

Report

Evaluation of sunflower cultivars: 2018/2019 season

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

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INTRODUCTION

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

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

MATERIALS AND METHODS

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

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

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

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

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

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

RESULTS

Days from planting to flowering

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

Oil and protein concentration

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

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

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

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

Seed yield

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

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

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

Oil yield

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

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

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

Parameters calculated from the analysis of variance

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

Regression line coordinates at different yield targets

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

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

Yield probability

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

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

Acknowledgements

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References

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

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

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

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

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

Table 3: Trial site information 2018/19

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

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

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

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

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

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

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

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

Cultivars	08/01/19 Boskop3	13/11/18 Boskop1	22/12/18 Boskop2	30/01/19 Colligny	05/02/19 Delareyville	10/01/19 Kroonstad	05/01/19 Lichtenburg	09/11/18 Potchefstroom	18/10/18 Potchefstroom	31/01/19 Venterdorp	14/01/19 Viljoenskroon	05/02/19 Wolmaransstad	Mean
AGSUN5101CLP	2,64	3,42	2,90	1,34	1,89	0,93	2,18	2,43	2,02	2,60	1,48	1,88	2,69
AGSUN5102CLP	2,80	3,13	2,41	1,50	1,98	1,30	1,50	2,80	2,29	2,57	1,62	1,66	2,50
AGSUN5103CLP	3,25	3,20	2,51	1,54	2,17	0,84	1,79	2,78	2,16	2,49	1,55	1,85	2,85
AGSUN5106CLP	3,56	3,48	2,82	1,26	1,96	1,12	1,51	2,83	2,37	2,17	1,48	1,75	2,90
AGSUN5270	3,40	3,41	2,99	1,46	2,33	1,31	2,17	3,03	2,18	2,57	1,83	1,66	2,89
AGSUN5273	2,37	3,16	2,32	0,99	2,15	0,92	1,53	2,52	2,12	2,80	1,44	1,79	2,76
AGSUN5278	2,68	3,00	2,67	1,14	1,71	1,16	1,17	2,65	1,80	2,60	1,70	2,01	2,46
AGSUN8251	3,28	3,54	2,64	1,41	2,04	1,37	2,49	2,68	2,29	2,29	1,86	2,00	2,97
LG5678CLP	3,05	2,72	2,48	1,10	1,86	1,05	1,70	2,20	2,19	2,53	1,84	1,47	2,57
LG5710	3,39	3,38	2,87	1,19	1,93	1,03	1,82	2,23	2,35	2,33	1,99	1,75	2,15
P64LL23	2,91	3,14	2,50	1,36	1,65	1,43	2,32	2,63	3,11	2,62	2,14	1,67	2,61
P65LL02	3,37	3,34	2,80	1,20	2,16	1,11	2,00	2,50	2,61	2,75	2,06	1,59	2,93
P65LL14	3,24	3,76	2,46	1,36	2,49	1,18	1,87	3,08	2,12	2,57	1,93	1,79	2,83
P65LP54	2,72	3,27	2,58	1,17	1,85	1,10	1,51	2,81	2,65	2,28	1,94	1,86	2,69
P65LC17	3,45	2,85	3,03	1,52	2,05	0,89	1,91	2,97	2,22	2,27	2,11	1,90	2,54
PAN7080	2,95	3,77	2,70	1,25	2,54	1,18	2,12	2,76	2,84	2,46	2,00	1,58	3,09
PAN7100	2,99	3,12	2,21	1,54	1,90	1,41	1,83	2,58	2,16	2,48	1,74	1,74	2,87
PAN7102CLP	3,60	3,54	2,40	1,47	2,43	1,25	2,37	2,62	2,48	2,41	2,04	2,05	2,88
PAN7156CLP	2,86	3,48	2,71	1,58	2,12	1,27	1,77	3,12	2,80	2,90	2,10	1,95	3,02
PAN7158HO	2,65	3,35	2,41	1,00	1,85	1,26	1,63	2,51	2,82	2,30	1,77	1,49	2,72
PAN7160CLP	3,51	3,34	2,98	1,44	2,02	1,04	1,70	2,61	2,42	2,65	2,04	1,59	3,06
SY3970CL	3,25	3,18	1,98	1,23	1,35	0,99	1,37	2,54	2,56	1,99	1,60	1,16	2,58
SY3975CLOH	2,59	2,64	2,07	1,01	1,73	1,19	1,58	2,72	1,56	2,22	1,56	1,21	2,35
SYArizona	3,22	3,31	2,54	1,02	1,69	1,17	1,86	2,50	3,20	1,96	2,14	1,81	2,31
mean	3,07	3,27	2,58	1,30	1,99	1,15	1,82	2,67	2,39	2,45	1,83	1,72	2,25
CV%	14,9	11,6	15,2	19,5	20,2	18,7	22,8	10,5	17,3	10,9	14,8	19,3	11,5

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

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

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

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

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

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

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

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

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

Cultivar	Yield potential (t ha ⁻¹)			
	1	1.5	2	2.5
AGSUN5101CLP	33	32	32	32
AGSUN5102CLP	53	41	27	18
AGSUN5103CLP	25	34	44	56
AGSUN5106CLP	37	45	52	61
AGSUN5270	72	75	75	77
AGSUN5273	36	30	23	18
AGSUN5278	55	45	33	24
AGSUN8251	69	65	61	55
P65LL02	61	68	72	78
P65LL14	58	60	61	63
P65LP54	37	40	42	46
PAN7080	44	53	62	71
PAN7100	62	60	58	56
PAN7102CLP	77	76	73	70
PAN7156CLP	78	76	73	70
PAN7158HO	45	43	41	39
PAN7160CLP	50	57	65	72
SY3970CL	19	18	16	16

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

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

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

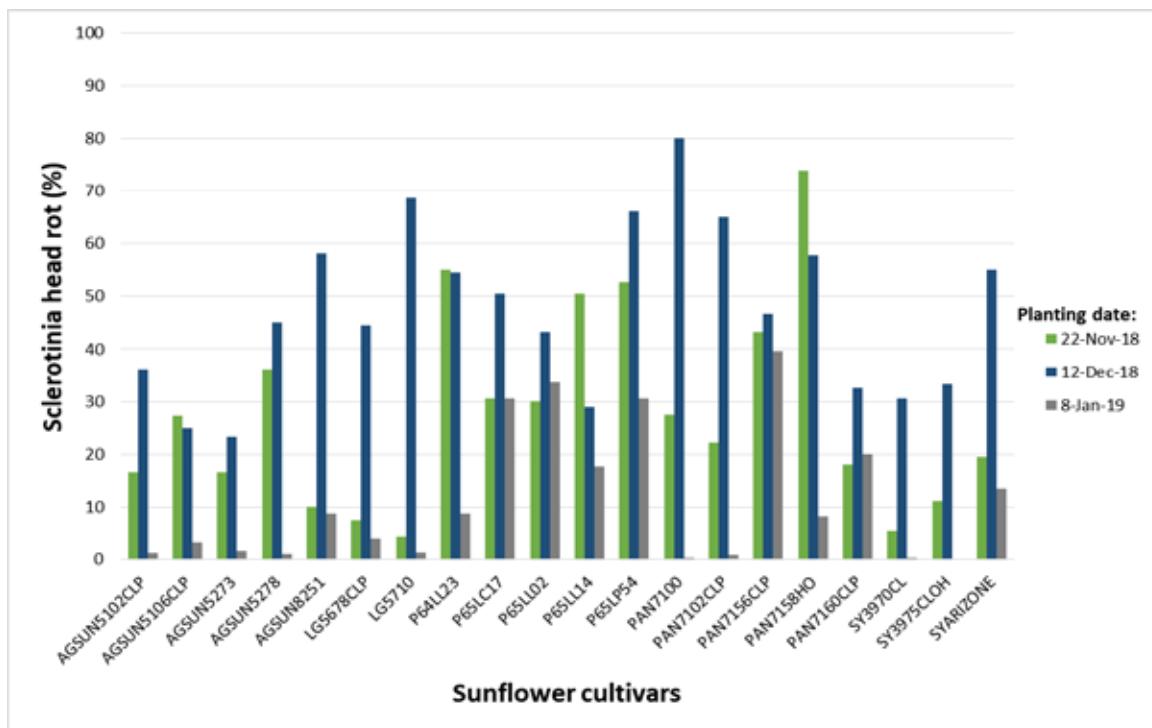


Figure 1: Sclerotinia head rot rating (%) for twenty sunflower hybrids planted at different planting dates during 2018-19 growing season in Delmas

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

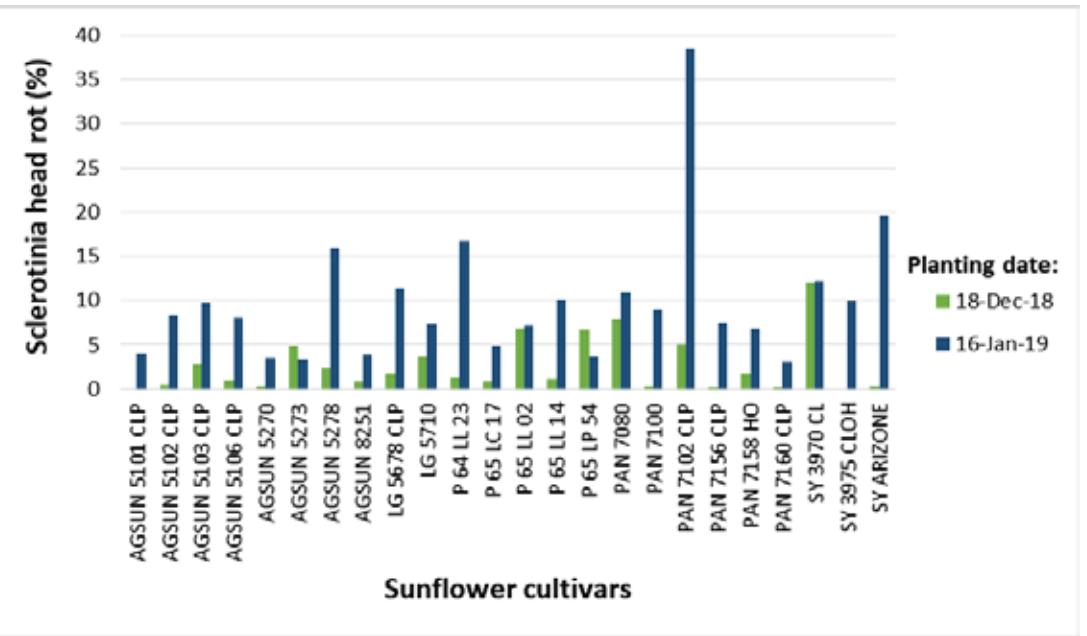
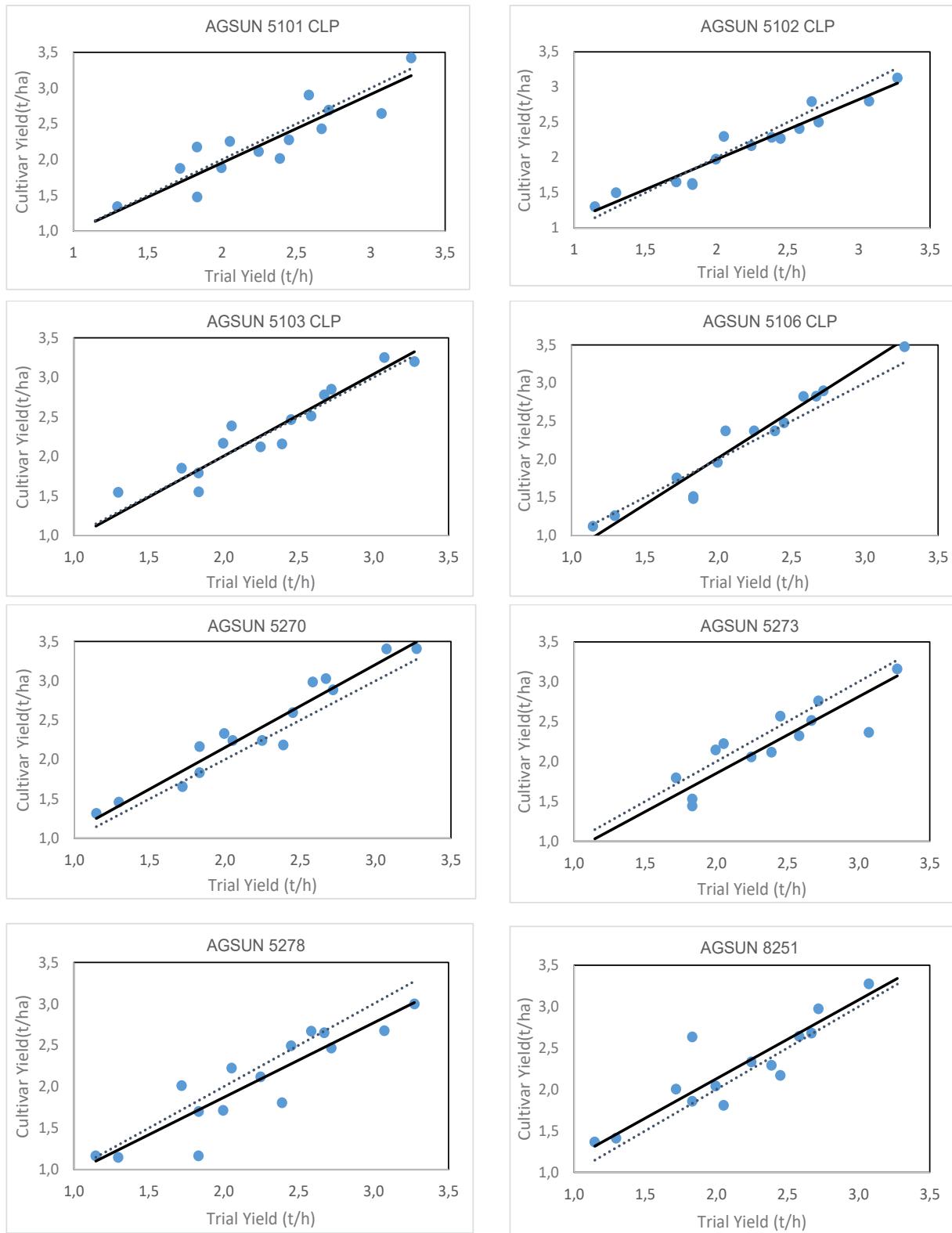


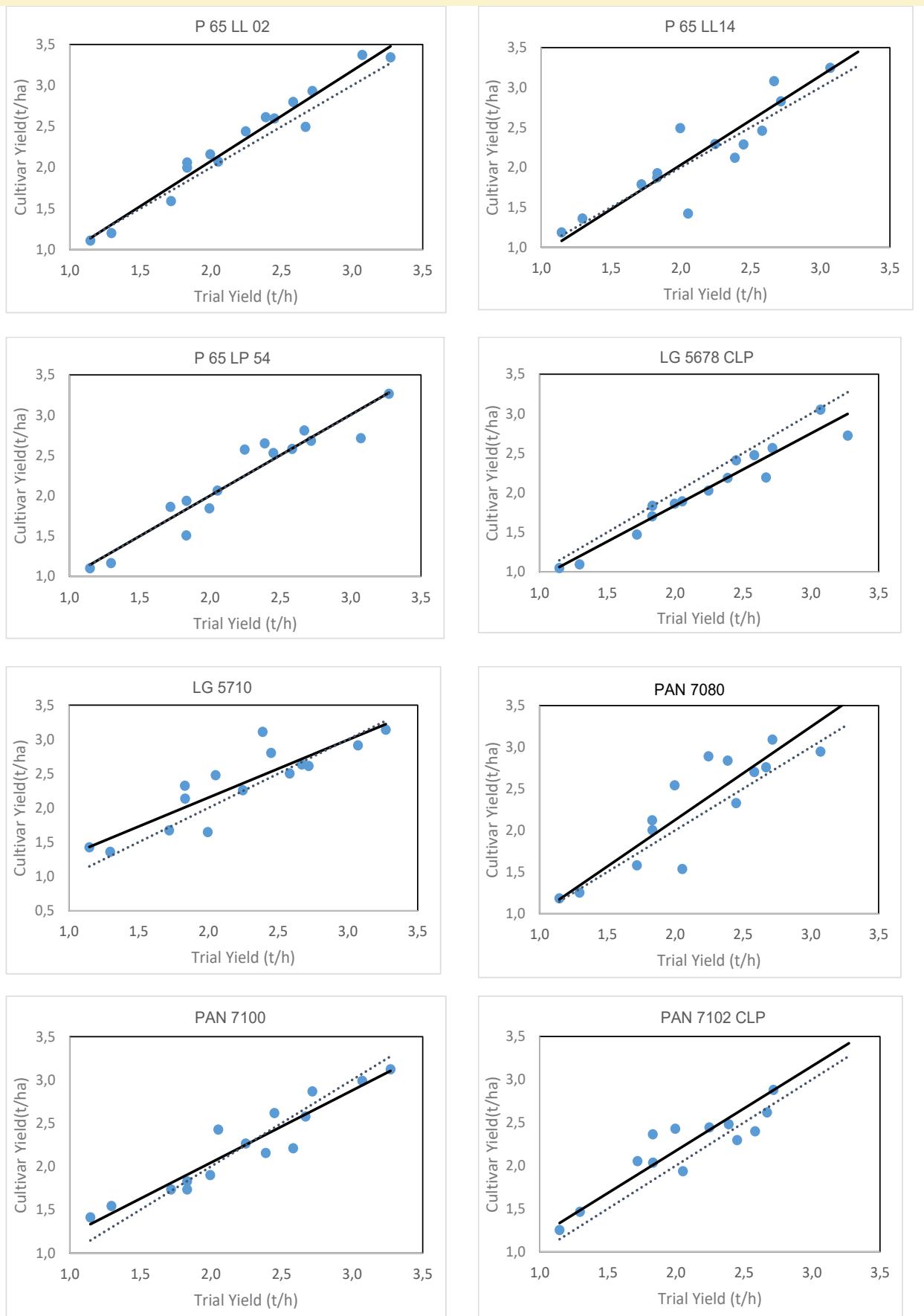
Figure 2: Sclerotinia head rot rating (%) for twenty-four sunflower hybrids planted at two planting dates during 2018-19 growing season in Clocolan

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

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

Figure 3: Regression lines for cultivars 2018/2018





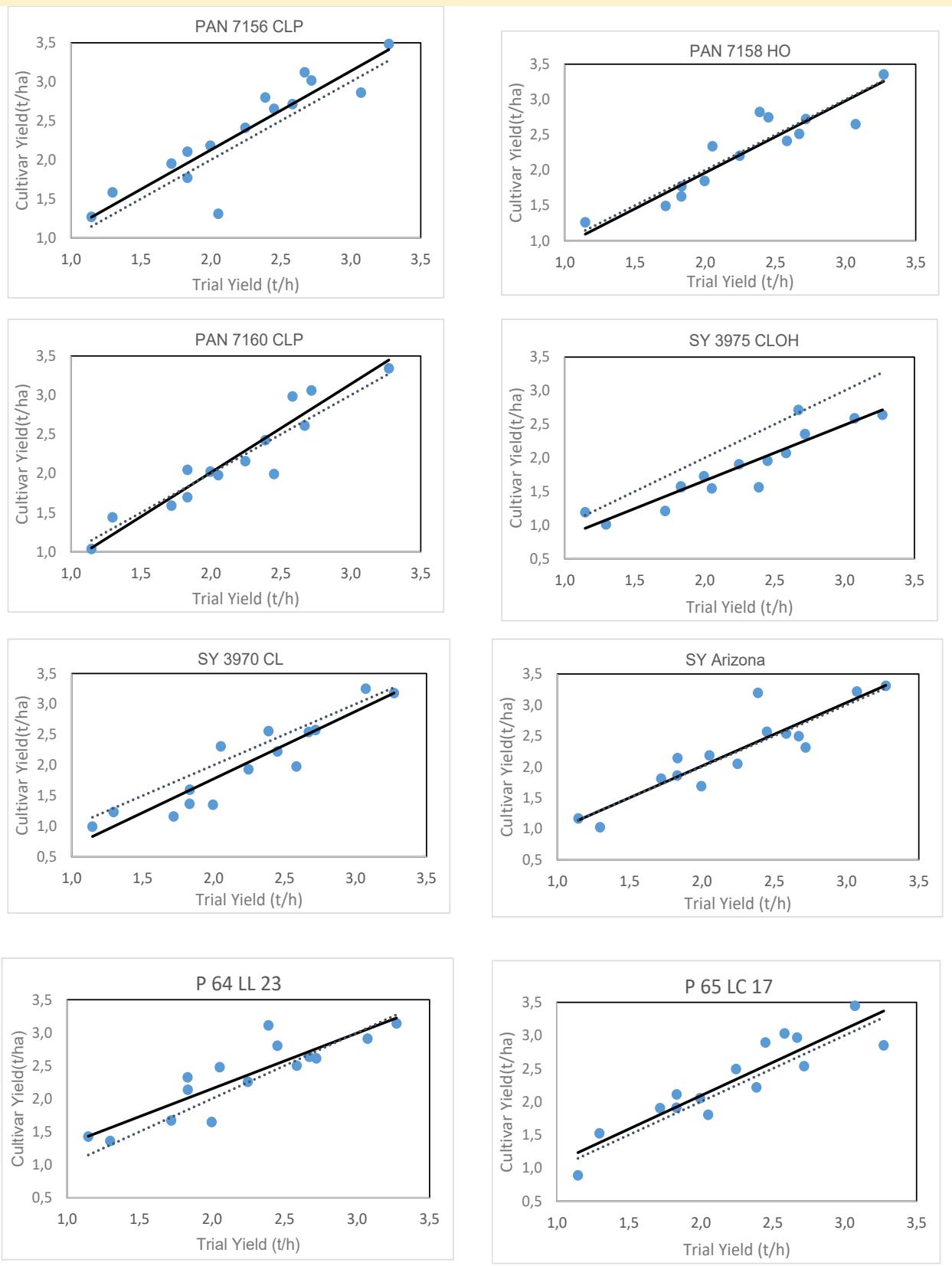


Figure 4: Regression lines for cultivars 2017/2018 and 2018/2019

