South African Sunflower Crop

Quality Report 2021/2022 season

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South African

Commercial sunflower quality for the 2021/22 Season

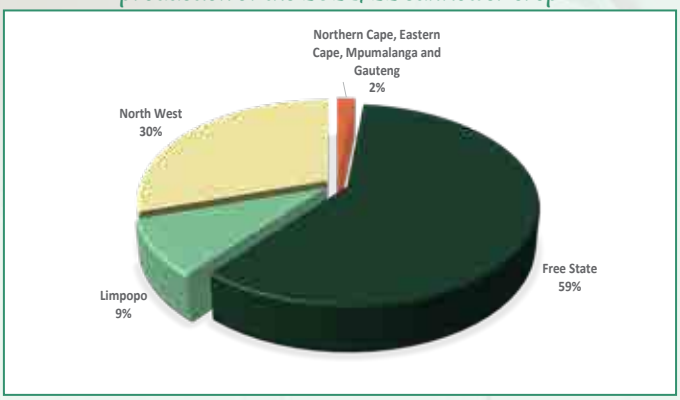
Acknowledgements
With gratitude to:

- ***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 commercial sunflower crop figure of the 2021/22 season as overseen by the National Crop Estimates Liaison Committee (CELC) is unchanged from the final crop estimate figure of 845 550 tons. The crop increased by almost 25% (167 550 tons) year on year. The major sunflower-producing provinces, namely the Free State and North West, contributed 89% of the total crop.

Graph 1: Provincial contribution to the production of the 2021/22 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-six (176) composite sunflower samples, representing the different production regions, were analysed for quality. The samples were graded, milled and analysed for moisture, crude protein, crude fat, crude fibre and ash content. Twenty-two samples, randomly selected to represent the different production regions, as well as 18 cultivar samples were submitted to Precision Oil Laboratories for fatty acid profile analyses.

This is the tenth 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, is 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 2021/22 season, conducted by the ARC-Grain Crops Institute in collaboration with Agricol, Pannar, Pioneer, Syngenta, Sensako and Limagrain, 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 2021/22 season stands at 57.9 million metric tons with the Ukraine and Russia contributing 56% to this total. An area of 30.2 million hectares were harvested resulting in a yield of 1.92 metric tons/hectare. The forecasted figure for the 2022/23 season is 52.9 million metric tons harvested on 28.7 million hectares and with a yield of 1.84 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	2017/18	2018/19	2019/20	2020/21	2021/22 (Revised)	2022/23 (Forecast)
Area Harvested (1 000 Ha)	***26 885***	***27 265***	***27 413***	***28 045***	***30 152***	***28 714***
Yield (MT/Ha)	***1.83***	***1.91***	***2.03***	***1.81***	***1.92***	***1.84***
Production (1 000 MT)						
Argentina	3 400	3 530	3 020	3 200	3 400	3 700
European Union	10 058	9 482	9 469	8 969	10 467	9 529
China	2 580	2 550	2 680	2 750	2 880	2 900
Russia	11 000	12 756	15 379	13 420	15 400	16 000
Ukraine	13 400	15 250	16 500	13 900	16 800	10 600
United States	970	956	887	1 353	864	1 276
South Africa	862	678	810	678	846	800
Turkey	1 700	1 530	1 700	1 580	1 750	2 050
Other	5 086	5 292	5 202	4 995	5 532	6 003
TOTAL	***49 056***	***52 024***	***55 647***	***50 845***	***57 939***	***52 858***
Import (1 000 MT)						
Turkey	721	1 051	1 058	844	673	570
European Union	520	550	1 057	817	1 805	1 936
Other	1 322	1 445	1 451	1 308	1 704	1 735
TOTAL	***2 563***	***3 046***	***3 566***	***2 969***	***4 182***	***4 241***
Export (1 000 MT)						
Argentina	58	149	214	178	158	155
United States	89	87	64	72	69	78
Russia	103	338	1 278	528	281	250
Ukraine	50	119	76	186	1 793	2 080
Other	2 234	2 392	1 980	1 907	1 895	1 762
TOTAL	***2 534***	***3 085***	***3 612***	***2 871***	***4 196***	***4 325***
Oilseed crushed	***44 663***	***47 231***	***50 300***	***45 568***	***48 526***	***49 346***

National Sunflower Association website www.sunflowernsa.com,
Table updated January 13, 2023; Source: Oil World & USDA.

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

The area utilised for sunflower production increased by 40% to 670 700 ha, compared to the 477 800 ha of the previous season. The national yield average decreased by 11% from to 1.42 t/ha in the previous season to 1.26 t/ha this season.

According to *The Bureau for Food and Agricultural Policy (BFAP) Baseline, Agricultural Outlook 2022 – 2031*, the area under sunflower should stabilise at around 500 000 hectares in the medium term. 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 23% gain in yields over the coming decade, reflecting technological gains and continuous improvement in production practices. This is sufficient to meet the growth in domestic demand.

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

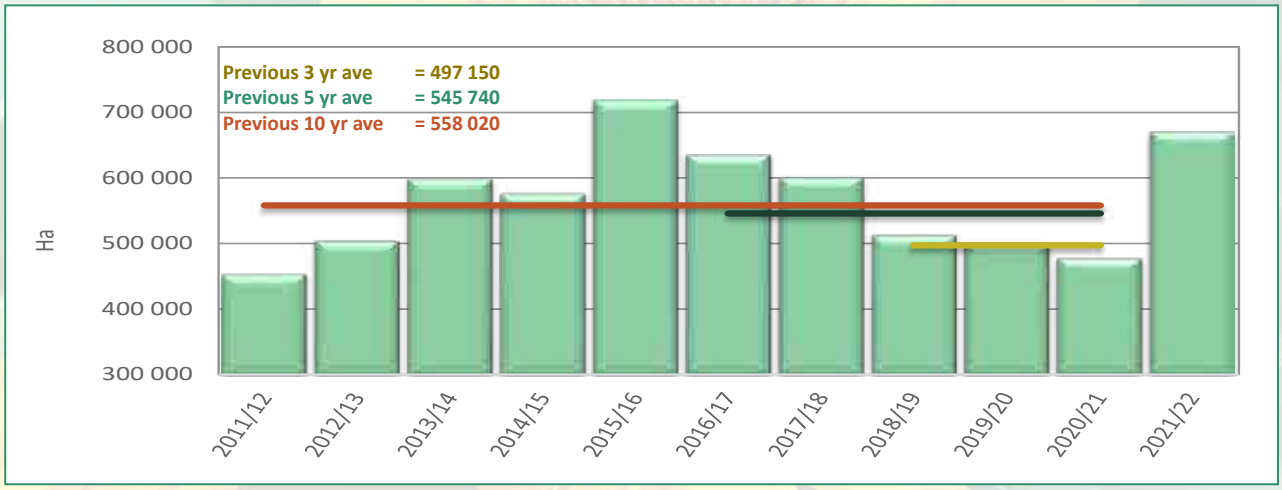
Please see Table 2 for an overview of sunflower production under dry land conditions versus irrigation in the 2021/22 season, compared to the 2020/21 season. Graphs 2 to 4 provide national figures with regards to hectares planted, tons produced and yields obtained over the last 11 seasons and Graphs 5 to 10 similar figures for the major sunflower producing provinces, namely the Free State and North West as well as Limpopo.

Table 2: Sunflower production overview over two seasons

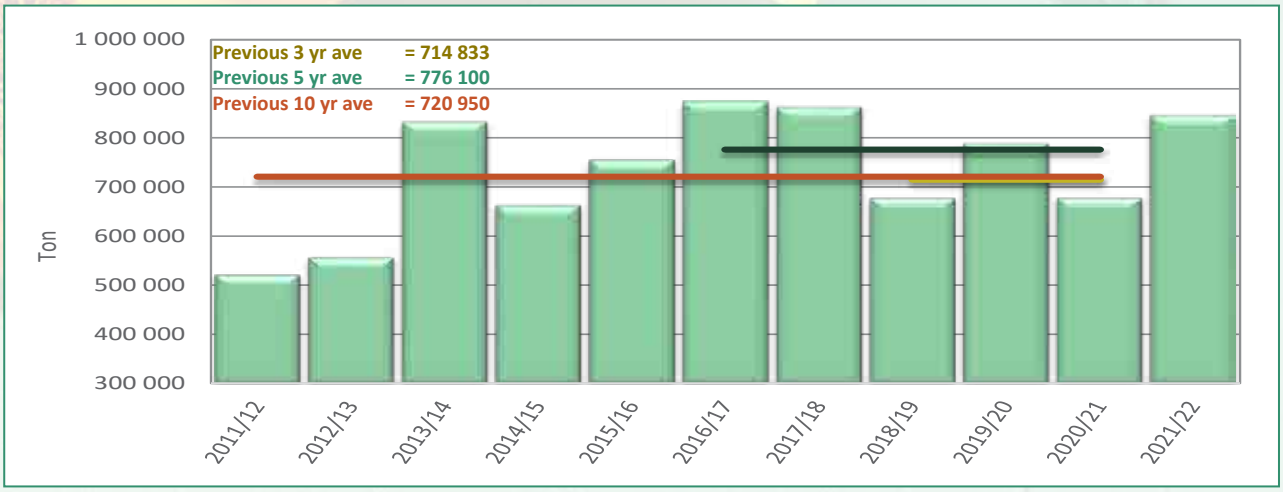
Province	Type of production	2021/22			2020/21		
		Hectares planted, ha	Production, tons	Yield, t/ha	Hectares planted, ha	Production, tons	Yield, t/ha
Western Cape	Dryland	-	-	-	-	-	-
	Irrigation	-	-	-	-	-	-
	Total	-	-	-	-	-	-
Northern Cape	Dryland	-	-	-	-	-	-
	Irrigation	2 500	6 250	2.50	1 100	1 320	1.20
	Total	2 500	6 250	2.50	1 100	1 320	1.20
Free State	Dryland	350 000	483 000	1.38	229 200	338 000	1.47
	Irrigation	7 000	16 800	2.40	5 800	14 500	2.50
	Total	357 000	499 800	1.40	235 000	352 500	1.50
Eastern Cape	Dryland	30	48	1.60	120	120	1.00
	Irrigation	270	702	2.60	180	330	1.83
	Total	300	750	2.50	300	450	1.50
KwaZulu-Natal	Dryland	-	-	-	-	-	-
	Irrigation	-	-	-	-	-	-
	Total	-	-	-	-	-	-
Mpumalanga	Dryland	3 500	5 250	1.50	3 500	5 250	1.50
	Irrigation	-	-	-	-	-	-
	Total	3 500	5 250	1.50	3 500	5 250	1.50
Limpopo	Dryland	107 000	72 200	0.67	73 500	70 800	0.96
	Irrigation	3 000	4 800	1.60	3 000	5 700	1.90
	Total	110 000	77 000	0.70	76 500	76 500	1.00
Gauteng	Dryland	2 400	3 000	1.25	4 400	5 720	1.30
	Irrigation	-	-	-	-	-	-
	Total	2 400	3 000	1.25	4 400	5 720	1.30
North West	Dryland	193 200	250 500	1.30	155 500	233 100	1.50
	Irrigation	1 800	3 000	1.67	1 500	3 160	2.11
	Total	195 000	253 500	1.30	157 000	236 260	1.50
RSA	Dryland	656 130	813 998	1.24	466 220	652 990	1.40
	Irrigation	14 570	31 552	2.17	11 580	25 010	2.16
	Total	670 700	845 550	1.26	477 800	678 000	1.42

Figures provided by the CEC.

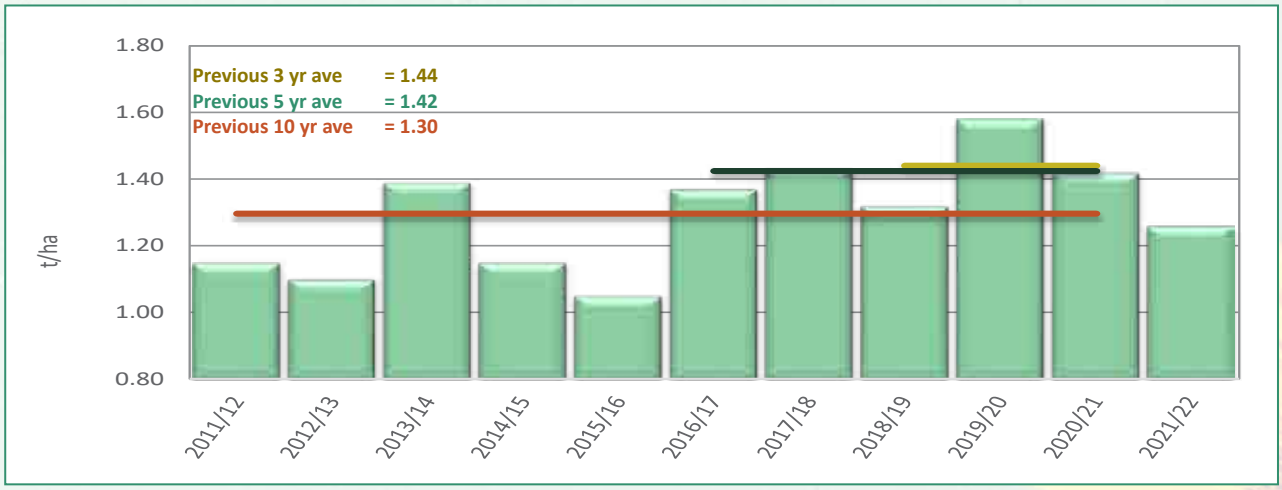
Graph 2: Total RSA area utilised for sunflower production from 2011/12 to 2021/22



Graph 3: Sunflower production in RSA from 2011/12 to 2021/22

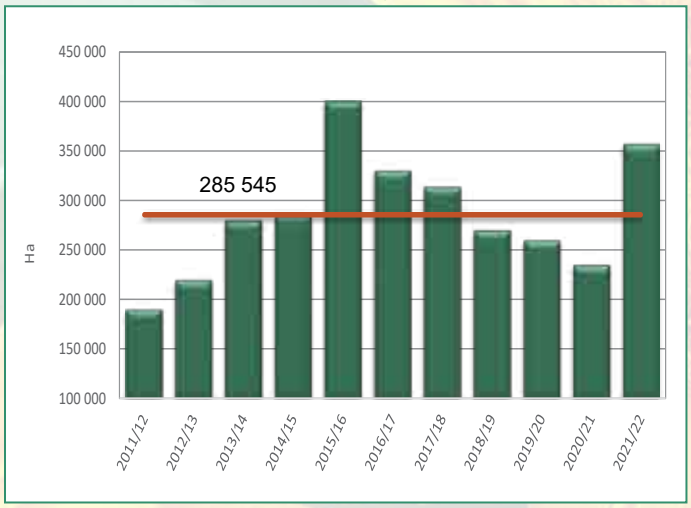


Graph 4: RSA Sunflower yield from 2011/12 to 2021/22

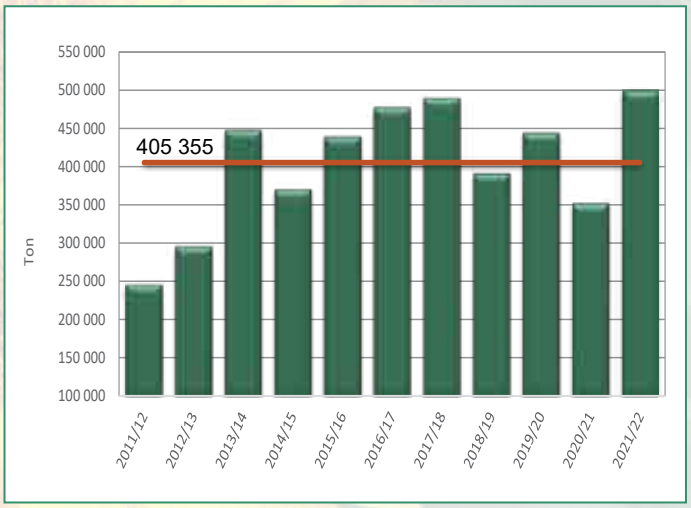


Figures provided by the CEC.

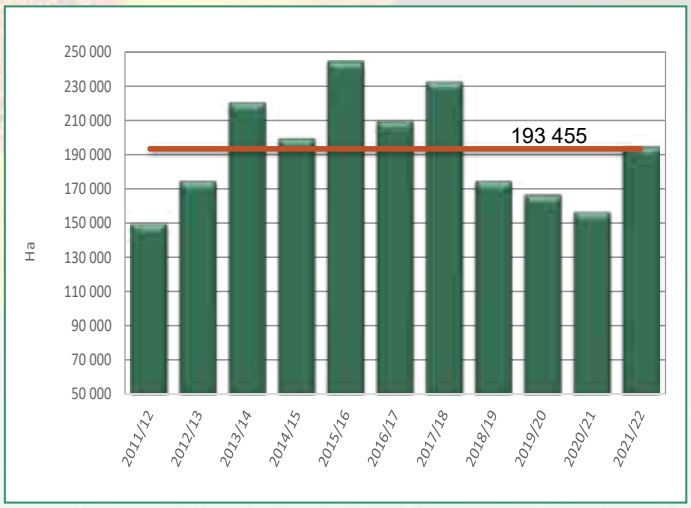
Graph 5: Area utilised for sunflower production in the Free State since 2011/12



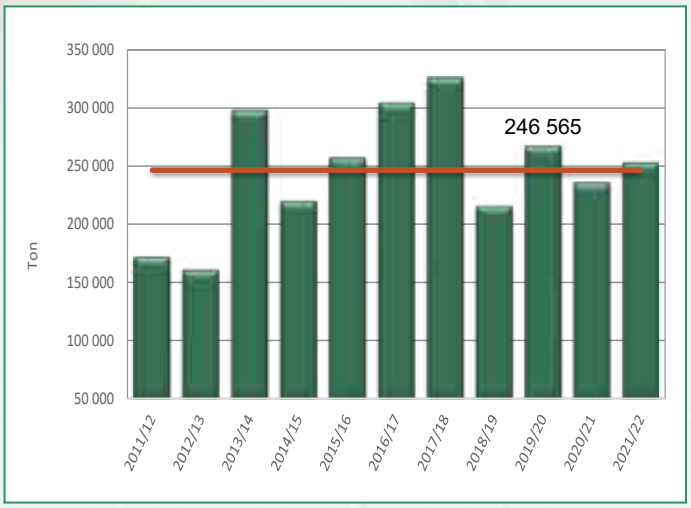
Graph 6: Sunflower production in the Free State since 2011/12



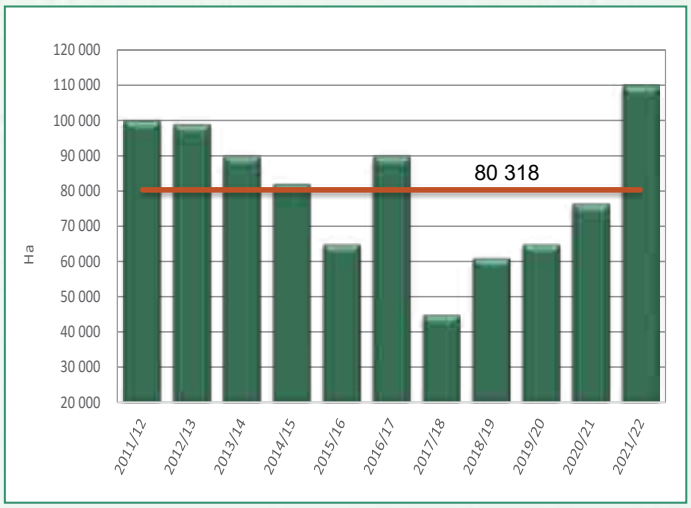
Graph 7: Area utilised for sunflower production in North West since 2011/12



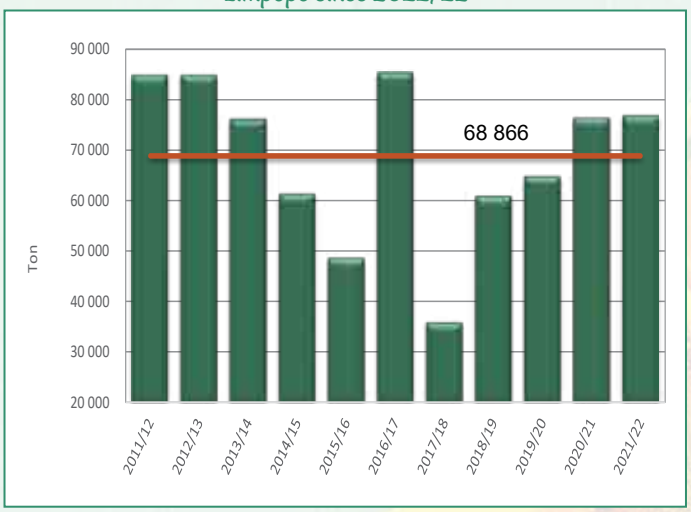
Graph 8: Sunflower production in North West since 2011/12



Graph 9: Area utilised for sunflower production in Limpopo since 2011/12



Graph 10: Sunflower production in Limpopo since 2011/12



Figures provided by the CEC.

Eleven season average

Supply and Demand

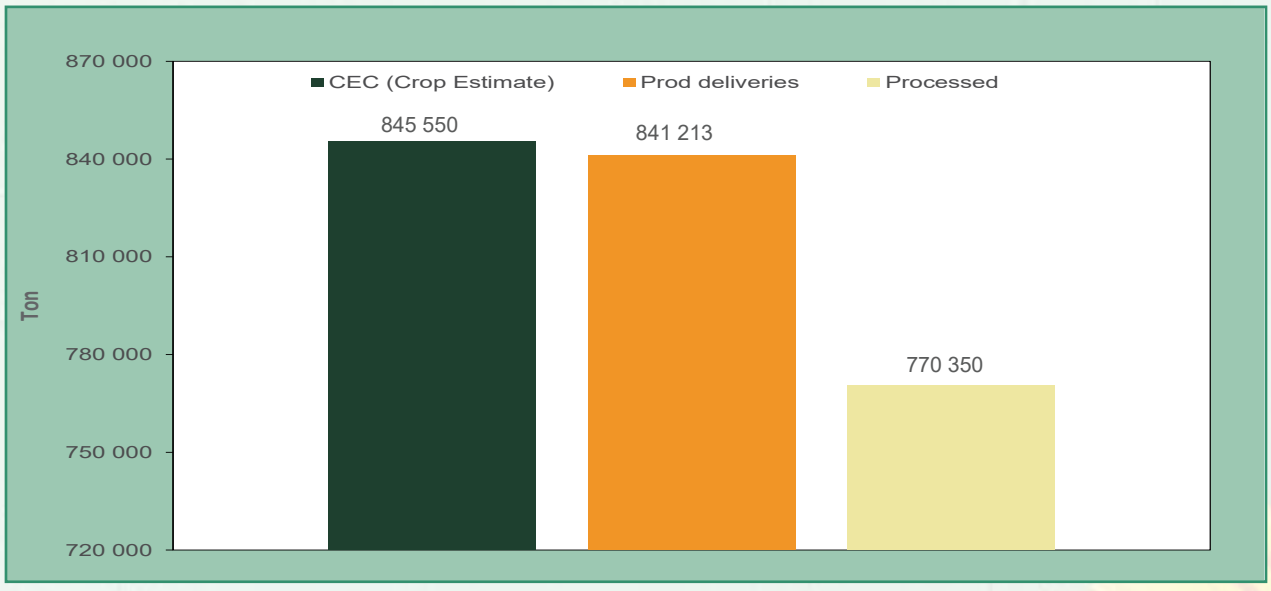
The sunflower seed marketing season dates from March to February. According to SAGIS supply and demand figures for the 2022/23 marketing season to date (March 2022 to January 2023), opening stock decreased by almost 48% compared to the previous marketing season and was 69% (69 269 tons) lower than the 10-year average.

To date, 6 775 tons of sunflower and sunflower seed products have been imported compared to the 1 256 and 471 tons of the previous two seasons respectively. The 10-year import average is 28 016 tons. Of the 770 350 tons of sunflower seeds processed so far, only 1 486 tons (0.2%) was used for human consumption and 5 640 tons (0.7%) 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 6% more than in the previous season and also 2% higher than the 10-year average of 750 846 tons.

According to *BFAP Baseline*, sunflower oil consumption increased by 4% from 2011 to 2021. This increase had been higher prior to the sharp decline in consumption in 2021 caused by spending power that remained constrained and prices that increased to unprecedented levels. Over the course of 2022 to 2031 however, sunflower oil consumption is expected to rise by 14%. By 2031, total vegetable oil consumption is expected to rise by 18%, relative to the average levels between 2019 and 2021.

Exports to date amount to 164 tons, compared to the 217 tons of the 2021/22 season. Globally, Ukraine, followed by Russia and Argentina were the largest exporters of sunflower seeds during 2021/22. The United States was only the fourth largest exporter during this season. Ukraine (4.7 million metric tons) and Russia (3.3 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 13, 2023; Source: Oil World & USDA).*

Graph 11: Sunflower supply and demand overview for the current marketing season (Mar 2022 - Feb 2023)



Information provided by SAGIS.

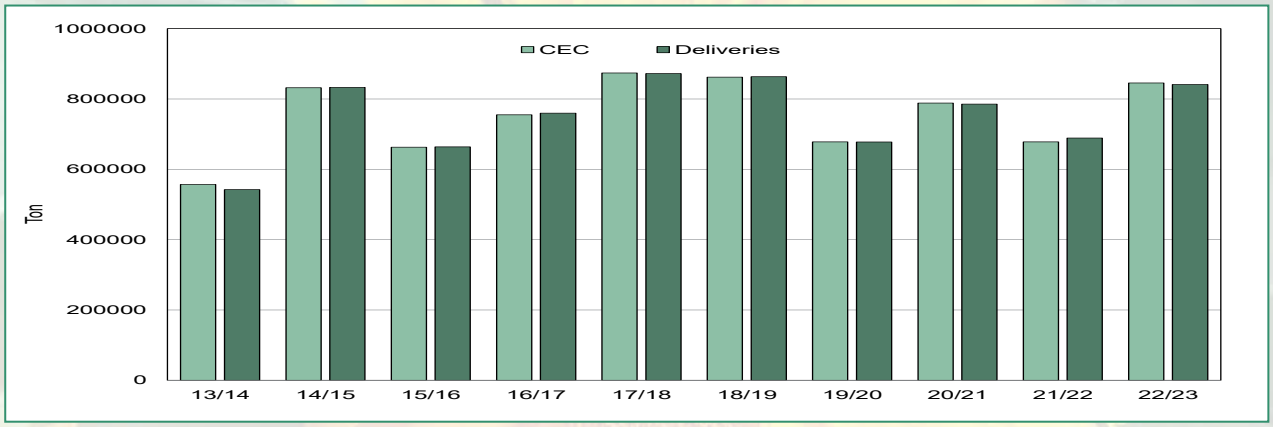
SAGIS South African Grain Information Service
Suid-Afrikaanse Graan Inligtingsdiens

SUNFLOWERSEED: SUPPLY AND DEMAND TABLE BASED ON SAGIS' INFO (TON) — **Publication date: 2023/02/27**

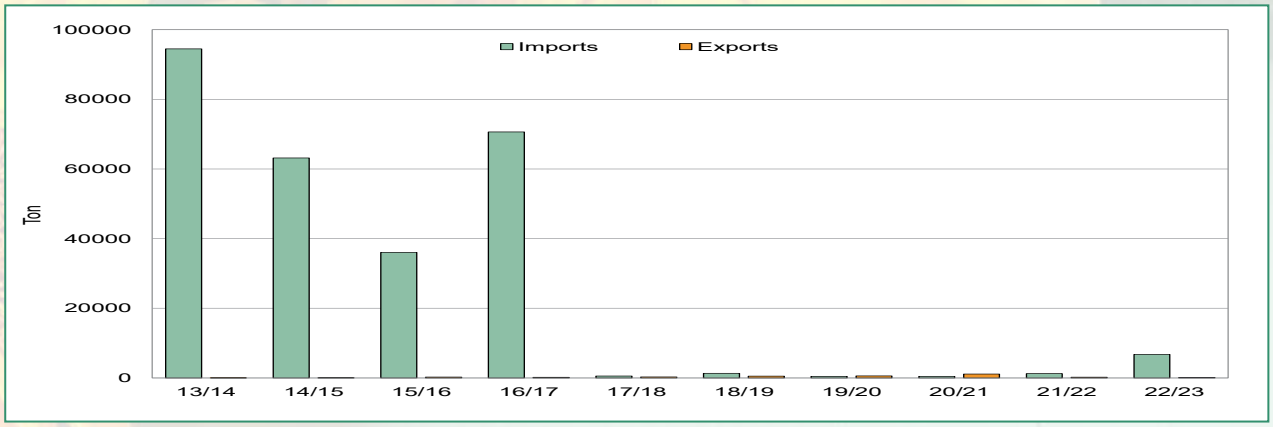
	Season (Mar - Feb)																Current Season Mar-Jan	10 Year average
	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	2012/13-2021/22
																	***	
																	11	
CEC (Crop Estimate)	520 000	300 000	872 000	801 000	490 000	860 000	522 000	557 000	832 000	663 000	755 000	874 000	862 000	678 000	788 500	678 000	845 550	720 950
SUPPLY																		
Opening stock (1 Mar)	40 700	90 400	64 700	164 300	157 200	18 800	109 000	81 302	47 116	92 927	45 867	163 086	154 841	120 165	135 325	60 964	31 790	101 059
Prod deliveries	524 900	310 100	846 600	806 900	477 300	866 300	534 251	542 165	833 165	663 669	759 614	872 171	863 184	677 674	785 567	689 083	841 213	722 054
Imports	3 100	8 900	25 600	45 300	62 400	10 800	11 737	94 475	63 180	36 064	70 643	554	1 324	457	471	1 256	6 775	28 016
Surplus	2 300	1 500	4 100	700	2 000	3 800	5 485	4 689	5 948	9 897	4 268	12 173	6 863	6 520	7 200	9 306	9 233	7 235
Total Supply	**571 000**	**410 900**	**941 000**	**1 017 200**	**698 900**	**899 700**	**660 473**	**722 631**	**949 409**	**802 557**	**880 392**	**1 047 984**	**1 026 212**	**804 816**	**928 563**	**760 609**	**889 011**	**858 365**
DEMAND																		
Processed	472 300	339 500	685 300	847 200	671 500	782 200	572 519	666 551	847 682	747 808	707 327	885 039	900 045	664 027	861 295	724 949	770 350	757 724
-human	1 200	2 100	2 400	1 900	1 600	1 300	904	1 162	467	1 003	1 192	1 487	1 609	1 478	1 652	1 556	1 486	1 251
-animal feed	3 100	3 500	3 400	3 300	3 100	2 900	3 022	2 777	2 893	8 995	10 665	5 737	5 114	5 511	5 432	6 129	5 640	5 628
-crush (oil and oilcake)	468 000	333 900	679 500	842 000	666 800	778 000	568 593	662 612	844 322	737 810	695 470	877 815	893 322	657 038	854 211	717 264	763 224	750 846
Withdrawn by producers	2 000	1 900	4 900	5 700	1 700	3 500	2 521	2 524	1 068	1 157	605	442	519	783	464	359	822	1 044
Released to end-consumers	3 500	3 000	2 800	4 800	4 100	3 700	3 154	2 923	2 799	2 936	2 867	2 592	1 764	1 023	1 144	666	32	2 187
Seed for planting purposes	1 200	1 800	3 300	2 700	1 700	2 500	2 700	2 903	3 804	2 824	3 474	3 026	3 582	2 447	2 493	2 495	1 773	2 975
Net receipts(-)/disp(+)	1 500	0	1 000	- 400	1 000	-1 200	-1 716	606	1 081	1 709	2 828	1 770	- 378	635	1 063	133	1 230	773
Deficit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exports	100	0	79 400	0	100	0	27	8	48	256	205	274	515	576	1 140	217	164	327
Total Demand	**480 600**	**346 200**	**776 700**	**860 000**	**680 100**	**790 700**	**579 205**	**675 515**	**856 482**	**756 690**	**717 306**	**893 143**	**906 047**	**669 491**	**867 599**	**728 819**	**774 371**	**765 030**
Ending Stock (28 Feb)	**90 400**	**64 700**	**164 300**	**157 200**	**18 800**	**109 000**	**81 268**	**47 116**	**92 927**	**45 867**	**163 086**	**154 841**	**120 165**	**135 325**	**60 964**	**31 790**	**114 640**	**93 335**
- processed p/month	39 400	28 300	57 100	70 600	65 000	65 200	47 700	55 546	70 640	62 317	58 944	73 753	75 004	55 336	71 775	60 412	70 032	63 143
- months' stock	2.3	2.3	2.9	2.2	0.3	1.7	1.7	0.8	1.3	0.7	2.8	2.1	1.6	2.4	0.8	0.5	1.6	2

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

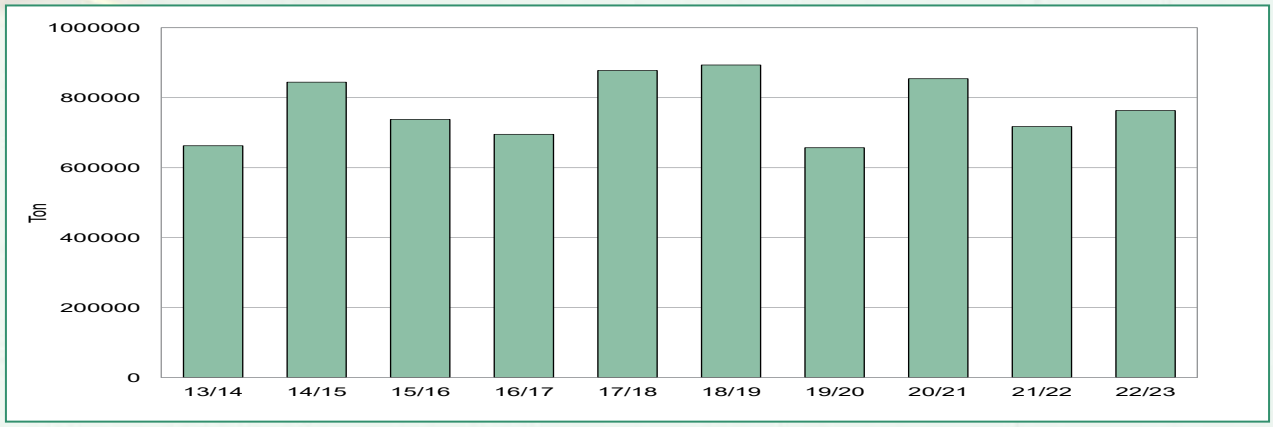
Graph 12: Sunflower: CEC Estimate vs SAGIS deliveries over 10 marketing seasons



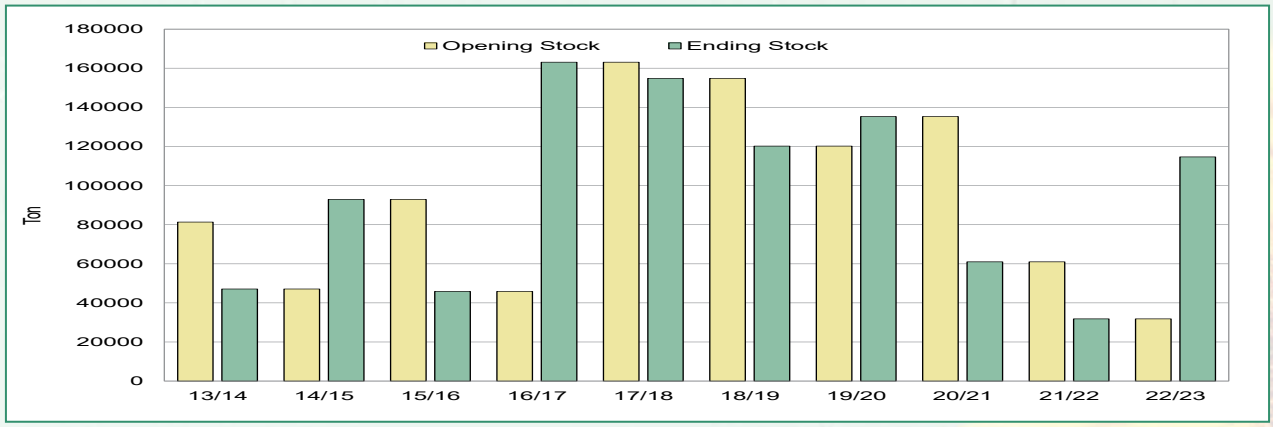
Graph 13: Sunflower: Imports and Exports over 10 marketing seasons



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	Total
2017/18	21	0	0	0	18	44	429	19	0	0	23	0	554
2018/19	65	381	0	0	0	23	855	0	0	0	0	0	1 324
2019/20	44	0	0	0	0	23	390	0	0	0	0	0	457
2020/21	87	0	20	0	0	90	274	0	0	0	0	0	471
2021/22	43	1 003	0	3	0	184	23	0	0	0	0	0	1 256
2022/23	66	6 564	0	0	0	0	145	0	0	0	0	0	6 775

Season	SUNFLOWER: IMPORTS PER HARBOUR (TONS)					
	Harbours					
	East London	Durban	Cape	Port Elizabeth	Richards Bay	Total
2008/09	0	0	0	0	0	0
2009/10	0	66 547	0	0	0	66 547
2010/11	0	50 209	0	0	0	50 209
2011/12	0	0	0	0	0	0
2012/13	0	0	0	0	0	0
2013/14	0	92 832	0	0	0	92 832
2014/15	0	57 842	0	0	0	57 842
2015/16	0	30 611	0	0	0	30 611
2016/17	0	68 533	0	0	0	68 533
2017/18	0	44	62	0	0	106
2018/19	0	88	0	0	0	88
2019/20	0	67	0	0	0	67
2020/21	0	132	65	0	0	197
2021/22	0	135	95	0	0	230
2022/23*	0	66	0	0	0	66

*Progressive March 2022 - January 2023
Note: Includes Imports for RSA and Other Countries

Season	WHOLE SUNFLOWER: RSA EXPORTS PER COUNTRY (TONS)						
	Australia	Botswana	Namibia	Eswatini	Uganda	Zimbabwe	Total
2017/18	0	23	136	115	0	0	274
2018/19	0	10	360	145	0	0	515
2019/20	0	95	341	140	0	0	576
2020/21	0	24	304	192	54	566	1 140
2021/22	0	35	65	117	0	0	217
2022/23	0	35	50	79	0	0	164

Season	SUNFLOWER: EXPORTS PER HARBOUR (TONS)					
	Harbours					
	East London	Durban	Cape	Port Elizabeth	Richards Bay	Total
2008/09	34 870	44 555	0	0	0	79 425
2009/10	0	0	0	0	0	0
2010/11	0	0	0	0	0	0
2011/12	0	0	0	0	0	0
2012/13	0	0	0	0	0	0
2013/14	0	0	0	0	0	0
2014/15	0	22	0	0	0	22
2015/16	0	0	0	0	0	0
2016/17	0	0	0	0	0	0
2017/18	0	0	0	0	0	0
2018/19	0	0	0	0	0	0
2019/20	0	0	0	0	0	0
2020/21	0	0	0	0	0	0
2021/22	0	0	0	0	0	0
2022/23*	0	0	0	0	0	0

*Progressive March 2022 - January 2023

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

	OIL SEEDS PRODUCTS MANUFACTURED (PER MONTH)													
	Marketing year Mar 2020 - Feb 2021 Progressive: 12 Months	Marketing year Mar 2021 - Feb 2022 Progressive: 12 Months	Mar 2022 Tons	Apr 2022 Tons	May 2022 Tons	June 2022 Tons	July 2022 Tons	Aug 2022 Tons	Sep 2022 Tons	Oct 2022 Tons	Nov 2022 Tons	Dec 2022 Tons	Jan 2023 Tons	Marketing year Mar 2022 - Feb 2023 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	**214 912**	**261 757**	21 277	23 081	19 705	20 685	23 665	25 683	27 188	27 193	25 800	22 439	26 364	**238 873**
Sunflower Oil	**305 099**	**263 060**	12 244	22 325	32 035	28 305	28 886	33 028	29 279	26 893	29 327	17 626	19 226	**259 553**
Coconut Oil/ Groundnut Oil / Canola Oil / Corn (Maize) Oil / Blends or mixes of Oils which includes one of the above Oils / Biodiesel / Cottonseed Oil	**48 762**	**68 734**	6 023	5 462	5 703	5 892	5 450	3 264	3 745	5 790	7 187	5 172	6 836	**62 092**
Sunflower Oilcake	**351 190**	**300 155**	12 644	28 267	34 508	31 594	31 272	34 154	30 477	28 172	32 263	17 964	20 441	**295 026**
Coconut Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Palmnut Oilcake	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oilcake / Canola Oilcake / Cottonseed Oilcake	**1 005 161**	**1 237 766**	99 366	103 621	95 164	104 079	112 314	122 517	127 814	129 345	125 705	109 331	129 212	**1 126 899**
Soybean Flours and Meals / Textured Vegetable Protein	**38 724**	**41 078**	3 787	3 409	3 603	3 072	3 836	3 392	3 350	3 765	4 393	2 710	3 367	**38 128**
Soybean Fullfat	**148 918**	**169 604**	15 360	12 920	14 646	15 602	15 716	16 591	15 946	14 823	15 207	11 285	14 008	**154 665**
Peanut Butter and Paste	**37 131**	**33 700**	3 209	2 478	2 612	3 072	2 499	2 863	2 560	2 759	2 483	2 221	1 693	**30 876**
Total	**2 149 897**	**2 375 854**	**173 910**	**201 563**	**207 976**	**212 301**	**223 638**	**241 492**	**240 359**	**238 740**	**242 365**	**188 748**	**221 147**	**2 206 112**

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

	OIL SEEDS PRODUCTS IMPORTED (PER MONTH)													
	Marketing year Mar 2020 - Feb 2021 Progressive: 12 Months	Marketing year Mar 2021 - Feb 2022 Progressive: 12 Months	Mar 2022 Tons	Apr 2022 Tons	May 2022 Tons	June 2022 Tons	July 2022 Tons	Aug 2022 Tons	Sep 2022 Tons	Oct 2022 Tons	Nov 2022 Tons	Dec 2022 Tons	Jan 2023 Tons	Marketing year Mar 2022 - Feb 2023 Progressive: 11 Months (Mar - Jan)
Palm Oil and Derivatives	**528 067**	**524 513**	57 561	34 481	40 624	17 897	39 353	73 621	55 851	31 778	45 879	38 275	2 075	**437 395**
Soybean Oil	**119 019**	**68 481**	0	0	0	0	0	0	0	0	0	0	0	**0**
Sunflower Oil	**136 571**	**107 808**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oil/Sunflower Oil	**0**	**0**	20 583	15 877	6 993	26 572	20 853	28 436	14 541	10 897	21 089	3 438	2 066	**171 345**
Coconut Oil/ Groundnut Oil / Canola Oil / Corn (Maize) Oil / Blends or mixes of Oils which includes one of the above Oils / Biodiesel / Cottonseed Oil	**12 702**	**10 035**	225	491	686	223	2 207	437	574	164	239	102	105	**5 453**
Sunflower Oilcake	**7 049**	**55 684**	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	**401 851**	**408 986**	685	27 348	7 707	33 343	3 730	1 148	35 917	29 705	7 826	293	33 799	**181 501**
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	**1 503**	**1 563**	124	157	109	78	65	210	213	62	276	272	174	**1 740**
Total	**1 206 762**	**1 177 070**	**79 178**	**78 354**	**56 119**	**78 113**	**66 208**	**103 852**	**107 096**	**72 606**	**75 309**	**42 380**	**38 219**	**797 434**

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

	OIL SEEDS PRODUCTS EXPORTED (PER MONTH)													
	Marketing year Mar 2020 - Feb 2021 Progressive: 12 Months	Marketing year Mar 2021 - Feb 2022 Progressive: 12 Months	Mar 2022 Tons	Apr 2022 Tons	May 2022 Tons	June 2022 Tons	July 2022 Tons	Aug 2022 Tons	Sep 2022 Tons	Oct 2022 Tons	Nov 2022 Tons	Dec 2022 Tons	Jan 2023 Tons	Marketing year Mar 2022 - Feb 2023 Progressive: 11 Months (Mar - Jan)
Palm Oil and Derivatives	**12 476**	**14 421**	595	389	497	1 163	1 294	1 423	836	972	1 117	810	982	**10 078**
Soybean Oil	**44 035**	**53 889**	0	0	0	0	0	0	0	0	0	0	0	**0**
Sunflower Oil	**3 200**	**2 971**	0	0	0	0	0	0	0	0	0	0	0	**0**
Soybean Oil/Sunflower Oil	**0**	**0**	5 335	5 639	4 495	3 335	2 235	4 788	4 309	5 008	6 279	4 084	4 255	**49 762**
Coconut Oil/ Groundnut Oil / Canola Oil / Corn (Maize) Oil / Blends or mixes of Oils which includes one of the above Oils / Biodiesel / Cottonseed Oil	**6 679**	**12 559**	920	780	2 035	2 289	1 477	927	509	828	452	1 556	1 129	**12 902**
Sunflower Oilcake	**1 510**	**1 755**	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 Oilcake / Cottonseed Oilcake	**11 547**	**18 052**	2 240	1 491	1 040	1 654	414	1 038	726	742	403	339	87	**10 174**
Soybean Flours and Meals / Textured Vegetable Protein	**5 267**	**21 019**	2 110	2 317	2 867	2 500	2 478	2 649	1 213	2 499	2 149	1 139	889	**22 810**
Soybean Fullfat	**2 742**	**3 450**	0	0	0	0	0	0	0	0	0	0	0	**0**
Peanut Butter and Paste	**228**	**240**	20	19	24	22	15	13	25	3	16	20	16	**193**
Total	**87 684**	**128 356**	**11 220**	**10 635**	**10 958**	**10 963**	**7 913**	**10 838**	**7 618**	**10 052**	**10 416**	**7 948**	**7 358**	**105 919**

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 2021/22 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.

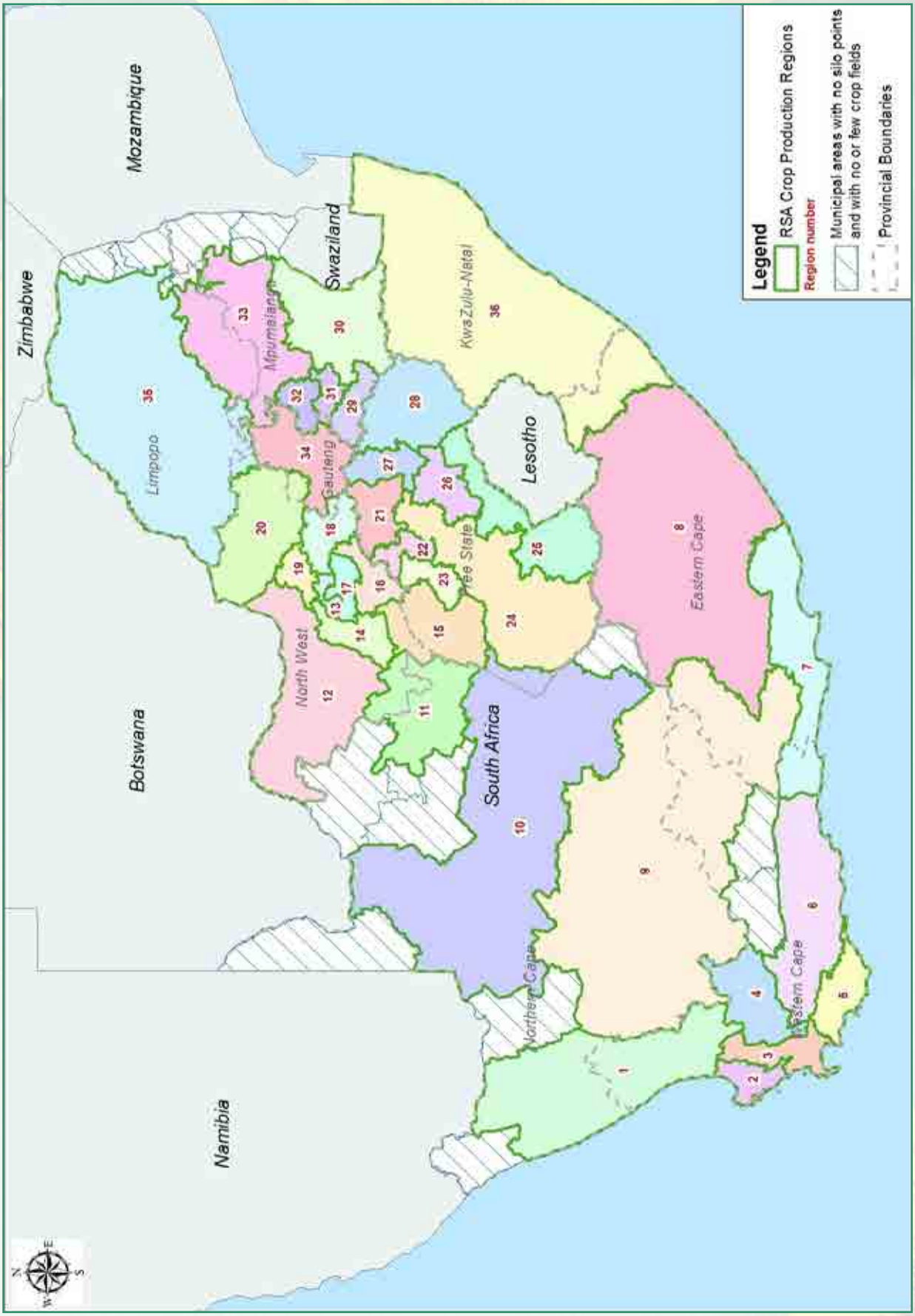


Figure 2: RSA Crop Production Regions

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 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)		

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)		

Grain Production Regions

Silo/Intake stands per region indicating type of storage structure

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

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

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

Region 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)

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

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

Grain Production Regions

Silo/Intake stands per region indicating type of storage structure

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

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

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

Sunflower Crop Quality 2021/22 – Summary of results

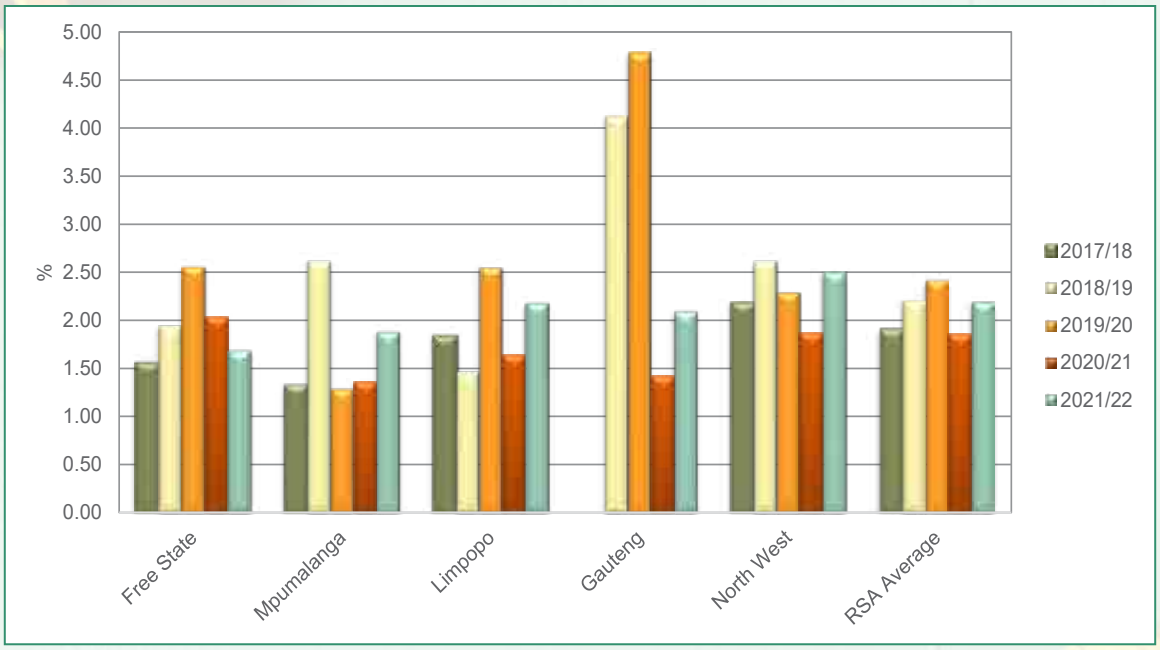
Seventy-five percent (132) of the 176 samples analysed for the purpose of this survey were graded as Grade FH1, with 44 (25%) of the samples downgraded to COSF (Class Other Sunflower Seed). The percentage of samples graded FH1 decreased compared to the previous season's 83%. The ten-year weighted average of the percentage samples graded as FH1 is 79%.

The grading results of the 44 samples downgraded to COSF can be summarised as follows:

- Percentage screenings exceeding the maximum permissible deviation of 4% was present in 21 samples.
- Percentage sclerotia from the fungus *Sclerotinia sclerotiorum* exceeding the maximum permissible deviation of 4% was present in nine samples.
- Percentage foreign matter exceeding the maximum permissible deviation of 4% was present in four samples.
- Percentage collective deviations exceeding the maximum permissible deviation of 6% was present in 30 samples.
- Poisonous seeds that exceeded the allowable number were present in a total of 15 samples. Eleven samples contained *Datura sp.* exceeding the maximum permissible number of 1 per 1000 g. Three samples contained *Ipomoea purpurea Roth.* (morning glory) seeds exceeding 7 per 1000 g and one sample contained *Xanthium sp.* seeds also exceeding 7 per 1000 g.
- Twenty-six of the 44 samples downgraded to COSF were as a result of a combination of two or more of the above mentioned deviations.

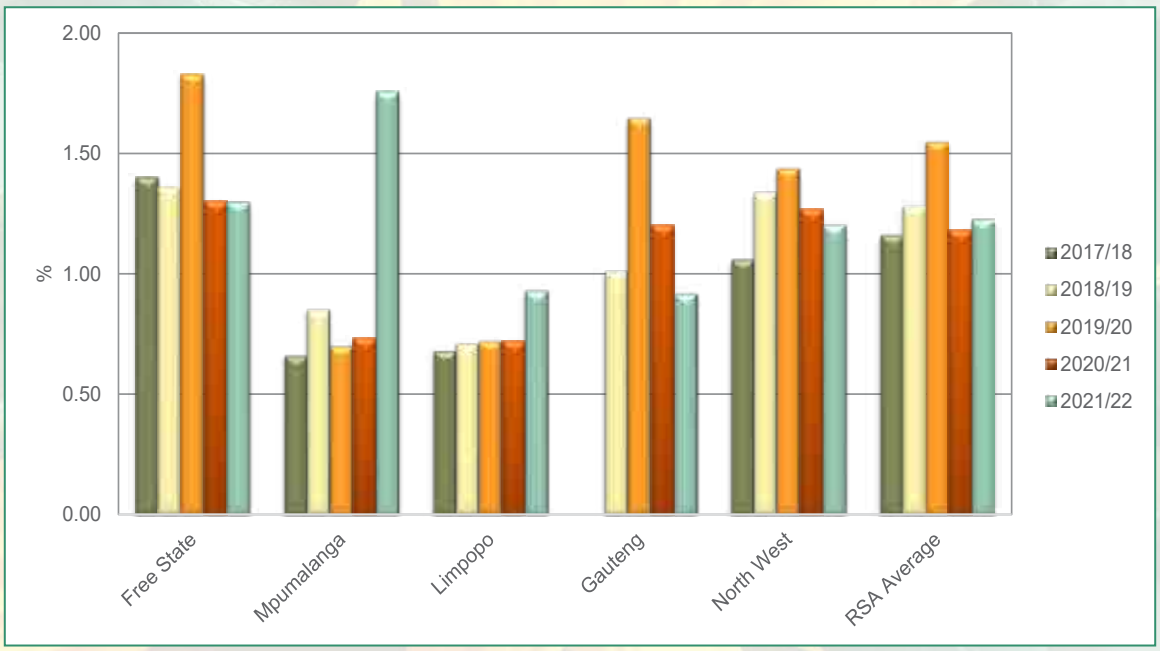
The samples from North West province (N = 89) reported the highest average percentage screenings namely 2.51%, followed by Limpopo (N = 27) and the single sample from Gauteng with 2.19% and 2.10% respectively. The Free State (N = 46) reported the lowest percentage screenings of 1.69%, while Mpumalanga averaged 1.88%. The weighted national average was 2.20% compared to the 1.86% of the previous season.

Graph 16: Average percentage screenings per province over five seasons



The highest weighted average percentage foreign matter (1.76%) was reported for the 13 samples from the Mpumalanga regions. The Free State and North West followed with 1.30% and 1.20% respectively. The lowest percentages were found in Limpopo (0.93%) and Gauteng (0.92%). The national average was 1.23% compared to the 1.18% and 1.55% of the previous two seasons. Please see Graph 17.

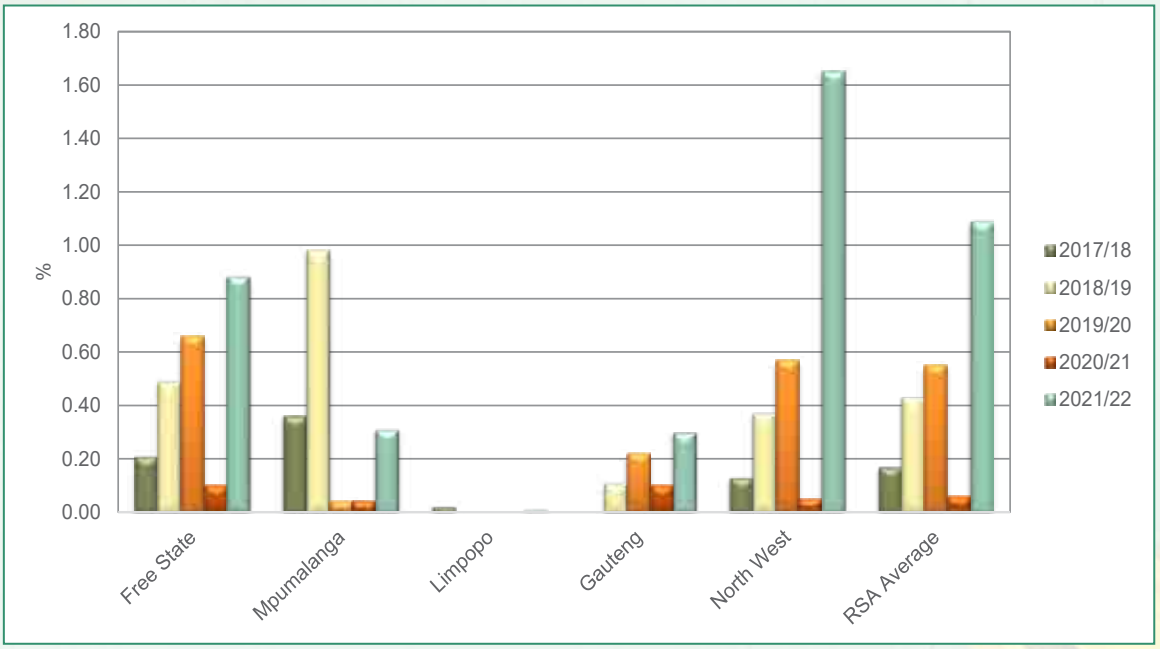
Graph 17: Average percentage foreign matter per province over five seasons



The percentage samples received for this survey that contained sclerotia from the fungus *Sclerotinia sclerotiorum*, increased from 22% in the previous season to 70% this season. In the 2019/20 season, 71% of samples contained sclerotia. 65% of the samples containing sclerotia this season originated in North West province, 25% in the Free State, 6% in Mpumalanga, 3% in Limpopo and the single sample from Gauteng also reported sclerotia.

Nine of the samples received exceeded the maximum permissible deviation of 4%. The highest percentage reported was 14.86%, followed by 11.60%. Seven of the nine samples originated in North West and the remaining two samples originated in the Free State. The national average of 1.09% is the highest of the last ten seasons.

Graph 18: Average percentage sclerotia per province over five seasons

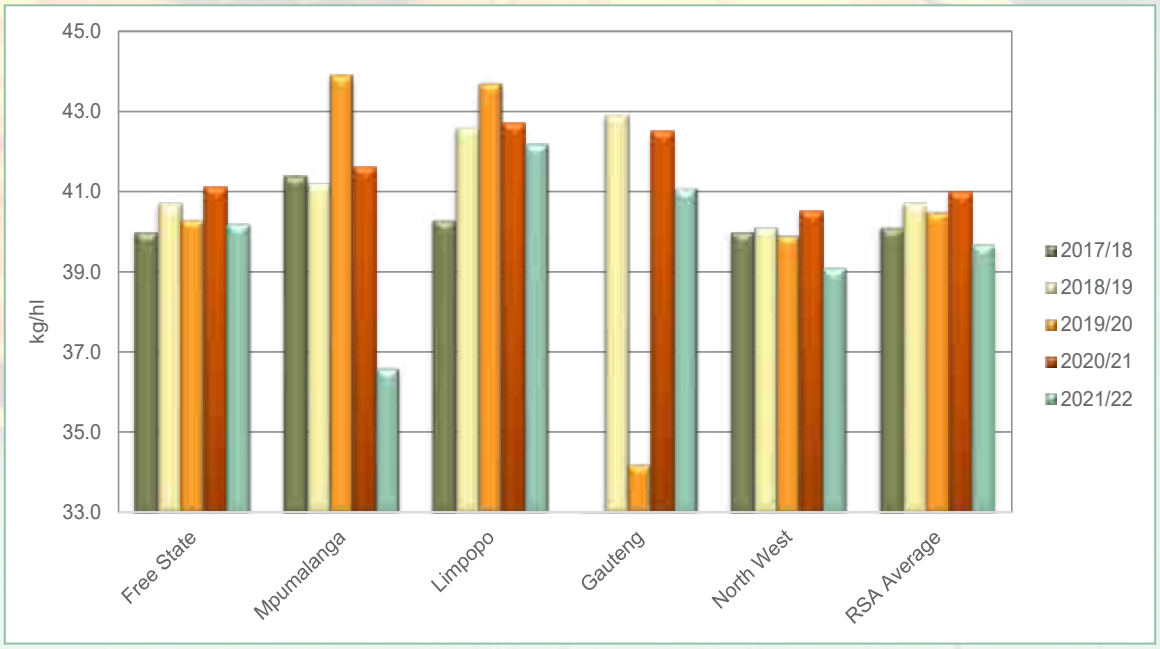


Test weight does not form part of the grading regulations for sunflower seed in South Africa. An approximation of the test weight of South African sunflower seed is provided in Table 3 for information purposes. The standard working procedure of the Kern 222 instrument, as described in ISO 7971-3:2019, 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								
	2021/22 Season			2020/21 Season			2019/20 Season		
	Weighted average	Range	No. of samples	Weighted average	Range	No. of samples	Weighted average	Range	No. of samples
Free State (Regions 21 - 28)	40.2	33.1 - 43.9	*45	41.1	38.0 - 44.9	*44	40.3	27.3 - 47.3	84
Mpumalanga (Regions 29 - 33)	36.6	35.2 - 44.5	13	41.6	40.4 - 42.5	7	43.9	43.7 - 44.0	6
Limpopo (Region 35)	42.2	39.9 - 47.3	27	42.7	40.5 - 44.4	19	43.7	38.7 - 47.4	13
Gauteng (Region 34)	41.1	-	1	42.5	-	1	34.2	-	1
North West (Region 12 - 20)	39.1	32.0 - 42.4	**86	40.5	30.4 - 43.7	85	39.9	30.9 - 48.4	72
RSA	***39.7***	***32.0 - 47.3***	***172***	***41.0***	***30.4 - 44.9***	***156***	***40.5***	***27.3 - 48.4***	***176***

**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



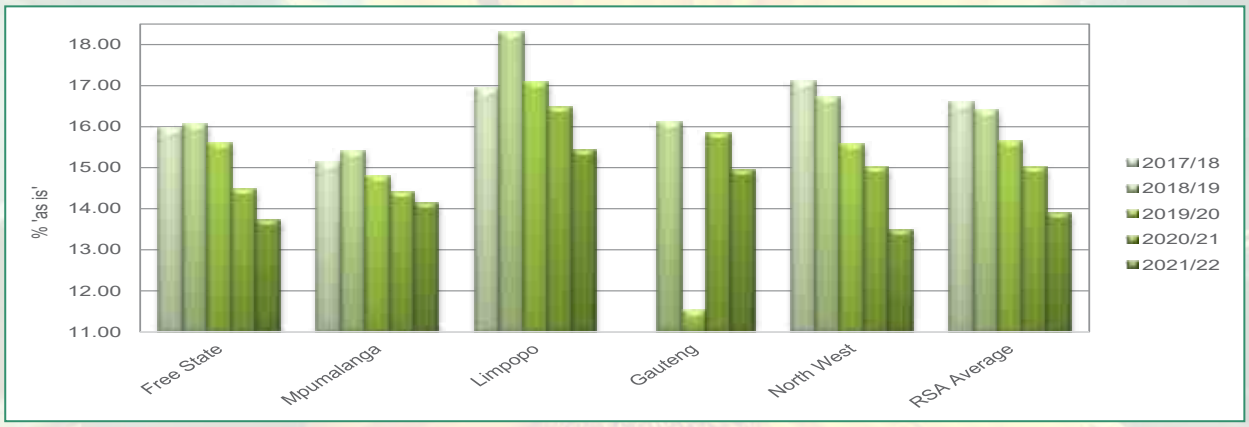
The nutritional component analyses, namely crude protein, -fat, -fibre and ash are reported as % (g/100 g) on an 'as received' or 'as is' basis.

The weighted average crude protein content this season was 13.90%, the lowest of the ten seasons for which crop survey results are available. The previous two seasons' averages were the second and third lowest respectively (15.02% and 15.66%). Limpopo had the highest weighted average crude protein content of 15.42%, followed by the sample from Gauteng with 14.94% and Mpumalanga with an average of 14.15%. The Free State averaged 13.74% and North West 13.48%. The weighted average crude fat percentage was 38.1% compared to the 39.5% of the previous season. The sample from Gauteng had the highest crude fat content of 39.9%, followed by Mpumalanga with 39.0% and North with West 38.4%. Limpopo and the Free State averaged 37.7% and 37.6% respectively.

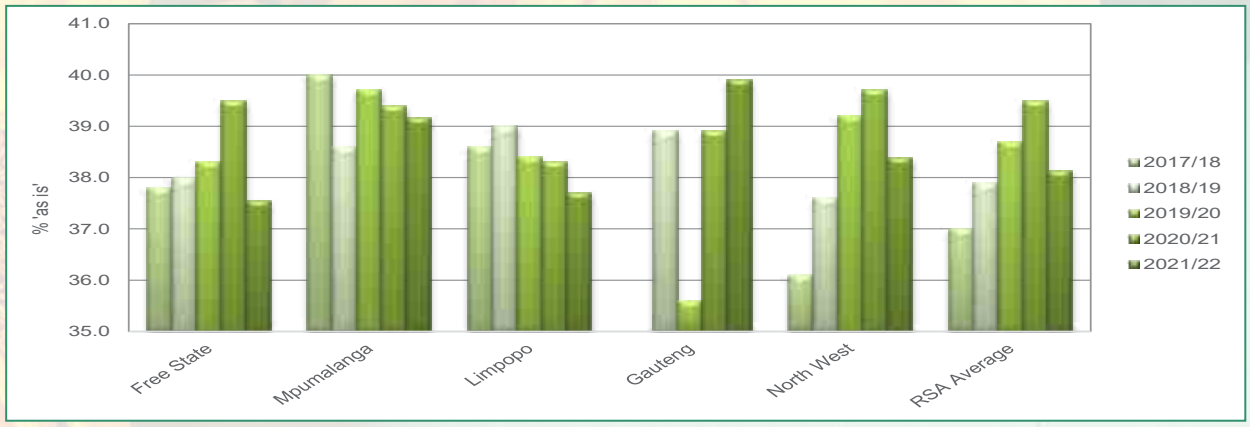
The weighted average percentage crude fibre was 23.1%, the highest weighted average value since the 2012/13 season. Average values varied from a low of 22.1% in Mpumalanga to a high of 23.6% in the Free State. The weighted average ash content was 2.61%. The provincial averages ranged from 2.49% in Gauteng to 2.64% in both North West and the Free State.

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

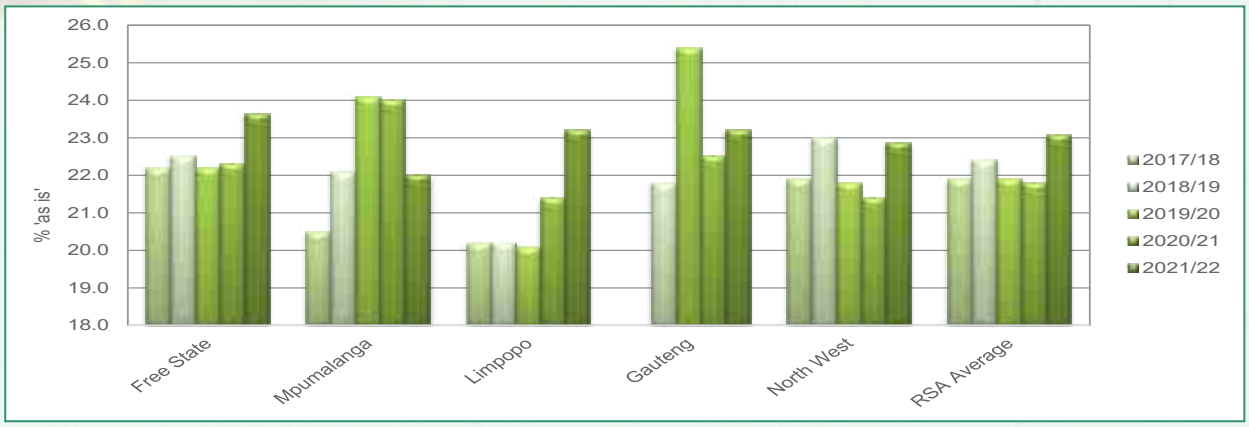
Graph 20: Average crude protein content per province over five seasons



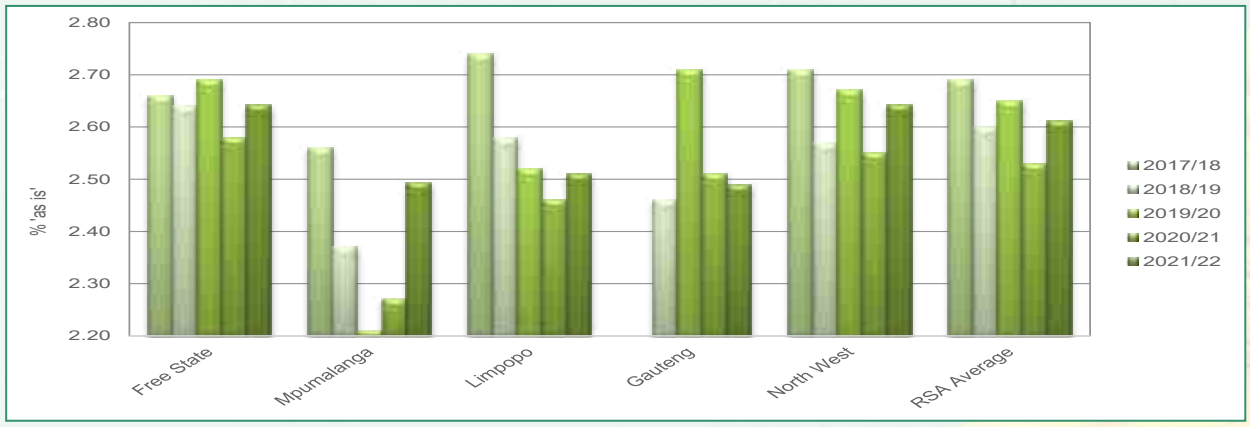
Graph 21: Average crude fat content per province over five seasons



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



Graph 23: Average ash content per province over five seasons



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

Table 4: Comparison between the moisture, crude protein and crude fat results of the sunflower crop quality and ARC cultivar trial samples of the 2021/22 season

Analysis	Moisture, % (5hr, 105°C)	Crude Protein, % (as is)	Crude Fat, % (as is)
Sunflower Crop Quality Survey results			
Average	5.2	13.90	38.1
Minimum	3.0	10.79	30.6
Maximum	7.8	19.73	45.2
Standard deviation	0.77	1.33	2.24
No. of samples	***176***	***176***	***176***
ARC Grains Crops Cultivar trial sample results			
Average	5.2	15.36	43.9
Minimum	3.2	11.26	35.8
Maximum	6.8	21.89	55.8
Standard deviation	0.69	2.64	3.57
No. of samples	***160***	***160***	***160***
% Difference between crop and cultivar samples	***0.0***	***-1.46***	***-5.8***

See Table 5 on page 23 for a summary of the RSA Sunflower Crop Quality averages of the 2021/22 season compared to those of the 2020/21 season.

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

Table 5: South African Sunflower Crop Quality Averages 2021/22 vs 2020/21						
Class and Grade Sunflower	**2021/22**			**2020/21**		
	FH1	**COSF**	**Average**	**FH1**	**COSF**	**Average**
Grading:						
1. Damaged sunflower seed, %	0.19	0.57	0.28	0.05	0.03	0.05
2. Screenings, %	1.61	3.95	2.20	1.55	3.41	1.86
3. Sclerotia, %	0.54	2.77	1.09	0.05	0.13	0.06
4. Foreign Matter, %	1.13	1.53	1.23	1.01	2.07	1.18
5. Deviations in 2,3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	3.28	8.24	4.52	2.61	5.61	3.11
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	6	1	0	3	1
Poisonous seeds (*Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.*)	0	2	0	0	1	0
Number of samples	***132***	***44***	***176***	***131***	***26***	***157***
Nutritional analysis:						
Moisture, % (5 hr, 105 °C)	5.3	5.0	5.2	5.0	4.9	5.0
Crude Protein, % (as is)	13.78	14.27	13.90	15.12	14.56	15.02
Crude Fat, % (as is)	38.1	38.0	38.1	39.5	39.1	39.5
Crude Fibre, % (as is)	23.4	22.2	23.1	21.7	22.22	21.8
Ash, % (as is)	2.58	2.70	2.61	2.54	2.52	2.53
Number of samples	***132***	***44***	***176***	***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, %	0.29	0.00	1.50	0.58	1.11	0.00	3.00	0.97	0.34	0.00	3.15	0.73
2. Screenings, %	2.39	0.90	8.90	2.48	3.54	1.26	6.62	1.77	0.85	0.22	3.30	0.84
3. Sclerotia, %	0.83	0.00	5.20	1.68	4.02	0.32	11.60	3.09	0.32	0.00	1.28	0.37
4. Foreign Matter, %	1.97	0.20	3.60	1.39	0.99	0.26	2.68	0.70	1.29	0.14	3.20	0.76
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	5.19	2.02	14.50	3.66	8.55	2.98	20.02	4.94	2.46	0.70	4.86	1.10
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	7	0	40	14.14	0	0	0	0.00	2	0	20	5.76
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	***9***				***12***				***23***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	5.6	4.3	6.4	0.76	5.1	3.7	6.0	0.63	5.4	3.1	6.8	0.90
Crude Protein, % (as is)	12.87	12.02	14.37	0.77	13.96	13.08	15.25	0.70	13.07	11.66	16.15	1.17
Crude Fat, % (as is)	39.1	35.5	43.6	2.29	38.5	33.8	41.4	1.95	38.2	31.5	45.2	2.65
Crude Fibre, % (as is)	23.0	18.9	25.1	1.75	22.0	18.7	25.4	1.76	23.2	16.5	26.4	2.36
Ash, % (as is)	2.62	2.52	2.88	0.11	2.73	2.55	3.08	0.16	2.63	2.44	3.05	0.13
Number of samples	***9***				***12***				***23***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(17) North-West Central-Northern Region (Ottosdal)				(18) North-West Central Region (Ventersdorp)				(19) North-West Central Region (Lichtenburg)			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.16	0.00	0.80	0.28	0.54	0.00	1.00	0.41	0.44	0.00	2.22	0.61
2. Screenings, %	2.35	1.60	4.30	0.91	4.28	1.40	8.28	2.31	3.14	0.80	15.74	3.11
3. Sclerotia, %	1.70	0.60	4.60	1.33	3.77	0.42	14.86	5.02	1.14	0.10	3.56	0.82
4. Foreign Matter, %	0.88	0.26	1.84	0.51	1.20	0.60	2.50	0.66	1.29	0.10	4.78	1.03
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	4.92	2.80	9.16	2.28	9.25	2.82	24.14	7.14	5.57	2.36	22.52	4.19
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	2	0	20	6.32	0	0	0	0.00	1	0	20	4.36
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	10	2.18
Number of samples	***10***				***7***				***21***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	5.4	4.0	6.6	1.00	4.9	4.0	6.1	0.76	5.0	3.8	5.8	0.63
Crude Protein, % (as is)	13.78	12.60	15.48	0.84	14.23	13.37	15.07	0.57	13.36	11.91	14.30	0.61
Crude Fat, % (as is)	38.4	36.4	41.2	1.56	38.5	36.3	41.3	1.95	37.6	33.4	40.0	1.67
Crude Fibre, % (as is)	22.5	20.6	24.3	1.17	21.2	20.0	23.1	1.08	24.3	21.6	28.8	1.73
Ash, % (as is)	2.65	2.42	2.75	0.10	2.79	2.64	3.15	0.18	2.60	2.31	2.82	0.13
Number of samples	***10***				***7***				***21***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(20) North-West Eastern Region				(21) Free State North-Western Region (Viljoenskroon)				(22) Free State North-Western Region (Bothaville)			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.77	0.00	2.18	0.73	0.21	0.00	0.80	0.35	0.00	0.00	0.00	0.00
2. Screenings, %	2.89	0.88	5.00	1.25	1.48	1.04	2.28	0.38	2.69	0.42	6.24	3.12
3. Sclerotia, %	2.38	0.40	4.08	1.72	1.29	0.00	4.00	1.31	0.22	0.00	0.66	0.38
4. Foreign Matter, %	0.52	0.12	1.20	0.39	1.02	0.22	2.02	0.60	1.42	1.04	1.80	0.38
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	5.79	3.84	9.62	2.06	3.79	2.30	6.20	1.44	4.33	1.84	8.70	3.80
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0.00	3	0	20	7.07	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	***7***				***8***				***3***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	4.3	3.0	5.5	0.84	4.8	4.2	5.7	0.57	5.0	4.6	5.7	0.64
Crude Protein, % (as is)	14.03	13.77	14.59	0.28	13.86	11.69	15.23	1.02	14.53	12.64	17.65	2.72
Crude Fat, % (as is)	40.1	37.5	43.0	1.86	38.4	37.3	39.9	0.97	38.8	36.4	40.6	2.18
Crude Fibre, % (as is)	21.0	19.3	22.9	1.08	23.7	21.3	25.2	1.32	24.0	22.3	25.6	1.66
Ash, % (as is)	2.53	2.41	2.68	0.09	2.57	2.30	2.75	0.15	2.64	2.61	2.68	0.04
Number of samples	***7***				***8***				***3***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(23) Free State North-Western Region				(24) Free State Central Region				(26) Free State South-Eastern Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.17	0.00	0.68	0.34	0.00	0.00	0.00	0.00	0.06	0.00	0.76	0.22
2. Screenings, %	1.27	0.64	2.00	0.66	1.59	0.16	3.40	1.06	1.94	0.60	5.46	1.27
3. Sclerotia, %	0.08	0.00	0.32	0.16	0.36	0.00	2.04	0.64	1.80	0.10	9.00	2.82
4. Foreign Matter, %	1.14	0.26	1.80	0.64	1.57	0.16	4.40	1.35	1.35	0.64	4.00	0.93
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	2.49	1.38	3.44	1.00	3.52	0.32	6.80	1.98	5.09	2.32	15.88	3.92
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	0	0	0.00	2	0	20	5.55	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	***4***				***13***				***12***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	6.4	4.6	7.8	1.62	5.6	4.9	6.2	0.43	5.5	4.6	5.9	0.41
Crude Protein, % (as is)	14.35	13.73	14.56	0.41	13.88	10.79	17.05	1.81	13.02	11.98	14.39	0.81
Crude Fat, % (as is)	35.9	34.7	36.8	0.87	37.6	34.5	41.0	2.30	36.7	30.6	40.1	2.81
Crude Fibre, % (as is)	23.9	23.3	24.4	0.46	24.0	22.7	25.9	1.11	23.4	20.0	26.4	1.76
Ash, % (as is)	2.64	2.52	2.76	0.13	2.61	2.40	2.84	0.15	2.67	2.41	3.03	0.23
Number of samples	***4***				***13***				***12***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(27) Free State Northern Region				(28) Free State Eastern Region				(29) Mpumalanga Southern Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.00	-	-	-	0.00	0.00	0.00	0.00	0.37	0.00	1.10	0.51
2. Screenings, %	2.16	-	-	-	1.31	0.20	2.26	0.79	1.71	0.60	5.24	1.49
3. Sclerotia, %	1.00	-	-	-	0.42	0.00	1.12	0.44	0.45	0.00	1.60	0.62
4. Foreign Matter, %	1.40	-	-	-	0.97	0.52	1.66	0.52	2.11	0.40	4.90	1.59
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	4.56	-	-	-	2.70	1.22	4.62	1.35	4.27	1.82	9.66	2.76
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	3	0	20	7.07
Number of samples	***1***				***5***				***8***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	5.4	-	-		5.6	5.2	6.6	0.58	4.8	4.5	5.1	0.27
Crude Protein, % (as is)	14.69	-	-	-	13.72	12.50	14.49	0.89	14.41	12.85	15.73	0.84
Crude Fat, % (as is)	35.7	-	-	-	38.8	36.8	40.9	1.58	38.6	34.9	42.1	2.77
Crude Fibre, % (as is)	24.0	-	-	-	22.7	22.0	23.3	0.56	22.1	20.4	24.9	1.40
Ash, % (as is)	2.59	-	-	-	2.78	2.50	3.39	0.35	2.63	2.37	2.84	0.16
Number of samples	***1***				***5***				***8***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(30) Mpumalanga Eastern Region				(33) Mpumalanga Northern Region				(34) Gauteng Region			
Grading:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.00	-	-	-	0.05	0.00	0.10	0.06	0.00	-	-	-
2. Screenings, %	1.80	-	-	-	2.23	1.80	3.00	0.53	2.10	-	-	-
3. Sclerotia, %	0.24	-	-	-	0.05	0.00	0.10	0.06	0.30	-	-	-
4. Foreign Matter, %	4.04	-	-	-	0.49	0.18	0.92	0.31	0.92	-	-	-
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	6.08	-	-	-	2.76	2.18	3.54	0.68	3.32	-	-	-
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	0	-	-	-	0	0	0	0.00	40	-	-	-
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	20	-	-	-	5	0	20	10.00	0	-	-	-
Number of samples	***1***				***4***				***1***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	5.3	-	-	-	4.8	4.3	5.3	0.48	5.4	-	-	-
Crude Protein, % (as is)	16.77	-	-	-	12.96	12.52	13.62	0.47	14.94	-	-	-
Crude Fat, % (as is)	36.7	-	-	-	40.3	37.4	43.4	2.88	39.9	-	-	-
Crude Fibre, % (as is)	23.4	-	-	-	21.8	19.2	22.9	1.74	23.2	-	-	-
Ash, % (as is)	3.09	-	-	-	2.22	2.18	2.25	0.03	2.49	-	-	-
Number of samples	***1***				***4***				***1***			

South Africa

REGIONAL SUNFLOWER QUALITY

PRODUCTION REGION	(35) Limpopo Region			
Grading:	***ave***	***min***	***max***	***stdev***
1. Damaged sunflower seed, %	0.00	0.00	0.00	0.00
2. Screenings, %	2.19	0.16	4.38	1.28
3. Sclerotia, %	0.01	0.00	0.10	0.04
4. Foreign Matter, %	0.93	0.10	2.00	0.54
5. Deviations in 2, 3 and 4 collectively, %: Provided that such deviations are individually within the limits of said items	3.14	0.26	5.92	1.56
Poisonous seeds *(Crotalaria sp., Datura sp., Ricinis communis)*	1	0	20	5.34
Poisonous seeds *(Argemone mexicana L., Convolvulus sp., Ipomoea purpurea Roth., Lolium temulentum, Xanthium sp.)*	0	0	0	0.00
Number of samples	***27***			
Nutritional analysis:	***ave***	***min***	***max***	***stdev***
Moisture, % (5 hr, 105 °C)	5.2	4.3	6.8	0.67
Crude Protein, % (as is)	15.42	12.76	19.73	1.40
Crude Fat, % (as is)	37.7	30.7	41.3	2.22
Crude Fibre, % (as is)	23.2	19.1	26.9	1.96
Ash, % (as is)	2.51	2.13	2.90	0.21
Number of samples	***27***			

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 third consecutive year to perform fatty acid profile analyses on 20 composite crop samples representing different production regions as well as 30 cultivar samples from different localities. Please refer to Tables 6, 7 and 8 on pages 32 to 34 for the results.

The following fatty acid were included in the profile analysis:

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
C17:1	Glinkgolic acid	C20:2	Eicosadienoic acid
C18:0	Stearic acid	C20:5	Eicosapentanoic acid
C18:1 t	trans Oleic acid	C21:0	Heneicosanoic acid
C18:1 c	cis Oleic acid	C22:0	Behenic acid
C18:1n7	Vaccenic acid	C22:0	Behenic acid
C18:2 t	trans Linoleic acid	C24:0	Lignoceric acid
C18:2 c	cis Linoleic acid	C24:1	Nervonic acid
C18:3n6	n6 Linolenic acid		

Vaccenic acid (C18:1n7) is an isomer of C18:1 which can now be distinguished with new technology and was previously included in the total amount for oleic acid.

References:

Accum, F., 1820. "A Treatise on Adulteration of Food and Culinary Poisons", Longman, Hurst, Rees, Orme and Row, London.

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Rossell, J.B., Measurement of rancidity. IN: J.C. and Hamilton R.J. (Eds), Rancidity in Foods. Blackie Academic and Professional, Glasgow, pp22-53.

Van Niekerk, P.J., 1990. Determination of the component oils of edible oil blends. University of Pretoria.

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

Table 6: Fatty acid profile results of a selection of crop quality samples from the 2021/22 season

Province	Region	g Fatty acids/100 g Fatty Acids																							
		C14:0	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1 t	C18:1 c	C18:1n7	C18:2 t	C18:2 c	C18:3n6	C18:3n5	C18:3n3	C20:0	C20:1	C20.2	C20.5	C21:0	C22:0	C22:1	C24:0	C24:1	Unknown
North West	12	ND	5.53	ND	ND	ND	4.38	ND	19.56	0.56	ND	67.7	ND	ND	LOQ	0.413	LOQ	ND	LOQ	ND	0.96	ND	0.31	ND	LOQ
	13	ND	5.57	ND	ND	ND	5.76	ND	15.84	0.48	ND	69.8	ND	ND	LOQ	0.456	LOQ	ND	LOQ	ND	1.06	ND	0.32	ND	LOQ
	14	ND	5.33	ND	ND	ND	5.97	ND	16.30	0.48	ND	69.4	ND	ND	LOQ	0.440	LOQ	ND	LOQ	ND	0.95	ND	LOQ	ND	LOQ
	14	ND	5.71	ND	ND	ND	3.98	ND	20.23	0.56	ND	67.1	ND	ND	LOQ	0.381	LOQ	ND	LOQ	ND	0.97	ND	0.33	ND	LOQ
	17	ND	5.47	ND	ND	ND	4.79	ND	18.79	0.51	ND	68.2	ND	ND	LOQ	0.416	LOQ	ND	LOQ	ND	0.88	ND	LOQ	ND	LOQ
	18	ND	5.38	ND	ND	ND	4.32	ND	21.33	0.52	ND	66.0	ND	ND	LOQ	0.395	LOQ	ND	LOQ	ND	0.97	ND	0.32	ND	LOQ
	19	ND	5.51	ND	ND	ND	5.35	ND	16.44	0.51	ND	69.6	ND	ND	LOQ	0.443	LOQ	ND	LOQ	ND	1.08	ND	0.291	ND	LOQ
	19	ND	5.84	ND	ND	ND	5.20	ND	15.35	0.55	ND	70.6	ND	ND	LOQ	0.448	LOQ	ND	LOQ	ND	1.06	ND	0.297	ND	LOQ
	20	ND	5.54	ND	ND	ND	5.60	ND	15.48	0.57	ND	70.2	ND	ND	LOQ	0.454	LOQ	ND	LOQ	ND	1.03	ND	0.290	ND	LOQ
	Min	*-*	*5.33*	*-*	*-*	*-*	*3.98*	*-*	*15.35*	*0.48*	*-*	*66.0*	*-*	*-*	*-*	*0.381*	*-*	*-*	*-*	*-*	*0.88*	*-*	*0.290*	*-*	*-*
	Max	*-*	*5.84*	*-*	*-*	*-*	*5.97*	*-*	*21.33*	*0.57*	*-*	*70.6*	*-*	*-*	*-*	*0.456*	*-*	*-*	*-*	*-*	*1.08*	*-*	*0.33*	*-*	*-*
	N	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*
Free State	21	ND	5.66	ND	ND	ND	5.61	ND	15.55	0.50	ND	70.2	ND	ND	LOQ	0.442	LOQ	ND	LOQ	ND	1.02	ND	LOQ	ND	LOQ
	22	ND	4.94	ND	ND	ND	6.58	ND	15.19	0.52	ND	70.1	ND	ND	LOQ	0.51	LOQ	ND	LOQ	ND	1.05	ND	0.285	ND	LOQ
	23	ND	5.46	ND	ND	ND	6.21	ND	14.63	0.50	ND	70.7	ND	ND	LOQ	0.468	LOQ	ND	LOQ	ND	1.06	ND	LOQ	ND	LOQ
	24	ND	5.28	ND	ND	ND	5.59	ND	17.90	0.49	ND	68.2	ND	ND	LOQ	0.436	LOQ	ND	LOQ	ND	0.96	ND	LOQ	ND	LOQ
	24	ND	4.84	ND	LOQ	ND	8.33	ND	14.09	0.44	ND	69.7	ND	ND	LOQ	0.55	LOQ	ND	LOQ	ND	1.00	ND	LOQ	ND	LOQ
	26	ND	5.64	ND	ND	ND	6.77	ND	15.26	0.54	ND	69.2	ND	ND	LOQ	0.58	LOQ	ND	LOQ	ND	1.13	ND	0.282	ND	LOQ
	28	ND	5.69	ND	ND	ND	5.98	ND	14.95	0.53	ND	70.4	ND	ND	LOQ	0.467	LOQ	ND	ND	ND	1.04	ND	LOQ	ND	LOQ
	Min	*-*	*4.84*	*-*	*-*	*-*	*5.59*	*-*	*14.09*	*0.44*	*-*	*68.2*	*-*	*-*	*-*	*0.436*	*-*	*-*	*-*	*-*	*0.96*	*-*	*0.282*	*-*	*-*
	Max	*-*	*5.69*	*-*	*-*	*-*	*8.33*	*-*	*17.90*	*0.54*	*-*	*70.7*	*-*	*-*	*-*	*0.58*	*-*	*-*	*-*	*-*	*1.13*	*-*	*0.285*	*-*	*-*
	N	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*	*7*
Mpumalanga	29	ND	5.67	ND	ND	ND	4.89	ND	19.92	0.53	ND	66.4	ND	ND	LOQ	0.439	LOQ	ND	LOQ	ND	1.03	ND	0.294	ND	LOQ
	29	ND	5.20	ND	ND	ND	5.75	ND	16.83	0.49	ND	69.2	ND	ND	LOQ	0.468	LOQ	ND	LOQ	ND	1.06	ND	0.292	ND	LOQ
	33	ND	5.89	ND	ND	ND	4.98	ND	20.36	0.59	ND	65.6	ND	ND	LOQ	0.438	LOQ	ND	LOQ	ND	1.05	ND	LOQ	ND	LOQ
	Min	*-*	*5.20*	*-*	*-*	*-*	*4.89*	*-*	*16.83*	*0.49*	*-*	*65.6*	*-*	*-*	*-*	*0.438*	*-*	*-*	*-*	*-*	*1.03*	*-*	*0.282*	*-*	*-*
	Max	*-*	*5.89*	*-*	*-*	*-*	*5.75*	*-*	*20.36*	*0.59*	*-*	*69.2*	*-*	*-*	*-*	*0.468*	*-*	*-*	*-*	*-*	*1.06*	*-*	*0.294*	*-*	*-*
	N	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
Gauteng	34	ND	5.21	ND	ND	ND	5.64	ND	17.95	0.53	ND	68.1	ND	ND	LOQ	0.47	LOQ	ND	LOQ	ND	1.11	ND	0.281	ND	LOQ
Limpopo	35	ND	5.64	LOQ	ND	ND	3.88	ND	28.43	0.72	ND	58.8	ND	ND	ND	0.349	LOQ	ND	0.31	ND	0.83	ND	0.293	ND	0.30
	35	ND	5.39	ND	ND	ND	6.28	ND	15.32	0.53	ND	69.9	ND	ND	LOQ	0.485	LOQ	ND	LOQ	ND	1.00	ND	LOQ	ND	LOQ
	Min	*-*	*5.39*	*-*	*-*	*-*	*3.88*	*-*	*15.32*	*0.53*	*-*	*58.8*	*-*	*-*	*-*	*0.349*	*-*	*-*	*-*	*-*	*0.83*	*-*	*0.293*	*-*	*0.30*
	Max	*-*	*5.64*	*-*	*-*	*-*	*6.28*	*-*	*28.43*	*0.72*	*-*	*69.9*	*-*	*-*	*-*	*0.485*	*-*	*-*	*0.31*	*-*	*1.00*	*-*	*-*	*-*	*-*
	N	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
RSA	*Min*	*-*	*4.84*	*-*	*-*	*-*	*3.88*	*-*	*14.09*	*0.44*	*-*	*58.8*	*-*	*-*	*-*	*0.349*	*-*	*-*	*-*	*-*	*0.83*	*-*	*0.282*	*-*	*-*
	Max	*-*	*5.89*	*-*	*-*	*-*	*8.33*	*-*	*28.43*	*0.72*	*-*	*70.6*	*-*	*-*	*-*	*0.58*	*-*	*-*	*0.31*	*-*	*1.13*	*-*	*0.33*	*-*	*0.30*
	N	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*	*22*

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

Table 7: Fatty acid profile results of a selection of cultivar samples from the 2021/22 season

Province	Locality	Region	Cultivar	g Fatty acids/100 g Fatty Acids																						
				C14:0	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1 t	C18:1 c	C18:1 n7	C18:2 t	C18:2 c	C18:3n6	C18:3n5	C18:3n3	C20:0	C20:1	C20.2	C20.5	C21:0	C22:0	C22:1	C24:0	C24:1	Unknown
North West	Potchefstroom 3	18	AGSUN 5106 CLP	ND	4.71	ND	ND	ND	5.59	ND	24.65	0.52	ND	62.0	ND	ND	ND	0.429	LOQ	ND	LOQ	ND	1.03	ND	0.291	ND	LOQ
			AGSUN 8251	ND	4.69	ND	ND	ND	5.82	ND	25.52	0.48	ND	60.9	ND	ND	ND	0.448	LOQ	ND	LOQ	ND	1.06	ND	0.33	ND	LOQ
			Aguara 6	ND	4.38	ND	LOQ	ND	4.22	ND	22.39	0.55	ND	65.8	ND	ND	ND	0.390	LOQ	ND	LOQ	ND	0.97	ND	0.34	ND	LOQ
			P 65 LL 14	ND	4.78	ND	ND	ND	5.33	ND	23.37	0.48	ND	63.5	ND	ND	ND	0.425	LOQ	ND	LOQ	ND	1.04	ND	0.31	ND	LOQ
			PAN 7180 CLP	ND	5.49	ND	ND	ND	4.85	ND	21.54	0.55	ND	64.8	ND	ND	LOQ	0.437	LOQ	ND	LOQ	ND	1.13	ND	0.32	ND	LOQ
			SY 3970 CL	ND	4.78	ND	ND	ND	5.50	ND	25.03	0.51	ND	61.3	ND	ND	LOQ	0.48	LOQ	ND	LOQ	ND	1.27	ND	0.34	ND	LOQ
		Min		-	*4.38*	-	-	-	*4.22*	-	*21.54*	*0.48*	-	*60.9*	-	-	-	*0.390*	-	-	-	-	*0.97*	-	*0.291*	-	-
		Max		-	*5.49*	-	-	-	*5.82*	-	*25.52*	*0.55*	-	*65.8*	-	-	-	*0.48*	-	-	-	-	*1.27*	-	*0.34*	-	-
		N		*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
Free State	Wesselsbron	23	AGSUN 5106 CLP	ND	4.44	ND	LOQ	ND	8.70	ND	14.26	0.49	ND	69.2	ND	ND	LOQ	0.63	LOQ	ND	LOQ	ND	1.29	ND	0.281	ND	LOQ
			AGSUN 8251	ND	4.77	ND	ND	ND	8.36	ND	13.48	0.47	ND	70.3	ND	ND	LOQ	0.57	LOQ	ND	LOQ	ND	1.06	ND	0.281	ND	LOQ
			Aguara 6	ND	4.52	ND	ND	ND	6.55	ND	15.92	0.52	ND	70.1	ND	ND	LOQ	0.49	LOQ	ND	LOQ	ND	1.04	ND	0.285	ND	LOQ
			P 65 LL 14	ND	5.00	ND	ND	ND	6.59	ND	13.82	0.46	ND	71.7	ND	ND	LOQ	0.49	LOQ	ND	LOQ	ND	1.08	ND	0.299	ND	LOQ
			PAN 7180 CLP	ND	5.81	ND	ND	ND	6.04	ND	14.57	0.58	ND	70.5	ND	ND	LOQ	0.53	LOQ	ND	ND	ND	1.04	ND	LOQ	ND	ND
			SY 3970 CL	ND	5.31	ND	ND	ND	6.82	ND	13.89	0.53	ND	70.8	ND	ND	LOQ	0.53	LOQ	ND	ND	ND	1.26	ND	0.280	ND	ND
		Min		-	*4.44*	-	-	-	*6.04*	-	*13.48*	*0.46*	-	*69.2*	-	-	-	*0.49*	-	-	-	-	*1.04*	-	*0.280*	-	-
		Max		-	*5.81*	-	-	-	*8.70*	-	*15.92*	*0.58*	-	*71.7*	-	-	-	*0.63*	-	-	-	-	*1.29*	-	*0.299*	-	-
		N		*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
	Steynsrus	26	AGSUN 5106 CLP	ND	4.23	ND	LOQ	ND	5.59	ND	32.19	0.49	ND	54.9	ND	ND	ND	0.463	LOQ	ND	LOQ	ND	1.12	ND	0.30	ND	LOQ
			AGSUN 8251	ND	4.27	ND	LOQ	ND	5.84	ND	33.06	0.45	ND	53.7	ND	ND	ND	0.48	LOQ	ND	LOQ	ND	1.14	ND	0.36	ND	LOQ
			Aguara 6	ND	3.83	ND	ND	ND	4.42	ND	31.76	0.51	ND	57.0	ND	ND	ND	0.399	LOQ	ND	LOQ	ND	0.98	ND	0.33	ND	LOQ
			P 65 LL 14	ND	4.81	ND	ND	ND	4.77	ND	22.85	0.53	ND	64.6	ND	ND	ND	0.399	LOQ	ND	LOQ	ND	0.98	ND	0.33	ND	LOQ
			PAN 7180 CLP	ND	5.60	ND	ND	ND	6.23	ND	14.49	0.55	ND	70.6	ND	ND	LOQ	0.465	LOQ	ND	LOQ	ND	1.02	ND	LOQ	ND	LOQ
			SY 3970 CL	ND	4.52	ND	ND	ND	7.36	ND	15.00	0.43	ND	70.0	ND	ND	LOQ	0.52	LOQ	ND	LOQ	ND	1.22	ND	LOQ	ND	LOQ
		Min		-	*3.83*	-	-	-	*4.42*	-	*14.49*	*0.43*	-	*53.7*	-	-	-	*0.399*	-	-	-	-	*0.98*	-	*0.30*	-	-
		Max		-	*5.60*	-	-	-	*7.36*	-	*33.06*	*0.55*	-	*70.6*	-	-	-	*0.52*	-	-	-	-	*1.22*	-	*0.36*	-	-
		N		*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*	*6*
		Min		-	*3.83*	-	-	-	*4.42*	-	*13.48*	*0.43*	-	*53.7*	-	-	-	*0.399*	-	-	-	-	*0.98*	-	*0.280*	-	-
		Max		-	*5.81*	-	-	-	*8.70*	-	*33.06*	*0.58*	-	*71.7*	-	-	-	*0.63*	-	-	-	-	*1.29*	-	*0.36*	-	-
		N		*12*	*12*	*12*	*12*	*12*	*6*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*	*12*
Min				-	*3.83*	-	-	-	*4.22*	-	*13.48*	*0.43*	-	*53.7*	-	-	-	*0.390*	-	-	-	-	*0.97*	-	*0.280*	-	-
Max				-	*5.81*	-	-	-	*8.70*	-	*33.06*	*0.58*	-	*71.7*	-	-	-	*0.63*	-	-	-	-	*1.29*	-	*0.36*	-	-
N				*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*	*18*

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

Table 8: Fatty acid profile results of a selection of cultivar samples from the 2021/22 season (continue)

Province	Region	Cultivar	g Fatty acids/100 g Fatty Acids																							
			C14:0	C16:0	C16:1	C17:0	C17:1	C18:0	C18:1 t	C18:1 c	C18:1 n7	C18:2 t	C18:2 c	C18:3n6	C18:3n5	C18:3n3	C20:0	C20:1	C20.2	C20.5	C21:0	C22:0	C22:1	C24:0	C24:1	Unknown
North West	18	AGSUN 5106 CLP	ND	4.71	ND	ND	ND	5.59	ND	24.65	0.52	ND	62.0	ND	ND	ND	0.429	LOQ	ND	LOQ	ND	1.03	ND	0.291	ND	LOQ
Free State	23		ND	4.23	ND	LOQ	ND	5.59	ND	32.19	0.49	ND	54.9	ND	ND	ND	0.463	LOQ	ND	LOQ	ND	1.12	ND	0.30	ND	LOQ
	26		ND	4.44	ND	LOQ	ND	8.70	ND	14.26	0.49	ND	69.2	ND	ND	LOQ	0.63	LOQ	ND	LOQ	ND	1.29	ND	0.281	ND	LOQ
Min			-	***4.23***	-	-	-	***5.59***	-	***14.26***	***0.49***	-	***54.9***	-	-	-	***0.429***	-	-	-	-	***1.03***	-	***0.281***	-	-
Max			-	***4.71***	-	-	-	***8.70***	-	***32.19***	***0.52***	-	***69.2***	-	-	-	***0.63***	-	-	-	-	***1.29***	-	***0.30***	-	-
N			***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***
North West	18	AGSUN 8251	ND	4.69	ND	ND	ND	5.82	ND	25.52	0.48	ND	60.9	ND	ND	ND	0.448	LOQ	ND	LOQ	ND	1.06	ND	0.33	ND	LOQ
Free State	23		ND	4.27	ND	LOQ	ND	5.84	ND	33.06	0.45	ND	53.7	ND	ND	ND	0.48	LOQ	ND	LOQ	ND	1.14	ND	0.36	ND	LOQ
	26		ND	4.77	ND	ND	ND	8.36	ND	13.48	0.47	ND	70.3	ND	ND	LOQ	0.57	LOQ	ND	LOQ	ND	1.06	ND	0.281	ND	LOQ
Min			-	***4.27***	-	-	-	***5.82***	-	***13.48***	***0.45***	-	***53.7***	-	-	-	***0.448***	-	-	-	-	***1.06***	-	***0.281***	-	-
Max			-	***4.77***	-	-	-	***8.36***	-	***33.06***	***0.48***	-	***70.3***	-	-	-	***0.57***	-	-	-	-	***1.14***	-	***0.36***	-	-
N			***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***
North West	18	Aguara 6	ND	4.38	ND	LOQ	ND	4.22	ND	22.39	0.55	ND	65.8	ND	ND	ND	0.390	LOQ	ND	LOQ	ND	0.97	ND	0.34	ND	LOQ
Free State	23		ND	3.83	ND	ND	ND	4.42	ND	31.76	0.51	ND	57.0	ND	ND	ND	0.399	LOQ	ND	LOQ	ND	0.98	ND	0.33	ND	LOQ
	26		ND	4.52	ND	ND	ND	6.55	ND	15.92	0.52	ND	70.1	ND	ND	LOQ	0.49	LOQ	ND	LOQ	ND	1.04	ND	0.285	ND	LOQ
Min			-	***3.83***	-	-	-	***4.22***	-	***15.92***	***0.51***	-	***57.0***	-	-	-	***0.390***	-	-	-	-	***0.97***	-	***0.285***	-	-
Max			-	***4.52***	-	-	-	***6.55***	-	***31.76***	***0.55***	-	***70.1***	-	-	-	***0.49***	-	-	-	-	***1.04***	-	***0.34***	-	-
N			***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***
North West	18	P 65 LL 14	ND	4.78	ND	ND	ND	5.33	ND	23.37	0.48	ND	63.5	ND	ND	ND	0.425	LOQ	ND	LOQ	ND	1.04	ND	0.31	ND	LOQ
Free State	23		ND	4.81	ND	ND	ND	4.77	ND	22.85	0.53	ND	64.6	ND	ND	ND	0.399	LOQ	ND	LOQ	ND	0.98	ND	0.33	ND	LOQ
	26		ND	5.00	ND	ND	ND	6.59	ND	13.82	0.46	ND	71.7	ND	ND	LOQ	0.49	LOQ	ND	LOQ	ND	1.08	ND	0.299	ND	LOQ
Min			-	***4.78***	-	-	-	***4.77***	-	***13.82***	***0.46***	-	***63.5***	-	-	-	***0.399***	-	-	-	-	***0.98***	-	***0.299***	-	-
Max			-	***5.00***	-	-	-	***6.59***	-	***23.37***	***0.53***	-	***71.7***	-	-	-	***0.49***	-	-	-	-	***1.08***	-	***0.33***	-	-
N			***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***
North West	18	PAN 7180 CLP	ND	5.49	ND	ND	ND	4.85	ND	21.54	0.55	ND	64.8	ND	ND	LOQ	0.437	LOQ	ND	LOQ	ND	1.13	ND	0.32	ND	LOQ
Free State	23		ND	5.60	ND	ND	ND	6.23	ND	14.49	0.55	ND	70.6	ND	ND	LOQ	0.465	LOQ	ND	LOQ	ND	1.02	ND	LOQ	ND	LOQ
	26		ND	5.81	ND	ND	ND	6.04	ND	14.57	0.58	ND	70.5	ND	ND	LOQ	0.53	LOQ	ND	ND	ND	1.04	ND	LOQ	ND	ND
Min			-	***5.49***	-	-	-	***4.85***	-	***14.49***	***0.55***	-	***64.8***	-	-	-	***0.437***	-	-	-	-	***1.02***	-	***0.320***	-	-
Max			-	***5.81***	-	-	-	***6.23***	-	***21.54***	***0.58***	-	***70.6***	-	-	-	***0.53***	-	-	-	-	***1.13***	-	***0.32***	-	-
N			***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***
North West	18	SY 3970 CL	ND	4.78	ND	ND	ND	5.50	ND	25.03	0.51	ND	61.3	ND	ND	LOQ	0.48	LOQ	ND	LOQ	ND	1.27	ND	0.34	ND	LOQ
Free State	23		ND	4.52	ND	ND	ND	7.36	ND	15.00	0.43	ND	70.0	ND	ND	LOQ	0.52	LOQ	ND	LOQ	ND	1.22	ND	LOQ	ND	LOQ
	26		ND	5.31	ND	ND	ND	6.82	ND	13.89	0.53	ND	70.8	ND	ND	LOQ	0.53	LOQ	ND	ND	ND	1.26	ND	0.280	ND	ND
Min			-	***4.52***	-	-	-	***5.50***	-	***13.89***	***0.43***	-	***61.3***	-	-	-	***0.480***	-	-	-	-	***1.22***	-	***0.280***	-	-
Max			-	***5.31***	-	-	-	***7.36***	-	***25.03***	***0.53***	-	***70.8***	-	-	-	***0.53***	-	-	-	-	***1.27***	-	***0.34***	-	-
N			***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***	***3***
RSA	*Min*		-	***3.83***	-	-	-	***4.22***	-	***13.48***	***0.43***	-	***53.7***	-	-	-	***0.390***	-	-	-	-	***0.97***	-	***0.280***	-	-
	Max		-	***5.81***	-	-	-	***8.70***	-	***33.06***	***0.58***	-	***71.7***	-	-	-	***0.63***	-	-	-	-	***1.29***	-	***0.36***	-	-
	N		***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***	***18***

Note:
Limit of detection (LOD) = 0.09 g Fatty acid/100 g Fatty acids.
Values below the limit of detection are reported as ND (not detected).
Limit of quantitation (LOQ) = 0.28 g Fatty acid/100 g Fatty acids.
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 65 to 73 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 chemical analyses, the sunflower seed samples were milled on a Retch ZM 200 mill fitted with a 1.0 mm screen.

Moisture

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

Crude Protein

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

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

Crude Fat

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

Crude Fibre

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
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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)
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Nominated Representative:

Mrs H Meyer

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: 2021/2022 season

ARC-Grain Crops Institute in collaboration with the following seed companies: Agricol, Pannar, Pioneer, Syngenta, Sensako 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 2021/2022 season with the voluntary collaboration of Agricol, Cortiva (Pannar, Pioneer), Syngenta, Sensako 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. Germination tests, according to ISTA rules, were done on the supplied seed by a service provider (Senwes Grainlink). Seed germination from all cultivars exceeded the 80% requirement except PAN 7100 has 78 % germination (Table 1). 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 15 trials, Cortiva (Pannar & Pioneer) with 10 trials, Syngenta/Sensako with one and Limagrain Zaad SA with four. 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 three trials were not harvested due to bad trial quality. Six trials were not statistically successful and were not included in the results. Two trials of Limagrain Zaad were damaged by animals or water. Four trials of Agricol were cancelled due to water logging and bad germination. 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 Klipdriftdam, Bultfontein, Kroonstad, Rustenburg, Sannieshof, Steynsrus, and Wesselsbron.

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 17 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 17 trials.

Yield probabilities were also calculated for 20 cultivars that were evaluated in 36 trials during 2020/2021 and 2021/2022.

RESULTS

Days from planting to flowering

The mean number of days from planting to 50% flowering of cultivars (Table 4) ranged from 68 days for AGSUN 5270, to 71 days SY 3970 CL Calculated across cultivars and planting dates, the average period from planting to flowering was 69 days. The longest days to flowering recorded at Potchefstroom planted on 2 November 2021.

Oil and protein concentration

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

The oil content on “as is” basis for cultivars at the various localities varied from 37.72%

to 47.50% with an overall mean of 41.66%. The highest mean oil concentration among localities was at Potchefstroom (planting date on 2 November 2021) with 44.64%. The locality with the lowest mean oil content of 39.51% was Wesselsbron planting date was 1 December 2021. The highest oil concentration among cultivars and calculated across localities, was SY 3970 CL at 47.50% followed by LG 710 at 46.54%.

The average protein content varied from 13.32 to 16.89% among cultivars at the different localities. Among localities, Wesselsbron planting date was 1 December 2021, had the highest and Potchefstroom planted in 24 January 2022 the lowest protein content of 18.08 and 12.30 % respectively. Calculated across localities, LG 5678 CLP had the highest protein content (16. 89 %) followed by LG 5710 (15.83) while PAN 7160 CLP the lowest (13.32%).

Seed yield

The mean seed yield of cultivars at the respective localities is presented in Table 7. The highest locality mean yield of 3.09 t ha^{-1} was obtained at Potchefstroom, planted on 6 of January 2022 and the lowest of 1.14 t ha^{-1}, at Petrusburg planted on 27 of January 2022. The five best performing cultivars, in terms of average yield calculated over localities, were PAN 7160 CLP, AGSUN 5270, AGSUN 5106 CLP, PAN 7080 CLP &. PAN 65 LP 65. The overall mean yield for 2020/21 was 2.20 t ha^{-1}, 8.18 % lower than the mean yield of the last year.

Elven Clearfield and Clearfield Plus cultivars, AGSUN 5101 CLP, AGSUN 5103 CLP, AGSUN 5106 CLP, AGSUN 5108 CLP, LG 5678 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 7160 CLP, AGSUN 5106 CLP, P 65 LP 65, PAN 7102 CLP , AGSUN 5108 CLP, AGSUN 5103 CLP,PAN 7180 CLP and P 65 LP 54 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 presented in Table 8. The oil yield for cultivars at the eight localities varied from 0.84 to 1.13 t ha^{-1} with an overall mean of 1.00 t ha^{-1}. The locality with the highest mean oil yield was Potchefstroom planted on 2 November 2021 at 1.27 t ha^{-1}. PAN 7180 CLP has the

highest oil yield of 1.13 t ha^{-1} followed by PAN 7160 CLP with 1.12 t ha^{-1}

Parameters calculated from the analysis of variance

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

Regression line coordinates at different yield targets

Regression line coordinates at different yield targets, the overall mean yield, the intercept and slope from the regression line and yield stability (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 2021/2022 are shown in Figure 1 and for the 20 cultivars evaluated in 2020/2021 and 2021/2022 in Figure 2.

The yield stability of cultivars varied up to 21-fold among cultivars (Table 10). 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 2021/2022 are shown in Table 11. It takes account of both the cultivar X environment interaction and the yield stability and is therefore a reliable measure for cultivar choice. Yield probabilities higher than or equal to 60% in Table 11 indicates which cultivars would be sensible choices at the various yield potentials.

The yield probabilities of 20 cultivars evaluated in 36 trials in 2020/2021 and 2020/21, and yield probabilities for the 16 cultivars evaluated in 57 trials are shown in Tables 12 and 13 respectively. Tables 11, 12 and 13 should be used jointly for cultivar selection.

Acknowledgements

Funding from the Oil and Protein Seed Development Trust and the participation of Agricol, Pannar, Pioneer, Syngenta/ Sensako 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.

Table 1: Cultivars evaluated and seed germination rate and supplier company 2021/22

Cultivar's Name	Germinated (%)			
	Normal	Abnormal	Dormant/dead	Company
AGSUN5101CLP	95	3	2	Agricol
AGSUN5103CLP	98	1	1	Agricol
AGSUN5106CLP	97	2	1	Agricol
AGSUN5108CLP	97	3	0	Agricol
AGSUN5270	97	2	1	Agricol
AGSUN8251	94	4	2	Agricol
AGUARA6	94	3	3	Limagrain Zaad SA
LG5678CLP	94	5	1	Limagrain Zaad SA
LG5710	94	4	2	Limagrain Zaad SA
P65LL02	97	3	0	Pioneer
P65LL14	87	7	6	Pioneer
P65LP54	95	2	3	Pioneer
P65LP65	93	5	2	Pioneer
PAN7080	96	4	0	Pannar
PAN7100	78	14	8	Pannar
PAN7102 CLP	92	7	1	Pannar
PAN7160 CLP	92	6	2	Pannar
PAN7170	94	5	1	Pannar
PAN7180CLP	96	2	2	Pannar
SY3970CL	94	5	1	Sensako

Table 2: Collaborating company, trial localities and responsible co-workers 2021/2022

Company	Localities	Planting dates	Co-workers	E-mail address of co-worker
Agricol	Boskop 1	18/11/2021	Joubert Swanepoel	Jouberts@agricol.co.za
	Boskop 2	31/12/2021		
	Boskop 3	12/01/2022		
	Hartbeesfontein	24/11/2021		
	Lichtenburg	03/12/2021		
	Wesselsbron	01/12/2021		
	Hertzogville	06/01/2022		
	Sannieshoff	07/01/2022		
	Bultfontein	11/01/2022		
	Wolmaranstad	21/01/2022		
	Kroonstad	25/01/2022		
	Steynsrus	25/01/2022		
	Reitz	27/10/2021		
	Klipdrif	11/01/2022		
ARC-GCI	Potchefstroom	02/11/2021	William Makgoga & Jan Erasmus	Makgogamw@arc.agric.za Erasmusj@arc.agric.za
		23/11/2021		
		11/12/2021		
		11/01/2022		
		24/01/2022		
Corteva	Bethlehem	05/01/2022	Abre Pretorius, Phillip Fourie & Louis Schoonraad	abre.pretorius@pannar.co.za phillip.fourie@pioneer.com louis.schoonraad@corteva.com
	Senekal	06/01/2022		
	Kroonstad	07/01/2022		
	Marquard	12/01/2022		
	Coligny	28/12/2021		
	Gerdau	15/12/2021		
	Coligny 2	09/12/2021		
Corteva	Lichtenburg	08/12/2021		
	Putfontein	29/11/2021		
Lima Grain	Potchefstroom	06/01/2022	Anita Janeke	anita.janeke@limagrain.com
	Wesselsbron	02/12/2021		
	Dwaalboom/Settlers	12/01/2022		
	Petrusburg	27/01/2022		
Syngenta	Kroonstad	05/01/2022	PieterTaljaard	Pieter.Taljaard@syngenta.com

Table 3: Trial successful site information 2021/2022 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 2	2021/12/31	40 000	-					-	-	0.91		11.83
Boskop 3	2022/12/01	40 000	-	-	-	-	-	-	-	0.91		11.83
Wsesselbron	2021/01/12	40 000	-	-	-	-	-	-	-	1.13		14.69
Rustenburg	2021/12/13	40 000	-	-	-	-	-	-	-	0.91		11.83
Sannieshoff	2022/07/01	40 000	-	-	-	-	-	-	-	0.91		11.83
Bultfontein	2020/11/01	40 000	-	-	-	-	-	-	-	0.91		11.83
Kronstad	2022/01/25	40 000	-	-	-	-	-	-	-	0.91		11.83
Steynrus	2022/01/25	40 000	-	-	-	-	-	-	-	0.91		11.83
Klipdrift	2022/11/01	40 000	-	-	-	-	-	-	-	0.91		11.83
Potchefstroom	2021/11/02	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	2021/11/23	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	2021/12/11	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	2022/01/11	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	2022/01/24	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
Potchefstroom	2022/01/06	32 000	-	-	-	-	-	-	-	-	-	14.40
Petrusburg	2021/07/01	40 000	-	-	-	-	-	-	-	-	-	7.60
Kroonstad	2022/01/05	40 000	-	-	-	-	-	-	-	-	-	9.10

Table 4: Number of days from planting to 50 percent flowering of cultivars at selected localities and planting dates 2021/2022

CULTIVAR	BOSKOP 2 2021/12/31	BOSKOP 3 2022/12/01	BULTFONTEIN 2022/11/01	KLIPDRIFT 2022/11/01	KROONSTAD 2022/01/25	POTCHEFSTROOM 2022/12/11	POTCHEFSTROOM 2022/01/06	POTCHEFSTROOM 2021/01/11	POTCHEFSTROOM 2022/01/24	POTCHEFSTROOM 2021/11/02	RUSTENBURG 2021/12/13	SANNIESHOF 2022/07/01	STEYNSRUS 2022/01/25	WESSELSBRON 2021/01/12	MEAN
AGSUN5101CLP	66	66	70	69	69	70	63	71	73	78	67	71	73	70	70
AGSUN5103CLP	66	67	71	68	71	70	62	68	74	79	67	71	73	71	70
AGSUN5106CLP	67	67	70	67	70	70	61	70	77	79	67	71	73	70	70
AGSUN5108CLP	69	66	69	72	70	67	61	72	70	74	66	70	73	71	69
AGSUN5270	68	64	68	68	69	70	63	68	69	73	66	69	72	69	68
AGSUN8251	66	65	68	71	70	67	61	69	70	75	67	70	71	70	69
AGUARA6	67	66	68	69	69	71	62	69	70	78	69	71	72	69	69
LG5678CLP	68	66	69	69	68	70	62	73	69	75	66	69	73	68	69
LG5710	68	65	68	67	71	67	63	65	78	78	64	69	69	71	69
P65LL02	66	65	68	74	69	70	60	72	70	77	69	69	72	69	69
P65LL14	68	67	68	69	69	69	63	70	73	76	68	70	73	69	69
P65LP54	65	66	69	69	71	69	63	70	73	73	67	70	72	71	69
P65LP65	66	66	72	73	69	73	63	72	72	78	68	70	73	70	70
PAN7080	68	66	69	69	71	70	62	70	74	76	67	71	72	71	70
PAN7100	67	64	70	68	70	70	60	68	73	74	67	69	72	70	69
PAN7102CLP	65	64	68	67	70	68	63	71	73	73	66	69	73	70	69
PAN7160CLP	67	66	68	68	73	70	61	72	71	73	68	70	73	73	70
PAN7170	64	65	71	69	69	68	62	69	78	74	67	70	73	69	69
PAN7180CLP	66	67	69	71	71	73	62	72	72	74	67	70	73	71	70
SY3970CL	67	68	72	70	72	69	61	72	78	78	68	70	72	71	71
MEAN	67	66	69	69	70	70	62	70	73	76	67	70	72	70	69

Table 5: The moisture free seed oil concentration (%) of cultivars at selected localities 2021/2022

CULTIVAR	BOSKOP 2 2021/12/31	KROONSTAD 2022/01/25	POTCHEFSTROOM 2021/11/02	POTCHEFSTROOM 2021/12/11	POTCHEFSTROOM 2021/01/11	POTCHEFSTROOM 2022/01/24	STEYNSRUS 2022/01/25	WESSELSBRON 2021/01/12	MEAN
AGSUN5101CLP	38.00	33.76	41.81	39.30	40.78	37.96	35.59	34.56	37.72
AGSUN5103CLP	38.45	35.38	41.25	42.22	39.56	38.29	36.29	37.69	38.64
AGSUN5106CLP	38.63	37.33	41.38	41.28	41.57	39.08	35.59	36.13	38.87
AGSUN5108CLP	37.37	37.49	41.76	41.10	41.86	38.43	38.51	35.32	38.98
AGSUN5270	40.59	41.00	46.27	45.55	44.88	42.89	39.44	38.08	42.34
AGSUN8251	37.51	40.35	41.76	41.40	39.70	39.45	37.99	36.96	39.39
AGUARA6	41.72	42.31	46.75	45.27	46.55	44.51	41.87	42.52	43.94
LG5678CLP	43.24	44.79	44.40	48.97	45.74	45.08	43.90	40.91	44.63
LG5710	42.25	46.70	50.28	47.71	49.27	48.27	43.19	44.65	46.54
P65LL02	42.66	43.22	46.75	44.88	45.84	44.41	43.13	42.57	44.18
P65LL14	39.33	41.00	46.27	44.08	46.55	42.80	41.54	41.44	42.88
P65LP54	35.68	37.09	39.87	39.90	41.19	39.22	35.38	35.06	37.92
P65LP65	41.62	41.42	43.69	44.36	43.46	41.95	38.07	40.27	41.86
PAN7080	37.11	39.18	44.13	44.18	43.42	41.06	39.48	38.15	40.84
PAN7100	39.08	40.62	45.17	44.27	42.86	41.53	41.51	39.97	41.88
PAN7102CLP	36.70	37.37	41.31	40.60	40.07	39.92	38.27	37.11	38.92
PAN7160CLP	40.19	40.36	44.45	46.94	44.46	41.43	40.63	40.15	42.33
PAN7170	41.53	41.85	48.58	45.55	45.36	43.70	41.96	42.43	43.87
PAN7180CLP	39.05	38.31	42.85	43.56	42.62	38.77	37.20	37.26	39.95
SY3970CL	42.99	46.65	54.01	50.08	43.42	47.47	46.40	49.00	47.50
MEAN	39.68	40.31	44.64	44.06	43.46	41.81	39.80	39.51	41.66

Table 6: The moisture free seed protein concentration (%) of cultivars at selected localities 2021/2022

CULTIVAR	BOSKOP 2 2021/12/31	KROONSTAD 2022/01/25	POTCHEFSTROOM 2021/11/02	POTCHEFSTROOM 2021/12/11	POTCHEFSTROOM 2022/01/11	POTCHEFSTROOM 2022/01/24	STEYNSRUS 2022/01/25	WESSELSBRON 2021/01/12	MEAN
AGSUN5101CLP	17.51	14.81	13.05	14.37	13.02	13.17	16.13	19.87	15.24
AGSUN5103CLP	17.99	13.51	14.19	12.70	14.54	12.33	16.42	18.04	14.97
AGSUN5106CLP	16.08	11.90	13.85	13.26	12.78	11.72	15.99	19.30	14.36
AGSUN5108CLP	18.63	12.66	14.22	13.08	12.69	13.21	16.16	20.23	15.11
AGSUN5270	18.27	13.89	14.81	13.47	12.54	12.26	15.98	19.71	15.12
AGSUN8251	17.48	11.98	13.57	13.08	12.86	11.83	16.11	18.49	14.43
AGUARA6	17.25	11.71	13.20	12.77	13.41	10.68	14.20	17.04	13.78
LG5678CLP	19.62	14.89	17.28	14.57	16.11	14.57	17.35	20.73	16.89
LG5710	19.92	15.18	14.89	14.31	13.69	13.69	16.68	18.31	15.83
P65LL02	17.45	12.90	13.79	13.55	12.01	12.77	14.86	17.65	14.37
P65LL14	17.80	12.71	13.14	13.31	12.19	11.88	15.79	17.14	14.25
P65LP54	19.38	12.35	14.47	12.49	11.90	11.80	13.97	18.44	14.35
P65LP65	17.75	12.51	13.99	11.36	13.44	11.87	14.26	18.89	14.26
PAN7080	17.32	12.07	13.39	11.73	11.75	11.64	12.64	17.35	13.49
PAN7100	18.14	13.07	14.19	12.07	12.52	12.62	12.79	16.95	14.05
PAN7102CLP	18.72	12.41	14.85	13.46	14.55	10.95	11.51	16.75	14.15
PAN7160CLP	17.37	11.44	13.65	12.84	11.72	11.65	11.33	16.54	13.32
PAN7170	16.82	12.65	13.97	12.70	11.47	11.30	13.05	16.96	13.62
PAN7180CLP	18.60	12.71	13.58	11.80	13.49	12.33	12.67	17.38	14.07
SY3970CL	17.67	14.93	14.42	14.86	17.68	13.83	13.46	15.76	15.33
MEAN	17.99	13.02	14.13	13.09	13.22	12.31	14.57	18.08	14.55

Table 7: Mean seed yield (t ha^{-1}) of cultivars at each locality 2021/2022

CULTIVAR/ LOCALITY	BOSKOP 2 2021/12/31	BOSKOP 3 2022/12/01	BULTFONTEIN 2022/11/01	KLIPDRIFT 2022/11/01	KROONSTAD 2022/01/25	KROONSTAD 2022/01/05	PETRUSBURG 2022/01/27	POTCHEFSTROOM 2021/12/11	POTCHEFSTROOM 2022/01/06	POTCHEFSTROOM 2022/01/11	POTCHEFSTROOM 2022/01/24	POTCHEFSTROOM 2021/11/02	POTCHEFSTROOM 2021/11/23	RUSTENBURG 2021/12/13	SANNIESHOF 2022/07/01	STEYNSRUS 2022/01/25	WESSELSBRON 2021/01/12	MEAN
AGSUN5101CLP	3.09	1.65	2.04	1.59	2.08	1.89	1.38	2.26	2.95	1.86	1.62	2.57	1.14	1.53	2.67	1.87	2.35	2.03
AGSUN5103CLP	3.39	1.97	2.51	1.91	2.29	2.6	1.11	2.18	2.74	1.69	1.75	2.57	1.41	1.71	2.94	2.23	3.09	2.24
AGSUN5106CLP	3.50	1.77	2.24	1.8	2.5	2.39	1.51	2.18	3.36	1.89	1.50	2.86	1.26	1.82	2.77	2.70	3.43	2.32
AGSUN5108CLP	3.03	1.95	2.21	1.82	2.26	2.84	1.13	2.25	3.64	2.04	1.52	2.74	1.2	1.89	3.14	2.13	2.74	2.27
AGSUN5270	3.67	1.71	2.6	2.13	2.42	2.66	0.78	2.53	2.77	2.18	1.92	2.51	1.49	1.57	3.10	2.33	3.13	2.32
AGSUN8251	2.94	1.82	2.2	1.92	2.16	2.89	1.06	2.4	2.97	2.02	1.65	2.87	1.30	1.45	2.86	2.17	2.94	2.21
AGUARA6	2.97	1.59	2.06	1.56	2.14	2.28	1.37	2.38	3.24	2.33	1.8	2.56	1.28	1.28	2.47	1.75	2.84	2.11
LG5678CLP	2.87	1.3	1.45	1.76	1.79	2.62	0.88	2.28	3.06	2.00	1.61	2.69	1.44	1.74	2.6	1.91	1.84	1.99
LG5710	3.06	1.78	1.82	1.16	2.01	2.23	1.12	2.56	2.88	2.31	1.73	3.22	1.52	1.46	2.11	1.65	2.68	2.08
P65LL02	3.54	1.81	1.84	2.05	2.16	2.5	1.42	2.61	3.16	1.94	1.57	3.28	1.37	1.36	3.13	2.26	2.61	2.27
P65LL14	2.41	1.77	1.62	2.22	2.36	2.84	1.10	2.5	2.44	2.08	1.72	2.75	1.30	1.82	2.85	2.33	3.05	2.19
P65LP54	2.74	1.9	2.22	1.90	2.07	2.87	1.04	2.51	3.04	1.90	1.97	3.05	1.67	1.53	2.33	1.90	2.83	2.20
P65LP65	3.02	1.78	2.21	1.90	2.11	2.84	1.05	2.47	3.58	2.13	1.76	3.02	1.41	1.61	3.06	2.18	3.14	2.31
PAN7080	3.73	1.72	2.72	1.8	2.12	2.79	1.14	2.17	2.62	1.90	1.70	2.88	1.44	1.49	3.17	2.40	3.49	2.31
PAN7100	2.98	1.71	2.31	1.88	2.03	2.86	1.18	2.63	3.23	2.05	1.91	3.25	1.51	1.41	2.88	2.12	2.67	2.27
PAN7102CLP	2.92	1.74	2.23	1.58	2.17	3.26	0.81	2.64	3.08	2.25	1.88	3.05	1.25	1.56	2.83	2.23	3.14	2.27
PAN7160CLP	3.44	2.03	2.14	1.99	2.26	2.73	1.21	2.33	3.78	2.11	1.94	2.92	1.51	1.45	3.06	2.35	3.04	2.37
PAN7170	3.42	1.91	2.24	1.69	2.15	2.5	1.15	2.7	2.91	1.98	1.64	2.93	0.89	1.66	2.29	1.83	2.96	2.17
PAN7180CLP	2.97	1.65	2.11	1.81	2.31	2.59	1.45	2.09	3.04	2.17	1.57	2.91	1.45	1.55	2.84	2.27	3.27	2.24
SY3970CL	1.81	0.95	1.63	1.27	1.72	2.62	0.91	2.55	3.24	1.97	1.33	2.33	1.52	1.1	2.46	1.97	2.17	1.86
MEAN	3.08	1.73	2.12	1.79	2.16	2.64	1.14	2.41	3.09	2.04	1.71	2.85	1.37	1.55	2.78	2.13	2.87	2.20
CV %	12.8	19.20	19.50	16.70	13.20	10.30	18.00	10.70	17.90	11.30	13.00	7.40	19.40	18.90	18.70	16.20	10.60	15.08

Table 8: Oil yield (t ha^{-1}) of cultivars at selected localities 2021/2022

CULTIVAR	BOSKOP 2 2021/12/31	KROONSTAD 2022/01/25	POTCHEFSTROOM 2021/11/02	POTCHEFSTROOM 2021/12/11	POTCHEFSTROOM 2022/01/11	POTCHEFSTROOM 2022/01/24	STEYNSRUS 2022/01/25	WESSELSBRON 2021/01/12	MEAN
AGSUN5101CLP	1.17	0.70	1.07	0.89	0.76	0.61	0.67	0.81	0.84
AGSUN5103CLP	1.30	0.81	1.06	0.92	0.67	0.67	0.81	1.16	0.93
AGSUN5106CLP	1.35	0.93	1.18	0.90	0.79	0.59	0.96	1.24	0.99
AGSUN5108CLP	1.13	0.85	1.14	0.92	0.85	0.58	0.82	0.97	0.91
AGSUN5270	1.49	0.99	1.16	1.15	0.98	0.82	0.92	1.19	1.09
AGSUN8251	1.10	0.87	1.20	0.99	0.80	0.65	0.82	1.09	0.94
AGUARA6	1.24	0.91	1.20	1.08	1.08	0.80	0.73	1.21	1.03
LG5678CLP	1.24	0.80	1.19	1.12	0.91	0.73	0.84	0.75	0.95
LG5710	1.29	0.94	1.62	1.22	1.14	0.84	0.71	1.20	1.12
P65LL02	1.51	0.93	1.53	1.17	0.89	0.70	0.97	1.11	1.10
P65LL14	0.95	0.97	1.27	1.10	0.97	0.74	0.97	1.26	1.03
P65LP54	0.98	0.77	1.22	1.00	0.78	0.77	0.67	0.99	0.90
P65LP65	1.26	0.87	1.32	1.10	0.93	0.74	0.83	1.26	1.04
PAN7080	1.38	0.83	1.27	0.96	0.82	0.70	0.95	1.33	1.03
PAN7100	1.16	0.82	1.47	1.16	0.88	0.79	0.88	1.07	1.03
PAN7102CLP	1.07	0.81	1.26	1.07	0.90	0.75	0.85	1.17	0.99
PAN7160CLP	1.38	0.91	1.30	1.09	0.94	0.80	0.95	1.22	1.08
PAN7170	1.42	0.90	1.42	1.23	0.90	0.72	0.77	1.26	1.08
PAN7180CLP	1.16	0.89	1.25	0.91	0.92	0.61	0.84	1.22	0.97
SY3970CL	0.78	0.80	1.26	1.28	0.86	0.63	0.91	1.06	0.95
MEAN	1.22	0.87	1.27	1.06	0.89	0.71	0.84	1.13	1.00

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

Locality	Mean (t/ha)	SE	CV (%)	GCV	t	SE(t)	tn
BOSKOP 2 2021/12/31	3.08	0.23	12.8	12.5	0.49	0.13	0.74
BOSKOP 3 2022/12/01	1.73	0.19	19.2	8.5	0.16	0.15	0.36
BULTFONTEIN 2022/11/01	2.12	0.24	19.5	10.2	0.21	0.15	0.44
KLIPDRIFT 2022/11/01	1.79	0.17	16.7	11.0	0.30	0.15	0.56
KROONSTAD 2022/01/25	2.16	0.16	13.2	4.2	0.09	0.14	0.23
KROONSTAD 2022/01/05	2.64	0.16	10.3	9.5	0.46	0.14	0.72
PETRUSBURG 2022/01/27	1.14	0.12	18.0	14.9	0.41	0.14	0.68
POTCHEFSTROOM 2022/12/11	2.41	0.15	10.7	4.4	0.14	0.15	0.33
POTCHEFSTROOM 2022/01/06	3.09	0.32	17.9	3.3	0.03	0.14	0.08
POTCHEFSTROOM 2022/01/11	2.04	0.13	11.3	4.4	0.13	0.15	0.31
POTCHEFSTROOM 2022/01/24	1.71	0.13	13.0	6.3	0.19	0.15	0.41
POTCHEFSTROOM 2021/11/02	2.85	0.12	7.4	8.1	0.54	0.13	0.78
POTCHEFSTROOM 2021/11/02	1.37	0.15	19.4	5.7	0.08	0.14	0.21
RUSTENBURG 2021/12/13	1.55	0.17	18.9	5.9	0.09	0.14	0.23
SANNIESHOF 2022/07/01	2.78	0.30	18.7	3.3	0.03	0.14	0.08
STEYNSRUS 2022/01/25	2.13	0.20	16.2	7.6	0.18	0.15	0.40
WESSELSBRON 2021/01/12	2.87	0.18	10.6	12.9	0.60	0.12	0.82

Table 10: Regression line coordinates at different yield potentials 2021/2022

Cultivar	Yield potential (t ha^{-1}) 1	1,5	2	2,5	3	3,5	Mean (t ha^{-1})	Intercept	Slope	Fprob	R^2
AGSUN5101CLP	1.0	1.4	1.9	2.3	2.7	3.1	2.0	0.16	0.85	<0.001	0.88
AGSUN5103CLP	1.1	1.6	2.1	2.5	3.0	3.5	2.2	0.16	0.95	<0.001	0.87
AGSUN5106CLP	1.1	1.6	2.1	2.7	3.2	3.7	2.3	-0.02	1.07	<0.001	0.85
AGSUN5108CLP	1.0	1.5	2.0	2.6	3.1	3.7	2.3	-0.10	1.07	<0.001	0.90
AGSUN5270	1.1	1.6	2.1	2.6	3.2	3.7	2.3	-0.01	1.06	<0.001	0.85
AGSUN8251	1.0	1.5	2.0	2.5	3.0	3.5	2.2	-0.03	1.02	<0.001	0.97
AGUARA6	1.0	1.5	1.9	2.4	2.9	3.3	2.1	0.06	0.93	<0.001	0.90
LG5678CLP	0.9	1.4	1.8	2.3	2.7	3.1	2.0	0.05	0.88	<0.001	0.78
LG5710	1.0	1.4	1.9	2.4	2.8	3.3	2.1	0.03	0.93	<0.001	0.79
P65LL02	1.0	1.5	2.1	2.6	3.1	3.7	2.3	-0.13	1.09	<0.001	0.89
P65LL14	1.2	1.6	2.0	2.4	2.8	3.2	2.2	0.44	0.79	<0.001	0.74
P65LP54	1.2	1.6	2.0	2.5	2.9	3.4	2.2	0.27	0.88	<0.001	0.88
P65LP65	0.9	1.5	2.1	2.7	3.2	3.8	2.3	-0.20	1.14	<0.001	0.97
PAN7080	1.0	1.5	2.1	2.7	3.2	3.8	2.3	-0.18	1.13	<0.001	0.84
PAN7100	1.0	1.6	2.1	2.6	3.1	3.6	2.3	0.01	1.03	<0.001	0.94
PAN7102CLP	0.9	1.5	2.0	2.6	3.2	3.8	2.3	-0.26	1.15	<0.001	0.93
PAN7160CLP	1.0	1.6	2.1	2.7	3.3	3.8	2.4	-0.12	1.13	<0.001	0.95
PAN7170	0.9	1.4	2.0	2.5	3.0	3.5	2.2	-0.14	1.05	<0.001	0.88
PAN7180CLP	1.1	1.6	2.0	2.5	3.0	3.5	2.2	0.12	0.96	<0.001	0.92
SY3970CL	0.8	1.3	1.7	2.1	2.6	3.0	1.9	-0.09	0.89	<0.001	0.69

Table 11: Yield probability (%) of cultivars for 2021/2022 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
AGSUN5101CLP	52	39	25	16	9	6	<0.001	0.88
AGSUN5103CLP	66	64	60	57	52	49	<0.001	0.87
AGSUN5106CLP	56	62	66	71	74	76	<0.001	0.85
AGSUN5108CLP	45	52	57	64	68	73	<0.001	0.90
AGSUN5270	56	61	65	69	72	73	<0.001	0.85
AGSUN8251	47	50	54	57	61	63	<0.001	0.97
AGUARA 6	48	43	35	30	25	22	<0.001	0.90
LG5678CLP	42	34	26	20	16	14	<0.001	0.78
LG5710	45	41	36	33	29	28	<0.001	0.79
P65LL02	44	52	58	66	71	76	<0.001	0.89
P65LL14	75	66	53	40	28	20	<0.001	0.74
P65LP54	74	66	56	44	34	27	<0.001	0.88
P65LP65	33	53	75	89	96	98	<0.001	0.97
PAN7080	44	52	60	68	74	78	<0.001	0.84
PAN7100	59	63	66	70	72	74	<0.001	0.94
PAN7102CLP	32	45	58	72	81	87	<0.001	0.93
PAN7160CLP	52	67	78	88	93	95	<0.001	0.95
PAN7170	37	41	44	48	52	56	<0.001	0.88
PAN7180CLP	66	63	59	54	50	46	<0.001	0.92
SY3970CL	32	27	21	18	15	14	<0.001	0.69

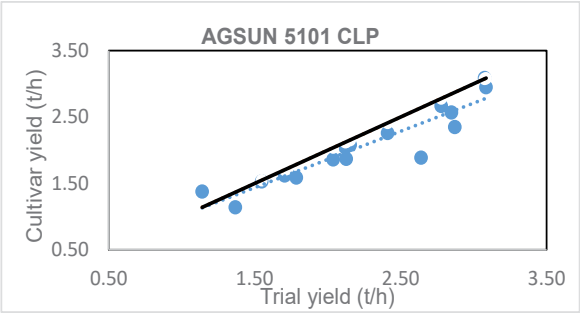
Table 12: Yield probability (%) of cultivars 2020/2021 and 2021/2022 at different yield potentials

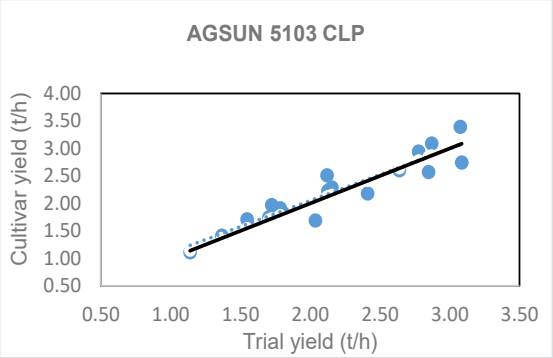
Cultivar	Yield potential (t ha^{-1})						Regression line	
	1	1,5	2	2,5	3	3,5	F prob	R^2
AGSUN5101CLP	33	33	31	31	30	30	<0.001	0.88
AGSUN5103CLP	46	51	57	62	67	72	<0.001	0.85
AGSUN5106CLP	47	55	61	69	74	79	<0.001	0.88
AGSUN5108CLP	46	48	50	52	54	56	<0.001	0.91
AGSUN5270	55	60	65	69	73	76	<0.001	0.88
AGSUN8251	63	63	64	64	63	63	<0.001	0.90
AGUARA 6	50	47	42	38	34	31	<0.001	0.86
LG5678CLP	40	30	20	14	8	6	<0.001	0.86
LG5710	40	39	39	39	39	39	<0.001	0.83
P65LL02	46	49	51	54	57	59	<0.001	0.83
P65LL14	69	59	48	37	27	20	<0.001	0.82
P65LP54	68	64	58	53	47	42	<0.001	0.84
P65LP65	46	52	56	61	65	69	<0.001	0.91
PAN7080	37	47	56	66	74	81	<0.001	0.88
PAN7100	69	69	69	69	69	69	<0.001	0.92
PAN7102CLP	55	57	59	60	62	63	<0.001	0.88
PAN7160CLP	57	63	69	74	78	82	<0.001	0.92
PAN7170	53	52	50	48	47	45	<0.001	0.86
PAN7180CLP	59	61	63	65	66	67	<0.001	0.88
SY3970CL	40	33	26	21	16	13	<0.001	0.62

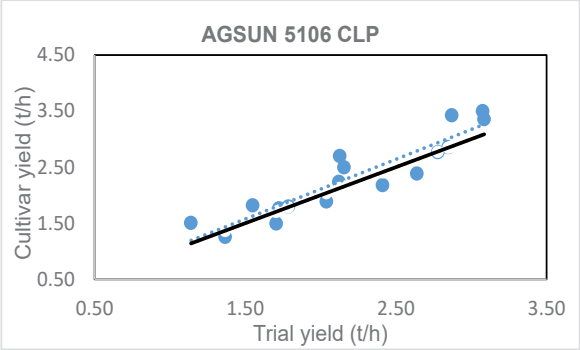
Table 13: Yield probability (%) of cultivars for three years' data 2019/2020 to 2021/2022 at different yield potentials

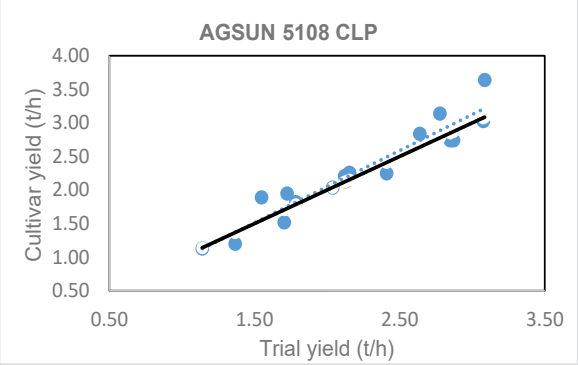
	Yield potential (t/ha)						Regression line	
	1	1,5	2	2,5	3	3,5	Fprob	R^2
AGSUN5101CLP	35	35	34	34	35	35	<0.001	0.90
AGSUN5103CLP	44	50	56	61	67	71	<0.001	0.87
AGSUN5106CLP	43	50	58	65	72	78	<0.001	0.89
AGSUN5270	72	70	68	66	63	60	<0.001	0.82
AGSUN8251	50	54	58	62	65	69	<0.001	0.92
LG5678CLP	35	26	18	13	8	5	<0.001	0.85
LG5710	46	42	38	35	31	28	<0.001	0.81
P65LL02	44	48	50	54	56	59	<0.001	0.82
P65LL14	58	55	50	47	42	39	<0.001	0.87
P65LP54	69	64	58	52	45	39	<0.001	0.85
PAN7080	34	45	57	68	78	86	<0.001	0.92
PAN7100	68	68	68	68	68	68	<0.001	0.93
PAN7102CLP	66	63	59	55	50	47	<0.001	0.89
PAN7160CLP	52	61	69	76	82	87	<0.001	0.94
PAN7170	53	55	55	57	57	58	<0.001	0.89
SY3970CL	38	33	27	23	18	16	<0.001	0.71

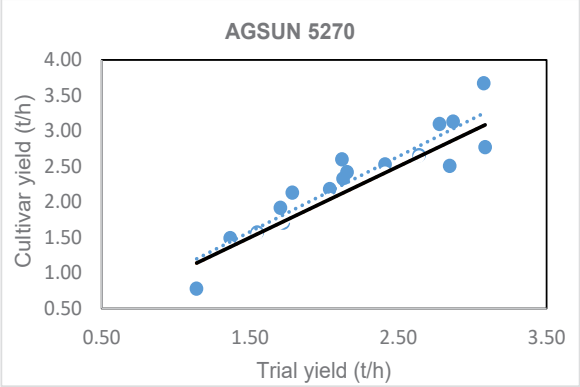
Figure 1: Regression lines for cultivars 2021/2022

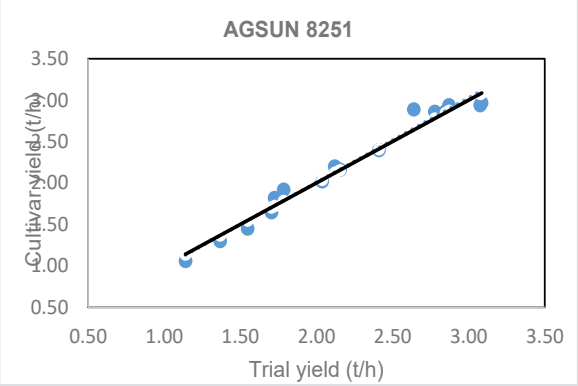


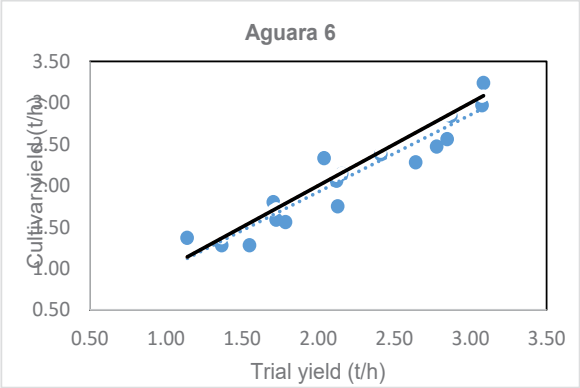


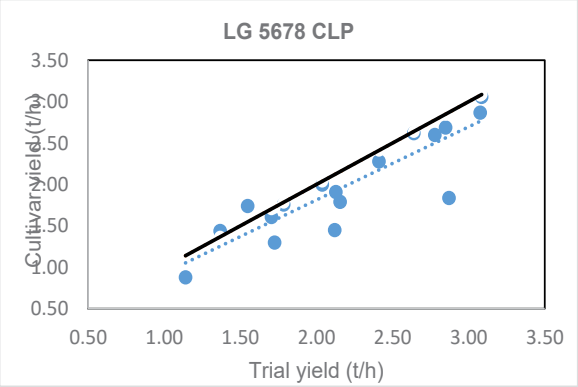


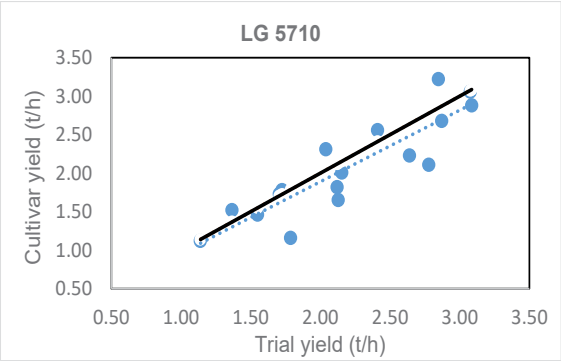


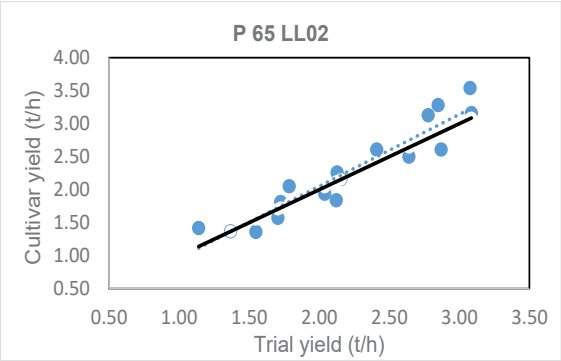


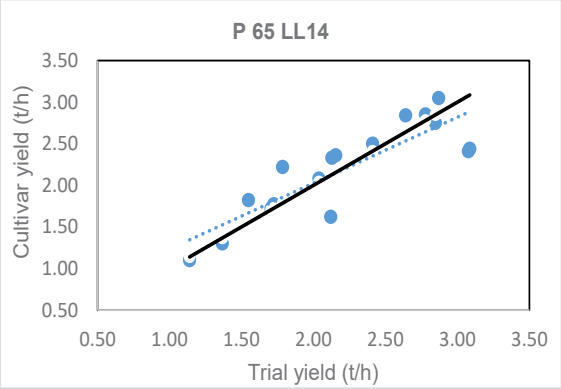


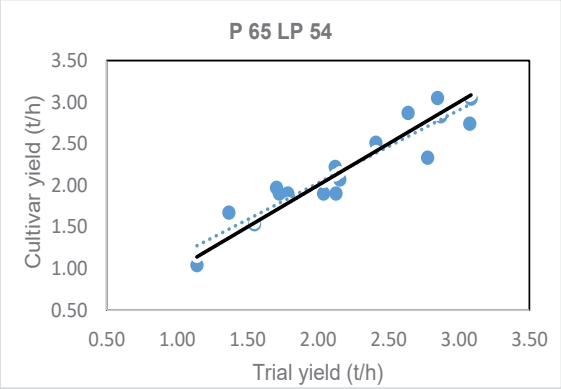


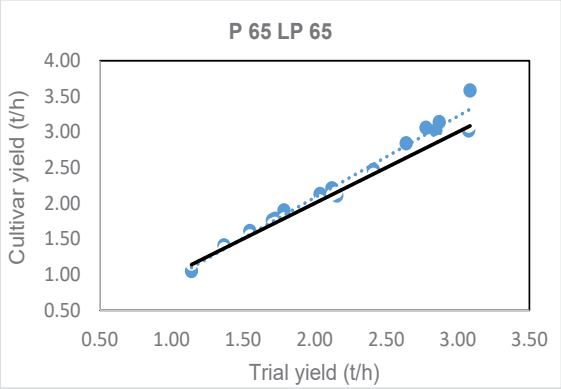


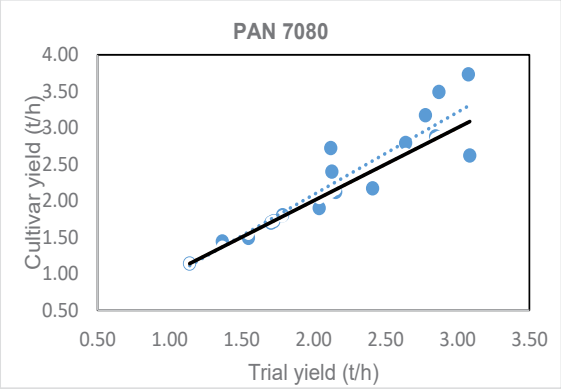

LG 5710
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50

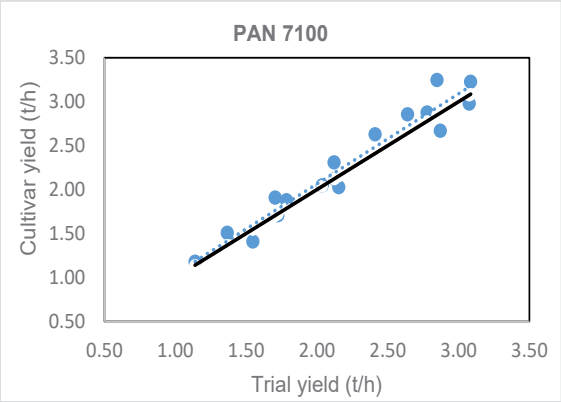

P 65 LL02
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00

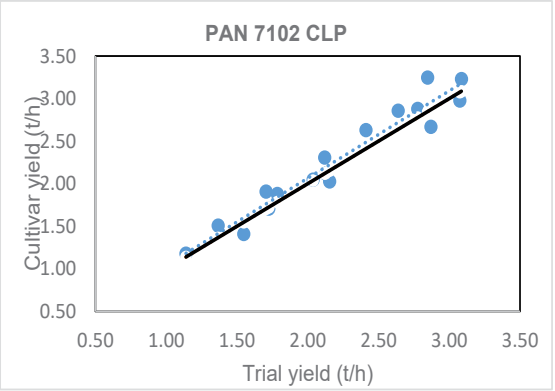

P 65 LL14
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50

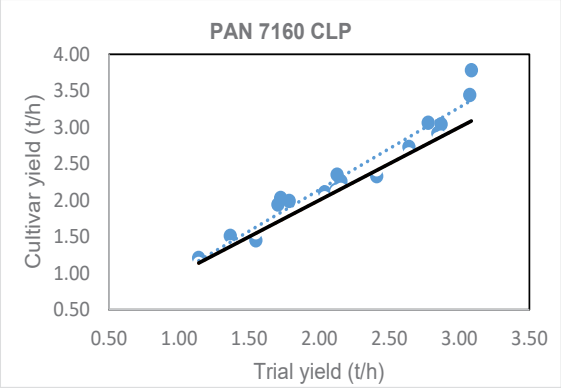

P 65 LP 54
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50

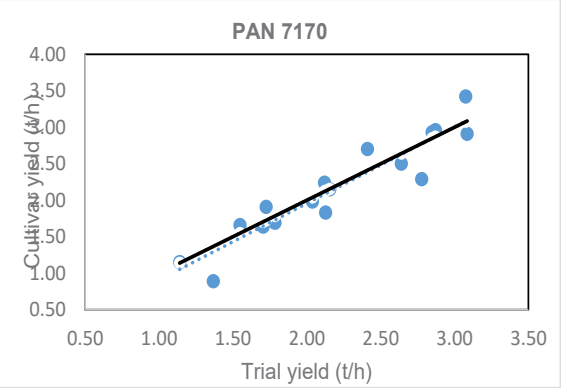

P 65 LP 65
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00

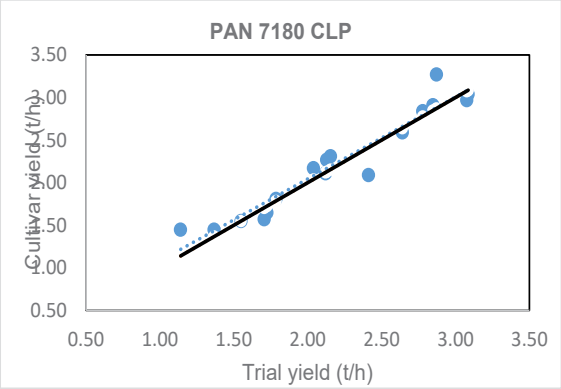

PAN 7080
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00


PAN 7100
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50


PAN 7102 CLP
Cultivar yield (t/h)
Trial yield (t/h)
0.50 1.00 1.50 2.00 2.50 3.00 3.50


PAN 7160 CLP
Cultivar yield (t/h)
Trial yield (t/h)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.50 1.00 1.50 2.00 2.50 3.00 3.50


PAN 7170
Cultivar yield (t/h)
Trial yield (t/h)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.50 1.00 1.50 2.00 2.50 3.00 3.50


PAN 7180 CLP
Cultivar yield (t/h)
Trial yield (t/h)
3.50
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2.50
2.00
1.50
1.00
0.50
0.50 1.00 1.50 2.00 2.50 3.00 3.50

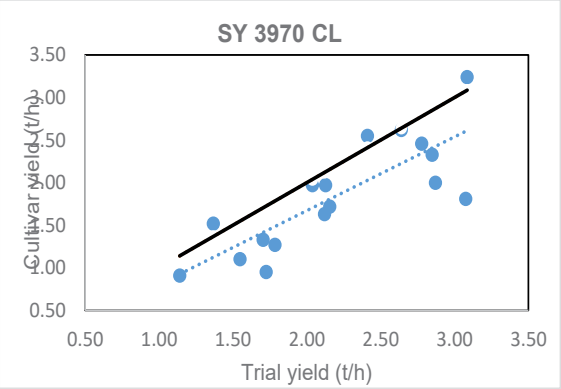
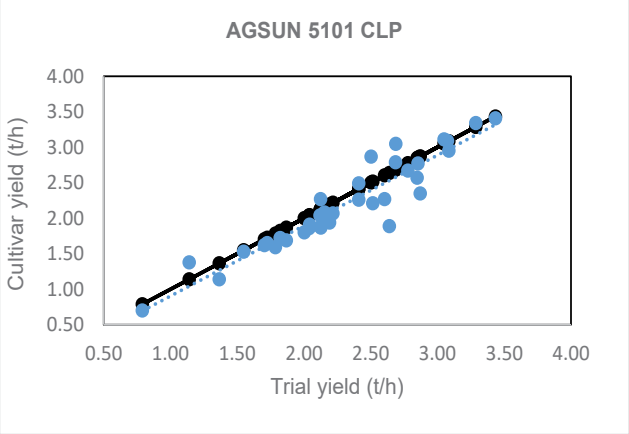
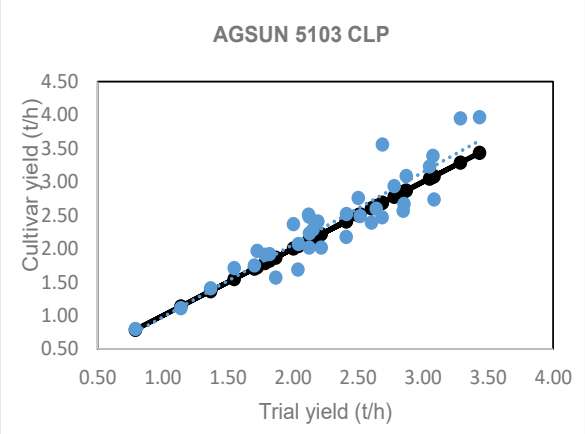
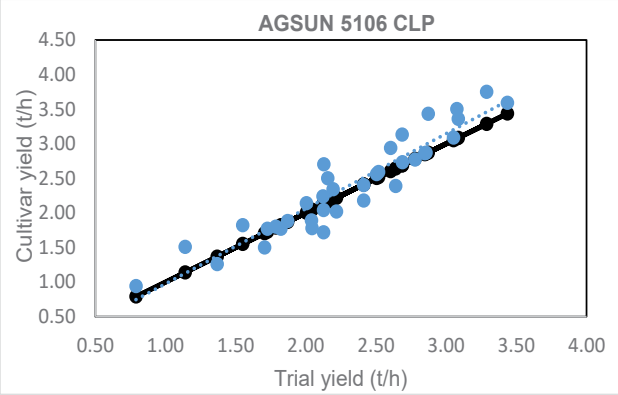
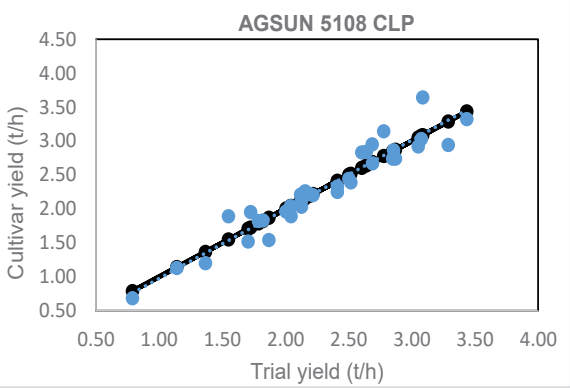

SY 3970 CL
Cultivar yield (t/h)
Trial yield (t/h)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.50 1.00 1.50 2.00 2.50 3.00 3.50

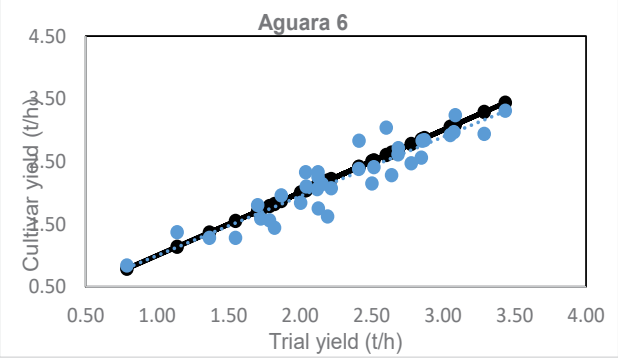
Figure 2: Regression lines for cultivars
2020/2021 & 2021/2022

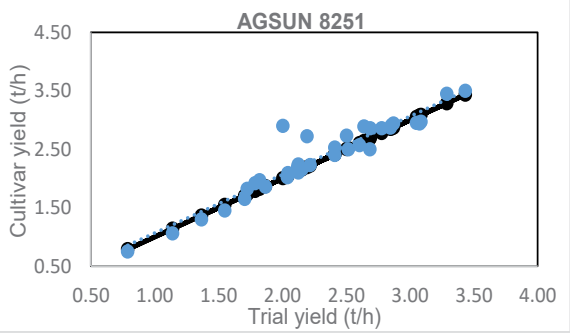


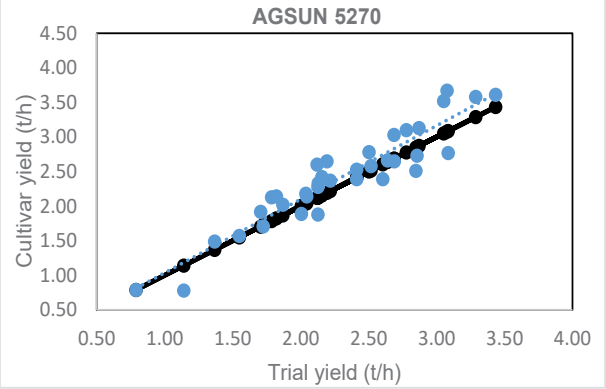


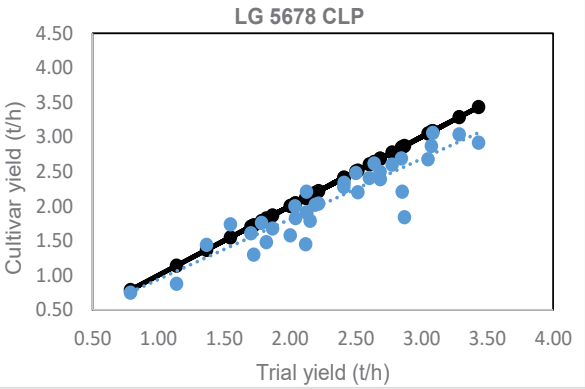




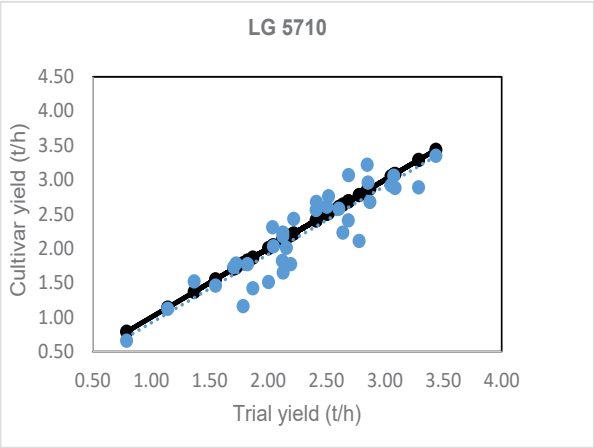


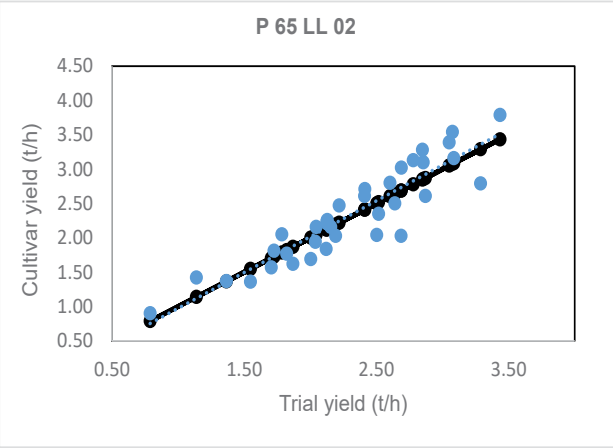


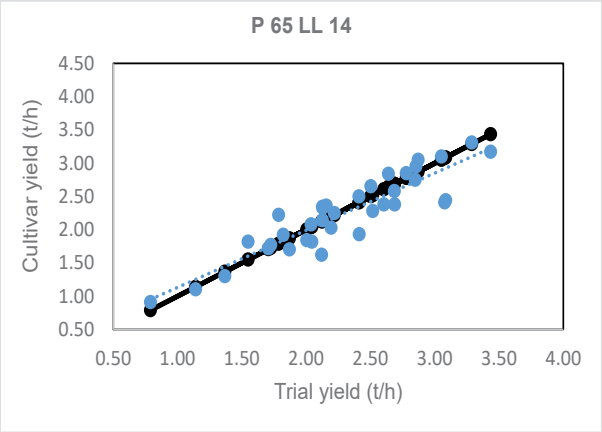


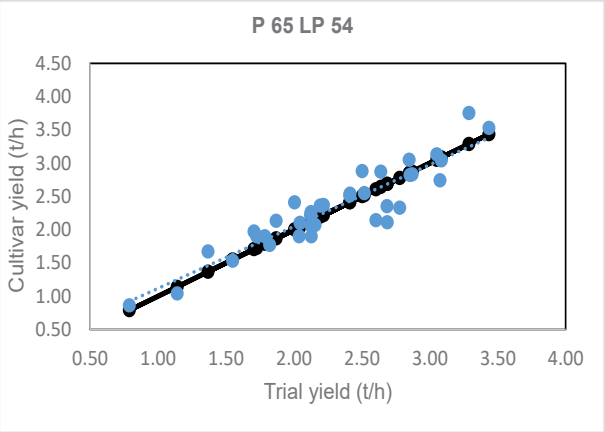


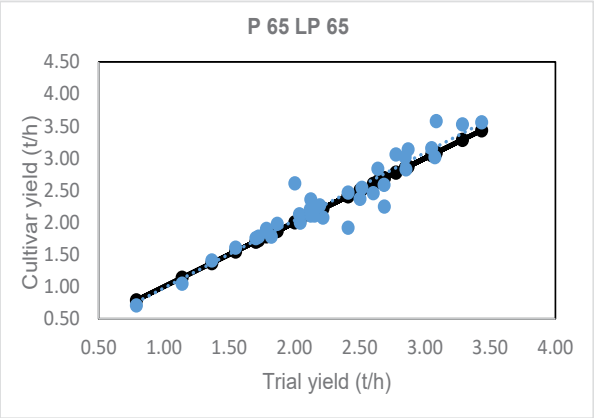
21

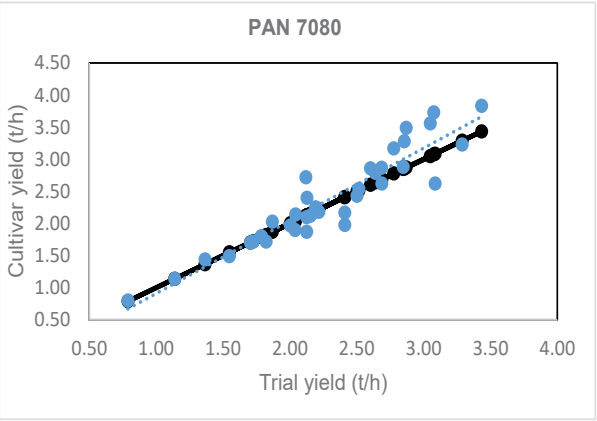

LG 5710
Cultivar yield (t/h)
Trial yield (t/h)

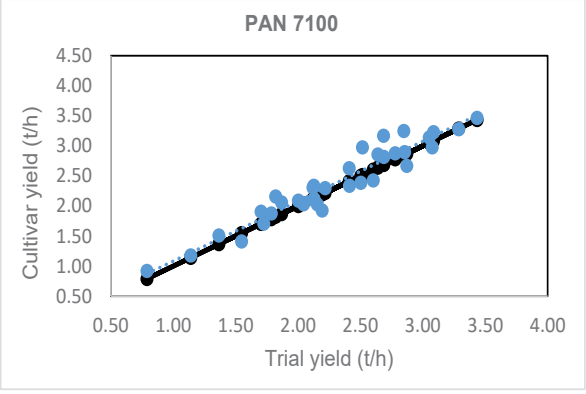

P 65 LL 02
Cultivar yield (t/h)
Trial yield (t/h)

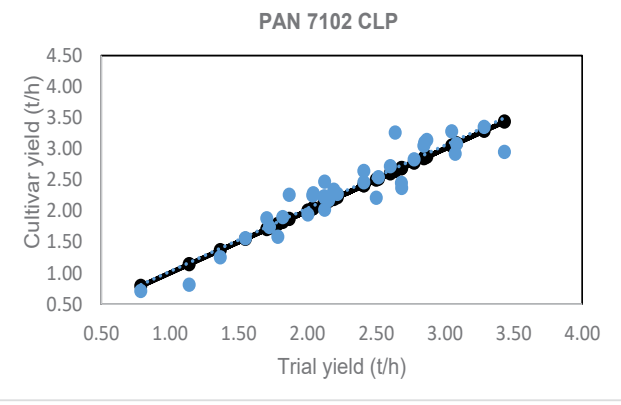

P 65 LL 14
Cultivar yield (t/h)
Trial yield (t/h)

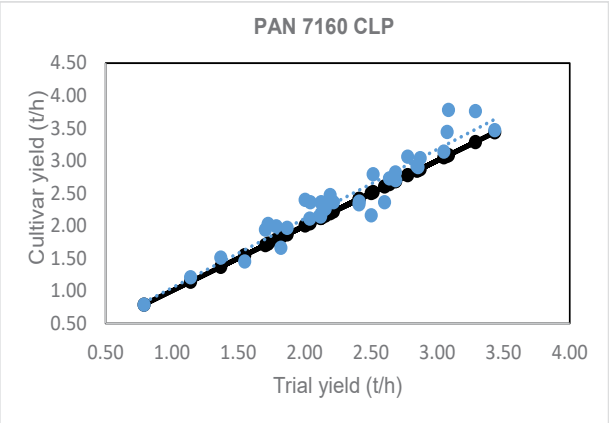

P 65 LP 54
Cultivar yield (t/h)
Trial yield (t/h)

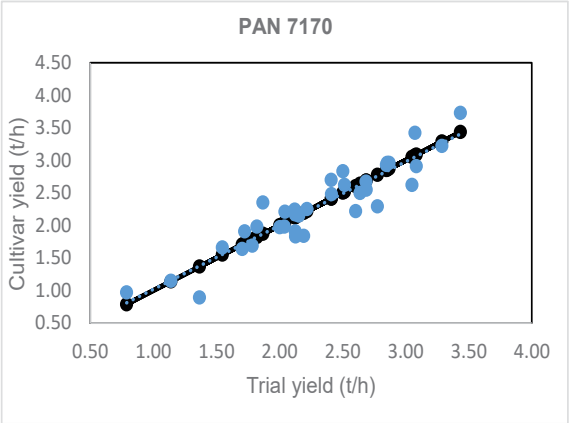

P 65 LP 65
Cultivar yield (t/h)
Trial yield (t/h)

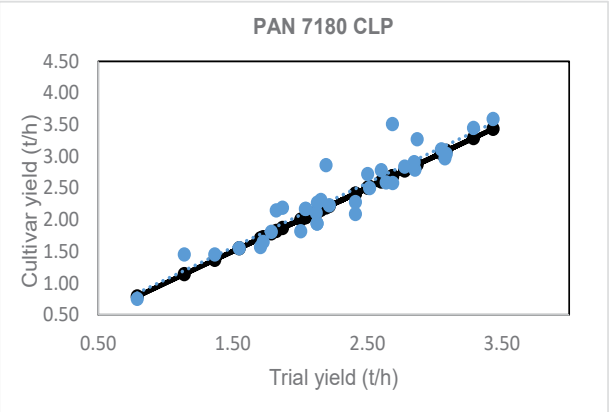

PAN 7080
Cultivar yield (t/h)
Trial yield (t/h)

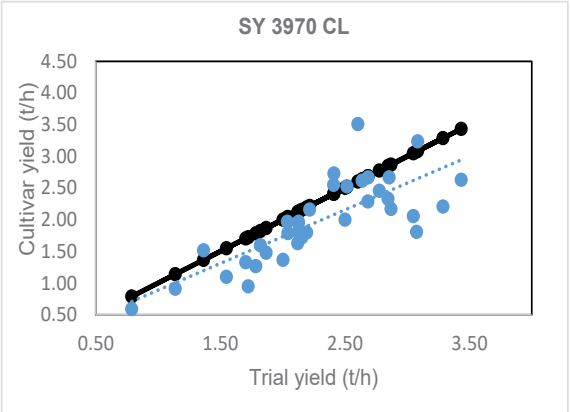

PAN 7100
Cultivar yield (t/h)
Trial yield (t/h)


PAN 7102 CLP
Cultivar yield (t/h)
Trial yield (t/h)


PAN 7160 CLP
Cultivar yield (t/h)
Trial yield (t/h)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00


PAN 7170
Cultivar yield (t/h)
Trial yield (t/h)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00


PAN 7180 CLP
Cultivar yield (t/h)
Trial yield (t/h)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.50 1.50 2.50 3.50


SY 3970 CL
Cultivar yield (t/h)
Trial yield (t/h)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.50 1.50 2.50 3.50

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%