

Report

Evaluation of sunflower cultivars: 2022/2023 season

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

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INTRODUCTION

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

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

MATERIALS AND METHODS

This project was conducted during the 2022/2023 season with the voluntary collaboration of Agricol, Cortiva (Pannar, Pioneer), Syngenta and Limagrain Zaad South Africa . Seed companies entered 20 cultivars for evaluation (Table 1) and supplied seed to the ARC-GC which planned the field trials with randomised complete-block design layouts with three replicates. Seed from cultivars were packed according to trial plans and sent to co-operators before the onset of the growing season.

Eleven of the 20 cultivars were Clearfield types on which the use of the post emergence broad leaf weed controlling herbicide mixture, imazapyr + imazamox (Euro-Lightning®), is possible. In the field trials these cultivars were treated in the same way as the regular cultivars and received no Euro-Lightning®.

Each collaborating seed company had to conduct at least one trial for each cultivar entry. Agricol was supplied with seed for 17 trials, Cortiva (Pannar & Pioneer) with 11 trials, Syngenta with one and Limagrain Zaad SA with three. Five trials were planted by the ARC-GC with different planting dates. Trial sites were selected by collaborators and the co-workers involved are listed in Table 2.

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

harvested due to bad trial quality. One trial of Cortiva and one of Limagrain Zaad was not statistically successful and were not included in the results. Four trials of Agricol were cancelled due to water logging and bad germination and one trial of Syngenta was not harvested due to bad trials quality. Planting dates, amount of fertiliser applied, soil analyses and other agronomic details from some successful field trials are reported in Table 3. Grain yields were recorded on these trials while the period from planting to 50% flowering was recorded on five trials at Potchefstroom and two trials at Boskop with different planting dates. One trial at Cornelia, Hoopstad, Krondal, Lichtenburg, Makwassie, Marquard, Reita, Senkal and Wolmarstad.

Yield data and seed samples were sent by collaborators to ARC-GC for analyses. Seed from selected trials sent to SAGL for oil and protein content analyses. Yield data from 27 field trials were subjected to analyses of variance. The regression line technique as described by Loubser and Grimbeek (1984) was used to calculate yield probabilities for cultivars at different yield potentials from the 27 trials.

Yield probabilities were also calculated for 15 cultivars that were evaluated in 44 trials during 2021/2022 and 2022/2023.

RESULTS

Days from planting to flowering

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

Oil and protein concentration

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

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

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

Seed yield

The mean seed yield of cultivars at the respective localities is presented in Table 6. The highest locality mean yield of 3.57 t ha⁻¹ was obtained at Boskop 3, planted on 20 of January 2023 and the lowest of 1.11 t ha⁻¹, at Kroonstad planted on 7th of February 2023. The five best performing cultivars, in terms of average yield calculated over localities, were PAN 7080, PAN 7180 CLP, AGSUN 5270, P 65 LP 65 and PAN 7090. The overall mean yield for 2022/23 was 2.23 t ha⁻¹, 1.36 % higher than the mean yield of the last year.

Elven Clearfield and Clearfield Plus cultivars AGSUN 5103 CLP, AGSUN 5106 CLP, AGSUN 5108 CLP, AGSUN 5110, CLP AGSUN 5111 CLP, P 65 LP 54, P 65 LP 65, PAN 7102 CLP, PAN 7160 CLP, PAN 7180 CLP, and SY 3970 CL were entered. Seven of these cultivars namely PAN 7180 CLP, P 65 LP 65, PAN 7102 CLP, P 65 LP 54, AGSUN 5111 CLP, AGSUN 5106 CLP and PAN 7160 CLP have yields even or higher than the overall mean yield of all cultivars.

Oil yield

Oil yield per unit area is the product of grain yield and seed oil content and is resented in

Table 8. The oil yield for cultivars at the eight localities varied from 0.88 to 1.11 t ha⁻¹ with an overall mean of 1.02 t ha⁻¹. The locality with the highest mean oil yield was Boskop 3 planted in 20 January 2023 at 1.39 t ha⁻¹. P 65 LL 46 has the highest oil yield of 1.11 t ha⁻¹ followed by P 65 LL 02 with 1.10 t ha⁻¹

Parameters calculated from the analysis of variance

The trial mean yield, standard error of the trial mean and other parameters, calculated for each locality, are shown in Table 8. These parameters are presented for the evaluation of individual trials.

Regression line coordinates at different yield targets

Regression line coordinates at different yield targets, the overall mean yield, the intercept and slope from the regression line and yield stability (R^2 - parameter) are shown in Table 10. The coordinate values of a particular cultivar are estimates of the mean expected yield at corresponding yield potentials. These values take the cultivar X environment interaction into account but not the yield stability. These values are accordingly not reliable for cultivar selection. Individual cultivar regression lines for 2022/2023 are shown in Figure 1 and for the 15 cultivars evaluated in 2020/2021 and 2022/2023 in Figure 2. The yield stability of cultivars varied up to 21-fold among cultivars (Table 9). Cultivars which had exceptionally high stabilities (R -parameter =1) were, AGSUN 58251, P 65 LP 65 and PAN 7160 CLP

Yield probability

The yield probability of a cultivar is the probability of exceeding the mean yield of all cultivars, at a particular yield potential. The yield probabilities of all 20 cultivars for 2022/2023 are shown in Table 10. It takes account of both the cultivar X environment interaction and the yield stability and is therefore a reliable measure for cultivar choice. Yield probabilities higher than or equal to 60% in Table 10 indicates which cultivars would be sensible choices at the various yield potentials

The yield probabilities of 15 cultivars evaluated in 44 trials in 2021/2022 and 2022/2023, and yield probabilities for the 15 cultivars evaluated in 63 trials are shown in Tables 11 and

12 respectively. Tables 10, 11 and 12 should be used jointly for cultivar selection.

Acknowledgements

Funding from the Oil and Protein Seed Development Trust and the participation of Agricol, Pannar, Pioneer, Syngenta and Limagrain Zaad SA, gratefully acknowledged.

References

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

SOUTH AFRICAN SCLEROTINIA RESEARCH NETWORK: CULTIVAR EVALUATIONS 2022/2023

Project charter

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

SUNFLOWER CULTIVAR EVALUATIONS AGAINST SCLEROTINIA SCLEROTIORUM

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

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

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

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

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

Sunflower Delmas Planting 1 ($\alpha = 0.01$)					
Factor	df	ss	ms	F-value	Pr (>F)
Block	2	785.9	393.0	5.71	0.0678
Cultivar	19	2131.3	112.2	1.63	0.09828
Residual	38	2614.3	68.8		

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

Sunflower Delmas Planting 2 ($\alpha = 0.05$)					
Factor	df	ss	Ms	F-value	Pr (>F)
Block	2	431	215.3	1.683	0.199
Cultivar	19	2369	124.7	0.975	0.508
Residual	38	4862	127.9		

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

Sunflower Clocolan Planting 1 ($\alpha = 0.01$)					
Factor	df	ss	ms	F-value	Pr (>F)
Block	2	9	4.26	0.027	0.9731
Cultivar	19	5208	274.09	1.756	0.0689
Residual	38	5932	156.1		

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

Sunflower Clocolan Planting 2 ($\alpha = 0.01$)					
Factor	df	Ss	ms	F-value	Pr (>F)
Block	2	136.1	68.03	2.25	0.119
Cultivar	19	783.8	41.25	1.364	0.203
Residual	38	1148.9	30.24		

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

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

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

Planting 1		Planting 2	
Cultivar	Mean Head Rot Prevalence (%)	Cultivar	Mean Head Rot Prevalence (%)
P 65 LL 46	24.5	P 65 LP 54	27.8
AGUARA 6	20.1	AGSUN 5270	25.9
AGSUN 5270	19.6	AGSUN 5110 CLP	24.5
P 65 LL 02	17.3	PAN 7160 CLP	23.7
PAN 7100	17.2	SY 3970 CL	23.1
SY 3970 CL	15.5	P 65 LL 02	21.7
P 65 LP 54	15.3	AGSUN 5108 CLP	20.6
AGSUN 5110 CLP	14.9	PAN 7080	19.8
PAN 7180 CLP	14.4	AGSUN 5103 CLP	17.5
LG 5710	13.7	AGUARA 6	16.9
AGSUN 5106 CLP	11.2	PAN 7180 CLP	15.2
PAN 7090	10.9	P 65 LP 65	15.1
LG 50745	10.7	LG 5710	14.2
P 65 LP 65	10.5	P 65 LL 46	12.7
PAN 7080	8.0	AGSUN 5111 CLP	12.4
AGSUN 5103 CLP	6.5	LG 50745	12.1
PAN 7102 CLP	6.5	PAN 7090	11.8
AGSUN 5111 CLP	3.3	PAN 7102 CLP	9.8
AGSUN 5108 CLP	3.0	AGSUN 5106 CLP	6.3
PAN 7160 CLP	2.1	PAN 7100	5.2

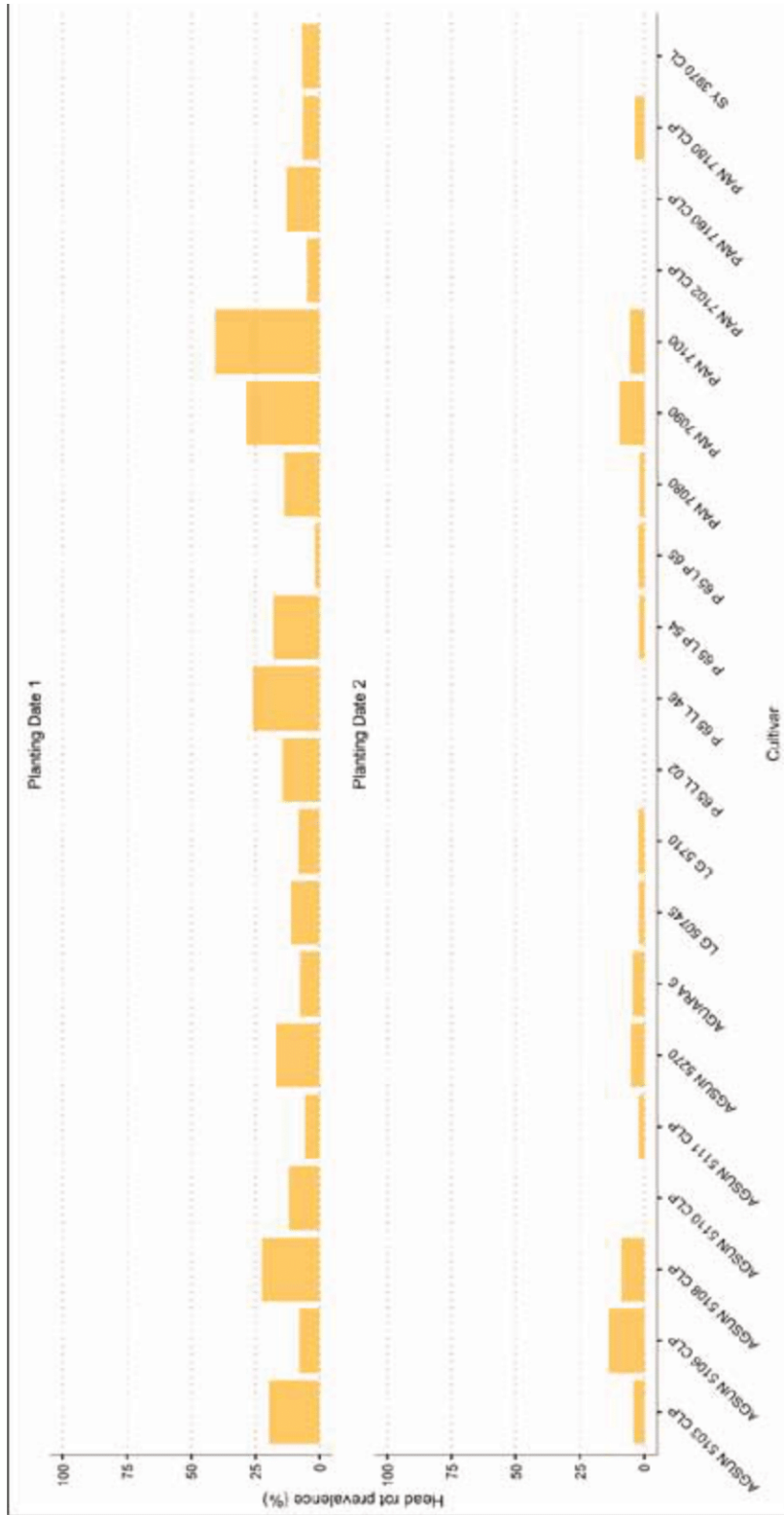


Figure 4. Mean head rot prevalence of sunflower cultivars screened against *Sclerotinia sclerotiorum* under natural conditions in Clocolan (FS) for the first and second planting on the 8 and 22 December 2022.

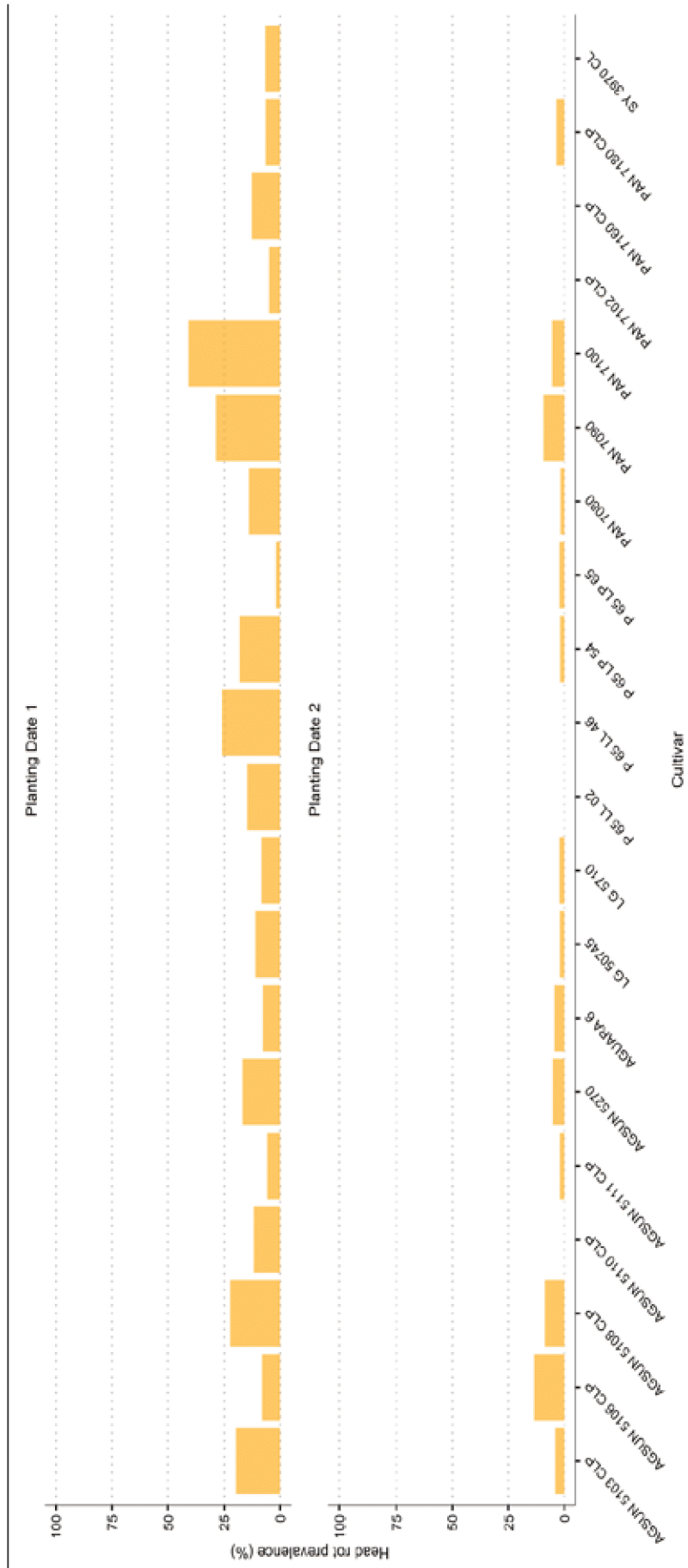


Figure 5. Mean head rot prevalence of sunflower cultivars screened against *Sclerotinia sclerotiorum* under inoculated field conditions in Delmas (MP) for the first and second planting on 13 and 21 December 2022.

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

Company	Localities	Planting dates	Co-workers	E-mail address of co-worker
Agricol	Boskop2	17/11/2022		
	Boskop 1	06/01/2023		
	Boskop3	23/01/2023		
	Koster	03/12/2022		
	Lichtenburg	01/12/2022		
	Wolmaranstad	22/12/2022		
	Carnelia	01/01/2023		
	Hoopstad	30/01/2023		
	Reitz	04/11/2022		JSwanepoel@agricol.co.za
	Kroonstad	07/02/2023		
	Ventersdorp	06/12/2022		
	Senekal	06/12/2022		
	Makwassie	21/12/2022		
	Marquard	22/12/2022		
	Kroondal	28/01/2023		
	Klipdrif	05/01/2022		
		09/12/2022		
ARC-GCI	Potchefstroom	31/10/2022		
		21/11/2022		
		21/12/2022	William Makgoga & Jan Erasmus	Makgogamw@arc.agric.za Erasmusj@arc.agric.za
		12/01/2023		
		31/01/2023		
Corteva	Delmas	18/11/2022		
	Senekal	23/12/2022		
	Kroonstad	08/12/2022		
	Marquard	Not planted		
	Henneman	28/12/2021		
	Gerdau	Not harvested		
	Coligny 2	01/12/2022	Abre Pretorius, Phillip Fourie & Louis Schoonraad	abre.pretorius@pannar.co.za phillip.fourie@pioneer.com louis.schoonraad@corteva.com
	Lichtenburg	06/01/2023		
Puffontein	09/12/2022			
Corteva	Gerdau-Oos	07/12/2022		
	Gerdau -Wes	22/12/2022		
Lima Grain	Lichtenburg	06/01/2022		
	Wesselsbron	02/12/2021		
	Dwaalboom/Settlers	05/12/2022	Anita Janeke	anita.janeke@limagrain.com
	Wesselsbron	16/11/2022		
	Wolmaranstad	08/12/2022		
Syngenta	Kroonstad	05/01/2023	PieterTajjaard	Pieter.Tajjaard@syngenta.com

Table 2: Trial successful site information 2022/2023 season

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

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

Cultivar Name	Boskop ¹ 2022-11-17	Boskop ³ 2023-01-20	Cornelia 2023-01-10	Hoopstad 2023-01-30	Kroondal 2023-01-05	Lichtenburg 2022-12-01	Makwasse 2022-12-22	Marquard ² 2023-01-23	Potch 2223-10-31	Potch 2223-11-21	Potch 2223-12-21	Potch 2223-01-12	Potch 2223-01-21	Reitz 2022-11-04	Senkal 2022-12-21	Wolmarsta d 2022-12-	Mean
AGSUN 5103 CLP	69	71	72	73	65	66	66	74	71	67	70	79	84	74	66	71	71
AGSUN 5106 CLP	69	72	72	72	65	66	67	73	71	68	73	79	80	70	67	71	71
AGSUN 5108 CLP	65	71	70	71	63	64	65	74	70	63	68	78	79	69	63	68	69
AGSUN 5110 CLP	67	73	71	71	64	66	65	74	73	64	69	79	80	70	64	67	70
AGSUN 5111 CLP	70	74	75	74	67	70	68	75	70	67	72	80	87	75	67	72	73
AGSUN 5270	65	67	70	69	62	66	64	71	70	65	71	81	80	72	64	68	69
Aguara ⁶	69	73	76	72	66	69	69	74	70	67	75	81	85	74	67	69	72
LG 50745	63	67	68	69	61	64	65	69	71	65	68	77	76	67	63	66	67
LG 5710	66	68	74	72	62	65	64	70	70	63	68	72	76	68	66	67	68
P 65 LL 02	70	69	74	73	65	66	67	71	71	67	71	78	79	72	66	72	71
P 65 LL 46	66	70	73	71	65	65	69	73	70	63	68	76	77	70	64	64	69
P 65 LP 54	66	71	70	72	64	67	68	74	72	64	72	82	84	74	68	70	71
P 65 LP 65	65	73	75	73	66	70	69	75	70	68	71	81	87	76	65	72	72
PAN 7080	69	74	73	71	66	68	66	73	71	67	72	80	87	75	66	69	72
PAN 7090	66	70	75	74	66	69	69	74	72	61	72	83	80	75	66	71	71
PAN 7100	65	69	74	71	65	67	66	71	70	67	73	83	78	76	64	70	71
PAN 7102 CLP	63	70	68	72	63	65	65	70	70	64	70	81	85	74	68	68	70
PAN 7160 CLP	66	72	70	70	65	70	69	75	70	68	73	81	85	74	67	70	72
PAN 7180CLP	69	74	71	73	66	69	67	74	71	67	73	78	87	74	67	71	72
SY 39 70 CL	69	71	71	72	66	67	69	73	72	67	73	75	74	74	65	68	70
Mean	67	71	72	72	65	67	67	73	71	66	71	79	82	73	66	69	71

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

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

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

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

Table 6: Mean seed yield (t ha⁻¹) of cultivars at each locality 2022/2023

Cultivar\ Locality	Boskop1 2022-11-17	Boskop3 2023-01-20	Colligny 2022-12-01	Comella 2023-01-10	Delmas 2022-11-18	Gerdau-Os 2022-12-07	Gerdau-Wes 2022-12-22	Hoopstad 2023-01-30	Koster 2022-12-03	Kroondal 2023-01-05	Kroonstad 2023-02-07	Lichtenburg 2022-12-01	Lichtenburg 2022-12-05	Lichtenburg 2023-01-06	Makwassie 2022-12-22	Marquard2 2023-01-23	Potch 2223-10-31	Potch 2223-11-21	Potch 2223-12-21	Potch 2223-01-12	Potch 2223-01-21	Putfontein 2022-12-09	Reitz 2022-11-04	Senkal 2022-12-12	Senkal 2022-12-23	Wesselsbron 2022-11-16	Wolmarstad 2022-12-22	Average
AGSUN5103CLP	2.93	3.57	2.26	1.63	1.93	2.48	2.56	3.23	2.52	1.63	0.98	3.39	2.10	1.95	2.15	2.70	2.86	2.56	1.78	1.80	1.27	0.94	2.90	2.39	1.57	1.28	1.24	2.17
AGSUN5106CLP	2.53	3.79	2.28	1.71	2.33	3.17	2.40	3.44	2.57	1.52	1.37	3.51	2.07	1.89	2.60	2.57	2.82	2.50	1.89	1.81	1.69	1.22	2.35	2.38	2.10	1.45	1.19	2.26
AGSUN5108CLP	2.92	3.61	2.40	1.80	2.47	1.86	2.67	2.89	2.37	1.45	1.38	3.24	1.75	1.90	2.66	2.34	2.63	2.67	1.83	1.57	1.63	0.89	2.74	2.25	1.85	1.47	1.31	2.17
AGSUN5110CLP	2.18	3.42	2.27	1.57	2.79	2.43	3.04	2.89	2.39	1.34	1.12	2.97	1.64	1.73	2.17	2.13	2.56	2.64	2.17	1.69	1.84	0.86	1.90	2.25	1.65	1.68	1.15	2.09
AGSUN5111CLP	3.46	3.68	2.08	2.02	1.92	2.34	2.30	2.91	2.77	1.32	1.11	3.52	2.22	2.21	3.19	2.59	2.85	2.76	1.99	1.69	1.89	1.16	2.51	2.33	1.87	1.03	1.53	2.27
AGSUN5270	2.72	3.71	2.56	2.08	2.94	2.86	2.55	3.32	2.19	1.47	1.22	3.63	1.90	1.56	2.83	2.27	3.07	2.57	2.23	1.84	2.25	1.52	2.49	2.56	2.03	1.56	1.51	2.35
Aguara6	1.96	2.75	2.16	1.32	2.78	2.70	2.17	2.32	2.19	1.08	0.98	2.80	1.89	2.39	1.17	2.05	2.22	2.81	2.14	1.62	1.63	0.97	2.39	2.19	1.68	1.55	1.22	1.97
LG50745	3.17	3.42	2.45	1.40	2.39	1.53	2.48	2.75	2.27	1.28	1.20	3.10	2.42	1.99	2.46	2.06	2.90	3.23	2.01	1.62	2.03	1.14	1.99	2.38	1.73	2.19	0.97	2.17
LG5710	2.46	3.31	2.20	1.53	2.09	2.50	2.01	2.74	2.13	1.24	1.15	3.03	1.90	2.24	2.02	2.03	3.31	3.27	2.11	1.62	2.02	0.90	1.63	2.00	2.05	1.28	1.11	2.07
P65LL02	2.52	3.75	2.14	1.93	2.76	2.63	2.36	3.44	2.19	1.31	1.46	3.18	1.65	2.00	2.23	2.79	3.32	2.72	2.02	1.95	2.23	1.46	2.27	2.37	2.14	1.70	1.13	2.28
P65LL46	2.40	3.55	2.41	1.69	2.29	1.94	3.08	2.77	2.44	1.43	1.18	3.59	1.71	2.46	2.87	2.26	3.22	2.93	2.42	1.56	1.94	1.42	1.61	2.10	2.38	1.69	1.17	2.24
P65LP54	2.44	3.80	2.49	2.05	2.50	2.79	2.35	2.51	2.24	1.46	0.94	3.29	2.17	1.38	2.94	2.58	3.00	3.04	1.97	2.13	1.96	1.28	2.73	2.42	2.04	1.82	1.17	2.28
P65LR65	1.99	3.66	2.61	1.48	2.41	2.87	2.98	3.21	2.41	1.38	1.06	3.34	2.28	2.21	2.60	2.14	3.15	2.70	1.94	1.78	2.12	1.50	2.55	2.54	2.12	2.34	1.32	2.32
PANT080	2.27	3.76	2.22	1.75	2.68	2.63	2.81	3.62	2.40	1.44	0.91	3.35	2.35	2.67	2.87	2.32	2.91	3.07	2.24	1.93	1.88	1.84	2.71	2.32	1.92	2.31	1.36	2.39
PANT090	2.76	3.88	2.51	1.56	1.80	2.53	2.66	3.42	2.40	1.48	1.12	3.30	2.29	2.43	2.62	2.17	2.89	2.65	2.17	2.02	2.09	1.38	2.76	2.29	1.86	1.92	1.15	2.30
PANT100	2.58	3.55	2.40	1.72	2.40	2.23	2.63	2.87	2.32	1.46	1.04	3.46	2.28	1.71	2.60	2.15	3.32	2.98	2.16	1.67	1.79	1.68	2.24	2.27	1.68	2.07	1.13	2.24
PANT102CLP	3.03	3.88	2.55	1.61	3.19	1.95	2.56	3.56	2.11	1.46	0.96	3.34	1.28	1.70	2.75	2.33	3.14	2.81	2.13	1.85	1.81	1.28	2.28	2.73	2.02	2.40	0.93	2.28
PANT160CLP	2.15	3.72	2.65	1.62	2.29	2.33	2.45	3.12	2.14	1.49	0.99	3.57	2.08	2.08	2.55	2.36	3.26	2.85	2.05	2.05	1.20	1.47	2.80	2.62	1.84	1.89	1.23	2.25
PANT180CLP	3.44	3.69	2.46	1.65	3.01	2.13	2.73	3.07	2.67	1.27	1.06	3.58	2.65	1.80	3.15	1.74	2.99	3.18	1.98	2.17	1.76	1.66	2.82	2.27	1.76	1.97	1.27	2.37
SY3970CL	2.39	2.97	2.78	1.34	2.07	3.11	3.12	2.50	2.10	1.24	1.01	3.03	2.23	1.67	1.94	2.05	2.98	2.69	1.98	1.80	1.77	1.35	1.89	2.18	1.83	2.02	1.19	2.12
MEAN	2.62	3.57	2.39	1.67	2.45	2.45	2.60	3.03	2.34	1.39	1.11	3.31	2.04	2.00	2.52	2.28	2.97	2.83	2.06	1.81	1.84	1.30	2.38	2.34	1.91	1.78	1.21	2.23

Table 7: Oil yield (t ha⁻¹) of cultivars at selected localities 2022/2023

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