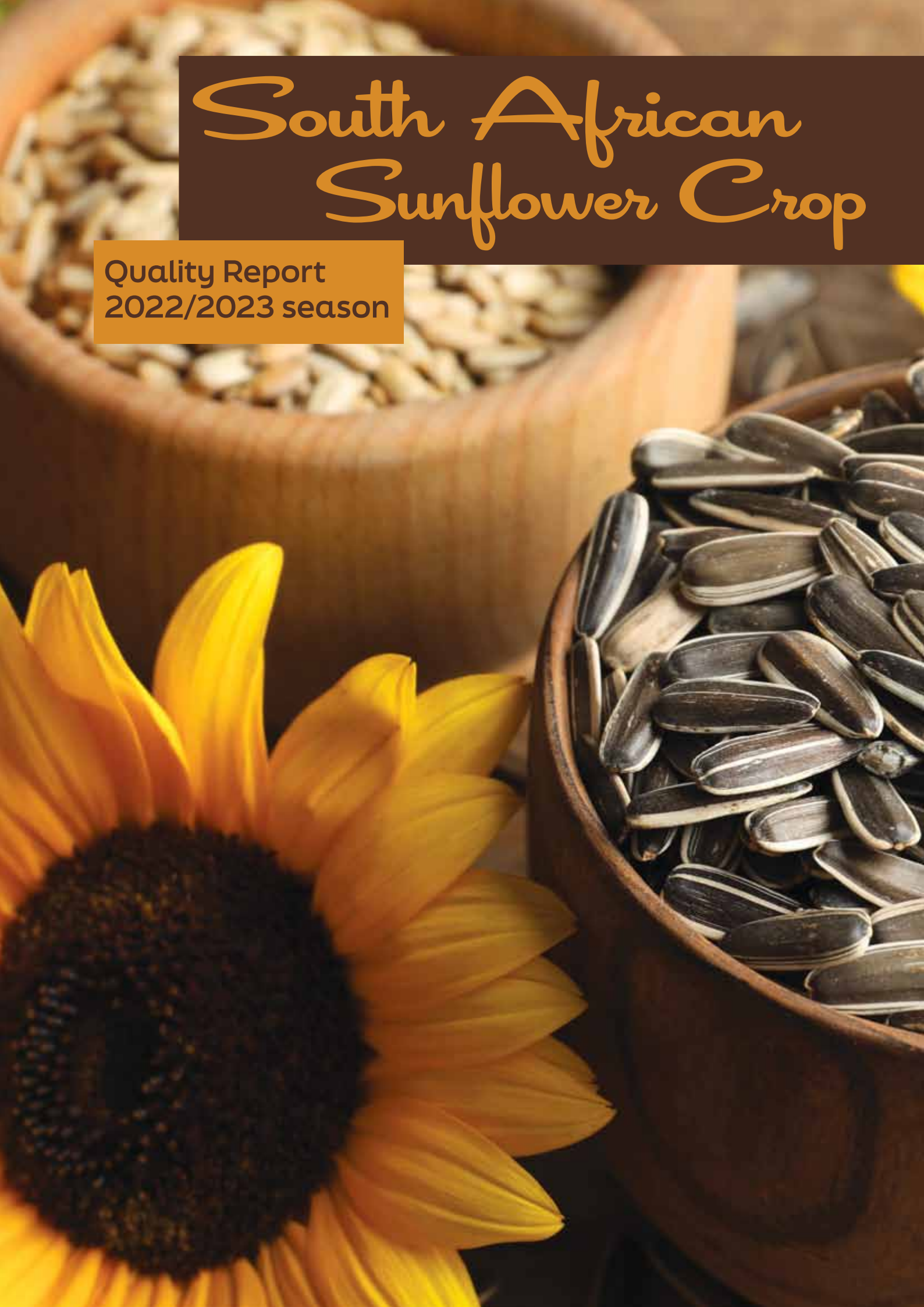
South African Sunflower Crop

Quality Report 2022/2023 season



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South African

Commercial sunflower quality for the 2022/23 Season

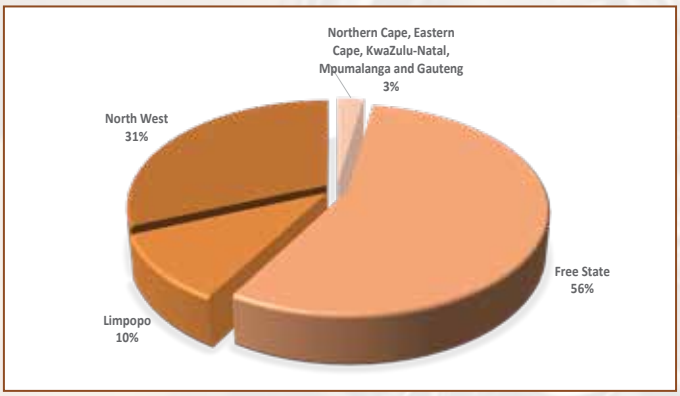
Acknowledgements
With gratitude to:

- ***Oilseeds Advisory Committee (OAC) as well as the Oil & Protein Seed Development Trust (OPDT) for its financial support in conducting this survey.***
- ***Agbiz Grain and its members for their cooperation in providing the samples for this survey.***
- ***The Crop Estimates Committee (CEC) of the Department of Agriculture, Land Reform and Rural Development (DALRRD) for providing production related figures.***
- ***South African Grain Information Service (SAGIS) for providing sunflower related supply and demand figures.***
- ***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 calculated commercial sunflower crop figure of the 2022/23 season as overseen by the National Crop Estimates Liaison Committee (CELC) is 720 000 tons, which is 0.57% less than the final crop estimate figure of 724 110 tons. The crop decreased by almost 15% (125 550 tons) year on year. The major sunflower-producing provinces, namely the Free State and North West, contributed 87% of the total crop.

Graph 1: Provincial contribution to the production of the 2022/23 sunflower crop



Figures provided by the CEC.

During the harvesting season, a representative sample of each delivery of sunflower seed was taken according to the prescribed grading regulations at the various grain intake points. The sampling procedure for the samples used in this survey is described on page 35. One hundred and seventy-four (174) 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, as well as 20 cultivar samples were submitted to Precision Oil Laboratories for fatty acid profile analyses.

This is the eleventh 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 various 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.

Results of previous surveys to date are available on the SAGL website (www.sagl.co.za). Reports in an easy to page format, are available to read or download. Hard copy reports are distributed to Directly Affected Groups and interested parties.

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 for the 2022/23 season, conducted by the ARC-Grain Crops Institute in collaboration with Agricol, Pannar, Pioneer, Syngenta and Limagrain Zaad South Africa, is included in totality and as received. 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 2022/23 season stands at 55.2 million metric tons with the Ukraine and Russia contributing 53% to this total. An area of 29.8 million hectares were harvested resulting in a yield of 1.85 metric tons/hectare. The forecasted figure for the 2023/24 season is 56.5 million metric tons harvested on 29.6 million hectares and with a yield of 1.91 metric tons/hectare.

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	2018/19	2019/20	2020/21	2021/22	2022/23 (Revised)	2023/24 (Forecast)
Area Harvested (1 000 Ha)	***27 185***	***27 413***	***28 045***	***29 877***	***29 801***	***29 552***
Yield (MT/Ha)	***1.91***	***2.03***	***1.81***	***1.95***	***1.85***	***1.91***
Production (1 000 MT)						
Argentina	3 530	3 020	3 200	3 360	4 130	3 600
European Union	9 482	9 469	8 969	10 389	9 520	9 863
China	2 550	2 680	2 750	2 880	2 930	3 000
Russia	12 756	15 379	13 420	15 660	16 600	16 800
Ukraine	15 250	16 500	13 900	16 900	12 400	14 400
United States	956	887	1 353	864	1 276	1 027
South Africa	678	810	678	846	724	830
Turkey	1 530	1 700	1 580	1 750	1 820	1 320
Other	5 292	5 202	4 995	5 652	5 834	5 674
TOTAL	***52 024***	***55 647***	***50 845***	***58 301***	***55 234***	***56 514***
Import (1 000 MT)						
Turkey	1 051	1 058	844	673	981	580
European Union	550	1 057	817	1 807	1 466	896
Other	1 445	1 451	1 308	1 639	1 513	1 571
TOTAL	***3 046***	***3 566***	***2 969***	***4 119***	***3 960***	***3 047***
Export (1 000 MT)						
Argentina	149	214	178	158	91	140
United States	87	64	72	69	64	72
Russia	338	1 278	528	280	285	352
Ukraine	119	76	186	1 793	1 685	640
Other	2 392	1 980	1 907	1 875	1 750	1 806
TOTAL	***3 085***	***3 612***	***2 871***	***4 175***	***3 875***	***3 010***
Oilseed crushed	***47 231***	***50 300***	***45 568***	***48 315***	***52 192***	***52 586***

National Sunflower Association website www.sunflowernsa.com,
Table updated January 16, 2024; Source: Oil World & USDA.

Sunflower seed production is very suitable for South African climatic conditions. Sunflower plants are drought tolerant and thus a crucial risk diversification crop going forward. The deep root system of a sunflower plant 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 utilised for sunflower production decreased by 17% to 555 700 ha, compared to the 670 700 ha of the previous season. The national yield average increased by just more than 3% from to 1.26 t/ha in the previous season to 1.30 t/ha this season.

According to *The Bureau for Food and Agricultural Policy (BFAP) Baseline, Agricultural Outlook 2023 – 2032*, an area of 500 000 hectares is expected to be planted to sunflower by 2032. The rising prevalence of *Sclerotinia sclerotiorum* is expected to remain a challenge, adding costs for producers and resulting in some area shifting to soybeans in affected regions. Despite the normalisation in area, production growth is supported by a projected 21% gain in yields over the coming decade, reflecting technological gains and continuous improvement in production practices. This will be sufficient to meet the growth in domestic demand.

The latest seed technology is providing promising results in high-oil content cultivars, without significant compromise in yields per hectare. High oil content cultivars will support the relative competitiveness of local sunflower crushing plants.

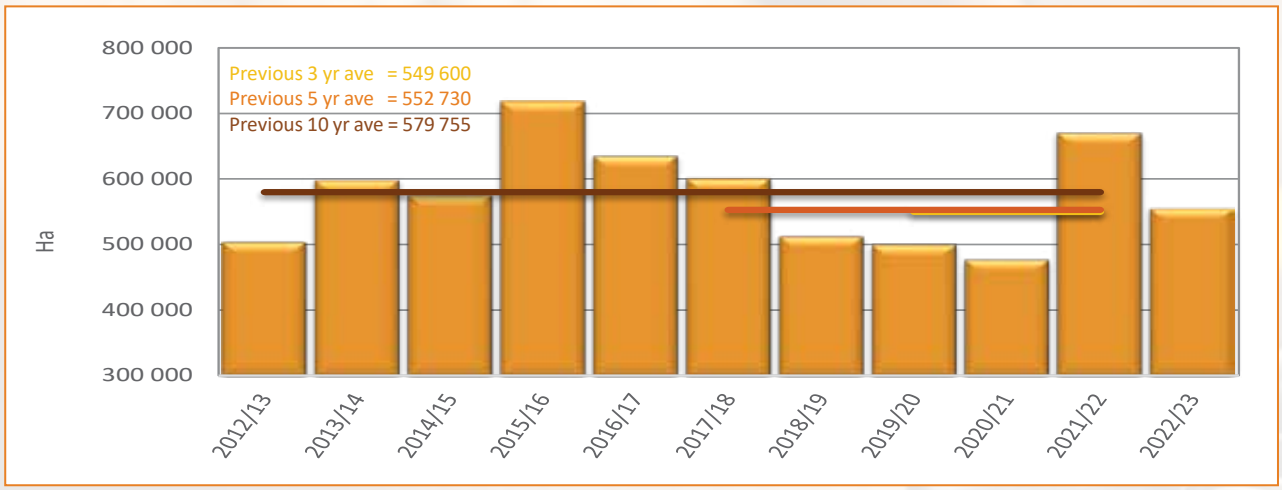
Please see Table 2 for an overview of sunflower production under dry land conditions versus irrigation in the 2022/23 season, compared to the 2021/22 season. Graphs 2 to 4 provide national figures with regards to hectares planted, tonage produced and yields obtained over the last 11 seasons and Graphs 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

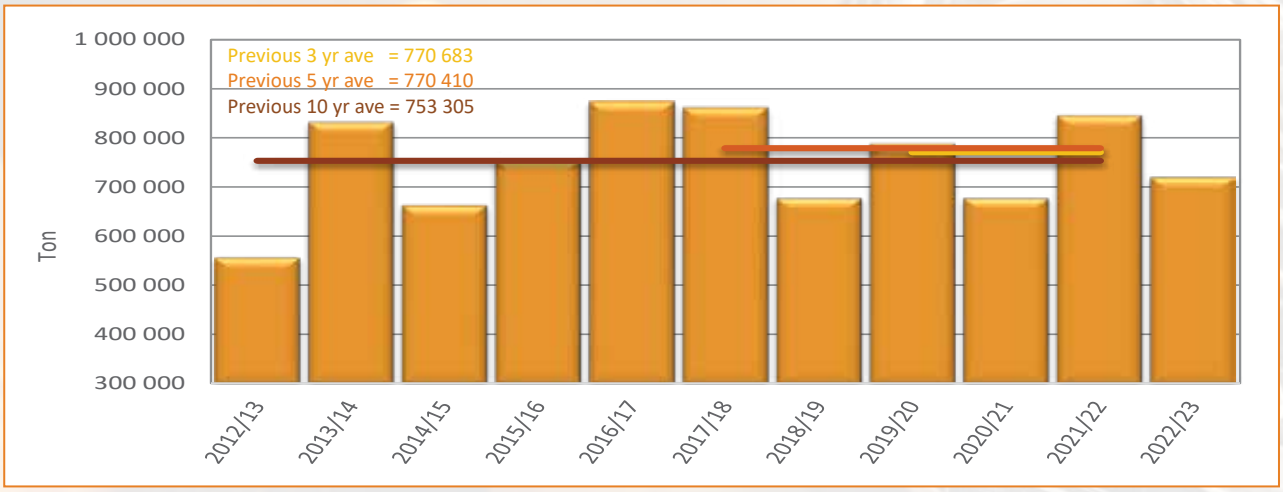
Province	Type of production	2022/23			2021/22		
		Hectares planted, ha	Production, tons	Yield, t/ha	Hectares planted, ha	Production, tons	Yield, t/ha
Western Cape	Dryland	-	-	-	-	-	-
	Irrigation	-	-	-	-	-	-
	Total	-	-	-	-	-	-
Northern Cape	Dryland	-	-	-	-	-	-
	Irrigation	2 500	6 250	2.50	2 500	6 250	2.50
	Total	2 500	6 250	2.50	2 500	6 250	2.50
Free State	Dryland	283 000	385 000	1.36	350 000	483 000	1.38
	Irrigation	7 000	17 000	2.43	7 000	16 800	2.40
	Total	290 000	402 000	1.39	357 000	499 800	1.40
Eastern Cape	Dryland	700	1 400	2.00	30	48	1.60
	Irrigation	-	-	-	270	702	2.60
	Total	700	1 400	2.00	300	750	2.50
KwaZulu-Natal	Dryland	300	600	2.00	-	-	-
	Irrigation	-	-	-	-	-	-
	Total	300	600	2.00	-	-	-
Mpumalanga	Dryland	5 000	7 140	1.43	3 500	5 250	1.50
	Irrigation	-	-	-	-	-	-
	Total	5 000	7 140	1.43	3 500	5 250	1.50
Limpopo	Dryland	99 000	72 600	0.73	107 000	72 200	0.67
	Irrigation	1 000	2 400	2.40	3 000	4 800	1.60
	Total	100 000	75 000	0.75	110 000	77 000	0.70
Gauteng	Dryland	2 200	2 860	1.30	2 400	3 000	1.25
	Irrigation	-	-	-	-	-	-
	Total	2 200	2 860	1.30	2 400	3 000	1.25
North West	Dryland	152 900	221 250	1.45	193 200	250 500	1.30
	Irrigation	2 100	3 500	1.67	1 800	3 000	1.67
	Total	155 000	224 750	1.45	195 000	253 500	1.30
RSA	Dryland	543 100	690 850	1.27	656 130	813 998	1.24
	Irrigation	12 600	29 150	2.31	14 570	31 552	2.17
	Total	555 700	720 000	1.30	670 700	845 550	1.26

Figures provided by the CEC.

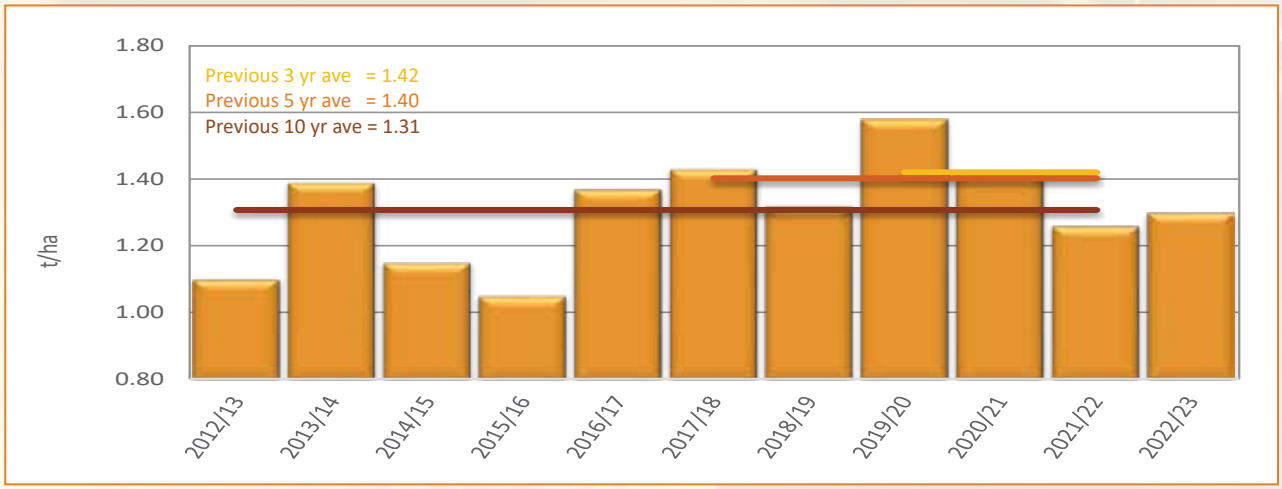
Graph 2: Total RSA area utilised for sunflower production from 2012/13 to 2022/23



Graph 3: Sunflower production in RSA from 2012/13 to 2022/23

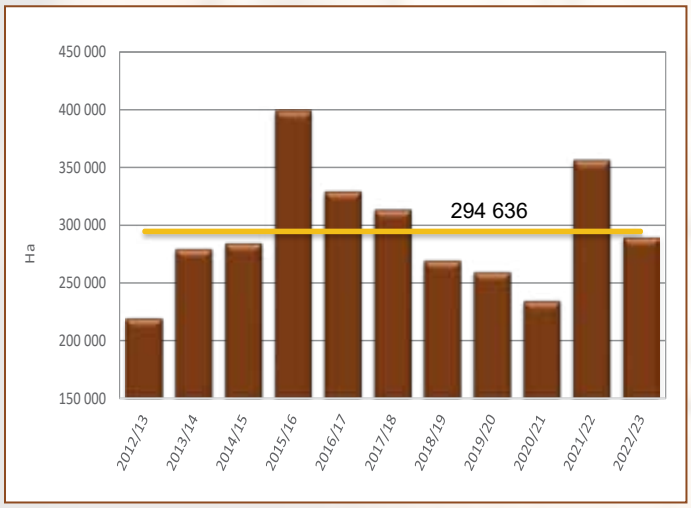


Graph 4: RSA Sunflower yield from 2012/13 to 2022/23

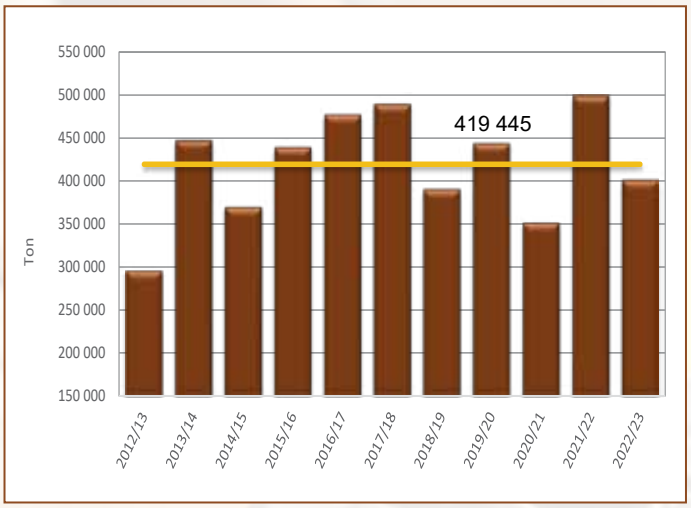


Figures provided by the CEC.

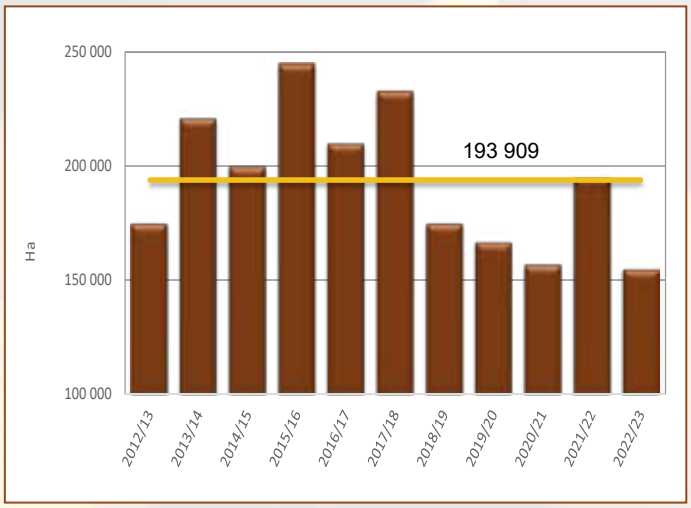
Graph 5: Area utilised for sunflower production in the Free State since 2012/13



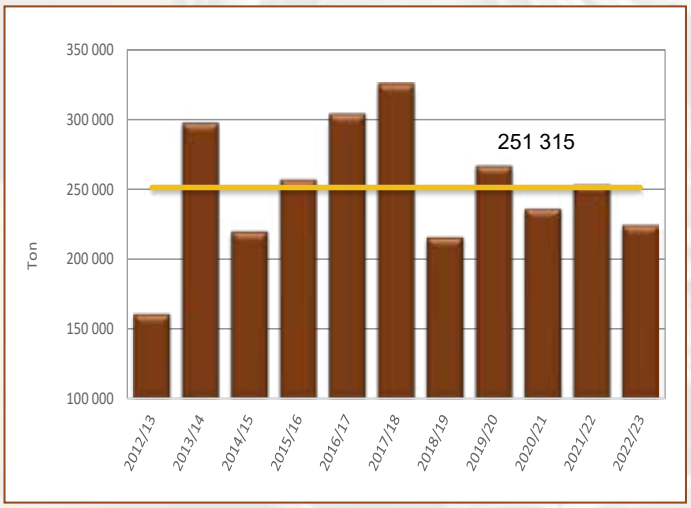
Graph 6: Sunflower production in the Free State since 2012/13



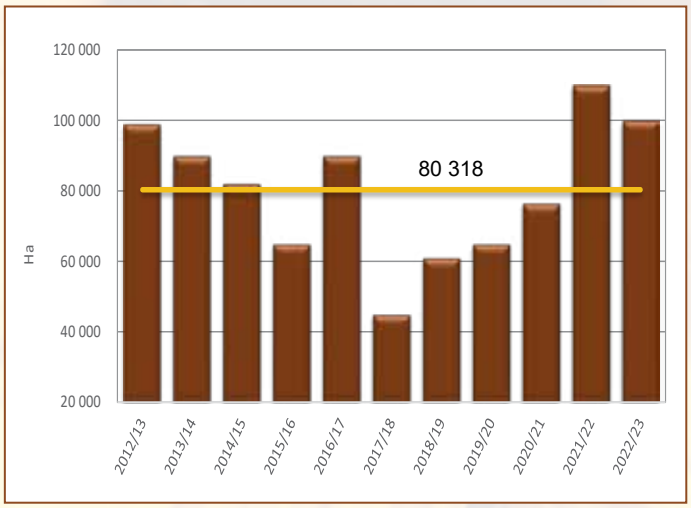
Graph 7: Area utilised for sunflower production in North West since 2012/13



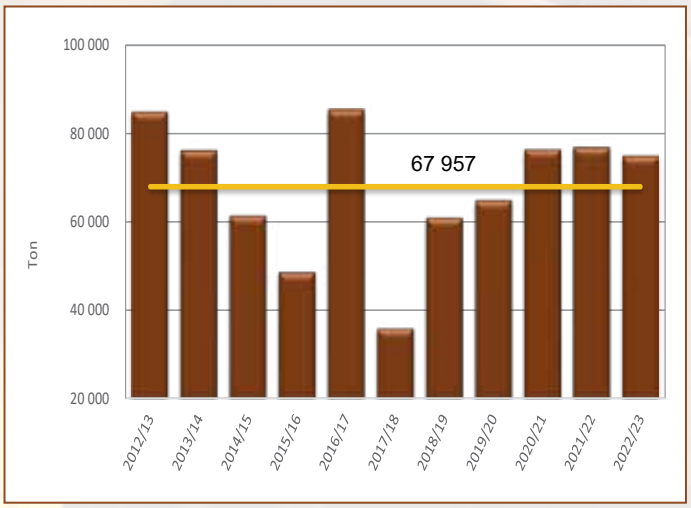
Graph 8: Sunflower production in North West since 2012/13



Graph 9: Area utilised for sunflower production in Limpopo since 2012/13



Graph 10: Sunflower production in Limpopo since 2012/13



Figures provided by the CEC.

Eleven season average

Supply and Demand

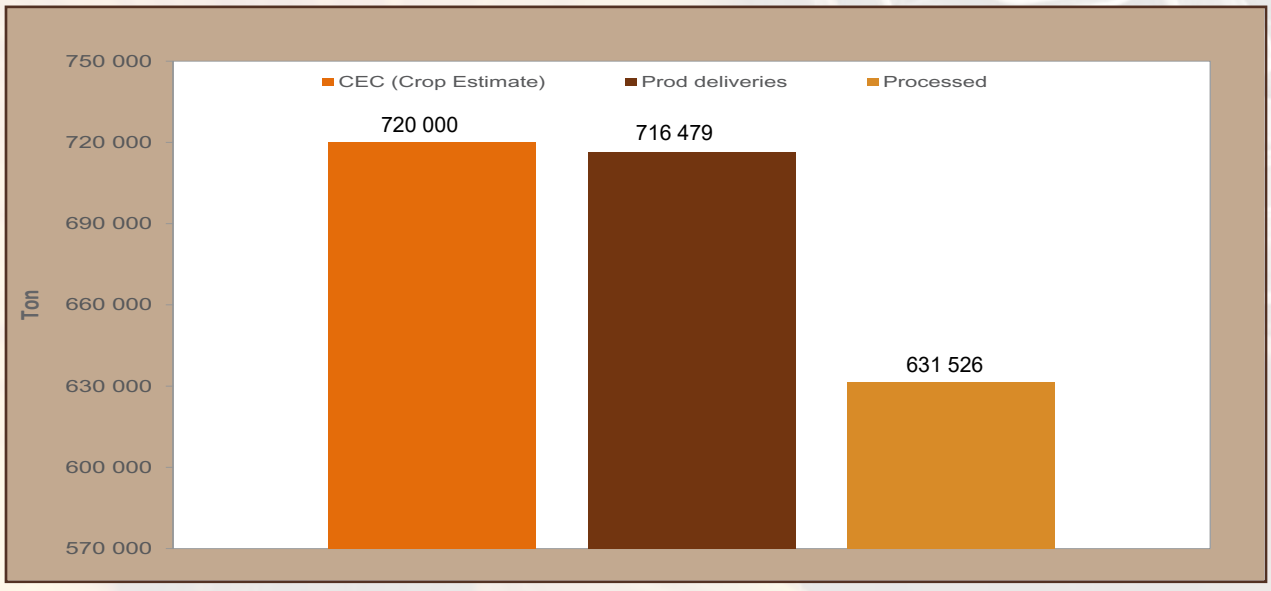
The sunflower seed marketing season dates from March to February. According to SAGIS supply and demand figures for the 2023/24 marketing season to date (March 2023 to January 2024), opening stock more than doubled compared to the previous marketing season. It is however still 21% (19 821 tons) lower than the 10-year average.

To date, 11 835 tons of sunflower and sunflower seed products have been imported compared to the 6 805 and 1 256 tons of the previous two seasons respectively. The 10-year import average is 27 523 tons. Of the 631 526 tons of sunflower seeds processed so far, only 1 870 tons (0.3%) was used for human consumption and 4 999 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 23% less than in the previous season and also 19% lower than the 10-year average of 774 741 tons.

Sunflower and canola are crushed predominantly for the vegetable oil market. Due to the combination of limited consumer spending and sharp price increases, vegetable oil consumption has slowed in recent years. By 2032, total vegetable oil consumption is expected to rise by 22% from 2022 levels, according to *BFAP Baseline*. The biggest share of total use is however attributed to imported palm oil, with imports expected to rise to more than 580 000 tons by 2032. While South Africa's production of soybean, sunflower and canola oil is expected to rise, processing growth is substantially slower than in the past decade and imported oils will therefor still constitute around two thirds of additional vegetable oil consumption in South Africa by 2032 relative to 2022.

Exports to date amount to only 43 tons, compared to the 170 and 217 tons of the two previous seasons respectively. Globally, Ukraine, followed by Russia, Argentina and the United States were the largest exporters of sunflower seeds during 2022/23. Ukraine (5.4 million metric tons) and Russia (4.2 million metric tons) accounted for 70% of total sunflower oil exports worldwide in the corresponding period *(National Sunflower Association website www.sunflowernsa.com, Table updated January 16, 2024; Source: Oil World & USDA).*

Graph 11: Sunflower supply and demand overview for the current marketing season (Mar 2023 - Feb 2024)



Information provided by SAGIS.

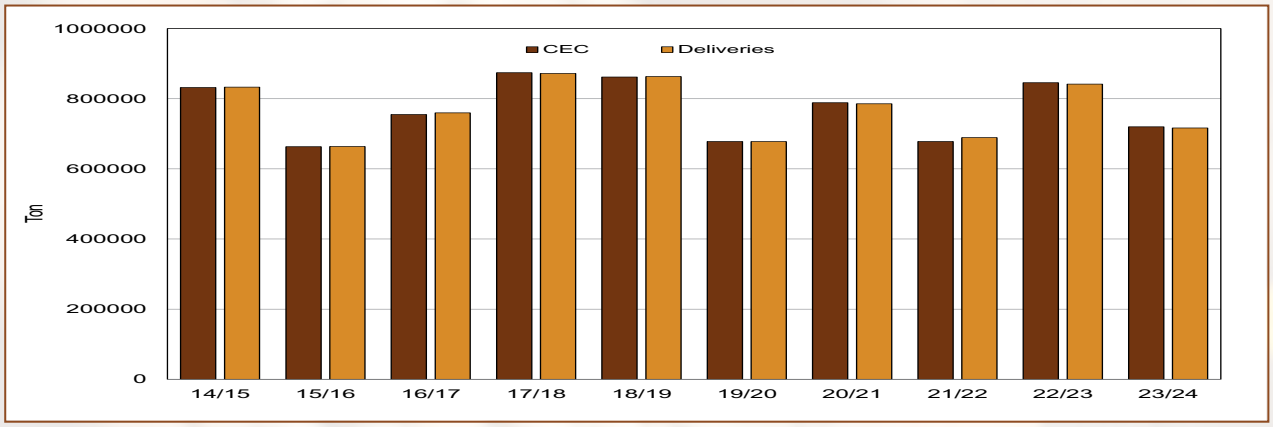
SAGIS South African Grain Information Service
Suid-Afrikaanse Graan Inligtingsdiens

SUNFLOWERSEED: SUPPLY AND DEMAND TABLE BASED ON SAGIS' INFO (TON) — **Publication date: 2024-02-27**

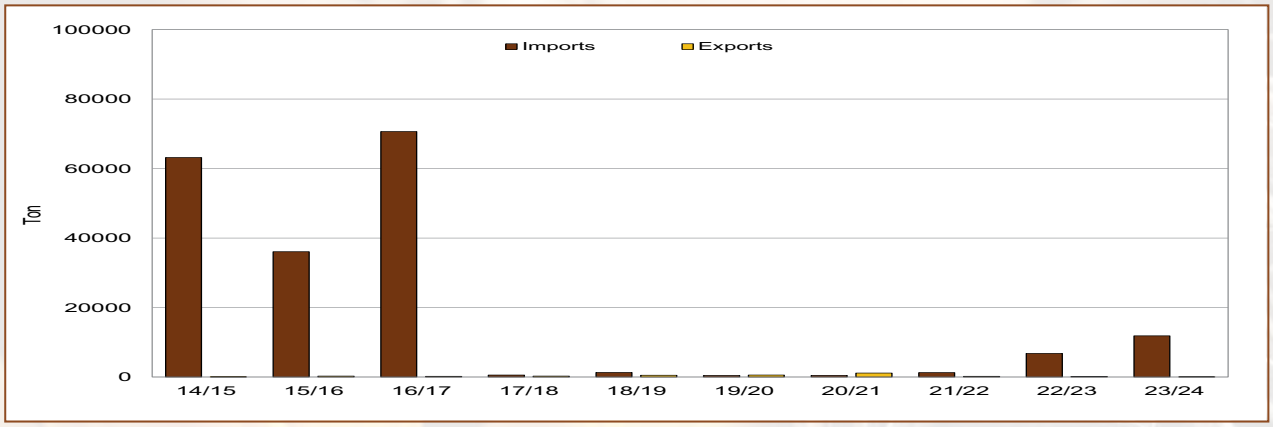
	Season (Mar - Feb)																Current Season Mar-Jan	10 Year average
	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	2013/14-2022/23
																	***	
																	11	
CEC (Crop Estimate)	300 000	872 000	801 000	490 000	860 000	522 000	557 000	832 000	663 000	755 000	874 000	862 000	678 000	788 500	678 000	845 550	720 000	753 305
SUPPLY																		
Opening stock (1 Mar)	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	135 325	60 964	31 790	73 517	93 338
Prod deliveries	310 100	846 600	806 900	477 300	866 300	534 251	542 165	833 165	663 669	759 614	872 171	863 184	677 674	785 567	689 083	841 784	716 479	752 808
Imports	8 900	25 600	45 300	62 400	10 800	11 737	94 475	63 180	36 064	70 643	554	1 324	457	471	1 256	6 805	11 835	27 523
Surplus	1 500	4 100	700	2 000	3 800	5 485	4 689	5 948	9 897	4 268	12 173	6 863	6 520	7 200	9 306	11 241	2 856	7 811
Total Supply	**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**	**804 816**	**928 563**	**760 609**	**891 620**	**804 687**	**881 479**
DEMAND																		
Processed	339 500	685 300	847 200	671 500	782 200	572 519	666 551	847 682	747 808	707 327	885 039	900 045	664 027	861 295	724 949	815 258	631 526	781 998
-human	2 100	2 400	1 900	1 600	1 300	904	1 162	467	1 003	1 192	1 487	1 609	1 478	1 652	1 556	1 656	1 870	1 326
-animal feed	3 500	3 400	3 300	3 100	2 900	3 022	2 777	2 893	8 995	10 665	5 737	5 114	5 511	5 432	6 129	6 058	4 999	5 931
-crush (oil and oilcake)	333 900	679 500	842 000	666 800	778 000	568 593	662 612	844 322	737 810	695 470	877 815	893 322	657 038	854 211	717 264	807 544	624 657	774 741
Withdrawn by producers	1 900	4 900	5 700	1 700	3 500	2 521	2 524	1 068	1 157	605	442	519	783	464	359	392	103	831
Released to end-consumers	3 000	2 800	4 800	4 100	3 700	3 154	2 923	2 799	2 936	2 867	2 592	1 764	1 023	1 144	666	106	157	1 882
Seed for planting purposes	1 800	3 300	2 700	1 700	2 500	2 700	2 903	3 804	2 824	3 474	3 026	3 582	2 447	2 493	2 495	1 775	3 286	2 882
Net receipts(-)/disp(+)	0	1 000	- 400	1 000	- 1 200	- 1 716	606	1 081	1 709	2 828	1 770	- 378	635	1 063	133	402	274	985
Deficit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	0	79 400	0	100	0	27	8	48	256	205	274	515	576	1 140	217	170	43	341
Total Demand	**346 200**	**776 700**	**860 000**	**680 100**	**790 700**	**579 205**	**675 515**	**856 482**	**756 690**	**717 306**	**893 143**	**906 047**	**669 491**	**867 599**	**728 819**	**818 103**	**635 389**	**788 920**
Ending Stock (28 Feb)	**64 700**	**164 300**	**157 200**	**18 800**	**109 000**	**81 268**	**47 116**	**92 927**	**45 867**	**163 086**	**154 841**	**120 165**	**135 325**	**60 964**	**31 790**	**73 517**	**169 298**	**92 560**
- processed p/month	28 300	57 100	70 600	65 000	65 200	47 700	55 546	70 640	62 317	58 944	73 753	75 004	55 336	71 775	60 412	67 938	57 411	65 167
- months' stock	2.3	2.9	2.2	0.3	1.7	1.7	0.8	1.3	0.7	2.8	2.1	1.6	2.4	0.8	0.5	1.1	2.9	1

Note: *** Figures for current season up to date

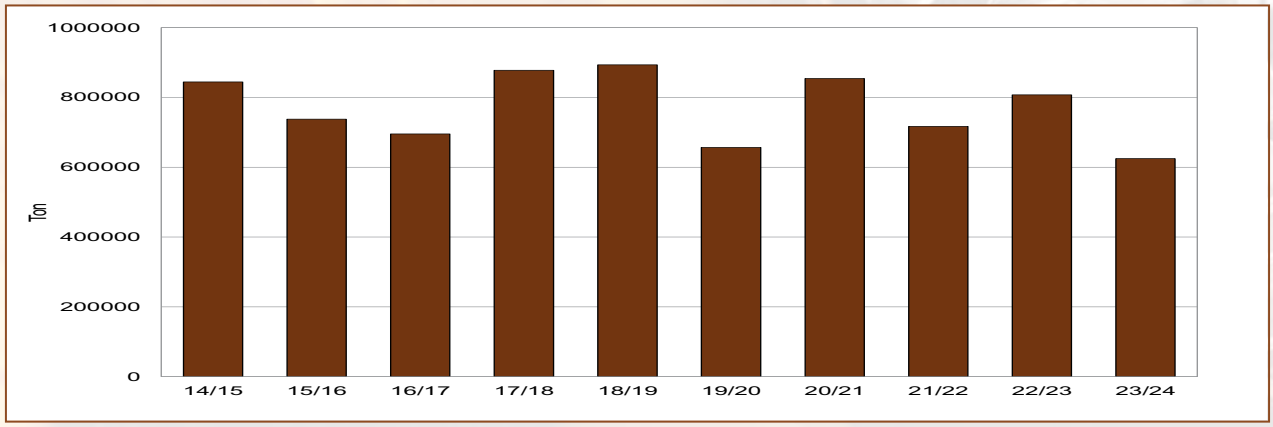
Graph 12: Sunflower: CEC Estimate vs SAGIS deliveries over 10 marketing seasons



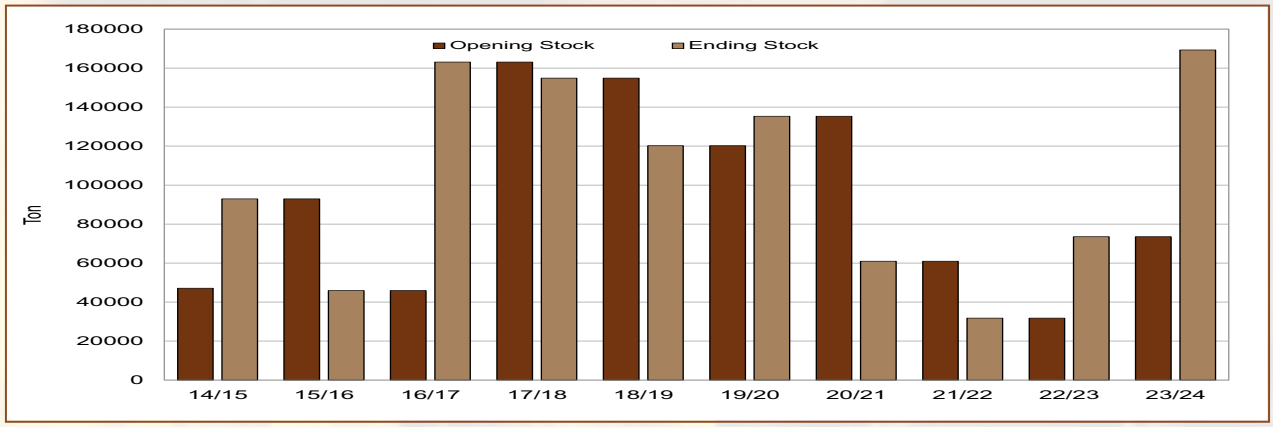
Graph 13: Sunflower: Imports and Exports over 10 marketing seasons



Graph 14: Sunflower: Crushed over 10 marketing seasons



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



Information provided by SAGIS.

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

Season	WHOLE SUNFLOWER: IMPORTS FOR RSA PER COUNTRY (TONS)													
	Argentina	Botswana	Brazil	Bulgaria	China	Egypt	Malawi	Mozambique	Romania	Ukraine	United Kingdom	Zambia	Zimbabwe	Total
2014/15	42	4 764	0	0	0	0	574	0	57 800	0	0	0	0	63 180
2015/16	80	4 518	0	0	0	0	663	0	30 531	0	0	272	0	36 064
2016/17	42	1 424	0	38 434	0	0	686	0	30 015	19	23	0	0	70 643
2017/18	21	0	0	0	18	44	429	19	0	0	23	0	0	554
2018/19	65	381	0	0	0	23	855	0	0	0	0	0	0	1 324
2019/20	44	0	0	0	0	23	390	0	0	0	0	0	0	457
2020/21	87	0	20	0	0	90	274	0	0	0	0	0	0	471
2021/22	43	1 003	0	3	0	184	23	0	0	0	0	0	0	1 256
2022/23	66	6 564	0	0	0	0	175	0	0	0	0	0	0	6 805
2023/24	22	11 753	0	0	0	44	10	0	0	0	0	0	6	11 835

Season	SUNFLOWER: IMPORTS PER HARBOUR (TONS)					
	Harbours					
	East London	Durban	Cape	Port Elizabeth	Richards Bay	Total
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
2020/21	0	132	65	0	0	197
2021/22	0	135	95	0	0	230
2022/23	0	66	0	0	0	66
2023/24*	0	66	0	0	0	66

*Progressive March 2023 - January 2024
Note: Includes Imports for RSA and Other Countries

Season	WHOLE SUNFLOWER: RSA EXPORTS PER COUNTRY (TONS)							
	Australia	Botswana	Mauritius	Namibia	Eswatini	Uganda	Zimbabwe	Total
2014/15	22	0	0	0	26	0	0	48
2015/16	0	10	0	158	88	0	0	256
2016/17	0	40	0	48	107	0	10	205
2017/18	0	23	0	136	115	0	0	274
2018/19	0	10	0	360	145	0	0	515
2019/20	0	95	0	341	140	0	0	576
2020/21	0	24	0	304	192	54	566	1 140
2021/22	0	35	0	65	117	0	0	217
2022/23	0	35	4	50	81	0	0	170
2023/24	0	0	0	1	42	0	0	43

Season	SUNFLOWER: EXPORTS PER HARBOUR (TONS)					
	Harbours					
	East London	Durban	Cape	Port Elizabeth	Richards Bay	Total
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
2020/21	0	0	0	0	0	0
2021/22	0	0	0	0	0	0
2022/23	0	4	0	0	0	4
2023/24*	0	0	0	0	0	0

*Progressive March 2023 - January 2024

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

	OIL SEEDS PRODUCTS MANUFACTURED (PER MONTH)												Date published: 2024/03/01	
	Marketing year Mar 2021 - Feb 2022 Progressive: 12 Months	Marketing year Mar 2022 - Feb 2023 Progressive: 12 Months	Mar 2023 Tons	Apr 2023 Tons	May 2023 Tons	June 2023 Tons	July 2023 Tons	Aug 2023 Tons	Sep 2023 Tons	Oct 2023 Tons	Nov 2023 Tons	Dec 2023 Tons	Jan 2024 Tons	Marketing year Mar 2023 - Feb 2024 Progressive: 11 Months (Mar - Jan)
Palm Oil and Derivatives	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oil	**261 757**	**287 762**	16 333	25 539	31 452	26 154	26 649	28 821	27 603	25 141	27 359	21 170	26 183	**282 404**
Sunflower Oil	**263 060**	**295 476**	12 798	21 475	31 272	24 863	26 496	25 732	23 192	19 190	18 447	17 215	16 878	**237 558**
Coconut Oil/ Groundnut Oil / Canola Oil / Corn (Maize) Oil / Blends or mixes of Oils which includes one of the above Oils / Biodiesel / Cottonseed Oil	**68 734**	**67 862**	7 215	7 803	5 780	6 975	4 565	6 521	7 272	6 449	7 207	6 905	6 457	**73 149**
Sunflower Oilcake	**300 155**	**319 018**	12 573	21 412	32 773	26 355	27 359	28 724	25 168	21 638	19 689	17 286	17 856	**250 833**
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 Oil-cake / Cottonseed Oilcake	**1 237 766**	**1 379 161**	83 133	119 005	145 729	125 039	124 519	135 594	133 476	122 091	128 776	101 467	122 823	**1 341 652**
Soybean Flours and Meals / Textured Vegetable Protein	**41 078**	**41 726**	4 154	3 312	4 344	4 518	4 344	4 043	4 870	4 760	4 465	2 899	4 071	**45 780**
Soybean Fullfat	**169 604**	**173 986**	14 194	13 396	15 399	15 828	16 462	15 859	11 998	10 952	10 582	9 934	10 146	**144 750**
Peanut Butter and Paste	**33 700**	**30 519**	2 082	2 406	3 717	3 115	2 390	3 025	2 673	2 856	1 878	1 967	2 138	**28 247**
Total	**2 375 854**	**2 595 510**	**152 482**	**214 348**	**270 466**	**232 847**	**232 784**	**248 319**	**236 252**	**213 077**	**218 403**	**178 843**	**206 552**	**2 404 373**

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

	OIL SEEDS PRODUCTS IMPORTED (PER MONTH)												Date published: 2024/03/01	
	Marketing year Mar 2021 - Feb 2022 Progressive: 12 Months	Marketing year Mar 2022 - Feb 2023 Progressive: 12 Months	Mar 2023 Tons	Apr 2023 Tons	May 2023 Tons	June 2023 Tons	July 2023 Tons	Aug 2023 Tons	Sep 2023 Tons	Oct 2023 Tons	Nov 2023 Tons	Dec 2023 Tons	Jan 2024 Tons	Marketing year Mar 2023 - Feb 2024 Progressive: 11 Months (Mar - Jan)
Palm Oil and Derivatives	**524 513**	**495 285**	41 627	43 561	46 814	46 092	46 927	45 459	51 516	48 623	39 625	28 575	31 888	**470 707**
Soybean Oil	**68 481**	**52 125**	2 974	4 672	6 653	1 020	1 509	3 811	11 871	6 059	1 026	221	882	**40 698**
Sunflower Oil	**107 808**	**125 929**	10 088	5 376	15 820	5 038	10 025	9 521	45 505	20 229	30 055	16 358	1 258	**169 273**
Coconut Oil/ Groundnut Oil / Canola Oil / Corn (Maize) Oil / Blends or mixes of Oils which includes one of the above Oils / Biodiesel / Cottonseed Oil	**10 035**	**5 537**	755	103	163	129	211	650	197	284	307	302	321	**3 422**
Sunflower Oilcake	**55 684**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
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 Oil-cake / Cottonseed Oilcake	**408 986**	**181 566**	33 610	1 441	27 864	401	1 570	1 034	777	509	1 121	797	888	**70 012**
Soybean Flours and Meals / Textured Vegetable Protein	**0**	**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	**0**
Peanut Butter and Paste	**1 563**	**1 969**	387	299	63	69	82	129	66	612	1 437	18	245	**3 407**
Total	**1 177 070**	**862 411**	**89 441**	**55 452**	**97 377**	**52 749**	**60 324**	**60 604**	**109 932**	**76 316**	**73 571**	**46 271**	**35 482**	**757 519**

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

	OIL SEEDS PRODUCTS EXPORTED (PER MONTH)												Date published: 204/03/01	
	Marketing year Mar 2021 - Feb 2022 Progressive: 12 Months	Marketing year Mar 2022 - Feb 2023 Progressive: 12 Months	Mar 2023 Tons	Apr 2023 Tons	May 2023 Tons	June 2023 Tons	July 2023 Tons	Aug 2023 Tons	Sep 2023 Tons	Oct 2023 Tons	Nov 2023 Tons	Dec 2023 Tons	Jan 2024 Tons	Marketing year Mar 2023 - Feb 2024 Progressive: 11 Months (Mar - Jan)
Palm Oil and Derivatives	**14 421**	**11 505**	1 235	839	789	1 384	937	993	1 198	982	1 204	618	1 159	**11 338**
Soybean Oil	**53 889**	**46 201**	8 905	6 260	12 108	10 470	8 225	7 187	3 808	4 929	1 052	536	4 580	**68 060**
Sunflower Oil	**2 971**	**9 330**	314	258	948	412	404	471	452	608	671	501	1 541	**6 580**
Coconut Oil/ Groundnut Oil / Canola Oil / Corn (Maize) Oil / Blends or mixes of Oils which includes one of the above Oils / Biodiesel / Cottonseed Oil	**12 559**	**13 624**	2 493	772	2 426	1 525	882	377	708	514	1 298	345	1 303	**12 643**
Sunflower Oilcake	**1 755**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
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 Oil-cake / Cottonseed Oilcake	**18 052**	**10 404**	192	584	810	554	659	1 356	1 407	969	1 256	1 250	1 046	**10 083**
Soybean Flours and Meals / Textured Vegetable Protein	**21 019**	**23 619**	1 787	1 056	1 329	769	639	1 666	1 419	1 193	2 469	1 105	2 130	**15 562**
Soybean Fullfat	**3 450**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Peanut Butter and Paste	**240**	**212**	23	17	13	20	16	15	21	26	9	16	17	**193**
Total	**128 356**	**114 895**	**14 949**	**9 786**	**18 423**	**15 134**	**11 762**	**12 065**	**9 013**	**9 221**	**7 959**	**4 371**	**11 776**	**124 459**

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.

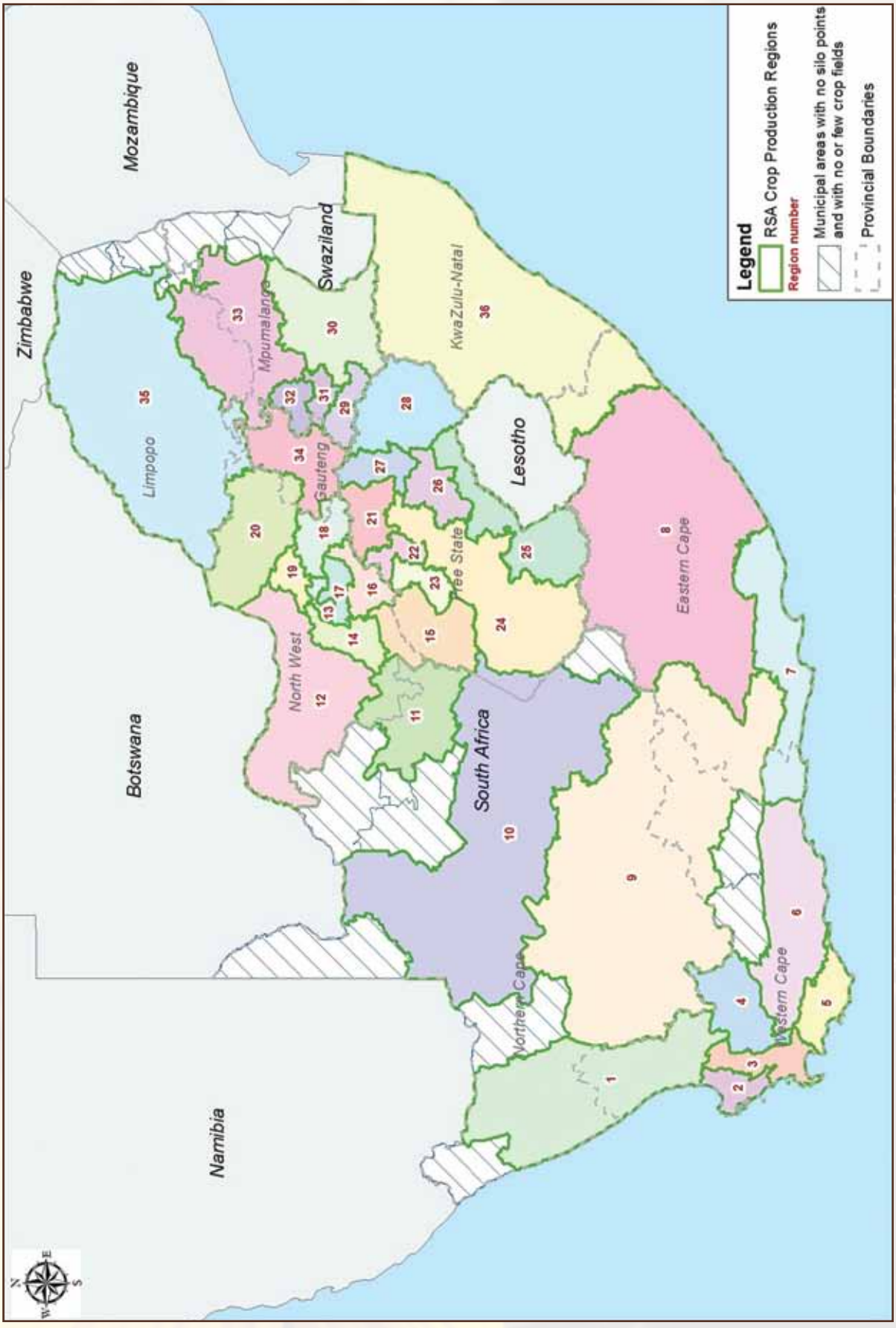
The 9 provinces are divided into 36 grain production regions.

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 2022/23 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)	Senwes	Kameel (Bins)
NWK	Kameel (Bins)	Senwes	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)	Senwes	Amalia (Bins)
NWK	Excelsior (Bins)	Senwes	Hallatshope (Bins)
NWK	Geysdorp (Bins)	Senwes	Migdol (Bins)
NWK	Migdol (Bins)	Senwes	Schweizer-Reneke (Bins)
NWK	Nooitgedacht (Bins)		

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

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)		

Grain Production Regions

Silo/Intake stands per region indicating type of storage structure

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	Bradfort (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)	Senwes	Dewetsdorp (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)

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)

Grain Production Regions

Silo/Intake stands per region indicating type of storage structure

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	Vaaldrift (Bunkers)
Afgri	Holmdene (Bins)	Afgri	Val (Bins)

Region 30: Mpumalanga Eastern Region			
Afgri	Amersfoort (Bins)	Afgri	Morgenzon (Bins)
Afgri	Carolina (Bins)	Afgri	Overvaal (Bins)
Afgri	Davel (Bins)	Afgri	Sandspruit (Bunkers)
Afgri	Eerstelingsfontein (Bunker)	Afgri	Hendriksvallei (Bunkers)
Afgri	Ermelo (Bins)	BKB	Waterval (Bunkers)
Afgri	Estancia (Bins)	TWK	Mkondo (Bins)
Afgri	Lothair (Bins)	TWK	Panbult (Panbult)
Afgri	Maizefield (Bins)		

Region 31: Mpumalanga Central Region			
Afgri	Bakenlaagte (Bunkers)	Afgri	Kortlaagte (Bins)
Afgri	Bethal (Bins)	Afgri	Leslie (Bins)
Afgri	Brakfontein (Bunkers)	Afgri	Palmietfontein (Bunkers)
Afgri	Devon (Bin)	Afgri	Trichardt (Bins)
Afgri	Kinross (Bins/Bunkers)	Afgri	Vaalkrantz (Bunkers)

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 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 2022/23 – Summary of results

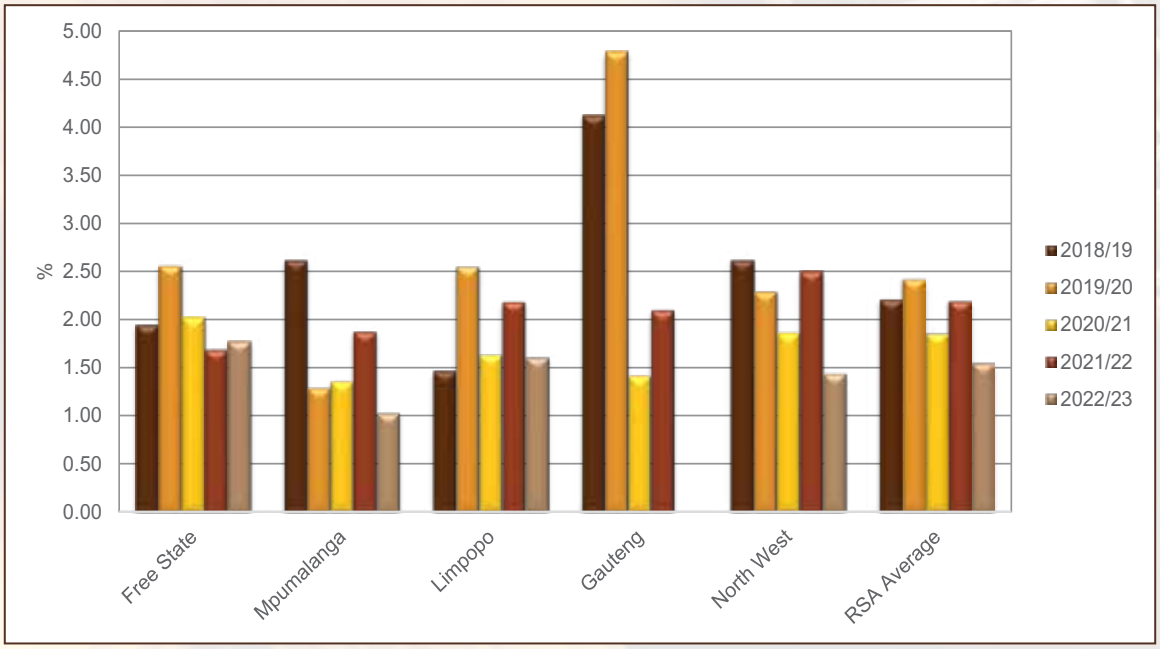
Eighty-three percent (145) of the 174 samples analysed for the purpose of this survey were graded as Grade FH1, with 29 (17%) of the samples downgraded to COSF (Class Other Sunflower Seed). The percentage of samples graded FH1 increased compared to the previous season's 75%. The ten-year weighted average of the percentage samples graded as FH1 is 79%.

The grading results of the 29 samples downgraded to COSF can be summarised as follows:

- Percentage screenings exceeding the maximum permissible deviation of 4% was present in eight samples.
- Percentage sclerotia from the fungus *Sclerotinia sclerotiorum* exceeding the maximum permissible deviation of 4% was present in two samples.
- Percentage foreign matter exceeding the maximum permissible deviation of 4% was present in five samples.
- Percentage collective deviations exceeding the maximum permissible deviation of 6% was present in 14 samples.
- Poisonous seeds *(Datura sp.)* exceeding the maximum permissible number of 1 per 1000 g were present in eleven samples.
- One sample was downgraded due to the presence of a musty odour and another due to the presence of a musty and sour odour.
- Eleven of the 29 samples downgraded to COSF were as a result of a combination of two or more of the above mentioned deviations.

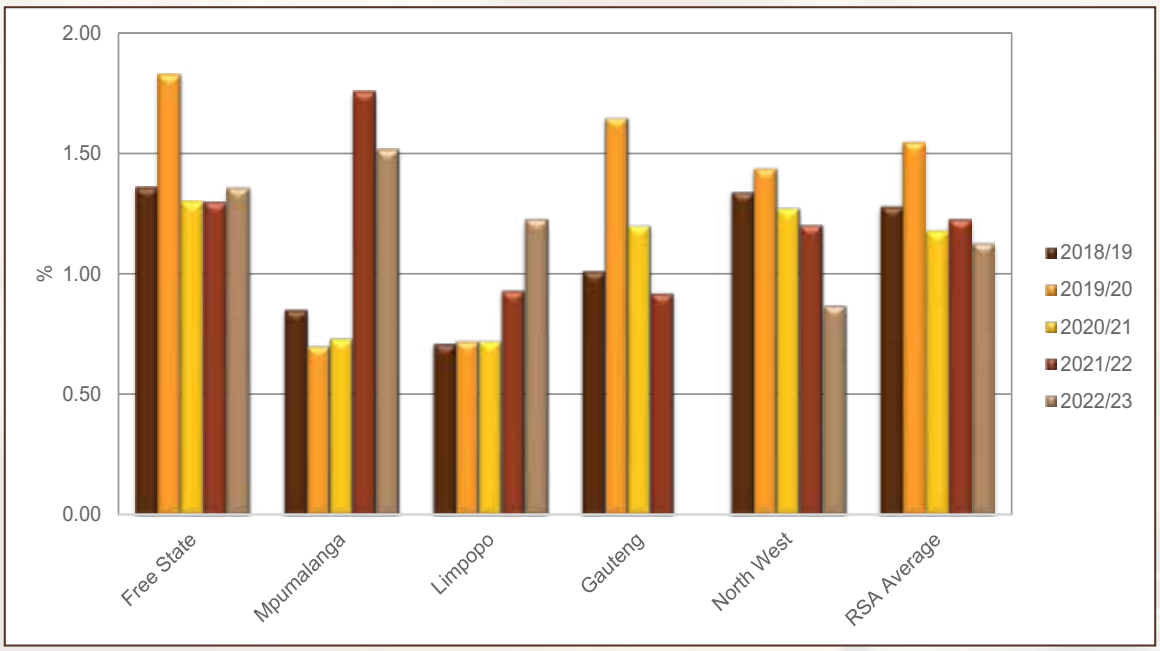
The samples from the Free State province (N = 64) reported the highest average percentage screenings namely 1.78%, followed by Limpopo (N = 17) and North West (N = 82) with 1.61% and 1.44% respectively. Mpumalanga (N = 11) reported the lowest percentage screenings of 1.03%. The weighted national average was 1.55% compared to the 2.20% of the previous season.

Graph 16: Average percentage screenings per province over five seasons



The highest weighted average percentage foreign matter (1.52%) was reported for the samples from the Mpumalanga regions. The Free State and Limpopo followed with 1.36% and 1.23% respectively. The lowest percentage was found in North West (0.87%). The national average was 1.13% compared to the 1.23% and 1.18% of the previous two seasons. Please see Graph 17.

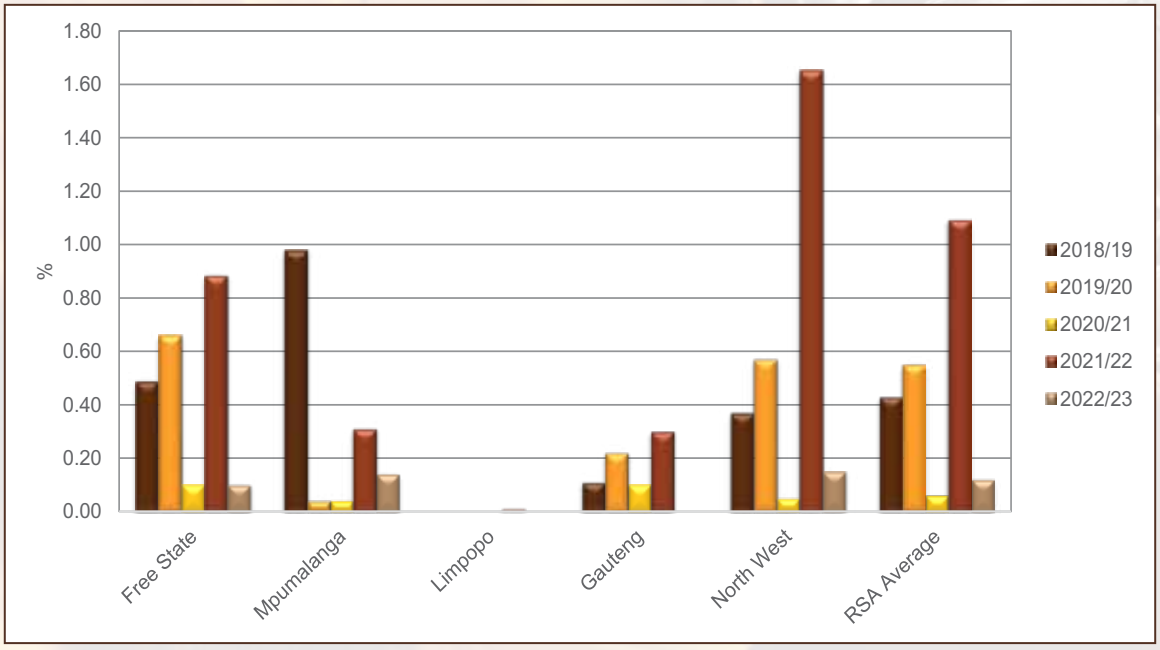
Graph 17: Average percentage foreign matter per province over five seasons



The percentage samples received for this survey that contained sclerotia from the fungus *Sclerotinia sclerotiorum* decreased from 70% in the previous season to 22% this season. The current season's 22% equals that of the 2020/21 season. 62% of the samples containing sclerotia this season originated in North West province, 28% in the Free State and 10% in Mpumalanga.

Two of the samples received exceeded the maximum permissible deviation of 4% for sclerotia. The highest percentage reported was 4.30% originating in the Free State, followed by 4.08% originating in North West. The national average of 0.12% is the second lowest of the past six seasons.

Graph 18: Average percentage sclerotia per province over five seasons

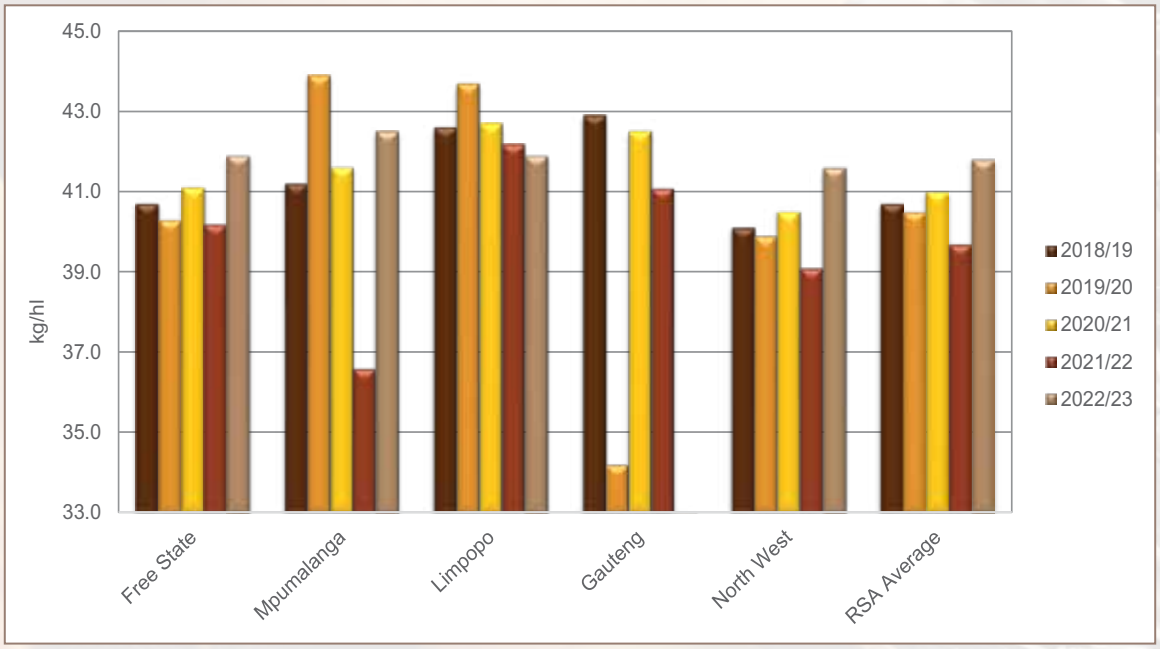


Test weight does not form part of the grading regulations for sunflower seed in South Africa. An approximation of the test weight of South African sunflower seed is provided in Table 3 for information purposes. The standard working procedure of the Kern 222 instrument, as described in ISO 7971-3:2019, 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								
	2022/23 Season			2021/22 Season			2020/21 Season		
	Weighted average	Range	No. of samples	Weighted average	Range	No. of samples	Weighted average	Range	No. of samples
Free State (Regions 21 - 28)	41.9	34.8 - 47.0	64	40.2	33.1 - 43.9	*45	41.1	38.0 - 44.9	*44
Mpumalanga (Regions 29 - 33)	42.5	40.9 - 45.2	11	36.6	35.2 - 44.5	13	41.6	40.4 - 42.5	7
Limpopo (Region 35)	41.9	36.4 - 47.2	17	42.2	39.9 - 47.3	27	42.7	40.5 - 44.4	19
Gauteng (Region 34)	-	-	-	41.1	-	1	42.5	-	1
North West (Region 12 - 20)	41.6	32.2 - 45.4	82	39.1	32.0 - 42.4	**86	40.5	30.4 - 43.7	85
RSA	***41.8***	***32.2 - 47.2***	***174***	***39.7***	***32.0 - 47.3***	***172***	***41.0***	***30.4 - 44.9***	***156***

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

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



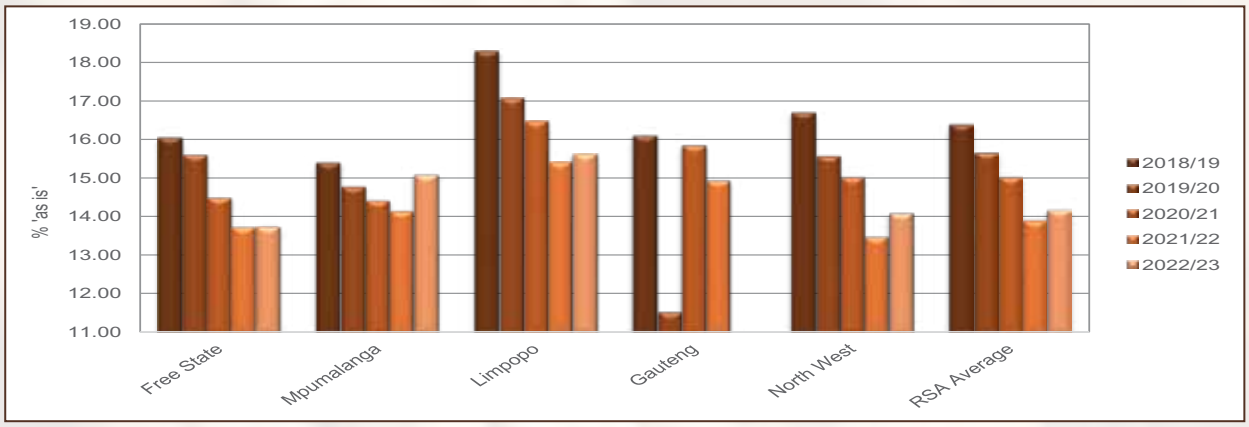
The nutritional component analyses, namely crude protein, -fat, -fibre and ash are reported as % (g/100 g) on an 'as received' or 'as is' basis.

The weighted average crude protein content this season was 14.17%. The last four seasons reported the lowest average values of the eleven seasons for which crop survey results are available. The 2021/22 season's average was 13.90%, the 2019/20 season was 15.02% and the 2019/20 season 15.66%. Limpopo had the highest weighted average crude protein content of 15.62%, followed by Mpumalanga with 15.08, North West with 14.09% and the Free State with the lowest average of 13.74%. The weighted average crude fat percentage was 39.9% compared to the 38.1% of the previous season. The samples from Mpumalanga had the highest crude fat content of 40.5%, followed by North West with 40.2%. The Free State and Limpopo averaged 39.7% and 39.1% respectively.

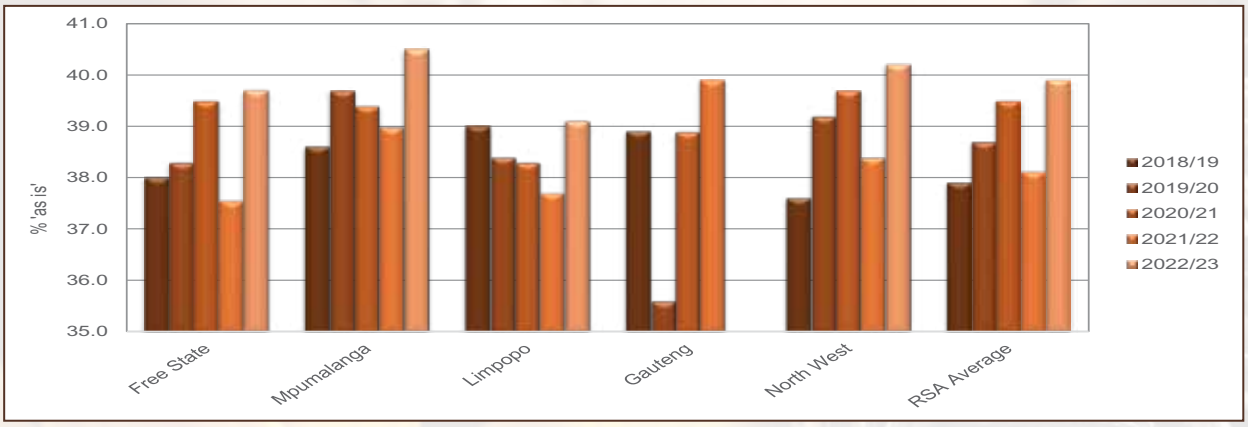
The weighted average percentage crude fibre was 22.9%, the second highest weighted average value since the start of this survey in 2012/13. Average values varied from a low of 21.9% in Limpopo to a high of 23.2% in the Free State. The weighted average ash content was 2.61%, equal to last season. The provincial averages ranged from 2.50% in Limpopo to 2.64% in North West.

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

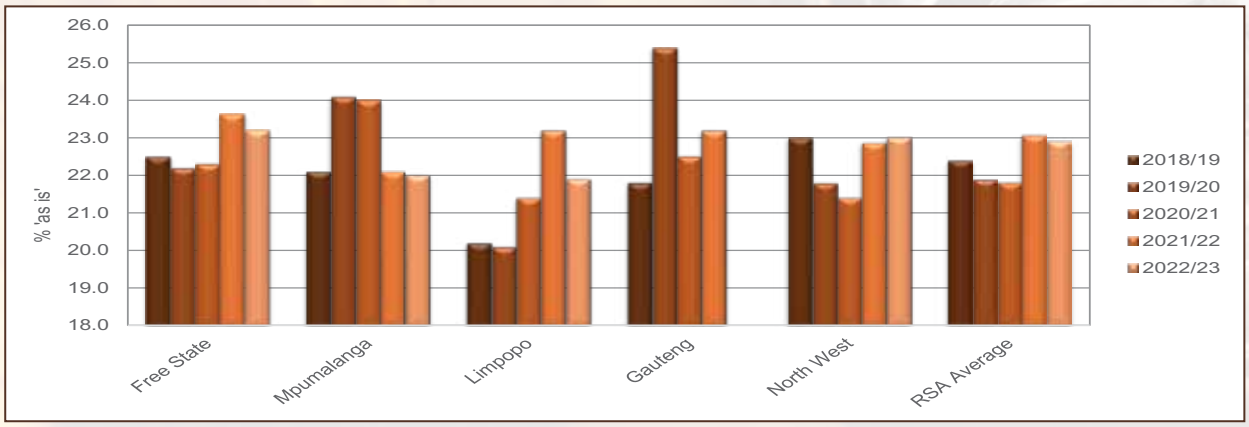
Graph 20: Average crude protein content per province over five seasons



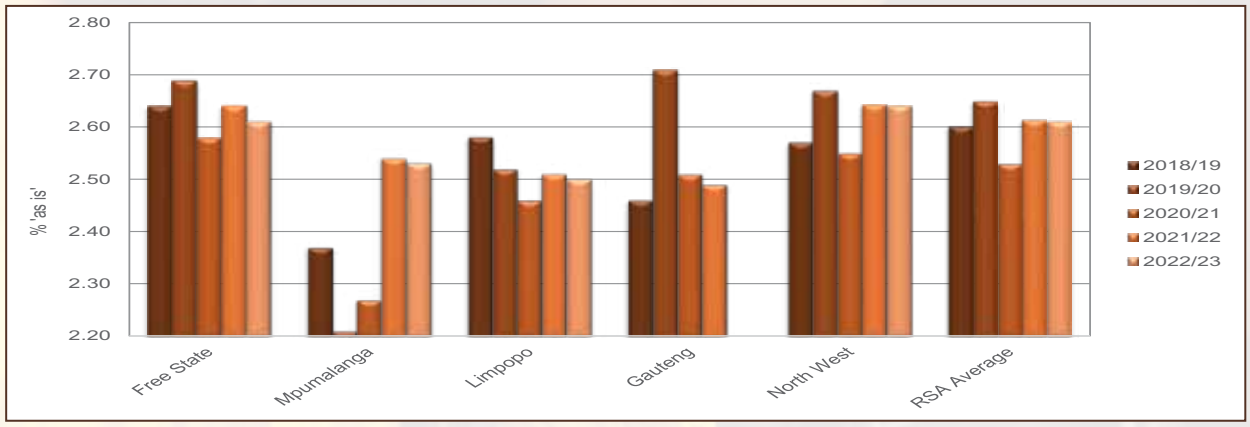
Graph 21: Average crude fat content per province over five seasons



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.

See Table 5 on page 23 for a summary of the RSA Sunflower Crop Quality averages of the 2022/23 season compared to those of the 2021/22 season.

Table 4: Comparison between the moisture, crude protein and crude fat results of the sunflower crop quality and ARC cultivar trial samples of the 2022/23 season

Analysis	Moisture, % (5hr, 105°C)	Crude Protein, % (as is)	Crude Fat, % (as is)
Sunflower Crop Quality Survey results			
Average	4.8	14.17	39.9
Minimum	2.8	10.80	30.6
Maximum	8.3	18.53	47.2
Standard deviation	0.65	1.50	2.35
No. of samples	***174***	***174***	***174***
ARC Grains Crops Cultivar trial sample results			
Average	5.3	15.16	44.2
Minimum	3.4	10.95	37.2
Maximum	6.5	22.64	53.4
Standard deviation	0.59	3.14	3.30
No. of samples	***160***	***160***	***160***
% Difference between crop and cultivar samples	***-0.5***	***-0.99***	***-4.3***

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

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

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

Table 5: South African Sunflower Crop Quality Averages 2022/23 vs 2021/22						
Class and Grade Sunflower	**2022/23**			**2021/22**		
	FH1	**COSF**	**Average**	**FH1**	**COSF**	**Average**
Grading:						
1. Damaged sunflower seed, %	0.06	1.01	0.22	0.19	0.57	0.28
2. Screenings, %	1.30	2.81	1.55	1.61	3.95	2.20
3. Sclerotia, %	0.05	0.46	0.12	0.54	2.77	1.09
4. Foreign Matter, %	0.92	2.18	1.13	1.13	1.53	1.23
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.27	5.45	2.80	3.28	8.24	4.52
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	7	1	0	6	1
Poisonous seeds (*Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.*)	0	0	0	0	2	0
Number of samples	***145***	***29***	***174***	***131***	***26***	***157***
Nutritional analysis:						
Moisture, % (5 hr, 105 °C)	4.8	4.8	4.8	5.0	4.9	5.0
Crude Protein, % (as is)	14.13	14.38	14.17	15.12	14.56	15.02
Crude Fat, % (as is)	40.0	39.7	39.9	39.5	39.1	39.5
Crude Fibre, % (as is)	23.0	22.3	22.9	21.7	22.22	21.8
Ash, % (as is)	2.59	2.69	2.61	2.54	2.52	2.53
Number of samples	***145***	***29***	***174***	***131***	***26***	***157***

South Africa

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, %	0.10	0.00	0.80	0.28	1.81	0.00	14.00	3.89	0.00	0.00	0.00	0.00
2. Screenings, %	0.81	0.20	1.88	0.57	2.38	0.50	4.40	1.28	1.39	0.40	4.50	1.29
3. Sclerotia, %	0.01	0.00	0.10	0.04	0.06	0.00	0.20	0.08	0.03	0.00	0.30	0.09
4. Foreign Matter, %	0.81	0.18	2.42	0.88	0.97	0.30	1.90	0.52	0.79	0.10	1.80	0.56
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	1.63	0.38	4.30	1.27	3.42	0.80	6.14	1.75	2.21	0.54	5.66	1.56
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0.00	2	0	20	5.55	1	0	10	2.94
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
Number of samples	***8***				***13***				***22***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.8	4.2	5.4	0.41	4.5	3.7	6.3	0.80	4.6	3.4	5.2	0.48
Crude Protein, % (as is)	15.34	13.41	18.18	1.50	14.69	13.13	15.65	0.84	13.46	10.80	18.53	1.35
Crude Fat, % (as is)	38.4	30.6	41.9	3.54	39.1	35.2	41.9	1.88	40.5	36.9	46.9	2.00
Crude Fibre, % (as is)	23.3	19.5	26.1	2.35	22.8	19.2	25.1	1.58	23.1	17.6	27.8	2.28
Ash, % (as is)	2.73	2.36	3.19	0.30	2.71	2.57	2.88	0.08	2.62	2.39	2.96	0.16
Number of samples	***8***				***13***				***22***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(16) North-West Central-Eastern Region				(17) North-West Central-Northern Region (Ottosdal)				(18) North-West Central Region (Ventersdorp)			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.00	-	-	-	0.08	0.00	0.90	0.27	0.11	0.00	1.00	0.33
2. Screenings, %	0.80	-	-	-	0.82	0.42	1.40	0.30	0.95	0.42	2.24	0.70
3. Sclerotia, %	0.00	-	-	-	0.02	0.00	0.10	0.04	0.52	0.00	4.02	1.31
4. Foreign Matter, %	0.20	-	-	-	0.78	0.10	1.60	0.52	1.16	0.28	2.90	0.93
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	1.00	-	-	-	1.62	0.66	2.74	0.65	2.63	0.80	6.70	2.07
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	-	-	-	4	0	20	8.09	4	0	40	13.33
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	-	-		0	0	0	0.00	0	0	0	0.00
Number of samples	***1***				***11***				***9***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	3.9	-	-	-	5.2	4.5	6.4	0.49	5.1	4.0	8.3	1.30
Crude Protein, % (as is)	10.97	-	-	-	12.95	11.36	14.20	1.15	14.70	13.27	16.79	1.25
Crude Fat, % (as is)	42.6	-	-	-	40.9	37.2	42.8	1.90	39.5	36.8	42.2	2.03
Crude Fibre, % (as is)	24.4	-	-	-	22.9	21.4	25.2	1.06	23.6	21.9	26.6	1.67
Ash, % (as is)	2.37	-	-	-	2.61	2.46	2.77	0.09	2.67	2.48	2.87	0.14
Number of samples	***1***				***11***				***9***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(19) North-West Central Region (Lichtenburg)				(20) North-West Eastern Region				(21) Free State North-Western Region (Viljoenskroon)			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.75	0.00	9.00	2.60	0.00	0.00	0.00	0.00	0.05	0.00	0.54	0.16
2. Screenings, %	1.65	0.44	3.80	1.01	1.93	0.70	4.16	1.19	2.76	0.46	6.94	2.18
3. Sclerotia, %	0.41	0.00	4.08	1.16	0.11	0.00	0.26	0.12	0.00	0.00	0.00	0.00
4. Foreign Matter, %	0.92	0.26	2.00	0.63	0.82	0.28	1.50	0.47	2.04	0.50	4.26	1.41
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.98	0.86	8.48	2.16	2.86	1.80	5.66	1.40	4.80	1.70	9.08	3.12
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0.00	5	0	30	12.25	1	0	14	4.22
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
Number of samples	***12***				***6***				***11***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.4	3.5	5.8	0.63	4.2	2.8	4.9	0.76	4.8	4.2	5.3	0.36
Crude Protein, % (as is)	14.22	12.91	15.17	0.84	14.81	12.08	16.87	1.63	14.44	12.74	17.19	1.25
Crude Fat, % (as is)	41.6	38.4	44.3	1.94	40.2	37.0	44.9	2.98	39.1	35.3	41.6	2.23
Crude Fibre, % (as is)	22.4	21.2	23.5	0.68	22.7	22.0	23.7	0.63	23.3	21.3	27.2	1.75
Ash, % (as is)	2.60	2.50	2.76	0.08	2.54	2.14	2.91	0.25	2.68	2.62	2.78	0.05
Number of samples	***12***				***6***				***11***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(22) Free State North-Western Region (Bothaville)				(23) Free State North-Western Region				(24) Free State Central 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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Screenings, %	1.57	0.70	2.00	0.75	1.01	0.40	2.20	0.69	2.10	0.64	4.26	1.23
3. Sclerotia, %	0.00	0.00	0.00	0.00	0.02	0.00	0.10	0.04	0.00	0.00	0.00	0.00
4. Foreign Matter, %	0.67	0.32	1.00	0.34	0.65	0.18	1.40	0.49	1.46	0.10	4.30	1.10
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.24	1.02	3.00	1.07	1.68	0.58	2.88	0.98	3.57	0.74	8.18	2.11
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0.00	0	0	0	0.00	3	0	20	5.94
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
Number of samples	***3***				***6***				***15***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.6	3.7	5.1	0.78	4.8	4.3	5.2	0.30	4.9	3.6	6.0	0.74
Crude Protein, % (as is)	13.79	12.80	14.83	1.02	14.25	13.13	16.59	1.22	13.88	12.62	17.36	1.32
Crude Fat, % (as is)	40.5	38.3	43.9	3.01	39.4	37.0	40.4	1.27	39.5	34.1	47.2	2.91
Crude Fibre, % (as is)	23.3	21.5	25.8	2.22	24.5	21.3	32.0	3.81	23.0	13.6	25.6	2.89
Ash, % (as is)	2.61	2.58	2.64	0.03	2.70	2.50	3.11	0.22	2.58	2.23	2.94	0.16
Number of samples	***3***				***6***				***15***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(25) Free State South-Western Region				(26) Free State South-Eastern Region				(27) Free State Northern Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.16	0.00	0.80	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Screenings, %	1.22	0.46	2.50	0.89	1.00	0.28	2.08	0.57	1.90	0.20	3.40	1.10
3. Sclerotia, %	0.88	0.00	4.30	1.91	0.12	0.00	0.42	0.17	0.06	0.00	0.50	0.17
4. Foreign Matter, %	0.63	0.22	1.00	0.28	0.98	0.12	2.66	0.82	1.77	0.26	4.28	1.40
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.72	1.32	7.40	2.63	2.10	0.66	4.20	1.27	3.73	0.88	6.30	1.86
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
Number of samples	***5***				***9***				***9***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	5.4	5.1	5.9	0.31	4.8	3.9	5.9	0.55	4.7	4.4	5.6	0.41
Crude Protein, % (as is)	11.73	10.94	13.35	0.94	12.81	11.88	14.21	0.87	14.32	11.71	15.56	1.16
Crude Fat, % (as is)	41.2	38.8	43.2	1.91	40.1	36.2	43.4	2.63	39.3	37.1	41.4	1.47
Crude Fibre, % (as is)	23.7	21.8	26.3	1.66	23.2	22.2	24.5	0.69	22.9	21.5	24.1	1.11
Ash, % (as is)	2.68	2.50	2.88	0.14	2.50	2.25	2.70	0.13	2.53	2.28	2.73	0.16
Number of samples	***5***				***9***				***9***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(28) Free State Eastern Region				(29) Mpumalanga Southern Region				(30) Mpumalanga Eastern 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	0.00	0.00	0.00	0.00	0.00	-	-	-
2. Screenings, %	1.45	1.08	2.14	0.39	0.67	0.22	2.02	0.68	1.44	-	-	-
3. Sclerotia, %	0.07	0.00	0.20	0.10	0.21	0.00	0.80	0.32	0.00	-	-	-
4. Foreign Matter, %	1.50	0.80	2.22	0.55	0.38	0.10	0.80	0.34	1.20	-	-	-
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	3.02	2.30	4.36	0.85	1.26	0.50	2.92	0.94	2.64	-	-	-
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0.00	0	0	0	0.00	0	-	-	-
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0.00	0	0	0	0.00	0	-	-	-
Number of samples	***6***				***6***				***1***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.8	4.2	5.3	0.37	5.1	4.4	5.5	0.37	5.0	-	-	-
Crude Protein, % (as is)	13.79	12.47	15.33	1.06	15.33	13.58	18.35	1.68	16.43	-	-	-
Crude Fat, % (as is)	40.4	40.0	40.8	0.36	39.5	35.7	43.3	2.83	40.6	-	-	-
Crude Fibre, % (as is)	22.6	20.5	24.4	1.26	22.7	21.2	25.5	1.74	20.7	-	-	-
Ash, % (as is)	2.65	2.43	2.93	0.16	2.54	2.31	2.64	0.12	2.75	-	-	-
Number of samples	***6***				***6***				***1***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(31) Mpumalanga Central Region				(33) Mpumalanga Northern Region				(35) Limpopo 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	0.00	0.06	0.00	1.08	0.26
2. Screenings, %	1.20	-	-	-	1.55	1.10	2.12	0.52	1.61	0.04	4.00	1.25
3. Sclerotia, %	0.00	-	-	-	0.10	0.00	0.30	0.17	0.00	0.00	0.00	0.00
4. Foreign Matter, %	9.20	-	-	-	1.34	0.32	2.50	1.10	1.23	0.00	6.00	1.33
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	10.40	-	-	-	2.99	1.42	4.24	1.44	2.84	0.04	7.10	1.88
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	-	-	-	0	0	0	0.00	0	0	0	0.00
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	-	-	-	0	0	0	0.00	0	0	0	0.00
Number of samples	***1***				***3***				***17***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.1	-	-	-	4.5	4.4	4.6	0.12	5.2	4.4	6.0	0.46
Crude Protein, % (as is)	15.29	-	-	-	14.06	13.26	14.77	0.76	15.62	13.94	18.22	1.38
Crude Fat, % (as is)	44.8	-	-	-	41.0	39.2	42.4	1.65	39.1	35.2	44.2	2.55
Crude Fibre, % (as is)	18.2	-	-	-	22.2	21.8	22.7	0.46	21.9	16.4	26.8	2.77
Ash, % (as is)	3.02	-	-	-	2.27	2.18	2.35	0.09	2.50	2.26	2.75	0.12
Number of samples	***1***				***3***				***17***			

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. Currently, no national updated database for fatty acid composition of sunflower oil is available.

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 for the fourth consecutive year 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 32 to 34 for the results.

C14:0	Myristic acid	C18:3n5	Eleostearic acid
C16:0	Palmitic acid	C18:3n3	n3 Linolenic acid
C16:1	Palmitoleic acid	C20:0	Arachidic acid
C17:0	Margaric acid	C20:1	Eicosenoic acid
C18:0	Stearic acid	C20:2	Eicosadienoic acid
C18:1 cis	cis Oleic acid	C22:0	Behenic acid
C18:1n7	Vaccenic acid	C24:0	Lignoceric acid
C18:2 cis	cis Linoleic acid	Unknown 1	
C18:3n6	n6 Linolenic acid	Unknown 2	

References:

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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 2022/23 season

Province	Region	g Fatty acids/100 g Fatty Acids																	
		C14:0	C16:0	C16:1	C17:0	C18:0	C18:1 cis	C18:1 n7*	C18:2 cis	C18:3 n6	C18:3 n5	C18:3 n3	C20:0	C20:1	C20.2	C22:0	C24:0	Unknown 1	Unknown 2
North West	12	ND	5.98	ND	ND	5.99	16.56	0.52	68.9	ND	ND	LOQ	0.396	LOQ	ND	0.907	0.198	LOQ	LOQ
	13	ND	6.61	ND	ND	6.14	14.91	0.55	68.6	ND	ND	LOQ	0.416	LOQ	ND	0.97	0.234	0.59	0.56
	14	LOQ	6.54	ND	ND	5.05	19.06	0.57	66.6	ND	ND	LOQ	0.356	LOQ	ND	0.851	0.213	0.18	0.17
	14	ND	6.27	ND	ND	5.86	17.05	0.53	68.0	ND	ND	LOQ	0.408	LOQ	ND	0.891	0.205	0.20	0.21
	14	LOQ	6.06	ND	ND	4.27	27.01	0.56	60.0	ND	ND	LOQ	0.332	0.143	ND	0.832	0.257	LOQ	LOQ
	17	LOQ	6.35	LOQ	ND	4.39	22.00	0.57	64.7	ND	ND	LOQ	0.322	LOQ	ND	0.805	0.219	0.16	0.15
	18	ND	5.53	ND	LOQ	6.61	17.22	0.54	68.2	ND	ND	LOQ	0.375	LOQ	ND	0.759	0.168	LOQ	LOQ
	19	LOQ	6.00	ND	ND	5.80	20.13	0.53	65.4	ND	ND	LOQ	0.370	LOQ	ND	0.833	0.209	0.19	0.17
	20	ND	5.93	ND	ND	5.83	17.27	0.48	68.2	ND	ND	LOQ	0.406	LOQ	ND	0.95	0.212	0.16	0.16
	Min	-	*5.53*	-	-	*4.27*	*14.91*	*0.48*	*60.0*	-	-	-	*0.322*	-	-	*0.759*	*0.168*	*0.16*	*0.15*
	Max	-	*6.61*	-	-	*6.61*	*27.01*	*0.57*	*68.9*	-	-	-	*0.416*	*0.143*	-	*0.97*	*0.257*	*0.59*	*0.56*
	N	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*
Free State	21	LOQ	6.21	ND	ND	5.11	18.78	0.49	67.2	ND	ND	LOQ	0.348	LOQ	ND	0.828	0.224	0.23	0.21
	23	ND	5.86	ND	ND	6.85	15.14	0.44	69.3	ND	ND	LOQ	0.414	LOQ	ND	0.881	0.211	0.28	0.27
	24	LOQ	6.38	ND	ND	4.52	20.32	0.51	66.0	ND	ND	LOQ	0.339	LOQ	ND	0.873	0.237	0.25	0.23
	24	ND	5.85	LOQ	ND	8.39	14.28	0.52	68.1	ND	ND	LOQ	0.516	LOQ	ND	1.06	0.227	0.37	0.36
	25	LOQ	6.65	ND	ND	4.41	18.45	0.58	68.0	ND	ND	LOQ	0.313	LOQ	ND	0.786	0.200	LOQ	LOQ
	26	ND	6.06	ND	ND	5.96	15.02	0.55	70.3	ND	ND	LOQ	0.379	LOQ	ND	0.895	0.205	LOQ	LOQ
	27	ND	6.63	ND	ND	6.15	18.86	0.58	65.1	ND	ND	LOQ	0.471	0.147	ND	1.22	0.337	LOQ	LOQ
	28	ND	6.24	ND	ND	5.85	18.28	0.52	67.1	ND	ND	LOQ	0.401	LOQ	ND	0.898	0.200	LOQ	LOQ
	Min	-	*5.85*	-	-	*4.41*	*14.28*	*0.44*	*65.13*	-	-	-	*0.313*	-	-	*0.786*	*0.200*	-	*0.21*
	Max	-	*6.65*	-	-	*8.39*	*20.32*	*0.58*	*70.31*	-	-	-	*0.516*	*0.147*	-	*1.22*	*0.337*	*0.37*	*0.36*
	N	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*
Mpumalanga	29	LOQ	6.23	ND	ND	5.35	19.44	0.53	66.2	ND	ND	LOQ	0.359	LOQ	ND	0.855	0.217	0.24	0.24
Limpopo	35	LOQ	6.62	LOQ	ND	5.27	18.80	0.59	66.4	ND	ND	LOQ	0.362	LOQ	ND	0.841	0.202	0.29	0.28
	35	LOQ	6.01	LOQ	ND	4.45	25.29	0.55	61.6	ND	ND	LOQ	0.308	0.141	ND	0.691	0.195	0.28	0.27
	Min	-	*6.01*	-	-	*4.45*	*18.80*	*0.55*	*61.6*	-	-	-	*0.308*	-	-	*0.691*	*0.195*	*0.28*	*0.27*
	Max	-	*6.62*	-	-	*5.27*	*25.29*	*0.59*	*66.4*	-	-	-	*0.362*	*0.141*	-	*0.841*	*0.202*	*0.29*	*0.28*
	N	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
RSA	*Min*	-	*5.53*	-	-	*4.27*	*14.28*	*0.44*	*60.01*	-	-	-	*0.308*	-	-	*0.691*	*0.168*	*0.16*	*0.15*
	Max	-	*6.65*	-	-	*8.39*	*27.01*	*0.59*	*70.31*	-	-	-	*0.516*	*0.147*	-	*1.22*	*0.337*	*0.59*	*0.56*
	N	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*

Note:
All fatty acids marked with an asterisk (*) are not SANAS accredited.
Limit of detection (LOD) = 0.06 g/100 g.
Values below the limit of detection are reported as ND (not detected).
Limit of quantitation (LOQ) = 0.14 g/100 g.
Values below the limit of quantitation cannot be accurately quantified.

Table 7: Fatty acid profile results of a selection of cultivar samples from the 2022/23 season

Province	Locality	Region	Cultivar	g Fatty acids/100 g Fatty Acids																	
				C14:0	C16:0	C16:1	C17:0	C18:0	C18:1 cis	C18:1 n7	C18:2 cis	C18:3 n6	C18:3 n5	C18:3 n3	C20:0	C20:1	C20.2	C22:0	C24:0	Unknown 1	Unknown 2
North West	Potchefstroom 3	18	AGSUN 5106 CLP	LOQ	6.18	LOQ	ND	5.28	18.47	0.61	67.4	ND	ND	LOQ	0.326	LOQ	ND	0.784	0.211	0.18	0.17
		18	AGSUN 5270	ND	5.71	ND	ND	4.80	21.72	0.54	65.4	ND	ND	LOQ	0.298	LOQ	ND	0.748	0.215	LOQ	LOQ
		18	P 65 LP 65	LOQ	6.47	ND	ND	4.52	20.36	0.55	66.0	ND	ND	LOQ	0.329	LOQ	ND	0.841	0.217	0.15	0.15
		18	PAN 7160 CLP	ND	5.66	ND	ND	5.49	22.42	0.45	63.8	ND	ND	LOQ	0.396	LOQ	ND	0.939	0.226	LOQ	LOQ
		18	SY 3970 CL	ND	5.43	ND	ND	6.07	21.47	0.45	64.3	ND	ND	LOQ	0.391	LOQ	ND	0.975	0.238	0.19	0.17
		Min		-	*5.43*	-	-	*4.52*	*18.47*	*0.45*	*63.8*	-	-	-	*0.298*	-	-	*0.748*	*0.211*	*0.15*	*0.15*
		Max		-	*6.47*	-	-	*6.07*	*22.42*	*0.61*	*67.4*	-	-	-	*0.396*	-	-	*0.975*	*0.238*	*0.19*	*0.17*
		N		*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	5.83	ND	LOQ	7.10	14.77	0.57	69.6	ND	ND	LOQ	0.421	LOQ	ND	0.849	0.192	0.15	0.15
		18	AGSUN 5270	ND	5.80	LOQ	ND	6.09	16.06	0.54	69.4	ND	ND	LOQ	0.375	LOQ	ND	0.845	0.221	0.15	0.15
		18	P 65 LP 65	ND	5.56	ND	ND	5.87	16.16	0.44	69.9	ND	ND	LOQ	0.382	LOQ	ND	0.866	0.201	0.15	0.14
		18	PAN 7160 CLP	ND	5.63	ND	ND	5.90	17.00	0.47	68.9	ND	ND	LOQ	0.395	LOQ	ND	0.898	0.203	LOQ	0.14
		18	SY 3970 CL	ND	5.15	ND	ND	6.64	15.49	0.43	70.0	ND	ND	LOQ	0.413	LOQ	ND	0.980	0.212	0.14	LOQ
		Min		-	*5.15*	-	-	*5.87*	*14.77*	*0.43*	*68.9*	-	-	-	*0.375*	-	-	*0.845*	*0.192*	*0.14*	*0.14*
		Max		-	*5.83*	-	-	*7.10*	*17.00*	*0.57*	*70.0*	-	-	-	*0.421*	-	-	*0.980*	*0.221*	*0.15*	*0.15*
		N		*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	5.22	ND	LOQ	7.02	15.22	0.46	70.0	ND	ND	LOQ	0.427	LOQ	ND	0.900	0.182	LOQ	LOQ
		18	AGSUN 5270	ND	5.15	ND	ND	6.74	17.51	0.44	68.1	ND	ND	LOQ	0.415	LOQ	ND	0.907	0.200	LOQ	LOQ
		18	P 65 LP 65	ND	5.48	ND	LOQ	5.79	15.91	0.44	70.4	ND	ND	LOQ	0.382	LOQ	ND	0.864	0.192	LOQ	LOQ
		18	PAN 7160 CLP	ND	5.53	ND	ND	6.25	15.78	0.47	69.8	ND	ND	LOQ	0.433	LOQ	ND	0.940	0.195	LOQ	LOQ
		18	SY 3970 CL	ND	4.93	ND	ND	6.93	17.32	0.41	68.2	ND	ND	LOQ	0.439	LOQ	ND	1.02	0.205	LOQ	LOQ
		Min		-	*4.93*	-	-	*5.79*	*15.22*	*0.41*	*68.1*	-	-	-	*0.382*	-	-	*0.864*	*0.182*	-	-
		Max		-	*5.53*	-	-	*7.02*	*17.51*	*0.47*	*70.4*	-	-	-	*0.439*	-	-	*1.02*	*0.205*	-	-
		N		*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
	Min			-	*4.93*	-	-	*4.52*	*14.77*	*0.41*	*63.8*	-	-	-	*0.298*	-	-	*0.748*	*0.182*	*0.14*	*0.14*
	Max			-	*6.47*	-	-	*7.10*	*22.42*	*0.61*	*70.4*	-	-	-	*0.439*	-	-	*1.02*	*0.238*	*0.19*	*0.17*
	N			*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*	*15*
Free State	Senekal	26	AGSUN 5106 CLP	LOQ	6.36	LOQ	ND	4.48	14.98	0.66	71.6	ND	ND	LOQ	0.320	LOQ	ND	0.746	0.247	LOQ	LOQ
		26	AGSUN 5270	LOQ	6.36	LOQ	ND	4.48	14.97	0.66	71.6	ND	0.27	LOQ	0.320	LOQ	ND	0.745	0.247	ND	ND
		26	P 65 LP 65	LOQ	6.81	LOQ	ND	4.25	15.95	0.61	70.5	ND	ND	LOQ	0.312	LOQ	ND	0.774	0.214	LOQ	LOQ
		26	PAN 7160 CLP	LOQ	6.84	ND	ND	4.10	16.07	0.62	70.4	ND	0.23	LOQ	0.314	LOQ	ND	0.791	0.220	ND	ND
		26	SY 3970 CL	LOQ	6.59	LOQ	ND	4.53	14.29	0.67	71.6	ND	0.33	LOQ	0.346	LOQ	ND	0.95	0.251	ND	ND
		Min		-	*6.36*	-	-	*4.10*	*14.29*	*0.61*	*70.4*	-	*0.23*	-	*0.312*	-	-	*0.745*	*0.214*	-	-
		Max		-	*6.84*	-	-	*4.53*	*16.07*	*0.67*	*71.6*	-	*0.33*	-	*0.346*	-	-	*0.95*	*0.251*	-	-
		N		*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
RSA	*Min*			-	*4.93*	-	-	*4.10*	*14.29*	*0.41*	*63.8*	-	*0.23*	-	*0.298*	-	-	*0.745*	*0.182*	*0.14*	*0.14*
	Max			-	*6.84*	-	-	*7.10*	*22.42*	*0.67*	*71.6*	-	*0.33*	-	*0.439*	-	-	*1.02*	*0.251*	*0.19*	*0.17*
	N			*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*

Note:
All fatty acids marked with an asterisk (*) are not SANAS accredited.
Limit of detection (LOD) = 0.06 g/100 g.
Values below the limit of detection are reported as ND (not detected).
Limit of quantitation (LOQ) = 0.14 g/100 g.
Values below the limit of quantitation cannot be accurately quantified.

Table 8: Fatty acid profile results of a selection of cultivar samples from the 2022/23 season

Province	Region	Cultivar	g Fatty acids/100 g Fatty Acids																	
			C14:0	C16:0	C16:1	C17:0	C18:0	C18:1 cis	C18:1 n7	C18:2 cis	C18:3 n6	C18:3 n5	C18:3 n3	C20:0	C20:1	C20.2	C22:0	C24:0	Unknown 1	Unknown 2
North West	18	AGSUN 5106 CLP	LOQ	6.18	LOQ	ND	5.28	18.47	0.61	67.4	ND	ND	LOQ	0.326	LOQ	ND	0.784	0.211	0.18	0.17
			ND	5.83	ND	LOQ	7.10	14.77	0.57	69.6	ND	ND	LOQ	0.421	LOQ	ND	0.849	0.192	0.15	0.15
			ND	5.22	ND	LOQ	7.02	15.22	0.46	70.0	ND	ND	LOQ	0.427	LOQ	ND	0.900	0.182	LOQ	LOQ
Free State	26		LOQ	6.36	LOQ	ND	4.48	14.98	0.66	71.6	ND	ND	LOQ	0.320	LOQ	ND	0.746	0.247	LOQ	LOQ
Min			-	*5.22*	-	-	*4.48*	*14.77*	*0.46*	*67.4*	-	-	-	*0.320*	-	-	*0.746*	*0.182*	*0.15*	*0.15*
Max			-	*6.36*	-	-	*7.10*	*18.47*	*0.66*	*71.6*	-	-	-	*0.427*	-	-	*0.900*	*0.247*	*0.18*	*0.17*
N			*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
North West	18	AGSUN 5270	ND	5.71	ND	ND	4.80	21.72	0.54	65.4	ND	ND	LOQ	0.298	LOQ	ND	0.748	0.215	LOQ	LOQ
			ND	5.80	LOQ	ND	6.09	16.06	0.54	69.4	ND	ND	LOQ	0.375	LOQ	ND	0.845	0.221	0.15	0.15
			ND	5.15	ND	ND	6.74	17.51	0.44	68.1	ND	ND	LOQ	0.415	LOQ	ND	0.907	0.200	LOQ	LOQ
Free State	26		LOQ	6.36	LOQ	ND	4.48	14.97	0.66	71.6	ND	0.27	LOQ	0.320	LOQ	ND	0.745	0.247	ND	ND
Min			-	*5.15*	-	-	*4.48*	*14.97*	*0.44*	*65.4*	-	-	-	*0.298*	-	-	*0.745*	*0.200*	-	-
Max			-	*6.36*	-	-	*6.74*	*21.72*	*0.66*	*71.6*	-	*0.27*	-	*0.415*	-	-	*0.907*	*0.247*	*0.15*	*0.15*
N			*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
North West	18	AGSUN 5270	LOQ	6.47	ND	ND	4.52	20.36	0.55	66.0	ND	ND	LOQ	0.329	LOQ	ND	0.841	0.217	0.15	0.15
			ND	5.56	ND	ND	5.87	16.16	0.44	69.9	ND	ND	LOQ	0.382	LOQ	ND	0.866	0.201	0.15	0.14
			ND	5.48	ND	LOQ	5.79	15.91	0.44	70.4	ND	ND	LOQ	0.382	LOQ	ND	0.864	0.192	LOQ	LOQ
Free State	26		LOQ	6.81	LOQ	ND	4.25	15.95	0.61	70.5	ND	ND	LOQ	0.312	LOQ	ND	0.774	0.214	LOQ	LOQ
Min			-	*5.48*	-	-	*4.25*	*15.91*	*0.44*	*66.0*	-	-	-	*0.312*	-	-	*0.774*	*0.192*	*0.15*	*0.14*
Max			-	*6.81*	-	-	*5.87*	*20.36*	*0.61*	*70.5*	-	-	-	*0.382*	-	-	*0.866*	*0.217*	*0.15*	*0.15*
N			*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
North West	18	AGSUN 5270	ND	5.66	ND	ND	5.49	22.42	0.45	63.8	ND	ND	LOQ	0.396	LOQ	ND	0.939	0.226	LOQ	LOQ
			ND	5.63	ND	ND	5.90	17.00	0.47	68.9	ND	ND	LOQ	0.395	LOQ	ND	0.898	0.203	LOQ	0.14
			ND	5.53	ND	ND	6.25	15.78	0.47	69.8	ND	ND	LOQ	0.433	LOQ	ND	0.940	0.195	LOQ	LOQ
Free State	26		LOQ	6.84	ND	ND	4.10	16.07	0.62	70.4	ND	0.23	LOQ	0.314	LOQ	ND	0.791	0.220	ND	ND
Min			-	*5.53*	-	-	*4.10*	*15.78*	*0.45*	*63.8*	-	-	-	*0.314*	-	-	*0.791*	*0.195*	-	-
Max			-	*6.84*	-	-	*6.25*	*22.42*	*0.62*	*70.4*	-	*0.23*	-	*0.433*	-	-	*0.940*	*0.226*	-	*0.14*
N			*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
North West	18	AGSUN 5270	ND	5.43	ND	ND	6.07	21.47	0.45	64.3	ND	ND	LOQ	0.391	LOQ	ND	0.975	0.238	0.19	0.17
			ND	5.15	ND	ND	6.64	15.49	0.43	70.0	ND	ND	LOQ	0.413	LOQ	ND	0.980	0.212	0.14	LOQ
			ND	4.93	ND	ND	6.93	17.32	0.41	68.2	ND	ND	LOQ	0.439	LOQ	ND	1.02	0.205	LOQ	LOQ
Free State	26		LOQ	6.59	LOQ	ND	4.53	14.29	0.67	71.6	ND	0.33	LOQ	0.346	LOQ	ND	0.95	0.251	ND	ND
Min			-	*4.93*	-	-	*4.53*	*14.29*	*0.41*	*64.3*	-	-	-	*0.346*	-	-	*0.95*	*0.205*	*0.14*	-
Max			-	*6.59*	-	-	*6.93*	*21.47*	*0.67*	*71.6*	-	*0.33*	-	*0.439*	-	-	*1.02*	*0.251*	*0.19*	*0.17*
N			*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*4*
RSA	*Min*		-	*4.93*	-	-	*4.10*	*14.29*	*0.41*	*63.8*	-	-	-	*0.298*	-	-	*0.745*	*0.182*	*0.14*	*0.14*
	Max		-	*6.84*	-	-	*7.10*	*22.42*	*0.67*	*71.6*	-	*0.33*	-	*0.439*	-	-	*1.02*	*0.251*	*0.19*	*0.17*
	N		*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*

Note:
All fatty acids marked with an asterisk (*) are not SANAS accredited.
Limit of detection (LOD) = 0.06 g/100 g.
Values below the limit of detection are reported as ND (not detected).
Limit of quantitation (LOQ) = 0.14 g/100 g.
Values below the limit of quantitation cannot be accurately quantified.

Methods

SAMPLING PROCEDURE:

A working group determined the procedure to be followed to ensure that the crop quality samples submitted to the SAGL by the various grain storage companies, 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, 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, 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 7971-3:2019, 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 nutritional 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

Crude fibre is the loss on ignition of the dried residue remaining after digestion of a sample with 1.25% Sulphuric acid (H_2SO_4) and 1.25% Sodium hydroxide (NaOH) solutions under specific conditions.

In-House method 031 was used for the determination of the crude fibre in the samples. This method is based on AACCI method 32-10.01 using the Velp FIWE Advance fibre AutoExtractor.

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.

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 Laboratories 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 A de Jager (Nutrients & Contaminants Methods)
Ms W Louw (In-house Methods 001, 002, 003, 010 & 026)
Ms D Moleke (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 T de Beer (Rheological Methods)

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Issue No.: 32
Date of Issue: 19 November 2021
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)

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: 2022/2023 season

ARC-Grain Crops Institute in collaboration with the following seed companies: Agricol, Pannar, Pioneer, Syngenta, and Limagrain Zaad South Africa.

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INTRODUCTION

Optimisation of crop production requires, among several 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 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 2022/2023 season with the voluntary collaboration of Agricol, Cortiva (Pannar, Pioneer), Syngenta and Limagrain Zaad South Africa . Seed companies entered 20 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. Seed from cultivars were packed according to trial plans and send to co-operators before the onset of the growing season.

Eleven of the 20 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®.

Each collaborating seed company had to conduct at least one trial for each cultivar entry. Agricol was supplied with seed for 17 trials, Cortiva (Pannar & Pioneer) with 11 trials, Syngenta with one and Limagrain Zaad SA with three. 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.

One trial of Cortiva not planted due to heavy rainfall at that site and one trial was not

harvested due to bad trial quality. One trial of Cortiva and one of Limagrain Zaad was not statistically successful and were not included in the results. Four trials of Agricol were cancelled due to water logging and bad germination and one trial of Syngenta was not harvested due to bad trials quality. 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 five trials at Potchefstroom and two trials at Boskop with different planting dates. One trial at Cornelia, Hoopstad, Krondal, Lichtenburg, Makwassie, Marquard, Reita, Senkal and Wolmarnstad.

Yield data and seed samples were sent by collaborators to ARC-GC for analyses. Seed from selected trials sent to SAGL for oil and protein content analyses. Yield data from 27 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 27 trials.
Yield probabilities were also calculated for 15 cultivars that were evaluated in 44 trials during 2021/2022 and 2022/2023.

RESULTS

Days from planting to flowering

The mean number of days from planting to 50% flowering of cultivars (Table 3) ranged from 67 days for LG 50745, to 73 days AGSUN 5111 CLP Calculated across cultivars and planting dates, the average period from planting to flowering was 71 days. The longest days to flowering 82 days recorded at Potchefstroom planted on 21 January 2023.

Oil and protein concentration

Oil and protein concentrations of seed from eight trial localities, as analyzed by the Southern African Grain Laboratory NPC, are shown in Tables 4 and 5 respectively. The oil analyses were done with a Soxhlet apparatus while the protein analyses were done according to the Dumas method.

The oil content on “as is“ basis for cultivars at the various localities varied from 39.04% to 48.44% with an overall mean of 41.90%. The highest mean oil concentration among localities was at Potchefstroom (planting date on 31 October 2022) with 44.29%. The locality with the lowest mean oil content of 39.12% was Boskop 3 planting date was 20 January 2023. The highest oil concentration among cultivars calculated across localities, was SY 3970 CL at 48.44% followed by LG 710 at 46.18%.70% of the tested hybrids have more than 40% oil content.

The average protein content varied from 13.24 to 16.24% among cultivars at the different localities. Among localities, Boskop 3 planting date was 20 January 2023, had the highest and Potchefstroom planted in 31 October 2022 the lowest protein content of 19.99 and 11.61 % respectively. Calculated across localities, LG 5710 had the highest protein content (16. 24 %) followed by AGSUN 5108 CLP
(15.81) while PAN7 090 the lowest (13.24%).

Seed yield

The mean seed yield of cultivars at the respective localities is presented in Table 6. The highest locality mean yield of 3.57 t ha^{-1} was obtained at Boskop 3, planted on 20 of January 2023 and the lowest of 1.11 t ha^{-1}, at Kroonstad planted on 7th of February 2023. The five best performing cultivars, in terms of average yield calculated over localities, were PAN 7080, PAN 7180 CLP, AGSUN 5270, P 65 LP 65 and PAN 7090. The overall mean yield for 2022/23 was 2.23 t ha^{-1}, 1.36 % higher than the mean yield of the last year.
Elven Clearfield and Clearfield Plus cultivars AGSUN 5103 CLP, AGSUN 5106 CLP, AGSUN 5108 CLP, AGSUN 5110, CLP AGSUN 5111 CLP, P 65 LP 54, P 65 LP 65, PAN 7102 CLP, PAN 7160 CLP, PAN 7180 CLP, and SY 3970 CL were entered. Seven of these cultivars namely PAN 7180 CLP, P 65 LP 65, PAN 7102 CLP, P 65 LP 54, AGSUN 5111 CLP, AGSUN 5106 CLP and PAN 7160 CLP have yields even or 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 is resented in

Table 8. The oil yield for cultivars at the eight localities varied from 0.88 to 1.11 t ha^{-1} with an overall mean of 1.02 t ha^{-1}. The locality with the highest mean oil yield was Boskop 3 planted in 20 January 2023 at 1.39 t ha^{-1}. P 65 LL 46 has the highest oil yield of 1.11 t ha^{-1} followed by P 65 LL 02 with 1.10 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 8. 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 (R^2 - 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 2022/2023 are shown in Figure 1 and for the 15 cultivars evaluated in 2020/2021 and 2022/2023 in Figure 2.
The yield stability of cultivars varied up to 21-fold among cultivars (Table 9). Cultivars which had exceptionally high stabilities (R-parameter =1) were, AGSUN 58251, P 65 LP 65 and PAN 7160 CLP

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 20 cultivars for 2022/2023 are shown in Table 10. 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 10 indicates which cultivars would be sensible choices at the various yield potentials
The yield probabilities of 15 cultivars evaluated in 44 trials in 2021/2022 and 2022/2023, and yield probabilities for the 15 cultivars evaluated in 63 trials are shown in Tables 11 and

12 respectively. Tables 10, 11 and 12 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 and Limagrain Zaad SA, gratefully acknowledged.

References

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

SOUTH AFRICAN SCLEROTINIA RESEARCH NETWORK: CULTIVAR EVALUATIONS 2022/2023

Project charter

Project title	*Evaluations of South African soybean and sunflower cultivars to escape sclerotinia stem and head rot.*
Principal investigator	Lisa Ann Rothmann
Industry Partner	Dr. Derick van Staden (industry partner, MP) Mr. Koos Strydom (producer, FS) Agricultural Research Council – Grain Crops Seed companies
Collaborating institution(s)	University of the Free State
Students and postdoctoral fellows	None
Technicians	None
High-level strategic issue	*Crop Protection*
Beneficiaries	Oilseed producers

SUNFLOWER CULTIVAR EVALUATIONS AGAINST SCLEROTINIA SCLEROTIORUM

In Clocolan (FS) under natural disease pressure 14.3% and 3.4% mean sclerotinia prevalence were observed at planting date one and planting date two, respectively. In Delmas (MP) under artificial disease pressure, 12.5% and 18.6% mean sclerotinia prevalence were observed at planting date one and planting date two, respectively. Head and stem rot were not observed in the third planting at Clocolan or Delmas. Although, no significant differences were reported, categorisations of cultivars according to a head rot prevalence was performed using thresholds, greater than 40% were considered least tolerant, 39-11% moderately tolerate and <10% greatest tolerance of *Sclerotinia sclerotiorum.*

PAN 7100 greatest mean prevalence in Clocolan at the first planting date (~40.8%), however, it had a moderate response to head rot, 5.6% mean head rot prevalence, in the second planting date where the disease pressure was lower. In the second planting date, AGSUN 5106 CLP had the highest mean prevalence, 13.7%, and in the first planting date a moderate response of 8.1% mean head rot was observed. Three cultivars which had no head rot observed in the second planting had lower mean head rot prevalence in planting one, these have been indicated in bold (Table 11).

Under inoculated field conditions similar ranges of mean head rot were observed in Delmas, across both planting dates, 24.5 to 2.1% and 27.8 to 5.2%, respectively. Distinguishing cultivars is more complex under inoculated trials, however, PAN7160 CLP responded with consistently lower mean

head rot prevalence than other cultivars in Delmas, indicated by bold text (Table 12).

Table 8 ANOVA for screening 26 sunflower cultivars in Delmas (MP) under field conditions, planted on 13 December 2023, under natural conditions to tolerance of *Sclerotinia sclerotiorum.*

Sunflower | Delmas | Planting 1 (α = 0.01)

Factor	df	ss	ms	F-value	Pr (>F)
Block	2	785.9	393.0	5.71	0.0678
Cultivar	19	2131.3	112.2	1.63	0.09828
Residual	38	2614.3	68.8		

Table 9 ANOVA for screening 26 sunflower cultivars in Delmas MP) under field conditions, planted on 21 December 2022, under natural conditions to tolerance of *Sclerotinia sclerotiorum.*

Sunflower | Delmas | Planting 2 (α = 0.05)

Factor	df	ss	Ms	F-value	Pr (>F)
Block	2	431	215.3	1.683	0.199
Cultivar	19	2369	124.7	0.975	0.508
Residual	38	4862	127.9		

Table 10 ANOVA for screening 20 sunflower cultivars in Clocolan (FS) under field conditions, planted on 8 December 2022, under natural conditions to tolerance of *Sclerotinia sclerotiorum.*

Sunflower | Clocolan | Planting 1 (α = 0.01)

Factor	df	ss	ms	F-value	Pr (>F)
Block	2	9	4.26	0.027	0.9731
Cultivar	19	5208	274.09	1.756	0.0689
Residual	38	5932	156.1		

Table 10 ANOVA for screening 20 sunflower cultivars in Cloclan (FS) under field conditions, planted on 22 December 2022, under natural conditions to tolerance of *Sclerotinia sclerotiorum.*

Sunflower | Clocolan | Planting 2 (α = 0.01)

Factor	df	Ss	ms	F-value	Pr (>F)
Block	2	136.1	68.03	2.25	0.119
Cultivar	19	783.8	41.25	1.364	0.203
Residual	38	1148.9	30.24		

Table 11. Mean head rot response on cultivars planted in Clocolan (FS) under natural field conditions.

Planting 1		Planting 2	
Cultivar	**Mean Head Rot Prevalence (%)**	**Cultivar**	**Mean Head Rot Prevalence (%)**
PAN 7100	40.8	AGSUN 5106 CLP	13.7
PAN 7090	28.7	PAN 7090	9.5
P 65 LL 46	26.0	AGSUN 5108 CLP	8.8
AGSUN 5108 CLP	22.3	PAN 7100	5.6
AGSUN 5103 CLP	19.7	AGSUN 5270	5.3
P 65 LP 54	18.0	AGUARA 6	4.5
AGSUN 5270	16.8	AGSUN 5103 CLP	3.9
P 65 LL 02	14.6	PAN 7180 CLP	3.5
PAN 7080	13.8	LG 5710	2.2
PAN 7160 CLP	12.7	P 65 LP 65	2.2
AGSUN 5110 CLP	11.9	AGSUN 5111 CLP	2.1
LG 50745	11.1	LG 50745	2.1
LG 5710	8.3	P 65 LP 54	2.0
AGSUN 5106 CLP	8.1	PAN 7080	1.9
AGUARA 6	7.8	AGSUN 5110 CLP	0.0
SY 3970 CL	**6.8**	P 65 LL 02	0.0
PAN 7180 CLP	6.5	P 65 LL 46	0.0
AGSUN 5111 CLP	**5.7**	PAN 7102 CLP	0.0
PAN 7102 CLP	**4.8**	PAN 7160 CLP	0.0
P 65 LP 65	1.7	SY 3970 CL	0.0

Table 12. Mean head rot response on cultivars planted in Delmas (MP) under inoculated field conditions.

Planting 1	
Cultivar	**Mean Head Rot Prevalence (%)**
P 65 LL 46	24.5
AGUARA 6	20.1
AGSUN 5270	19.6
P 65 LL 02	17.3
PAN 7100	17.2
SY 3970 CL	15.5
P 65 LP 54	15.3
AGSUN 5110 CLP	14.9
PAN 7180 CLP	14.4
LG 5710	13.7
AGSUN 5106 CLP	11.2
PAN 7090	10.9
LG 50745	10.7
P 65 LP 65	10.5
PAN 7080	8.0
AGSUN 5103 CLP	6.5
PAN 7102 CLP	6.5
AGSUN 5111 CLP	3.3
AGSUN 5108 CLP	3.0
PAN 7160 CLP	**2.1**

Planting 2	
Cultivar	**Mean Head Rot Prevalence (%)**
P 65 LP 54	27.8
AGSUN 5270	25.9
AGSUN 5110 CLP	24.5
PAN 7160 CLP	23.7
SY 3970 CL	23.1
P 65 LL 02	21.7
AGSUN 5108 CLP	20.6
PAN 7080	19.8
AGSUN 5103 CLP	17.5
AGUARA 6	16.9
PAN 7180 CLP	15.2
P 65 LP 65	15.1
LG 5710	14.2
P 65 LL 46	12.7
AGSUN 5111 CLP	12.4
LG 50745	12.1
PAN 7090	11.8
PAN 7102 CLP	**9.8**
AGSUN 5106 CLP	6.3
PAN 7100	5.2

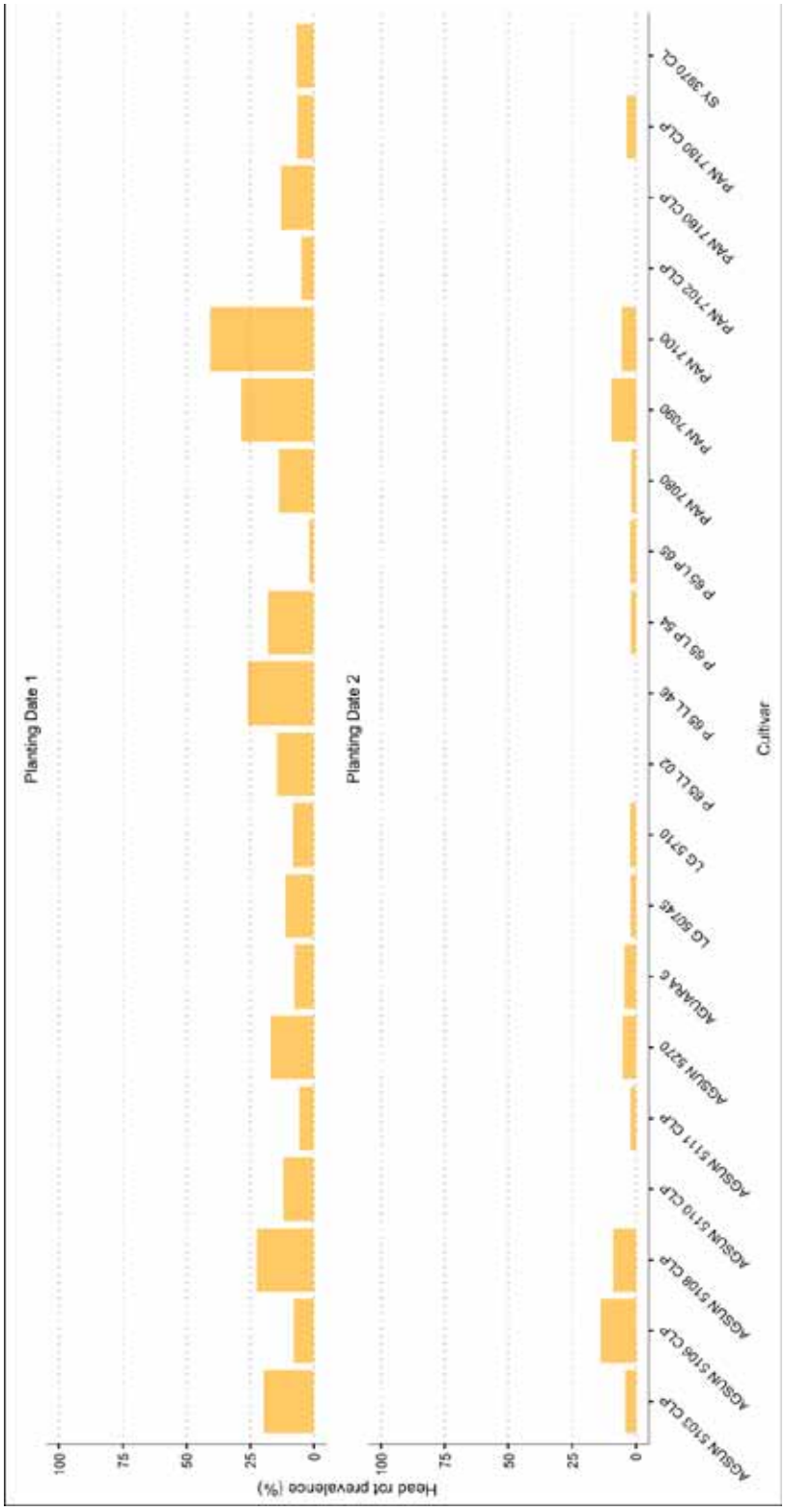


Figure 4. Mean head rot prevalence of sunflower cultivars screened against *Sclerotinia sclerotiorum* under natural conditions in Clocolan (FS) for the first and second planting on the 8 and 22 December 2022.

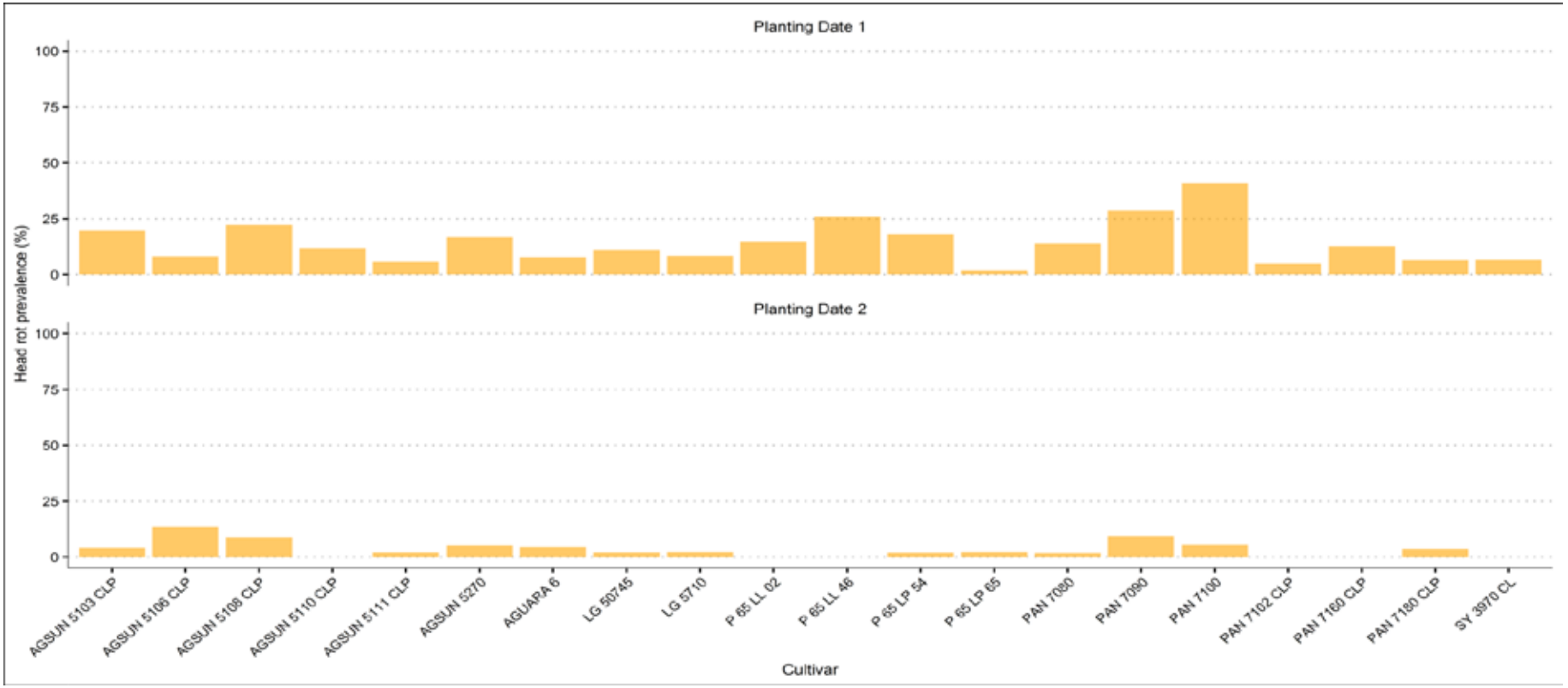


Figure 5. Mean head rot prevalence of sunflower cultivars screened against *Sclerotinia sclerotiorum* under inoculated field conditions in Delmas (MP) for the first and second planting on 13 and 21 December 2022.

Table 1: Collaborating company, trial localities and responsible co-workers 2022/2023

Company	Localities	Planting dates	Co-workers	E-mail address of co-worker
Agricol	Boskop2	17/11/2022	Joubert Swanepoel ()	JSwanepoel@agricol.co.za
	Boskop1	06/01/2023		
	Boskop3	23/01/2023		
	Koster	03/12/2022		
	Lichtenburg	01/12/2022		
	Wolmaranstad	22/12/2022		
	Carnelia	01/01/2023		
	Hoopstad	30/01/2023		
	Reitz	04/11/2022		
	Kroonstad	07/02/2023		
	Ventersdorp	06/12/2022		
	Marquard	06/12/2022		
	Senekal	21/12/2022		
	Makwassie	22/12/2022		
	Marquard	28/01/2023		
	Kroondal	05/01/2022		
	Klipdrif	09/12/2022		
ARC-GCI	Potchefstroom	31/10/2022	William Makgoga & Jan Erasmus	Makgogamw@arc.agric.za Erasmusj@arc.agric.za
		21/11/2022		
		21/12/2022		
		12/01/2023		
		31/01/2023		
Corteva	Delmas	18/11/2022	Abre Pretorius, Phillip Fourie & Louis Schoonraad	abre.pretorius@pannar.co.za phillip.fourie@pioneer.com louis.schoonraad@corteva.com
	Senekal	23/12/2022		
	Kroonstad	08/12/2022		
	Marquard	Not planted		
	Henneman	28/12/2021		
	Gerdau	Not harvested		
	Coligny 2	01/12/2022		
	Lichtenburg	06/01/2023		
Corteva	Putfontein	09/12/2022		
	Gerdau-Oos	07/12/2022		
	Gerdau -Wes	22/12/2022		
Lima Grain	Lichtenburg	06/01/2022	Anita Janeke	anita.janeke@limagrain.com
	Wesselsbron	02/12/2021		
	Dwaalboom/Settlers	05/12/2022		
	Wesselsbron	16/11/2022		
	Wolmaranstad	08/12/2022		
Syngenta	Kroonstad	05/01/2023	PieterTaljaard	Pieter.Taljaard@syngenta.com

Table 2: Trial successful site information 2022/2023 season

				Topsoil analysis (mg kg-1)								
Locality	**Planting date**	**Plant Population**	**Soil Classification**	**pH (KCL)**	**P**	**K**	**Ca**	**Mg**	**Fertiliser applied (Kg ha-1)**	**Row width (cm)**	**Weed control and insecticides**	**Net plot size (m2)**
Boskop 1	17/11/2022	40 000	-					-	-	0.91		11.83
Boskop 3	23/01/2023	40 000	-	-	-	-	-	-	-	0.91		11.83
Koster	2021/01/12	40 000	-	-	-	-	-	-	-	1.13		14.69
Lichtenburg	01/12/2022	40 000	-	-	-	-	-	-	-	0.91		11.83
Wolmaranstad	22/12/2022	40 000	-	-	-	-	-	-	-	0.91		11.83
Carnelia	01/01/2023	40 000	-	-	-	-	-	-	-	0.91		11.83
Hoopstad	30/01/2023	40 000	-	-	-	-	-	-	-	0.91		11.83
Reitz	04/11/2022	40 000	-	-	-	-	-	-	-	0.91		11.83
Kroonstad	07/02/2023	40 000	-	-	-	-	-	-	-	0.91		11.83
Senekal	21/12/2022	40 000	-	-	-	-	-	-	-	0.91		11.83
Makwassie	22/12/2022	40 000	-	-	-	-	-	-	-	0.91		11.83
Marquard	28/01/2023	40 000	-	-	-	-	-	-	-	0.91		11.83
Kroondal	05/01/2022	40 000	-	-	-	-	-	-	-	0.91		11.83
Potchefstroom	31/10/2022	38 000	Westleigh	6,91	49	345	1150	560	N:73,P:8.3, K:4.1	0.90	Metagen Gold and Mechanical weeding	12.60
Potchefstroom	21/11/2022	38 000	Clovelly	6,47	39	373	1050	513	N:74,P:8.3, K:4.1	0.90	Metagen Gold and Mechanical weeding	12.60
Potchefstroom	21/12/2022	38 000	Westleigh	6,47	39	373	1050	513	N:76,P:8.3, K:4.1	0.90	Metagen Gold and Mechanical weeding	12.60
Potchefstroom	12/01/2023	38 000	Clovelly	6,47	39	373	1050	513	N:76,P:8.3. K:4.1	0.90	Metagen Gold and Mechanical weeding	12.60
Potchefstroom	31/01/2023	38 000	Clovelly	6,58	54	255	1060	608	N:76,P:8.3, K:4.1	0.90	Metagen Gold and Mechanical weeding	12.60
Lichtenburg	05/12/2022	48 000	-	-	-	-	-	-	-4:2:1 (37) Zn; 220kg/ha	0.91	-	9.0
Wesselsbron	06/11/2022	48.000							15:10:6 (31) + 9%S; 220kg/ha	0.91		9.0
Delmas	18/11/2022	40 000										10.8
Senekal	23/12/2022	40 000										17.1
Kroonstad	08/12/2022	40 000										17.1
Coligny	01/12/2022	40 000										18.0
Gerdau-Oos	07/12/2022	40 000										18.0
Lichtenburg	06/01/2023	40 000										18.0
Putfontein	09/12/2022	40 000										18.0
Gerdau -Wes	22/12/2022	40 000										18.0

Table 3: Number of days from planting to 50 percent flowering of cultivars at selected localities and planting dates 2022/2023

Cultivar Name	Boskop1 2022-11-17	Boskop3 2023-01-20	Cornelia 2023-01-10	Hoopstad 2023-01-30	Kroondal 2023-01-05	Lichtenburg 2022-12-01	Makwassie 2022-12-22	Marquard2 2023-01-23	Potch 2223-10-31	Potch 2223-11-21	Potch 2223-12-21	Potch 2223-01-12	Potch 2223-01-21	Reitz 2022-11-04	Senkal 2022-12-21	Wolmarnstad 2022-12-	Mean
AGSUN 5103 CLP	69	71	72	73	65	66	66	74	71	67	70	79	84	74	66	71	71
AGSUN 5106 CLP	69	72	72	72	65	66	67	73	71	68	73	79	80	70	67	71	71
AGSUN 5108 CLP	65	71	70	71	63	64	65	74	70	63	68	78	79	69	63	68	69
AGSUN 5110 CLP	67	73	71	71	64	66	65	74	73	64	69	79	80	70	64	67	70
AGSUN 5111 CLP	70	74	75	74	67	70	68	75	70	67	72	80	87	75	67	72	73
AGSUN 5270	65	67	70	69	62	66	64	71	70	65	71	81	80	72	64	68	69
Aguara6	69	73	76	72	66	69	69	74	70	67	75	81	85	74	67	69	72
LG 50745	63	67	68	69	61	64	65	69	71	65	68	77	76	67	63	66	67
LG 5710	66	68	74	72	62	65	64	70	70	63	68	72	76	68	66	67	68
P 65 LL 02	70	69	74	73	65	66	67	71	71	67	71	78	79	72	66	72	71
P 65 LL 46	66	70	73	71	65	65	69	73	70	63	68	76	77	70	64	64	69
P 65 LP 54	66	71	70	72	64	67	68	74	72	64	72	82	84	74	68	70	71
P 65 LP 65	65	73	75	73	66	70	69	75	70	68	71	81	87	76	65	72	72
PAN 7080	69	74	73	71	66	68	66	73	71	67	72	80	87	75	66	69	72
PAN 7090	66	70	75	74	66	69	69	74	72	61	72	83	80	75	66	71	71
PAN 7100	65	69	74	71	65	67	66	71	70	67	73	83	78	76	64	70	71
PAN 7102 CLP	63	70	68	72	63	65	65	70	70	64	70	81	85	74	68	68	70
PAN 7160 CLP	66	72	70	70	65	70	69	75	70	68	73	81	85	74	67	70	72
PAN 7180CLP	69	74	71	73	66	69	67	74	71	67	73	78	87	74	67	71	72
SY 39 70 CL	69	71	71	72	66	67	69	73	72	67	73	75	74	74	65	68	70
Mean	67	71	72	72	65	67	67	73	71	66	71	79	82	73	66	69	71

Table 4: The “as is” seed oil concentration (%) of cultivars at selected localities 2022/2023

CULTIVAR	BOSKOP3 2023/01/20	Potch1 2022/10/31	Potch3 2022/12/21	Potch4 2023/01/12 2023	Potch5 2023/01/21	MAKWASSIE 2022/12/22	KOSTER 2022/12/03	Senekal 2022/12/21	Mean
AGSUN 5103 CLP	36.15	41.19	40.08	37.60	40.28	41.62	42.19	39.04	39.77
AGSUN 5106 CLP	35.81	41.48	42.94	37.08	41.90	41.15	42.62	39.36	40.29
AGSUN 5108 CLP	37.71	41.25	41.06	35.96	40.40	37.75	41.34	39.65	39.39
AGSUN 5110 CLP	36.58	44.03	42.72	37.69	41.19	42.15	40.44	37.50	40.29
AGSUN 5111 CLP	34.78	39.55	41.87	37.08	35.93	40.69	41.77	40.63	39.04
AGSUN 5270	39.28	47.14	45.27	42.70	42.94	42.19	43.56	40.00	42.88
Aguara6	43.52	47.96	44.13	41.58	42.25	45.17	44.13	44.55	44.16
LG 50745	40.32	46.37	44.84	43.51	44.70	44.03	43.98	42.85	43.82
LG 5710	44.56	51.58	49.42	41.97	44.56	46.36	46.74	44.23	46.18
P 65 LL 02	43.04	45.41	41.01	47.04	45.13	42.60	44.89	43.61	44.09
P 65 LL 46	43.05	48.43	45.36	42.39	45.79	45.69	38.85	41.46	43.88
P 65 LP 54	36.45	39.56	40.21	38.10	39.41	37.57	42.95	39.37	39.20
P 65 LP 65	38.95	41.32	41.62	39.28	37.76	42.71	42.19	43.27	40.89
PAN 7080	36.97	43.61	41.53	37.65	40.93	41.86	42.72	38.52	40.47
PAN 7090	38.11	44.84	43.04	40.51	42.71	42.81	44.32	42.01	42.29
PAN 7100	41.10	44.21	44.41	40.25	40.78	44.37	43.52	40.93	42.45
PAN 7102 CLP	35.53	43.11	39.15	38.56	40.54	41.38	39.96	37.98	39.53
PAN 7160 CLP	39.64	43.24	38.85	41.81	39.69	43.89	41.86	43.21	41.52
PAN 7180CLP	36.28	40.62	36.30	40.97	37.00	41.36	40.64	42.04	39.40
SY 39 70 CL	44.65	50.88	50.73	46.22	48.81	50.76	47.55	47.95	48.44
Mean	39.12	44.29	42.73	40.40	41.63	42.81	42.81	41.41	41.90

Table 5: The “as is” seed protein concentration (%) of cultivars at selected localities 2022/2023

CULTIVAR	BOSKOP3 2023/01/20	Potch1 2022/10/31	Potch3 2022/12/21	Potch4 2023/01/12 2023	Potch5 2023/01/21	MAKWASSIE 2022/12/22	KOSTER 2022/12/03	Senekal 2022/12/21	Mean
AGSUN 5103 CLP	19.98	11.36	15.54	18.04	15.10	12.57	13.42	14.23	15.03
AGSUN 5106 CLP	20.46	11.24	13.19	17.21	15.05	12.96	13.60	14.37	14.76
AGSUN 5108 CLP	20.28	12.38	14.41	19.92	15.04	15.73	13.54	15.21	15.81
AGSUN 5110 CLP	20.60	11.80	14.48	18.31	13.80	12.61	12.78	13.99	14.80
AGSUN 5111 CLP	21.16	11.89	14.25	18.02	15.46	11.46	11.34	11.63	14.40
AGSUN 5270	20.85	11.07	12.91	15.38	14.75	14.06	12.64	12.06	14.21
Aguara6	18.73	11.53	14.81	15.06	13.57	11.45	12.30	11.07	13.56
LG 50745	18.85	11.78	14.08	16.09	14.85	12.88	14.78	13.52	14.60
LG 5710	20.43	12.25	14.44	20.71	16.64	14.00	17.55	13.91	16.24
P 65 LL 02	19.15	11.77	18.41	13.25	11.50	12.42	15.08	11.81	14.18
P 65 LL 46	19.64	12.76	12.77	17.94	14.56	12.58	13.29	11.59	14.39
P 65 LP 54	19.76	12.24	13.99	16.22	13.89	11.33	15.48	11.55	14.31
P 65 LP 65	20.56	11.40	13.20	16.20	14.78	11.55	12.00	10.86	13.82
PAN 7080	18.86	10.80	12.50	15.93	13.84	10.95	12.80	11.23	13.36
PAN 7090	19.28	10.54	13.51	15.16	12.92	11.54	12.48	10.48	13.24
PAN 7100	19.10	11.46	13.85	16.58	13.10	11.74	11.57	11.27	13.58
PAN 7102 CLP	20.22	10.58	12.48	17.35	13.35	11.58	13.42	11.59	13.82
PAN 7160 CLP	20.67	11.23	15.39	16.73	13.06	11.09	12.53	10.54	13.91
PAN 7180CLP	20.59	12.76	15.64	16.08	12.25	12.98	12.60	11.65	14.32
SY 39 70 CL	20.54	11.36	15.24	18.25	14.90	12.46	12.44	11.66	14.61
Mean	19.99	11.61	14.25	16.92	14.12	12.40	13.28	12.21	14.35

Table 6: Mean seed yield (t ha^{-1}) of cultivars at each locality 2022/2023

Cultivar\ Locality	Boskop1 2022-11-17	Boskop3 2023-01-20	Coligny 2022-12-01	Cornelia 2023-01-10	Delmas 2022-11-18	Gerdau-Oos 2022-12-07	Gerdau-Wes 2022-12-22	Hoopstad 2023-01-30	Koster 2022-12-03	Kroondal 2023-01-05	Kroonstad 2023-02-07	Lichtenburg 2022-12-01	Lichtenburg 2022-12-05	Lichtenburg 2023-01-06	Makwassie 2022-12-22	Marquard2 2023-01-23	Potch 2223-10-31	Potch 2223-11-21	Potch 2223-12-21	Potch 2223-01-12	Potch 2223-01-21	Putfontein 2022-12-09	Reitz 2022-11-04	Senkal 2022-12-12	Senekal 2022-12-23	wesselsbron 2022-11-16	Wolmarnstad 2022-12-22	Average
AGSUN5103CLP	2.93	3.57	2.26	1.63	1.93	2.48	2.56	3.23	2.52	1.63	0.98	3.39	2.10	1.95	2.15	2.70	2.86	2.56	1.78	1.80	1.27	0.94	2.90	2.39	1.57	1.28	1.24	2.17
AGSUN5106CLP	2.53	3.79	2.28	1.71	2.33	3.17	2.40	3.44	2.57	1.52	1.37	3.51	2.07	1.89	2.60	2.57	2.82	2.50	1.89	1.81	1.69	1.22	2.35	2.38	2.10	1.45	1.19	2.26
AGSUN5108CLP	2.92	3.61	2.40	1.80	2.47	1.86	2.67	2.89	2.37	1.45	1.38	3.24	1.75	1.90	2.66	2.34	2.63	2.67	1.83	1.57	1.63	0.89	2.74	2.25	1.85	1.47	1.31	2.17
AGSUN5110CLP	2.18	3.42	2.27	1.57	2.79	2.43	3.04	2.89	2.39	1.34	1.12	2.97	1.64	1.73	2.17	2.13	2.56	2.64	2.17	1.69	1.84	0.86	1.90	2.25	1.65	1.68	1.15	2.09
AGSUN5111CLP	3.46	3.68	2.08	2.02	1.92	2.34	2.30	2.91	2.77	1.32	1.11	3.52	2.22	2.21	3.19	2.59	2.85	2.76	1.99	1.69	1.89	1.16	2.51	2.33	1.87	1.03	1.53	2.27
AGSUN5270	2.72	3.71	2.56	2.08	2.94	2.86	2.55	3.32	2.19	1.47	1.22	3.63	1.90	1.56	2.83	2.27	3.07	2.57	2.23	1.84	2.25	1.52	2.49	2.56	2.03	1.56	1.51	2.35
Aguara6	1.96	2.75	2.16	1.32	2.78	2.70	2.17	2.32	2.19	1.08	0.98	2.80	1.89	2.39	1.17	2.05	2.22	2.81	2.14	1.62	1.63	0.97	2.39	2.19	1.68	1.55	1.22	1.97
LG50745	3.17	3.42	2.45	1.40	2.39	1.53	2.48	2.75	2.27	1.28	1.20	3.10	2.42	1.99	2.46	2.06	2.90	3.23	2.01	1.62	2.03	1.14	1.99	2.38	1.73	2.19	0.97	2.17
LG5710	2.46	3.31	2.20	1.53	2.09	2.50	2.01	2.74	2.13	1.24	1.15	3.03	1.90	2.24	2.02	2.03	3.31	3.27	2.11	1.62	2.02	0.90	1.63	2.00	2.05	1.28	1.11	2.07
P65LL02	2.52	3.75	2.14	1.93	2.76	2.63	2.36	3.44	2.19	1.31	1.46	3.18	1.65	2.00	2.23	2.79	3.32	2.72	2.02	1.95	2.23	1.46	2.27	2.37	2.14	1.70	1.13	2.28
P65LL46	2.40	3.55	2.41	1.69	2.29	1.94	3.08	2.77	2.44	1.43	1.18	3.59	1.71	2.46	2.87	2.26	3.22	2.93	2.42	1.56	1.94	1.42	1.61	2.10	2.38	1.69	1.17	2.24
P65LP54	2.44	3.80	2.49	2.05	2.50	2.79	2.35	2.51	2.24	1.46	0.94	3.29	2.17	1.38	2.94	2.58	3.00	3.04	1.97	2.13	1.96	1.28	2.73	2.42	2.04	1.82	1.17	2.28
P65LP65	1.99	3.66	2.61	1.48	2.41	2.87	2.98	3.21	2.41	1.38	1.06	3.34	2.28	2.21	2.60	2.14	3.15	2.70	1.94	1.78	2.12	1.50	2.55	2.54	2.12	2.34	1.32	2.32
PAN7080	2.27	3.76	2.22	1.75	2.68	2.63	2.81	3.62	2.40	1.44	0.91	3.35	2.35	2.67	2.87	2.32	2.91	3.07	2.24	1.93	1.88	1.84	2.71	2.32	1.92	2.31	1.36	2.39
PAN7090	2.76	3.88	2.51	1.56	1.80	2.53	2.66	3.42	2.40	1.48	1.12	3.30	2.29	2.43	2.62	2.17	2.89	2.65	2.17	2.02	2.09	1.38	2.76	2.29	1.86	1.92	1.15	2.30
PAN7100	2.58	3.55	2.40	1.72	2.40	2.23	2.63	2.87	2.32	1.46	1.04	3.46	2.28	1.71	2.60	2.15	3.32	2.98	2.16	1.67	1.79	1.68	2.24	2.27	1.68	2.07	1.13	2.24
PAN7102CLP	3.03	3.88	2.55	1.61	3.19	1.95	2.56	3.56	2.11	1.46	0.96	3.34	1.28	1.70	2.75	2.33	3.14	2.81	2.13	1.85	1.81	1.28	2.28	2.73	2.02	2.40	0.93	2.28
PAN7160CLP	2.15	3.72	2.65	1.62	2.29	2.33	2.45	3.12	2.14	1.49	0.99	3.57	2.08	2.08	2.55	2.36	3.26	2.85	2.05	2.05	1.20	1.47	2.80	2.62	1.84	1.89	1.23	2.25
PAN7180CLP	3.44	3.69	2.46	1.65	3.01	2.13	2.73	3.07	2.67	1.27	1.06	3.58	2.65	1.80	3.15	1.74	2.99	3.18	1.98	2.17	1.76	1.66	2.82	2.27	1.76	1.97	1.27	2.37
SY3970CL	2.39	2.97	2.78	1.34	2.07	3.11	3.12	2.50	2.10	1.24	1.01	3.03	2.23	1.67	1.94	2.05	2.98	2.69	1.98	1.80	1.77	1.35	1.89	2.18	1.83	2.02	1.19	2.12
MEAN	2.62	3.57	2.39	1.67	2.45	2.45	2.60	3.03	2.34	1.39	1.11	3.31	2.04	2.00	2.52	2.28	2.97	2.83	2.06	1.81	1.84	1.30	2.38	2.34	1.91	1.78	1.21	2.23

Table 7: Oil yield (t ha^{-1}) of cultivars at selected localities 2022/2023

	BOSKOP3 2023/01/20	Potch1 2022/10/31	Potch3 2022/12/21	Potch4 2023/01/12 2023	Potch5 2023/01/21	MAKWASSIE 2022/12/22	KOSTER 2022/12/03	Senekal 2022/12/21	Mean
AGSUN 5103 CLP	1.29	1.18	0.71	0.68	0.51	0.89	1.06	0.93	0.91
AGSUN 5106 CLP	1.36	1.17	0.81	0.67	0.71	1.07	1.10	0.94	0.98
AGSUN 5108 CLP	1.36	1.08	0.75	0.56	0.66	1.00	0.98	0.89	0.91
AGSUN 5110 CLP	1.25	1.13	0.93	0.64	0.76	0.91	0.97	0.84	0.93
AGSUN 5111 CLP	1.28	1.13	0.83	0.63	0.68	1.30	1.16	0.95	0.99
AGSUN 5270	1.46	1.45	1.01	0.79	0.97	1.19	0.95	1.02	1.10
Aguara6	1.20	1.06	0.94	0.67	0.69	0.53	0.97	0.98	0.88
LG 50745	1.38	1.34	0.90	0.70	0.91	1.08	1.00	1.02	1.04
LG 5710	1.47	1.71	1.04	0.68	0.90	0.94	1.00	0.88	1.08
P 65 LL 02	1.61	1.51	0.83	0.92	1.01	0.95	0.98	1.03	1.10
P 65 LL 46	1.53	1.56	1.10	0.66	0.89	1.31	0.95	0.87	1.11
P 65 LP 54	1.39	1.19	0.79	0.81	0.77	1.10	0.96	0.95	1.00
P 65 LP 65	1.43	1.30	0.81	0.70	0.80	1.11	1.02	1.10	1.03
PAN 7080	1.39	1.27	0.93	0.73	0.77	1.20	1.03	0.89	1.03
PAN 7090	1.48	1.30	0.93	0.82	0.89	1.12	1.06	0.96	1.07
PAN 7100	1.46	1.47	0.96	0.67	0.73	1.15	1.01	0.93	1.05
PAN 7102 CLP	1.38	1.35	0.83	0.71	0.73	1.14	0.84	1.04	1.00
PAN 7160 CLP	1.47	1.41	0.80	0.86	0.48	1.12	0.90	1.13	1.02
PAN 7180CLP	1.34	1.21	0.72	0.89	0.65	1.30	1.09	0.95	1.02
SY 39 70 CL	1.33	1.52	1.00	0.83	0.86	0.98	1.00	1.05	1.07
Mean	1.39	1.32	0.88	0.73	0.77	1.07	1.00	0.97	1.02

Table 8: Parameters calculated from the analysis of variance for yield data at each locality

Locality	Mean (t/ha)	SE	CV (%)	GCV	t	SE(t)	tn
Boskop1	2.6	0.24	16.2	13.8	0.42	0.14	0.68
Boskop3	3.6	0.18	8.5	6.4	0.36	0.15	0.63
Coligny	2.4	0.18	12.7	3.0	0.05	0.14	0.14
Cornelia	1.7	0.13	13.0	11.0	0.42	0.14	0.68
Delmas	2.5	0.20	14.1	13.4	0.48	0.14	0.73
Gerdau-Oos	2.5	0.26	18.2	13.8	0.37	0.15	0.64
Gerdau-Wes	2.6	0.25	16.4	6.8	0.15	0.15	0.35
Hoopstad	3.0	0.34	19.3	5.4	0.07	0.14	0.18
Koster	2.3	0.16	12.2	4.1	0.10	0.14	0.25
Kroondal	1.4	0.11	13.9	4.4	0.09	0.14	0.23
Kroonstad	1.1	0.13	19.7	7.9	0.14	0.15	0.33
Lichtenburg (Ag)	3.3	0.19	10.1	4.0	0.14	0.15	0.33
Lichtenburg (Lim)	2.0	0.20	17.1	12.6	0.35	0.15	0.62
Lichtenburg (PAN)	2.0	0.22	18.9	12.9	0.32	0.15	0.59
Makwassie	2.5	0.26	17.8	15.6	0.44	0.14	0.70
Marquard2	2.3	0.16	12.5	9.0	0.34	0.15	0.61
Potch1	3.0	0.17	10.1	7.4	0.35	0.15	0.62
Potch2	2.8	0.16	9.7	5.9	0.27	0.15	0.53
Potch3	2.1	0.12	10.3	4.4	0.16	0.15	0.36
Potch4	1.8	0.13	12.9	7.0	0.23	0.15	0.47
Potch5	1.8	0.20	18.8	10.1	0.22	0.15	0.46
Putfontein	1.3	0.13	17.9	19.5	0.54	0.13	0.78
Reitz	2.4	0.23	17.0	13.6	0.39	0.14	0.66
Senkal	2.3	0.17	12.7	1.4	0.01	0.13	0.03
Senekal	1.9	0.16	14.9	6.2	0.15	0.15	0.35
Wesselsbron	1.8	0.18	17.3	18.9	0.54	0.13	0.78
Wolmarnstad	1.2	0.12	17.7	6.4	0.12	0.15	0.29

Table 9: Regression line coordinates at different yield potentials 2022/2023

	Yield potential (t ha^{-1})						Mean (t ha^{-1})	Intercept	Slope	Fprob	R^2
Cultivar	1	1,5	2	2,5	3	3,5					
AGSUN 5103 CL	0.8	1.4	1.9	2.5	3.0	3.6	2.2	-0.25	1.09	<0.00	0.86
AGSUN 5106 CL	1.0	1.5	2.0	2.6	3.1	3.6	2.3	-0.07	1.05	<0.00	0.89
AGSUN 5108 CL	0.9	1.4	1.9	2.4	2.9	3.4	2.2	-0.05	0.99	<0.00	0.88
AGSUN 5110 CL	0.9	1.4	1.9	2.4	2.8	3.3	2.1	-0.05	0.96	<0.00	0.88
AGSUN 5111 CL	1.0	1.5	2.0	2.6	3.1	3.6	2.3	-0.05	1.04	<0.00	0.79
AGSUN 5270	1.1	1.6	2.1	2.6	3.1	3.6	2.4	0.10	1.01	<0.00	0.89
Aguara6	1.0	1.4	1.8	2.2	2.6	2.9	2.0	0.27	0.76	<0.00	0.65
LG 50745	1.0	1.5	2.0	2.4	2.9	3.4	2.2	-0.01	0.98	<0.00	0.81
LG 5710	0.9	1.4	1.9	2.3	2.8	3.3	2.1	-0.09	0.97	<0.00	0.82
P 65 LL 02	1.1	1.6	2.1	2.6	3.1	3.5	2.3	0.11	0.98	<0.00	0.86
P 65 LL 46	1.0	1.5	2.0	2.5	3.0	3.5	2.2	0.04	0.99	<0.00	0.81
P 65 LP 54	1.1	1.6	2.1	2.6	3.1	3.6	2.3	0.05	1.00	<0.00	0.86
P 65 LP 65	1.1	1.6	2.1	2.6	3.1	3.6	2.3	0.13	0.98	<0.00	0.88
PAN 7080	1.2	1.7	2.2	2.7	3.2	3.7	2.4	0.17	1.00	<0.00	0.87
PAN 7090	1.1	1.6	2.1	2.6	3.1	3.6	2.3	0.04	1.02	<0.00	0.90
PAN 7100	1.0	1.5	2.0	2.5	3.0	3.5	2.2	0.00	1.00	<0.00	0.93
PAN 7102 CLP	0.9	1.4	2.0	2.6	3.2	3.8	2.3	-0.30	1.16	<0.00	0.84
PAN 7160 CLP	1.0	1.5	2.0	2.5	3.1	3.6	2.3	-0.11	1.06	<0.00	0.89
PAN 7180CLP	1.0	1.6	2.1	2.7	3.2	3.8	2.4	-0.07	1.09	<0.00	0.83
SY 39 70 CL	1.1	1.5	1.9	2.4	2.8	3.2	2.1	0.18	0.87	<0.00	0.76

Table 10: Yield probability (%) of cultivars for 2022/2023 at different yield potentials

Cultivar	Yield potential (t ha^{-1})						Regression line	
	1	1,5	2	2,5	3	3,5	F prob	R^2
AGSUN 5103 CLP	30	35	40	47	53	59	<0.001	0.86
AGSUN 5106 CLP	47	52	55	60	63	67	<0.001	0.89
AGSUN 5108 CLP	40	40	38	38	37	37	<0.001	0.88
AGSUN 5110 CLP	36	32	29	26	24	22	<0.001	0.88
AGSUN 5111 CLP	49	51	53	56	58	60	<0.001	0.79
AGSUN 5270	67	69	70	71	71	71	<0.001	0.89
Aguara6	53	40	28	18	11	7	<0.001	0.65
LG 50745	46	45	43	42	41	40	<0.001	0.81
LG 5710	35	33	30	29	27	27	<0.001	0.82
P 65 LL 02	63	62	61	59	58	56	<0.001	0.86
P 65 LL 46	54	54	53	53	51	51	<0.001	0.81
P 65 LP 54	57	57	58	58	57	57	<0.001	0.86
P 65 LP 65	67	66	65	63	61	59	<0.001	0.88
PAN 7080	74	75	75	75	75	74	<0.001	0.87
PAN 7090	60	62	64	66	67	68	<0.001	0.90
PAN 7100	50	50	50	50	50	50	<0.001	0.93
PAN 7102 CLP	34	43	52	62	71	77	<0.001	0.84
PAN 7160 CLP	42	47	52	57	61	65	<0.001	0.89
PAN 7180CLP	52	58	63	69	73	77	<0.001	0.83
SY 39 70 CL	56	49	40	33	26	21	<0.001	0.76

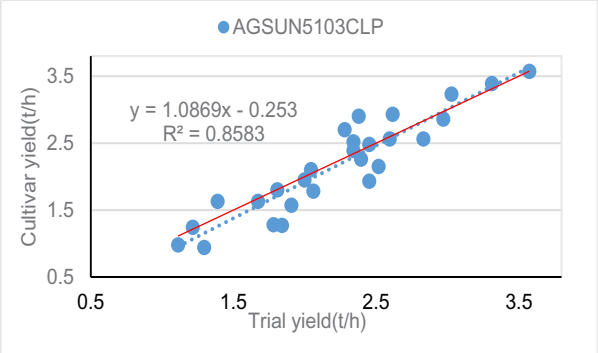
Table 11: Yield probability (%) of cultivars 2021/2022 and 2022/2023 at different yield potentials

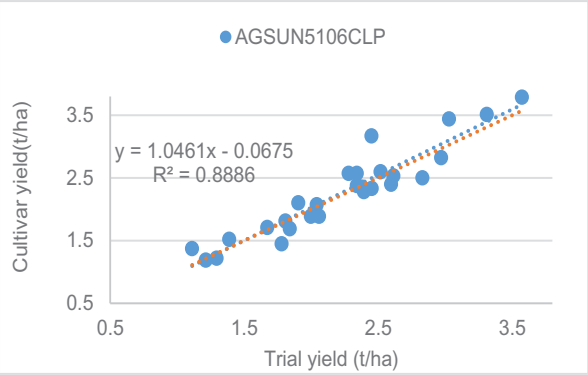
Cultivar	Yield potential (t ha^{-1})						Regression line	
	1	1,5	2	2,5	3	3,5	F prob	R^2
AGSUN 5103 CLP	39	41	43	46	47	50	<0.001	0.85
AGSUN 5106 CLP	52	55	58	61	64	67	<0.001	0.87
AGSUN 5108 CLP	45	45	45	45	45	45	<0.001	0.88
AGSUN 5270	62	64	66	67	69	70	<0.001	0.88
Aguara 6	51	40	29	20	13	8	<0.001	0.75
LG 5710	40	36	31	28	24	21	<0.001	0.79
P 65 LL 02	52	53	55	56	58	59	<0.001	0.87
P 65 LP 54	62	59	55	52	48	45	<0.001	0.88
P 65 LP 65	60	64	66	70	71	74	<0.001	0.92
PAN 7080	62	65	67	70	71	72	<0.001	0.85
PAN 7100	58	57	54	52	50	48	<0.001	0.93
PAN 7102 CLP	32	41	51	61	71	78	<0.001	0.88
PAN 7160 CLP	46	56	63	72	78	84	<0.001	0.92
PAN 7180 CLP	56	59	61	64	65	67	<0.001	0.87
SY 3970 CL	44	37	31	25	20	17	<0.001	0.71

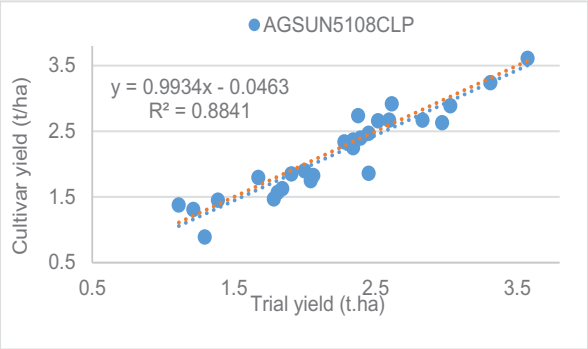
Table 12: Yield probability (%) of cultivars for three years' data 2020/2021 to 2022/2023 at different yield potentials

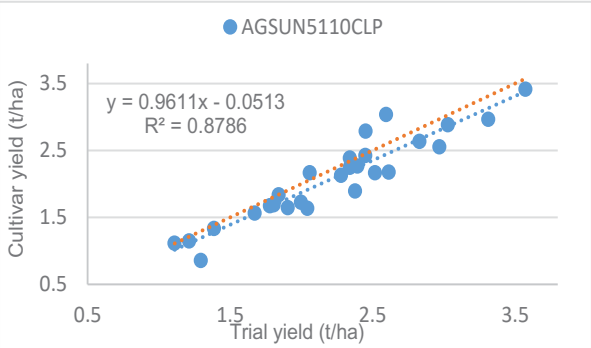
	Yield potential (t/ha)						Regression line	
	1	1,5	2	2,5	3	3,5	Fprob	R^2
AGSUN 5103 CLP	37	41	46	51	56	61	<0.001	0.83
AGSUN 5106 CLP	47	52	57	62	66	71	<0.001	0.88
AGSUN 5108 CLP	43	43	41	41	39	39	<0.001	0.89
AGSUN 5270	60	63	65	68	70	72	<0.001	0.89
Aguara 6	50	42	33	25	18	14	<0.001	0.78
LG 5710	37	36	35	33	32	31	<0.001	0.81
P 65 LL 02	49	50	50	52	52	53	<0.001	0.86
P 65 LP 54	66	62	58	53	48	44	<0.001	0.84
P 65 LP 65	57	59	59	61	61	63	<0.001	0.89
PAN 7080	56	61	64	68	71	74	<0.001	0.86
PAN 7100	63	63	61	61	59	58	<0.001	0.92
PAN 7102 CLP	43	49	53	59	63	68	<0.001	0.86
PAN 7160 CLP	58	65	69	74	77	81	<0.001	0.92
PAN 7180 CLP	56	59	61	63	65	67	<0.001	0.86
SY 3970 CL	46	39	31	24	18	14	<0.001	0.67

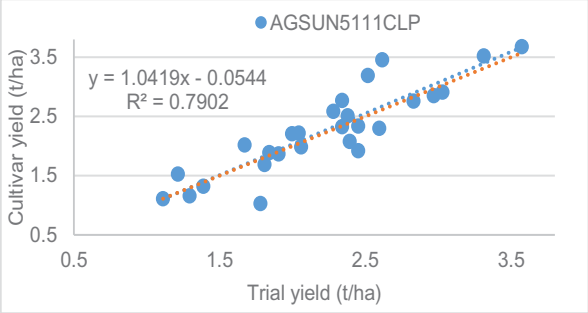
Figure 1: Regression lines for cultivars 2022/2023

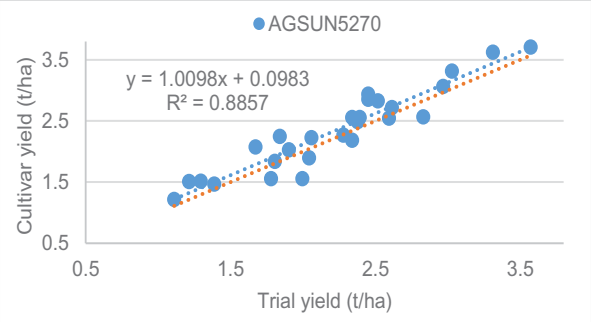


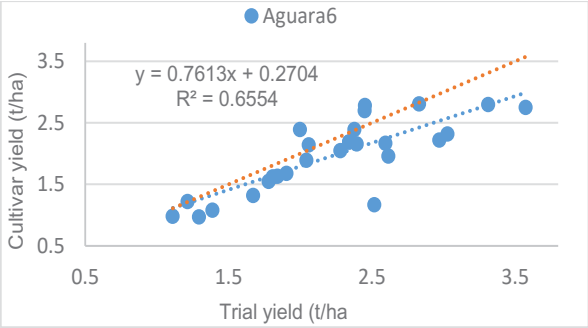


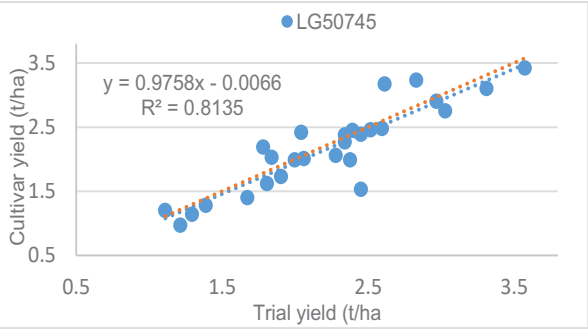


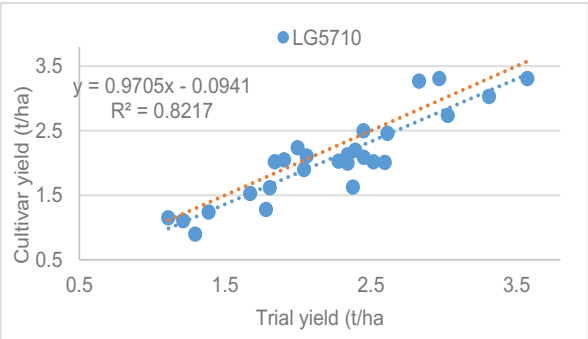


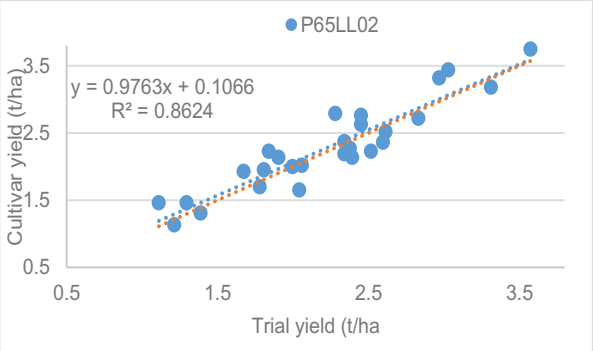












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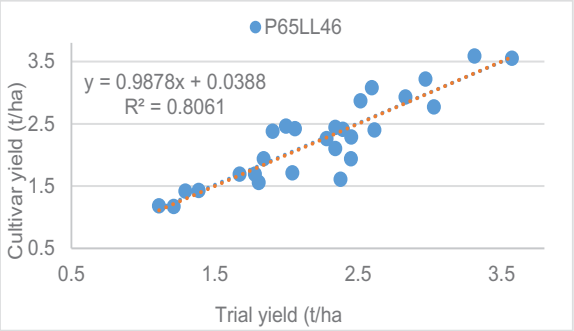
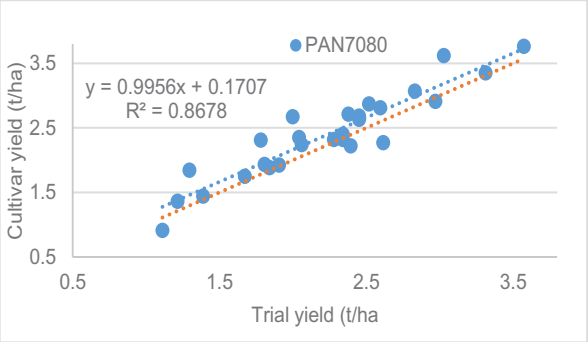
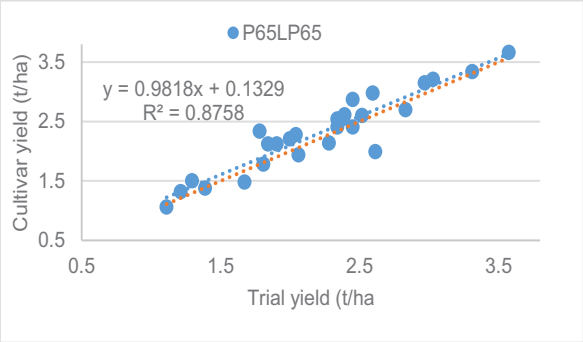

P65LL46
y = 0.9878x + 0.0388
R² = 0.8061
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7080
y = 0.9956x + 0.1707
R² = 0.8678
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5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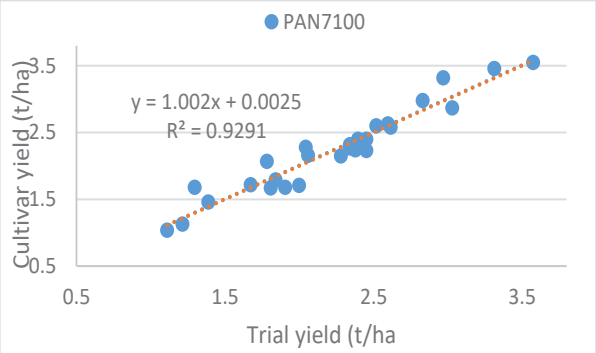
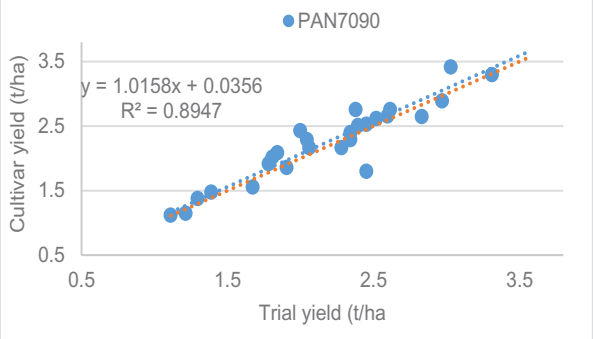
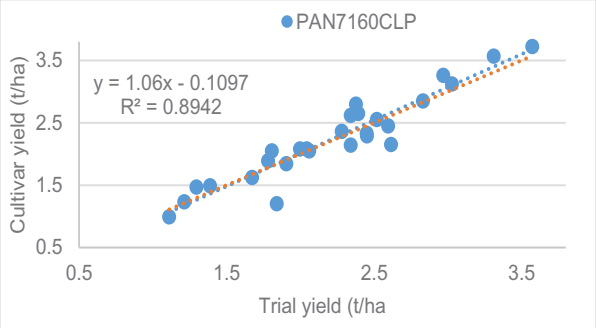
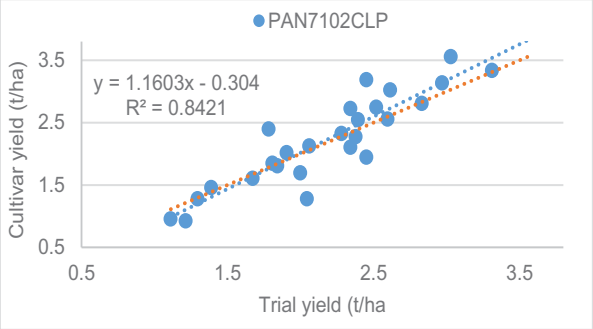
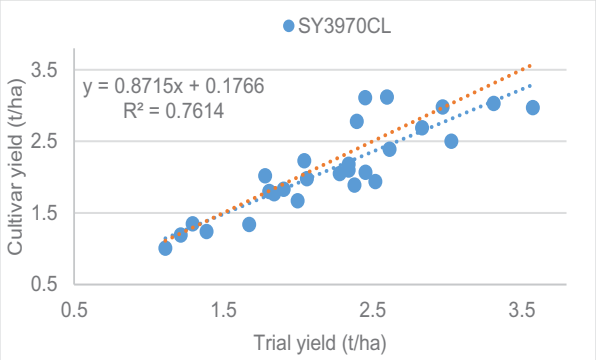
y = 0.9818x + 0.1329
R² = 0.8758
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7100
y = 1.002x + 0.0025
R² = 0.9291
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7090
y = 1.0158x + 0.0356
R² = 0.8947
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7160CLP
y = 1.06x - 0.1097
R² = 0.8942
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7102CLP
y = 1.1603x - 0.304
R² = 0.8421
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


SY3970CL
y = 0.8715x + 0.1766
R² = 0.7614
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5

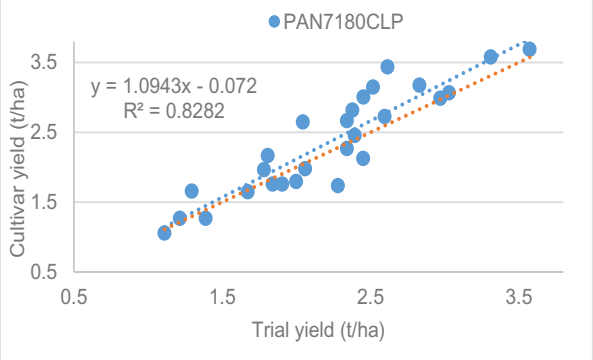
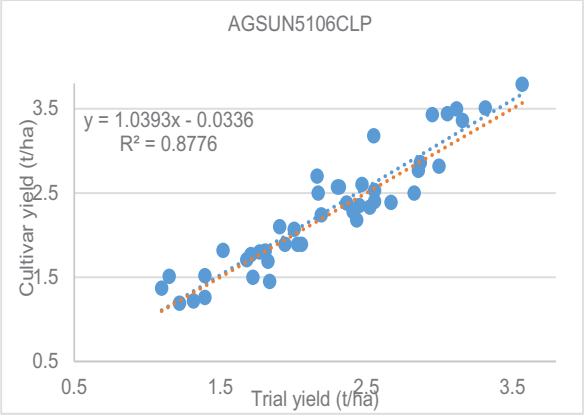
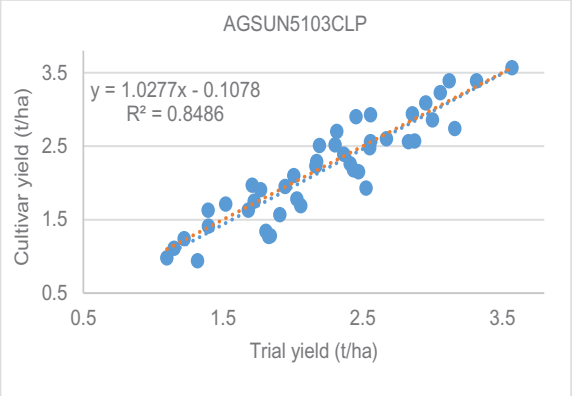
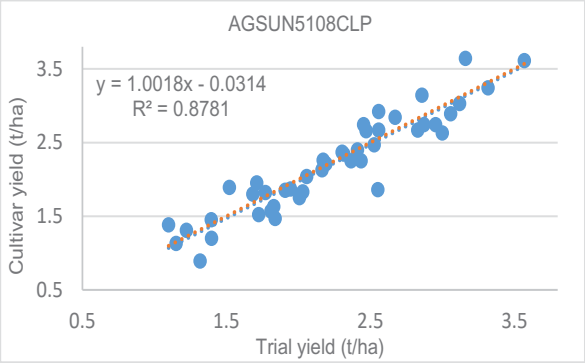
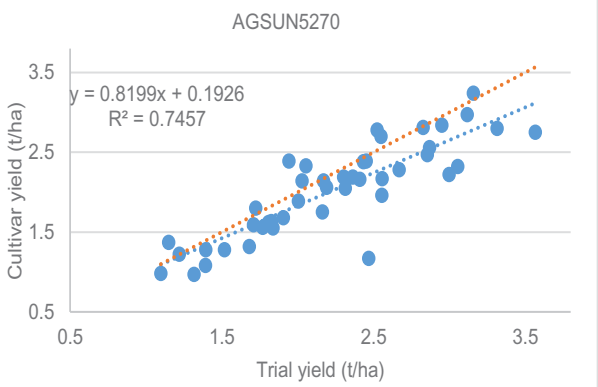

PAN7180CLP
y = 1.0943x - 0.072
R² = 0.8282
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5

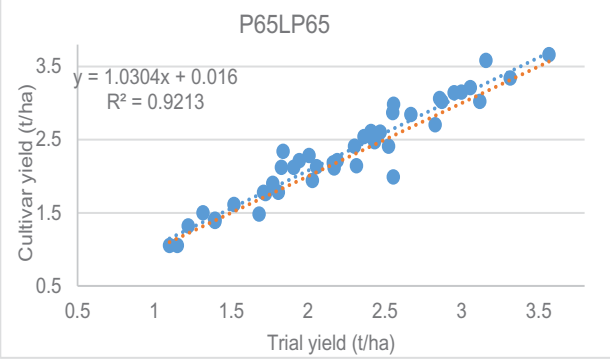
Figure 2: Regression lines for cultivars 2021/2022 & 2022/2023

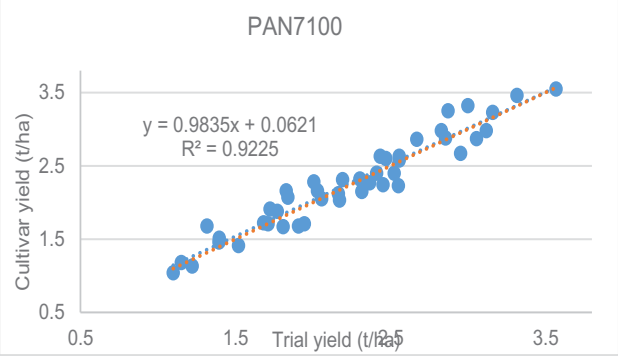


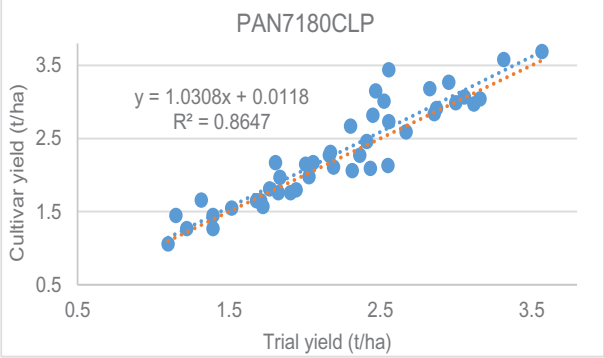


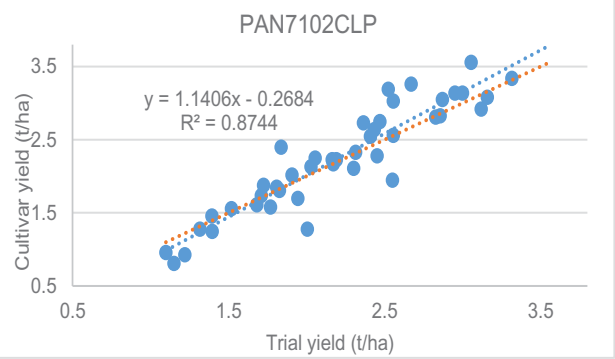


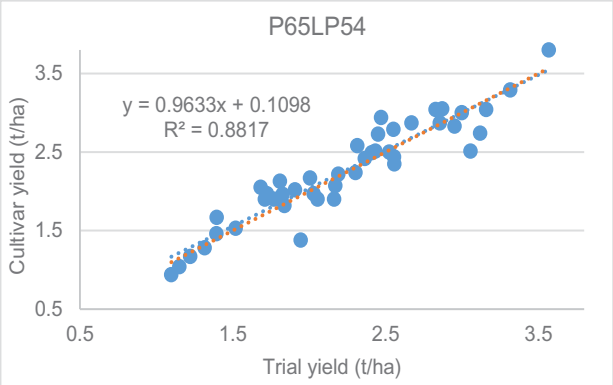


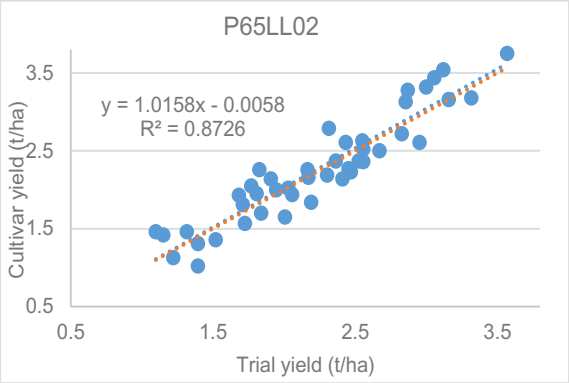


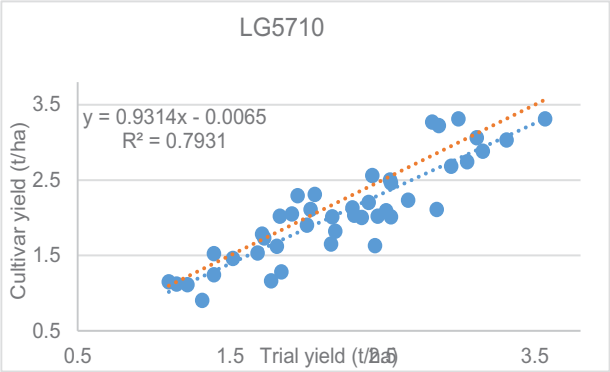


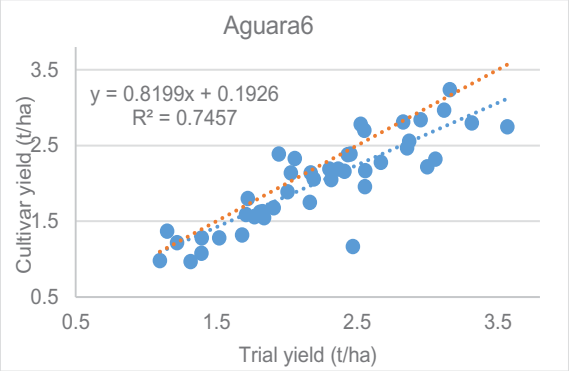


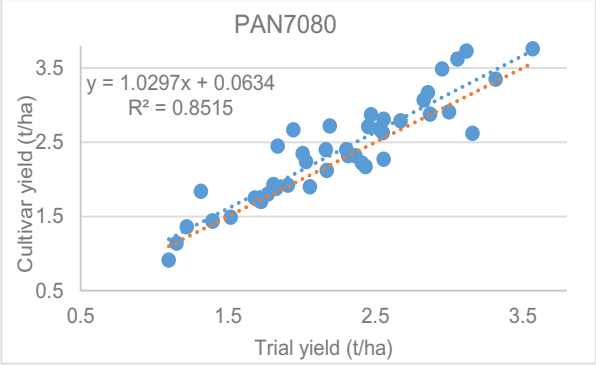


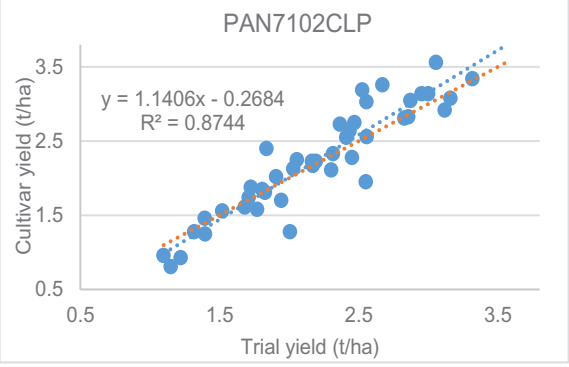

P65LP54
y = 0.9633x + 0.1098
R² = 0.8817
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5

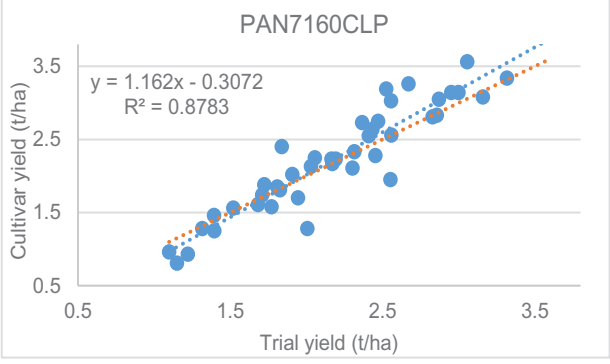

P65LL02
y = 1.0158x - 0.0058
R² = 0.8726
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


LG5710
y = 0.9314x - 0.0065
R² = 0.7931
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


Aguara6
y = 0.8199x + 0.1926
R² = 0.7457
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7080
y = 1.0297x + 0.0634
R² = 0.8515
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7102CLP
y = 1.1406x - 0.2684
R² = 0.8744
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5


PAN7160CLP
y = 1.162x - 0.3072
R² = 0.8783
Cultivar yield (t/ha)
Trial yield (t/ha)
0.5
1.5
2.5
3.5

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.

"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;

(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.

(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--

(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.

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.

(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.

(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%