

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 in 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

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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 2020/21

Cultivar's Name	Germinated (%)			Company
	Normal	Abnormal	Dormant/dead	
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
Corteva	Gerdau	15/12/2021			
		Coligny 2			09/12/2021
		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	Pieter Taljaard	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 (m ²)
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)						Mean (t ha ⁻¹)	Intercept	Slope	Fprob	R ²
	1	1,5	2	2,5	3	3,5					
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

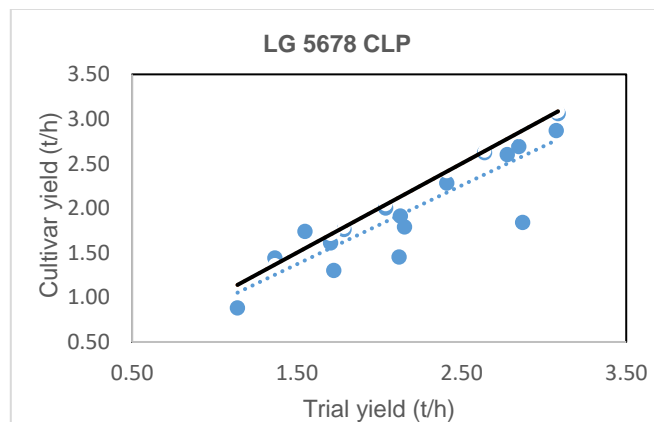
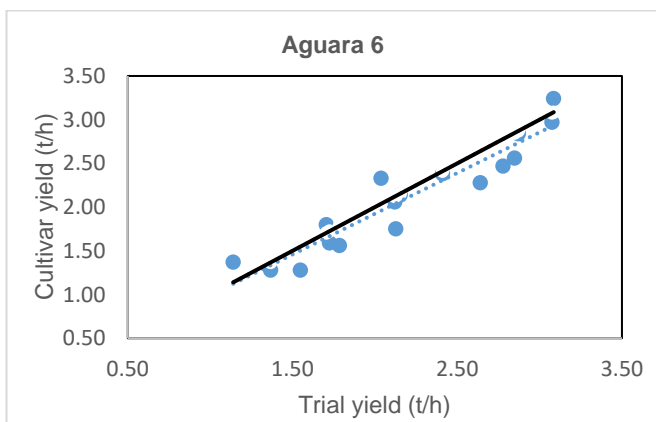
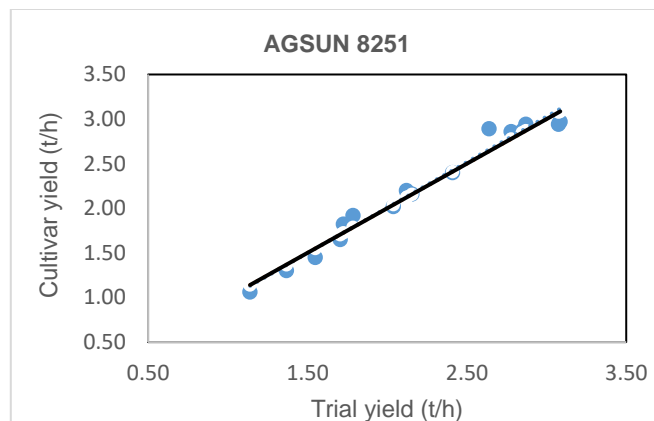
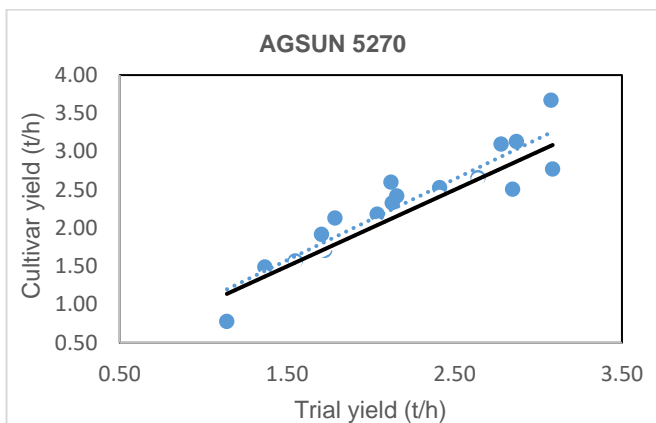
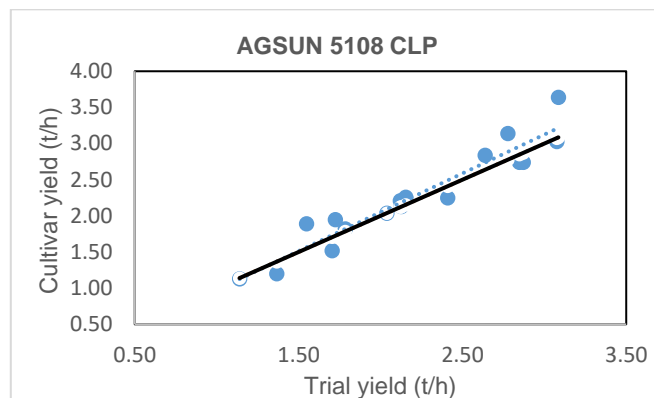
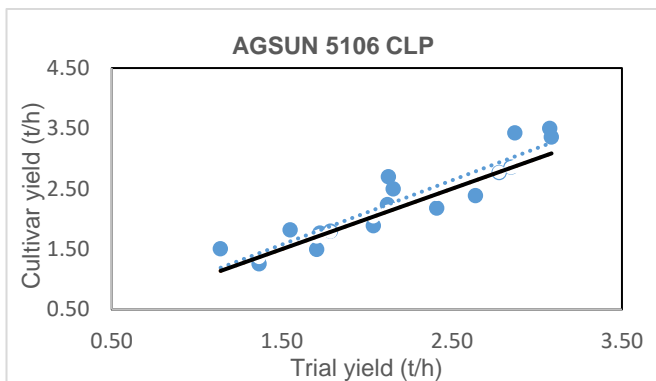
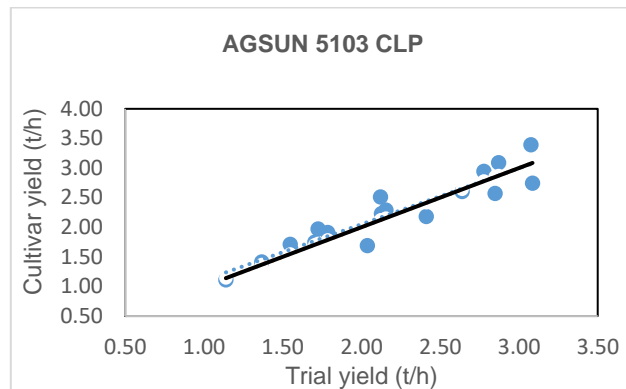
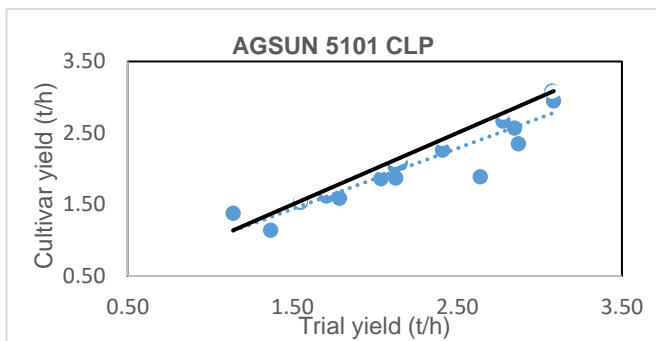
Table 12: Yield probability (%) of cultivars 2020/2021 and 2021/2022 at different yield potentials

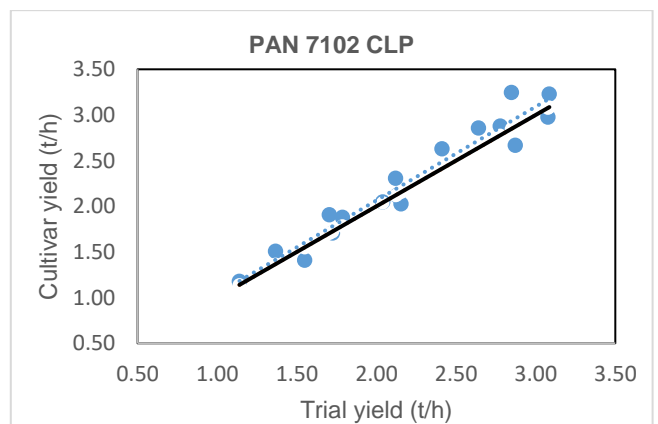
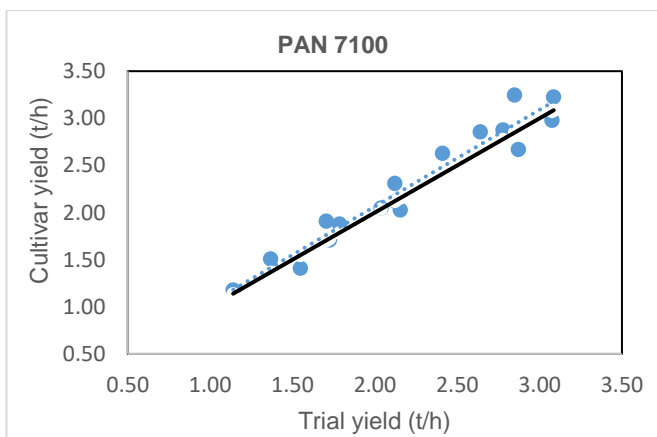
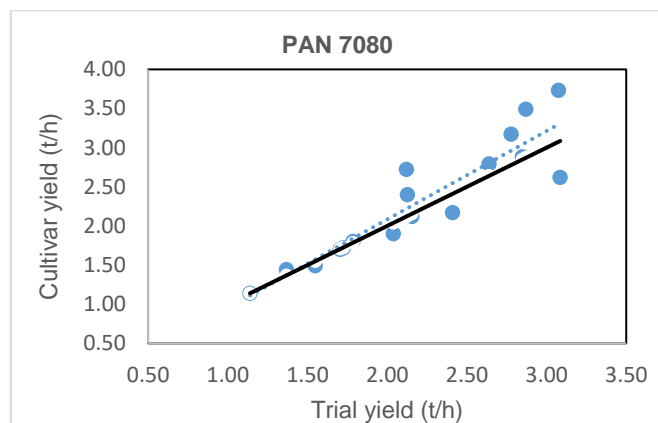
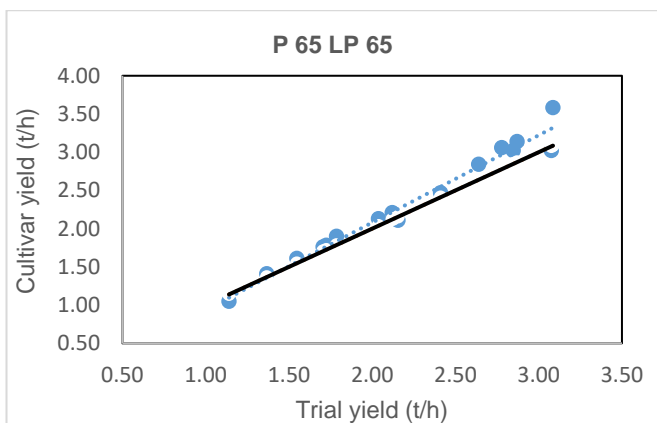
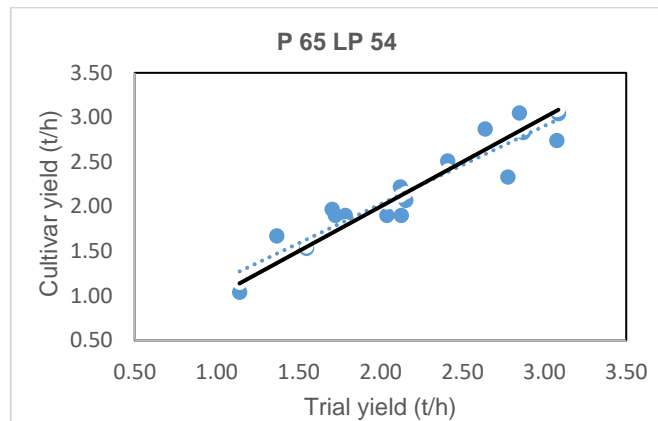
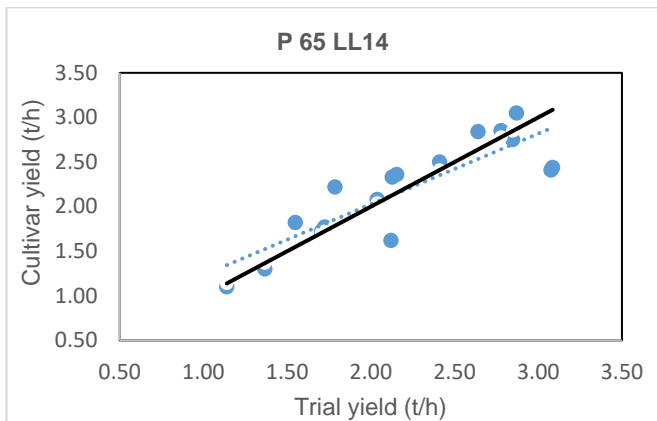
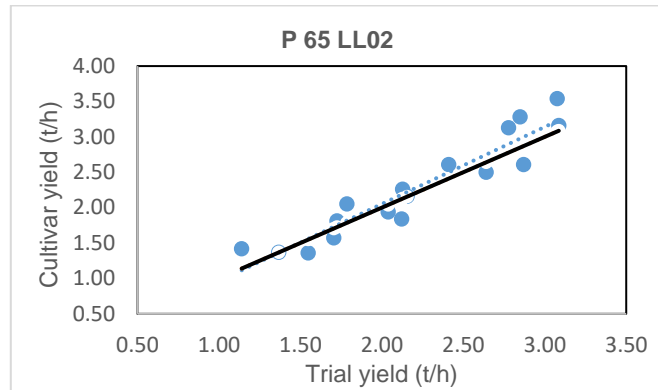
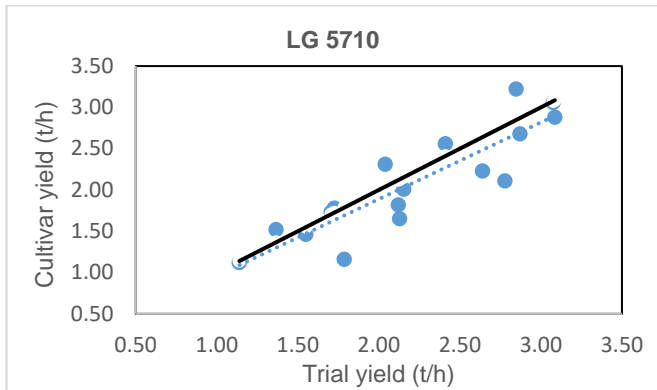
Cultivar	Yield potential (t ha ⁻¹)						Regression line	
	1	1,5	2	2,5	3	3,5	F prob	R ²
AGSUN5101CLP	33	33	31	31	30	30	<0.001	0.88
AGSUN5103CLP	46	51	57	62	67	72	<0.001	0.85
AGSUN5106CLP	47	55	61	69	74	79	<0.001	0.88
AGSUN5108CLP	46	48	50	52	54	56	<0.001	0.91
AGSUN5270	55	60	65	69	73	76	<0.001	0.88
AGSUN8251	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 2020/2021 to 2021/2022 at different yield potentials

Cultivar	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





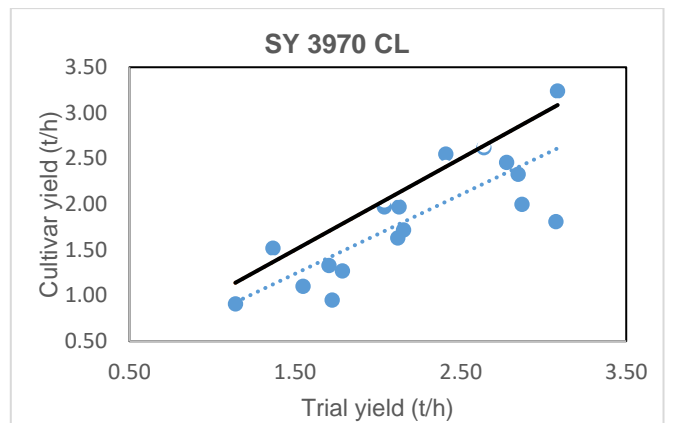
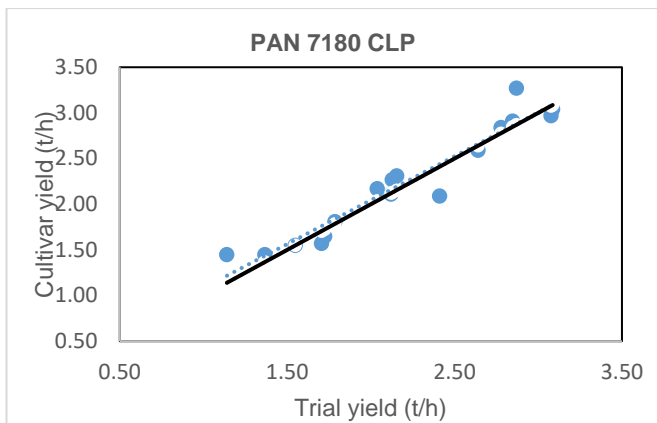
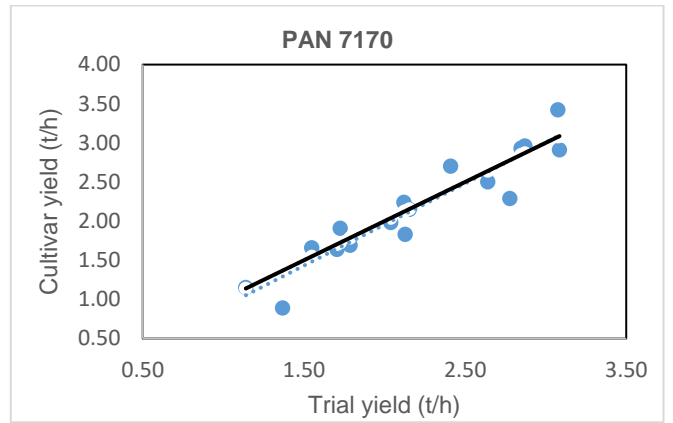
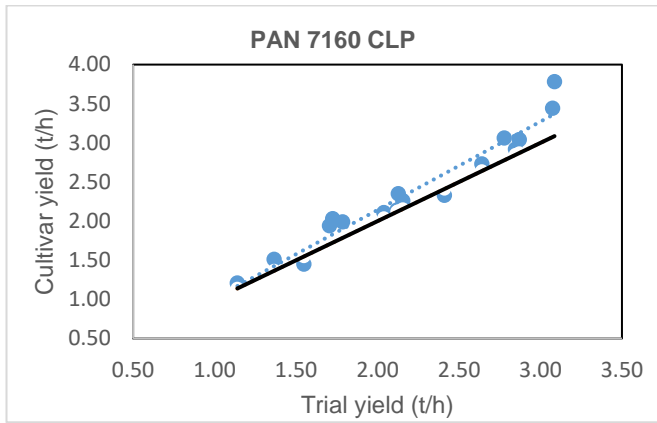


Figure 2: Regression lines for cultivars 2020/2021 & 2021/2022

