Report

Evaluation of sunflower cultivars: 2024/2025 season

ARC-Grain Crops Institute in collaboration with the following seed companies: Agricol, Corteva (Pannar & Pioneer), Syngenta, and Limagrain Field Seeds.

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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 2024/2025 season with the voluntary collaboration of Agricol, Corteva (Pannar, Pioneer), Syngenta and Limagrain Field Seeds. Seed companies entered 17 cultivars for evaluation (Table 1) and supplied seed to the ARC-GC which planned the field trials with randomised complete-block design layouts with three replicates. Seed from cultivars were packed according to trial plans and send to co-operators before the onset of the growing season.

Eleven of the 17 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 20 trials, Corteva (Pannar & Pioneer) with 9 trials, Syngenta with four and Limagrain Field Seeds with one. Five trials were planted by the ARC-GC with different planting dates at Potchefstroom and one trial planted at Bethlehem. Two trials of Syngenta not harvested due to drought and bad trial quality. Eight trials of Agricol, four trials of Corteva and three trials of ARC-Grain Crops 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 18 trials at different localities with different planting dates at northwest and Free State table 2.

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 24 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 24 trials.
Yield probabilities were also calculated for 14 cultivars that were evaluated in 54 trials during 2023/2024 and 2024/2025.

RESULTS

Days from planting to flowering

The mean number of days from planting to 50% flowering of cultivars (Table 2) ranged from 64 days for LG 50745, to 72 days AGSUN 5111 CLP Calculated across cultivars and planting dates, the average period from planting to flowering was 70 days. The longest days to flowering 86 days recorded at Potchefstroom planted on 2025/02/1010 of February 2025.

Oil and protein concentration

Oil and protein concentrations of seed from ten trial localities, as analysed by the Southern African Grain Laboratory NPC, are shown in Tables 3 and 4 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 36.79% to 46.08% with an overall mean of 39.44%. The highest mean oil concentration among localities was at Potchefstroom (planting date on 25 November 2024) with 46.08%. The locality with the lowest mean oil content of 36.79% was Wolmaransstand2 2025/01/03 planting date was 03 January 2025. The highest oil concentration among cultivars calculated across localities, was SNK 242 CL at 46.47% followed by SNK 441 CL at 44.90%.41 % of the tested hybrids have more than 40% oil content.

The average protein content varied from 11.93 to 19.32% among cultivars at the different localities. Among localities, Coligny1 planting date was 17 January 2025, had the highest and Potchefstroom planted on 25 November 2025 the lowest protein content of 19.32 and 11.93 % respectively. Calculated across localities, AGSUN 5103CLP had the highest protein content (17.49 %) followed by PAN 7102CLP (17.25) while SNK 441 CL the lowest (15.45%).

Seed yield

The mean seed yield of cultivars at the respective localities is presented in Table 5. The highest locality mean yield of 3.42 t ha^{-1} was obtained at Boskop 1 planted on 18 of November 2024 and the lowest of 0.89 t ha^{-1}, at Baberspan planted on 9th of January 2025.

The five best performing cultivars, in terms of average yield calculated over localities, were PAN 7180CLP, AGSUN 5111CLP, PAN 7090, P 65 LP65 and LG 50745. The overall mean yield for 2024/25 was 2.04 t ha^{-1}, 8.01% lower than the mean yield of the last year.

Elven Clearfield and Clearfield Plus cultivars AGSUN 5103CLP, AGSUN 5106CLP, CLP AGSUN 5111CLP, P 65LP54, P 65LP65, PAN 7102CLP, PAN 7160CLP, PAN 7180CLP, SNK 270 CL, SNK 242 CL, SNK 441CL and SY 3970 CL were entered. Three of these cultivars namely PAN 7180CLP, AGSUN 5111CLP and P 65LP65 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 ten localities varied from 0.63 to 1.14 t ha^{-1} with an overall mean of 0.88 t ha^{-1}. The locality with the highest mean oil yield was Boskop 1 planted on 18 November 2024 at 1.31 t ha^{-1}. PAN 7180CLP has the highest oil yield of 0.97 t ha^{-1} followed by PAN 7090 with 0.96 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 7. 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 2024/2025 are shown in Figure 1 and for the 14 cultivars

evaluated in 2022/2023 and 2024/2025 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 17 cultivars for 2024/2025 are shown in Table 9. 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 14 cultivars evaluated in 54 trials in 2023/2024 and 2024/2025, and yield probabilities for the 12 cultivars evaluated in 81 trials are shown in Tables 11 and 12 respectively. Tables 10, 11 and 12 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: Collaborating company, trial localities and responsible co-workers 2024/2025

Company	Localities	Planting dates	Co-workers	E-mail address of co-worker
Agricol	Rysmierbult	2024/11/13	Joubert Swanepoel	JSwanepoel@agricol.co.za
	Arlington	2024/11/20		
	Boskop 1	2024/11/18		
	Heilbron	2024/11/19		
	Hoopstad	2024/11/21		
	Lindley	2024/11/22		
	Boskop 2	2024/12/04		
	Koster	2024/12/04		
	Ventersdorp	2024/12/19		
	Lichtenburg	2024/12/26		
	Wolmaranstad	2024/12/27		
	Coligny 1	2024/12/27		
	Wolmaranstad 2	2025/01/03		
	Viljoenskroon	2025/01/03		
	Baberspan	2025/01/09		
	Delareyville	2025/01/13		
	Coligny 2	2025/01/17		
	Kroondal	2025/01/21		
	Boskop 3	2025/01/22		
	Petrusburg-	2025/01/30		
	Rysmierbult	2024/11/13		
ARC-GCI	Potchefstroom	2024/11/15	William Makgoga & Jan Erasmus	Makgogamw@arc.agric.za Erasmusj@arc.agric.za
	Potchefstroom	2024/11/25		
	Potchefstroom	2025/02/10		
	Potchefstroom	2025/01/24		
	Potchefstroom	2024/11/20		
	Bethlehem	2024/11/20		
Corteva	Coligny	24/11/20	Abre Pretorius, Phillip Fourie & Louis Schoonraad	abre.pretorius@pannar.co.za phillip.fourie@pioneer.com louis.schoonraad@corteva.com
	Vredefort	24/12/09		
	Putfontein	24/12/12		
	Koster	24/12/19		
	Gerdau	24/12/08		
	Biesiesvlei	25/01/17		
	Lichtenburg	25/01/15		
	Excelsio	25/01/10		
	Coligny	2024/11/20		
Lima Grain	Putfontein	2025/01/14	Anita Janeke	anita.janeke@limagrain.com
Syngenta	Bethlehem	2024/11/06	PieterTaljaard	Pieter.Taljaard@syngenta.com
	Bethlehem	2024/11/14		
	Bethlehem	2024/12/04		
	Bethlehem	2024/12/17		

Table 2: Number of days from planting to 50 percent flowering of cultivars at selected localities and planting dates 2024/2025

Cultivar's name	Bethlehem 2024/11/14	Potchefstroom 2024/11/25	Potchefstroom 2025/02/10	Putfontein 2025-01-14	Wolmaransstand1 2024/12/27	Coligny1 2024/12/27	Wolmaransstand 22025/01/03	Baberspan 2025/01/09	Delareyville 2025/01/13	Boskop 3 2025/01/22	Boskop1 2024/11/18	Heilbron 2024/11/19	Hoopstand 2024/11/21	Coligny 2024/11/20	Excelcior 2025/01/10	Gerdau 2024/12/28	Koster 2024/12/19	Putfontein 2024/12/12	Mean
AGSUN 5103CLP	70	76	85	76	66	64	68	68	69	68	65	71	68	73	66	68	69	67	70
AGSUN 5106CLP	69	70	85	76	66	66	69	68	69	68	65	71	67	71	64	69	70	67	69
AGSUN 5111CLP	74	72	89	79	67	69	72	71	71	71	67	71	70	71	68	72	74	73	72
AGSUN 5270	72	70	84	75	63	65	69	66	68	66	62	70	68	70	63	70	70	74	69
AGSUN 5280	65	70	83	73	64	63	66	67	67	67	66	71	65	71	61	66	66	65	68
LG 50745	64	67	83	48	61	61	64	65	65	65	61	68	64	70	60	62	66	65	64
P 65LL25	72	74	87	79	65	66	71	68	69	68	65	70	69	69	68	71	73	71	71
P 65 LP 54	72	70	89	75	65	67	68	67	69	67	61	69	67	73	63	68	70	73	70
P 65 LP 65	74	71	86	80	68	69	71	68	69	68	64	71	70	71	66	70	73	71	71
PAN 7090	72	73	85	78	66	69	71	66	69	66	65	71	70	69	66	68	70	73	70
PAN 7102CLP	65	72	87	76	64	68	69	65	69	65	61	69	67	71	61	70	68	72	69
PAN 7160CLP	74	73	90	81	64	69	70	67	68	67	62	70	68	70	64	71	72	72	71
PAN 7180CLP	74	74	89	55	67	69	71	67	70	67	66	71	69	71	67	70	73	70	70
SNK 242 CL	65	67	83	76	64	66	69	67	67	67	66	69	69	69	61	65	67	70	68
SNK 270 CL	69	71	83	74	65	66	69	68	68	68	67	70	69	71	66	67	67	70	69
SNK 441 CL	75	74	84	80	68	68	71	70	69	70	71	71	70	76	68	71	72	72	72
SY 3970 CL	72	73	83	76	66	67	70	68	68	68	69	70	70	70	67	69	69	68	70
Mean	71	72	86	74	65	67	69	67	68	67	65	70	68	71	65	68	70	70	70

Table 3: The “as is” seed oil concentration (%) of cultivars at selected localities 2024/2025

Cultivar Name	Coligny1 2024/12/27	Coligny2 2025/01/17	Potchefstroom 2024-11-25	Potchefstroom 2025/02/10	Wolmaransstand1 2024/12/27	Wolmaransstad 2 2025/01/03	Boskop1 2024/11/18	Putfontein Lim 2025/01/14	Mean
AGSUN5103CLP	35.26	36.10	41.51	35.23	33.58	35.01	36.04	36.01	36.09
AGSUN5106CLP	36.56	36.17	42.67	36.89	36.85	39.21	36.41	35.70	37.56
AGSUN5111CLP	37.94	36.45	42.59	32.13	39.66	35.59	38.83	35.42	37.32
AGSUN5270	38.72	39.59	46.89	37.04	38.77	38.37	40.11	41.87	40.17
AGSUN5280	36.84	35.77	43.00	36.77	36.07	33.14	37.80	36.22	36.95
LG50745	39.32	41.66	47.89	42.96	44.03	33.19	42.85	40.98	41.61
P65LL25	37.27	40.35	47.17	37.99	36.11	38.45	42.76	43.04	40.39
P65LP54	33.02	33.76	40.74	33.00	33.67	30.67	36.76	35.53	34.64
P65LP65	37.07	36.78	45.50	34.02	32.21	36.10	38.95	40.56	37.65
PAN7090	38.76	37.99	46.70	37.49	35.78	37.67	37.55	40.48	39.05
PAN7102CLP	33.30	31.52	40.20	33.55	36.13	30.54	36.21	46.20	35.96
PAN7160CLP	37.03	37.68	45.84	33.89	35.74	34.72	37.67	37.37	37.49
PAN7180CLP	36.34	35.57	43.61	32.64	32.61	35.59	35.12	35.90	35.92
SNK242CL	46.57	45.48	53.06	47.84	45.41	42.19	42.57	48.67	46.47
SNK270CL	44.75	42.49	50.36	45.50	44.23	38.49	38.47	44.60	43.61
SNK441CL	45.92	45.92	52.27	44.23	43.85	44.65	37.49	44.89	44.90
SY3970CL	44.46	44.32	53.34	45.12	45.64	41.85	37.41	45.03	44.65
Mean	38.77	38.68	46.08	38.02	38.26	36.79	38.41	40.50	39.44

Table 4: The “as is” seed protein concentration (%) of cultivars at selected localities 2024/2025

Cultivar Name	Coligny-1 2024/12/27	Coligny-2 2025/01/17	Potchefstroom 2024-11-25	Potchefstroom 2025/02/10	Wolmaransstand-1 2024/12/27	Wolmaransstad-2 2025/01/03	Boskop1 2024/11/18	Putfontein Lim 2025/01/14	Mean
AGSUN 5103CLP	19.65	19.53	13.89	14.34	20.96	18.52	18.02	15.02	17.49
AGSUN 5106CLP	17.95	20.26	10.85	14.67	19.86	16.27	18.84	16.38	16.89
AGSUN 5111CLP	15.51	19.77	10.89	14.01	16.89	19.94	17.74	13.89	16.08
AGSUN 5270	16.46	19.06	11.16	13.57	18.51	16.10	19.47	12.59	15.86
AGSUN 5280	18.58	18.86	12.27	13.64	18.37	19.41	17.42	15.45	16.75
LG 50745	17.95	18.52	10.15	13.90	16.90	21.17	15.96	14.61	16.15
P 65LL25	18.85	21.14	12.74	13.16	18.82	19.10	16.79	15.69	17.04
P 65LP54	17.97	20.30	11.64	11.60	18.88	19.94	18.11	13.50	16.49
P 65LP65	15.53	20.11	10.47	12.88	18.65	18.50	17.87	14.04	16.01
PAN 7090	15.68	19.56	10.79	12.52	18.60	18.18	18.04	13.87	15.91
PAN 7102CLP	17.51	21.54	14.99	11.72	17.34	20.02	19.22	15.63	17.25
PAN 7160CLP	16.94	19.82	12.16	11.19	17.87	18.13	18.86	15.49	16.31
PAN 7180CLP	15.40	18.45	12.04	12.36	18.47	17.38	19.03	13.68	15.85
SNK 242 CL	16.24	18.28	12.67	15.31	16.76	19.27	16.84	15.67	16.38
SNK 270 CL	14.53	17.04	12.10	15.70	16.09	19.37	16.49	17.89	16.15
SNK 441 CL	15.17	17.73	10.76	14.78	16.81	16.64	16.83	14.84	15.45
SY 3970 CL	15.98	18.53	13.24	15.26	16.99	18.03	17.67	17.77	16.68
Mean	16.82	19.32	11.93	13.57	18.05	18.59	17.84	15.06	16.40

Table 5: Mean seed yield (t ha^{-1}) of cultivars at each locality 2024/2025

Cultivar's name	Baberspan 2025/01/09	Bethlehem 2024/11/14	Bethlehem 2024/12/04	Biesiesvlei Pio 2025-01-17	Boskop1 2024/11/18	Boskop 3 2025/01/22	Coligny1 2024/12/27	Coligny Pan 2024/11/20	Coligny2 2025/01/17Ag	Delareyville 2025/01/13Ag	Excelcior Pio 2025/01/10	Gerdau Pio 2024/12/08	Heilbron AG 2024/11/19	Hoopstand Ag 2024/11/21	KosterPan 2024-12-19	Lindley Ag 2024/11/22	Potchestroom 2024-11-15	Potchestroom 2024-11-25	Potchefstroom 2025/02/10	Putfontein Pan 2024-12-12	Putfontein Lim 2025/01/14	Ventersdorp Ag 2024/12/19	Wolmaransstand1 Ag 2024/12/27	Wolmaransstand2 Ag 2025/01/03	mean
AGSUN 5103CLP	0.88	2.91	2.30	1.36	3.58	0.54	2.62	3.01	1.63	1.70	1.80	2.78	1.53	2.97	0.61	2.92	1.96	2.18	1.09	0.84	1.75	2.10	2.66	2.71	2.02
AGSUN 5106CLP	0.65	2.89	2.56	1.09	3.79	0.91	2.54	2.69	1.91	1.35	1.61	1.99	1.65	2.99	0.66	3.04	2.34	2.27	0.99	0.90	1.77	2.16	2.90	2.92	2.02
AGSUN 5111CLP	1.12	2.65	1.71	1.17	3.98	1.87	3.64	3.29	2.31	1.78	2.73	1.88	2.33	3.24	0.98	2.74	2.29	2.37	1.10	0.85	1.31	2.44	2.83	3.12	2.24
AGSUN 5270	0.92	2.38	1.91	1.12	3.12	1.14	2.61	2.31	2.31	1.22	2.10	2.81	1.94	2.33	0.90	3.18	2.09	2.67	1.32	0.84	1.89	2.71	2.59	2.36	2.03
AGSUN 5280	0.93	3.09	2.60	1.17	3.95	1.00	2.28	3.40	1.83	1.76	1.80	2.86	1.50	2.73	0.97	2.86	2.23	2.07	1.28	0.86	1.62	1.92	2.54	0.83	2.00
LG 50745	1.47	2.93	2.12	1.56	4.03	0.96	2.34	2.55	1.99	1.50	2.22	2.43	1.19	2.63	1.48	2.71	2.45	2.42	1.52	0.68	1.53	2.07	3.08	1.94	2.08
P 65 LL25	0.54	2.73	2.63	1.11	3.54	1.00	2.76	3.29	1.55	1.20	1.89	1.75	1.88	3.16	0.78	2.93	2.36	2.69	1.06	1.25	1.59	2.23	2.26	1.98	2.01
P 65 LP54	0.59	2.39	1.87	0.91	3.29	0.47	2.74	2.11	1.29	1.11	1.64	1.90	2.14	2.56	2.01	2.86	2.50	2.53	0.92	0.96	1.50	2.51	2.17	2.06	1.88
P 65 LP65	0.74	2.57	2.74	1.36	3.47	1.35	2.89	3.02	1.99	1.47	3.21	2.15	2.10	2.87	1.22	2.51	2.35	2.43	0.94	1.12	1.75	2.02	2.70	2.50	2.14
PAN 7090	1.11	2.89	2.52	1.11	3.76	1.28	3.14	3.07	2.01	1.71	1.99	2.30	1.82	3.18	0.99	3.02	2.13	2.57	1.26	1.21	1.97	2.28	2.80	2.16	2.18
PAN 7102CLP	0.72	2.25	2.12	1.02	3.98	0.69	2.69	3.01	1.52	1.28	1.96	2.37	1.64	2.51	1.43	2.41	3.73	2.80	1.08	0.99	1.43	2.28	2.69	1.82	2.02
PAN 7160CLP	0.86	2.98	2.17	1.05	3.37	0.81	2.68	2.61	1.74	1.22	2.23	2.63	1.82	2.47	1.21	2.38	3.17	2.64	0.95	1.35	1.48	2.23	2.44	2.27	2.03
PAN 7180CLP	0.83	2.84	2.70	1.43	3.36	1.32	2.89	3.10	1.66	1.39	3.56	3.00	2.43	2.92	2.19	2.56	2.18	2.68	1.01	1.23	1.91	2.50	2.70	2.46	2.29
SNK 242CL	1.02	3.25	1.73	1.53	2.86	0.54	2.40	3.37	1.38	1.79	2.51	2.90	1.66	3.14	1.37	2.52	2.19	2.43	0.86	0.70	1.00	2.12	2.58	2.17	2.00
SNK 270CL	0.94	2.97	2.66	1.21	2.76	0.60	2.19	2.64	1.55	1.32	2.98	2.59	1.44	3.32	0.60	2.29	2.34	2.77	0.97	1.12	1.50	1.95	2.83	2.14	1.96
SNK 441CL	0.86	2.77	2.32	1.08	2.59	0.72	2.41	3.06	1.46	1.63	3.12	2.44	1.84	2.91	0.81	2.47	2.36	2.45	0.72	0.99	1.53	1.86	2.36	2.24	1.96
SY 3970CL	0.88	2.84	1.90	1.31	2.72	0.47	1.94	2.66	1.37	1.41	2.79	2.72	1.66	3.09	0.82	2.30	2.42	2.22	0.91	0.74	1.06	2.15	2.55	1.82	1.86
mean	0.89	2.78	2.27	1.21	3.42	0.92	2.63	2.89	1.74	1.46	2.36	2.44	1.80	2.88	1.12	2.69	2.42	2.48	1.06	0.98	1.56	2.21	2.63	2.21	**2.04**
cv%	18.50	4.80	5.60	18.10	10.50	19.70	16.30	18.10	19.20	17.30	14.60	17.10	19.40	13.90	17.20	14.60	16.70	11.10	14.60	19.70	14.60	19.10	17.80	19.00	**16.08**

Table 6: Oil yield (t ha^{-1}) of cultivars at selected localities 2024/2025

Cultivar Name	Coligny-1 2024/12/27	Coligny-2 2025/01/17	Potchefstroom 2024-11-25	Potchefstroom 2025/02/10	Wolmaransstand-1 2024/12/27	Wolmaransstad- 2 2025/01/03	Boskop1 2024/11/18	Putfontein Lim 2025/01/14	Mean
AGSUN 5103CLP	0.92	0.59	0.90	0.38	0.89	0.95	1.29	0.63	0.82
AGSUN 5106CLP	0.93	0.69	0.97	0.37	1.07	1.14	1.38	0.63	0.90
AGSUN 5111CLP	1.38	0.84	1.01	0.35	1.12	1.11	1.55	0.46	0.98
AGSUN 5270	1.01	0.91	1.25	0.49	1.00	0.91	1.25	0.79	0.95
AGSUN 5280	0.84	0.65	0.89	0.47	0.92	0.28	1.49	0.59	0.77
LG 50745	0.92	0.83	1.16	0.65	1.36	0.64	1.73	0.63	0.99
P 65LL25	1.03	0.63	1.27	0.40	0.82	0.76	1.51	0.68	0.89
P 65LP54	0.90	0.44	1.03	0.30	0.73	0.63	1.21	0.53	0.72
P 65LP65	1.07	0.73	1.11	0.32	0.87	0.90	1.35	0.71	0.88
PAN 7090	1.22	0.76	1.20	0.47	1.00	0.81	1.41	0.80	0.96
PAN 7102CLP	0.90	0.48	1.13	0.36	0.97	0.56	1.44	0.66	0.81
PAN 7160CLP	0.99	0.66	1.21	0.32	0.87	0.79	1.27	0.55	0.83
PAN 7180CLP	1.05	0.59	1.17	0.33	0.88	0.88	1.18	0.69	0.85
SNK 242 CL	1.12	0.63	1.29	0.41	1.17	0.92	1.22	0.49	0.90
SNK 270 CL	0.98	0.66	1.39	0.44	1.25	0.82	1.06	0.67	0.91
SNK 441 CL	1.11	0.67	1.28	0.32	1.03	1.00	0.97	0.69	0.88
SY 3970 CL	0.86	0.61	1.18	0.41	1.16	0.76	1.02	0.48	0.81
Mean	1.02	0.67	1.14	0.40	1.01	0.81	1.31	0.63	0.88

Table 7: Parameters calculated from the analysis of variance for yield data at each locality

Locality	Mean (t/ha)	SE	CV (%)	GCV	t	SE(t)	tn
Baberspan2025/01/09Ag	0.89	0.09	18.5	22.7	0.6	0.127	0.82
Bethlehem2024/11/14Sy	2.78	0.08	4.8	9.1	0.78	0.081	0.91
Bethlehem2024/12/04Sy	2.27	0.07	5.6	15.4	0.88	0.048	0.96
Biesiesvlei2025-01-17 Pioneer	1.21	0.13	18.1	11	0.27	0.162	0.53
Boskop12024/11/18Ag	3.42	0.21	10.5	12.5	0.59	0.129	0.81
Boskop32025/01/22Ag	0.92	0.1	19.7	39.9	0.8	0.075	0.92
Coligny112024/12/27Ag	2.63	0.25	16.3	11.5	0.33	0.161	0.6
Coligny2024-11-20Pan	2.89	0.3	18.1	7.7	0.15	0.159	0.35
Coligny22025/01/17Ag	1.74	0.19	19.2	14.3	0.36	0.159	0.63
Delareyville2025/01/13Ag	1.46	0.15	17.3	11.9	0.32	0.161	0.59
Excelcior2025-01-10Pioneer	2.36	0.2	14.6	24.1	0.73	0.096	0.89
Gerdau2024-12-08Pioneer	2.44	0.24	17.1	12.8	0.36	0.159	0.63
Heilbron2024/11/19Ag	1.80	0.2	19.4	14	0.34	0.16	0.61
Hoopstad2024/11/21Ag	2.84	0.29	17.9	.	-0.02	0.141	-0.06
Koster2024/12/18Ag	1.44	0.31	37.5	10.3	0.07	0.153	0.18
Koster2024-12-19Pan	1.12	0.11	17.2	40	0.84	0.062	0.94
Lindley2024/11/22Ag	2.69	0.23	14.6	6.1	0.15	0.159	0.35
Potchefstroom2025/01/24	1.43	0.2	24.1	3.1	0.02	0.147	0.06
Potchefstroom2025/02/10	1.06	0.09	14.6	16.4	0.56	0.135	0.79
Potchestroom2024-11-15GC	2.42	0.23	16.7	14.7	0.44	0.152	0.7
Potchestroom2024-11-25GC	2.48	0.16	11.1	5.7	0.21	0.162	0.44
Putfontein2024-12-12Pan	0.98	0.11	19.7	17.3	0.44	0.152	0.7
Putfontein2025-01-14Lim	1.56	0.13	14.6	15.2	0.52	0.141	0.76
Senekal2025-01-09Pioneer	1.10	0.14	22.9	15.1	0.3	0.162	0.56
Ventersdorp2024/12/19Ag	2.21	0.24	19.1	.	-0.04	0.138	-0.13
Vredefort2024-12-10Pan	1.18	0.16	23.2	10.5	0.17	0.161	0.38
Wolmaransstad12024/12/27Ag	2.63	0.27	17.8	.	-0.09	0.129	-0.33
Wolmaransstad22025/01/03Ag	2.21	0.24	19	20.3	0.53	0.14	0.77

Table 8: Regression line coordinates at different yield potentials 2024/2025

	Yield potential (t ha^{-1})						Mean (t ha^{-1})	Intercept	Slope	Fprob	R^2
Cultivar	1	1,5	2	2,5	3	3,5					
AGSUN 5103CLP	0.9	1.4	2.0	2.5	3.1	3.6	2.0	-0.21	1.09	<0.001	0.90
AGSUN 5106CLP	0.9	1.4	2.0	2.5	3.1	3.7	2.0	-0.24	1.11	<0.001	0.88
AGSUN 5111CLP	1.2	1.7	2.2	2.7	3.2	3.8	2.2	0.12	1.04	<0.001	0.77
AGSUN 5270	1.1	1.6	2.0	2.4	2.9	3.3	2.0	0.26	0.87	<0.001	0.80
AGSUN 5280	0.9	1.4	2.0	2.5	3.0	3.5	2.0	-0.11	1.03	<0.001	0.78
LG 50745	1.1	1.6	2.0	2.5	3.0	3.4	2.1	0.20	0.92	<0.001	0.83
P 65 LL25	0.9	1.4	2.0	2.5	3.0	3.6	2.0	-0.20	1.08	<0.001	0.89
P 65 LP54	0.9	1.4	1.8	2.3	2.7	3.2	1.9	0.03	0.90	<0.001	0.77
P 65 LP65	1.1	1.6	2.1	2.6	3.1	3.5	2.1	0.18	0.96	<0.001	0.89
PAN 7090	1.1	1.6	2.1	2.6	3.1	3.6	2.2	0.13	1.00	<0.001	0.92
PAN 7102CLP	0.9	1.4	2.0	2.5	3.1	3.6	2.0	-0.19	1.08	<0.001	0.82
PAN 7160CLP	1.0	1.5	2.0	2.5	3.0	3.4	2.0	0.04	0.97	<0.001	0.90
PAN 7180CLP	1.3	1.8	2.2	2.7	3.2	3.6	2.3	0.40	0.92	<0.001	0.80
SNK 242CL	0.9	1.4	2.0	2.5	3.0	3.5	2.0	-0.11	1.03	<0.001	0.85
SNK 270CL	0.9	1.4	2.0	2.5	3.0	3.5	2.0	-0.11	1.03	<0.001	0.85
SNK 441CL	0.9	1.4	1.9	2.4	2.9	3.4	2.0	-0.04	0.98	<0.001	0.87
SY 3970CL	0.8	1.3	1.8	2.3	2.8	3.3	1.9	-0.16	0.99	<0.001	0.87

Table 10: Yield probability (%) of cultivars for 2024/2025 at different yield potentials

Cultivar	Yield potential (t ha^{-1})						Regression line	
	1	1,5	2	2,5	3	3,5	F prob	R^2
AGSUN 5103CLP	34	40	46	53	58	64	<0.001	0.90
AGSUN 5106CLP	34	41	47	55	61	67	<0.001	0.88
AGSUN 5111CLP	63	66	67	69	70	71	<0.001	0.77
AGSUN 5270	65	58	50	43	35	30	<0.001	0.80
AGSUN 5280	43	44	45	47	48	50	<0.001	0.78
LG 50745	64	60	55	50	45	41	<0.001	0.83
P 65 LL25	34	39	44	50	55	60	<0.001	0.89
P 65 LP54	43	38	33	28	25	22	<0.001	0.77
P 65 LP65	69	67	65	62	59	56	<0.001	0.89
PAN 7090	71	71	71	71	71	70	<0.001	0.92
PAN 7102CLP	39	43	47	51	55	58	<0.001	0.82
PAN 7160CLP	52	50	47	45	42	41	<0.001	0.90
PAN 7180CLP	41	43	44	46	48	50	<0.001	0.80
SNK 242CL	42	41	39	38	37	36	<0.001	0.85
SNK 270CL	29	29	27	27	27	28	<0.001	0.85
SNK 441CL	40	42	43	46	47	50	<0.001	0.87
SY 3970CL	42	41	39	38	37	37	<0.001	0.87

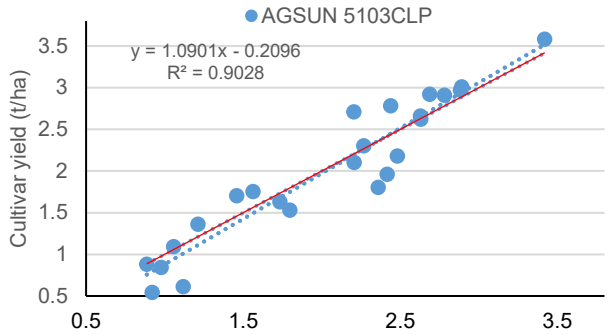
Table 11: Yield probability (%) of cultivars 2022/2023 and 2024/2025 at different yield potentials

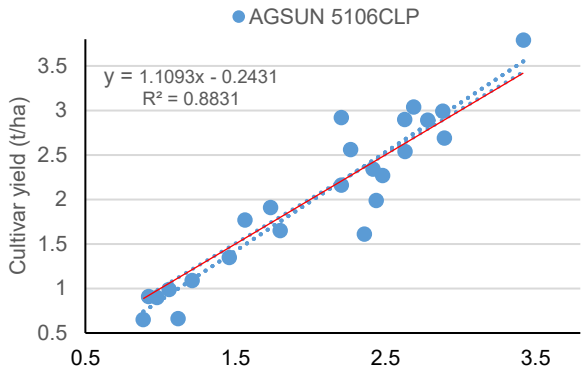
Cultivar	Yield potential (t ha^{-1})						Regression line	
	1	1,5	2	2,5	3	3,5	F prob	R^2
AGSUN 5103CLP	36	41	44	48	52	56	<0.001	0.89
AGSUN 5106CLP	36	42	48	55	61	67	<0.001	0.90
AGSUN 5111CLP	58	61	63	66	68	69	<0.001	0.82
AGSUN 5270	69	61	52	42	34	26	<0.001	0.85
LG 50745	54	49	42	36	30	26	<0.001	0.83
P 65 LL25	35	42	50	58	66	72	<0.001	0.91
P 65 LP54	42	40	39	38	36	35	<0.001	0.84
P 65 LP65	65	64	60	59	55	53	<0.001	0.89
PAN 7090	59	59	59	59	59	58	<0.001	0.89
PAN 7102CLP	45	49	51	55	58	61	<0.001	0.85
PAN 7160CLP	55	55	54	54	52	52	<0.001	0.90
PAN 7180CLP	75	72	67	64	58	54	<0.001	0.82
SNK 270 CL	39	41	42	43	45	46	<0.001	0.84
SY 3970 CL	27	27	26	26	25	25	<0.001	0.85

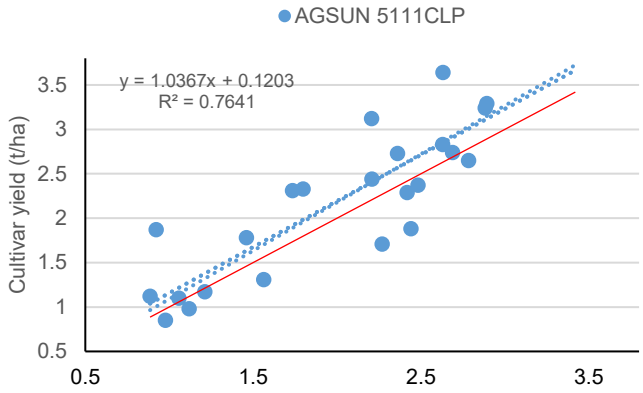
Table 12: Yield probability (%) of cultivars for three years' data 2021/2022 to 2024/2025 at different yield potentials

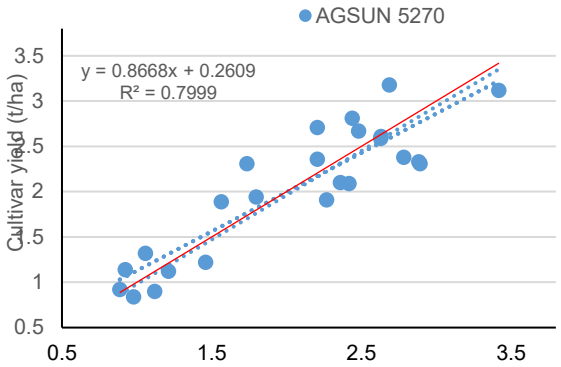
	Yield potential (t/ha)						Regression line	
	1	1,5	2	2,5	3	3,5	Fprob	R^2
AGSUN 5103CLP	29	33	37	42	47	52	<0.001	0.88
AGSUN 5106CLP	39	43	48	53	58	63	<0.001	0.89
AGSUN 5111CLP	55	57	60	62	64	67	<0.001	0.81
AGSUN 5270	68	64	58	53	47	42	<0.001	0.86
LG 50745	51	46	40	35	30	26	<0.001	0.82
P 65 LP54	44	44	43	43	41	41	<0.001	0.86
P 65 LP65	65	63	60	58	55	53	<0.001	0.88
PAN 7090	59	59	59	59	59	59	<0.001	0.90
PAN 7102CLP	38	43	49	54	59	64	<0.001	0.85
PAN 7160CLP	54	55	55	57	57	59	<0.001	0.90
PAN 7180CLP	67	66	65	64	62	61	<0.001	0.85
SY 3970 CL	35	32	28	26	23	16	<0.001	0.81

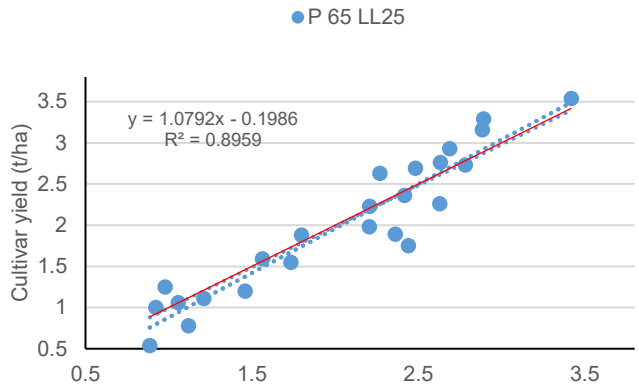
Figure 1: Regression lines for cultivars 2024/2025

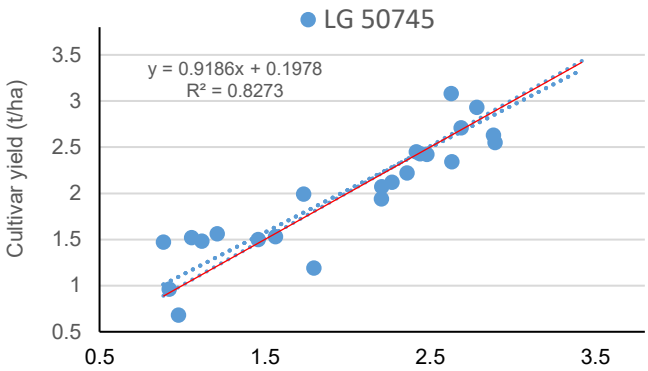


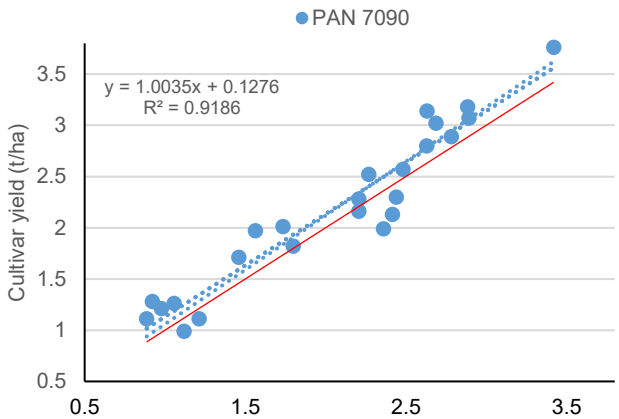


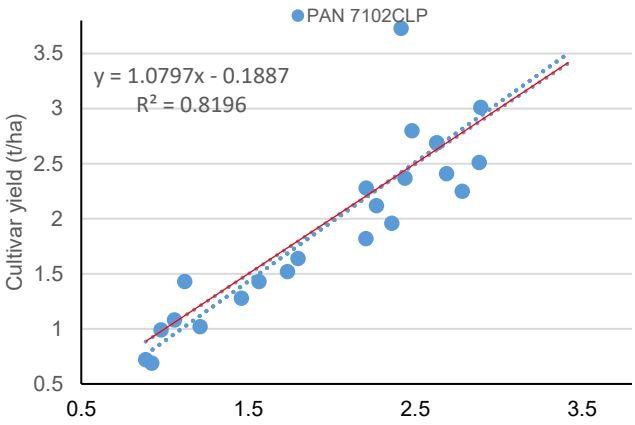


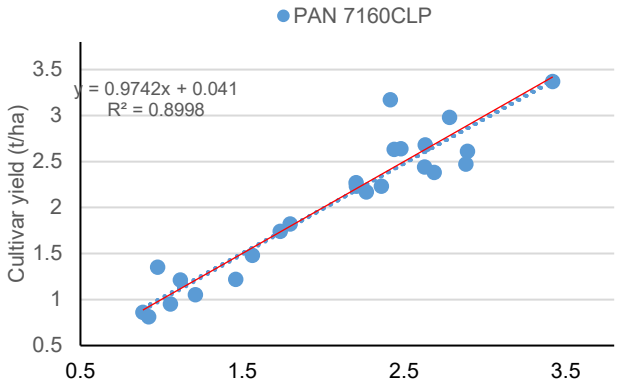


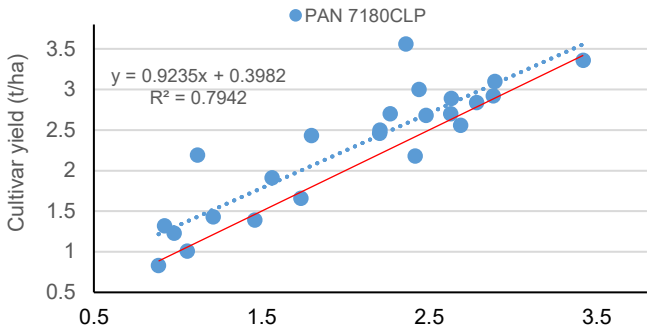


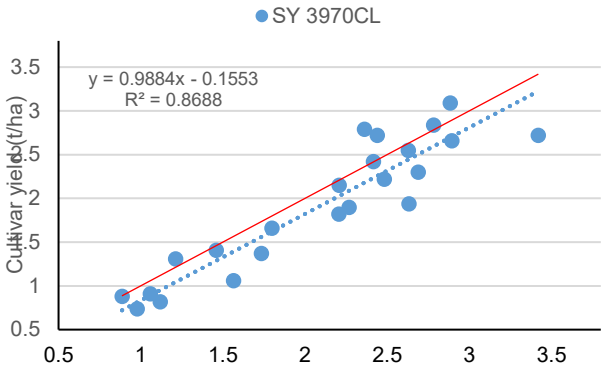


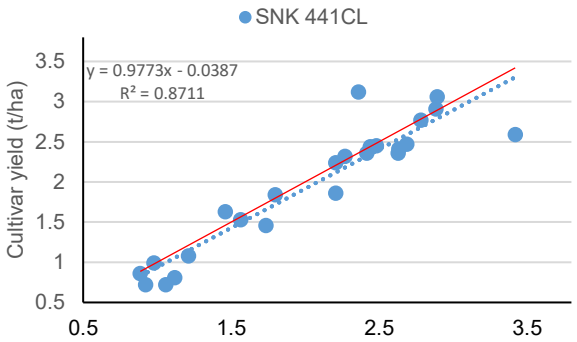


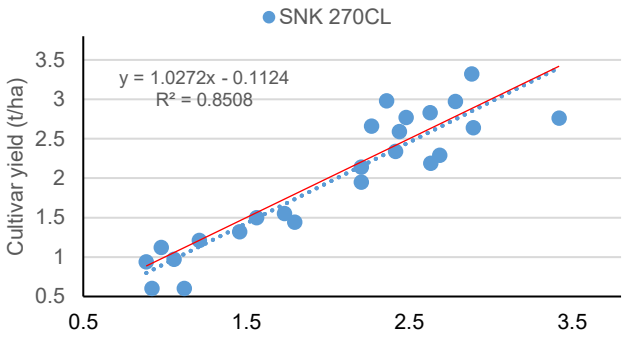



PAN 7160CLP
y = 0.9742x + 0.041
R² = 0.8998
Cultivar yield (t/ha)
0.5
1
1.5
2
2.5
3
3.5
0.5
1.5
2.5
3.5


PAN 7180CLP
y = 0.9235x + 0.3982
R² = 0.7942
Cultivar yield (t/ha)
0.5
1
1.5
2
2.5
3
3.5
0.5
1.5
2.5
3.5


SY 3970CL
y = 0.9884x - 0.1553
R² = 0.8688
Cultivar yield (t/ha)
0.5
1
1.5
2
2.5
3
3.5
0.5
1
1.5
2
2.5
3
3.5


SNK 441CL
y = 0.9773x - 0.0387
R² = 0.8711
Cultivar yield (t/ha)
0.5
1
1.5
2
2.5
3
3.5
0.5
1.5
2.5
3.5


SNK 270CL
y = 1.0272x - 0.1124
R² = 0.8508
Cultivar yield (t/ha)
0.5
1
1.5
2
2.5
3
3.5
0.5
1.5
2.5
3.5

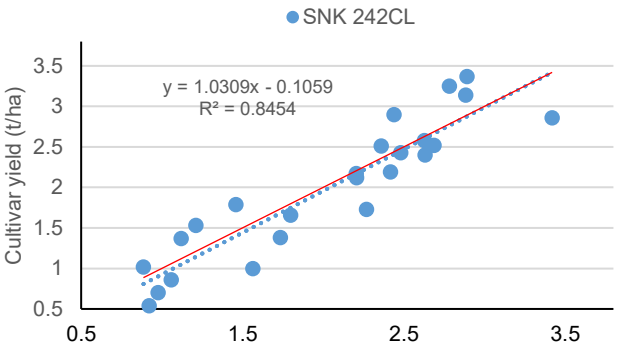
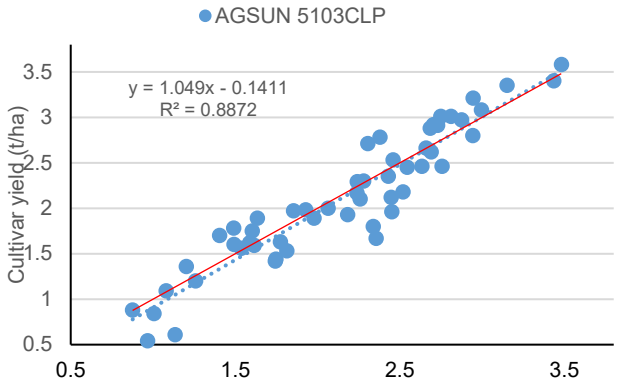
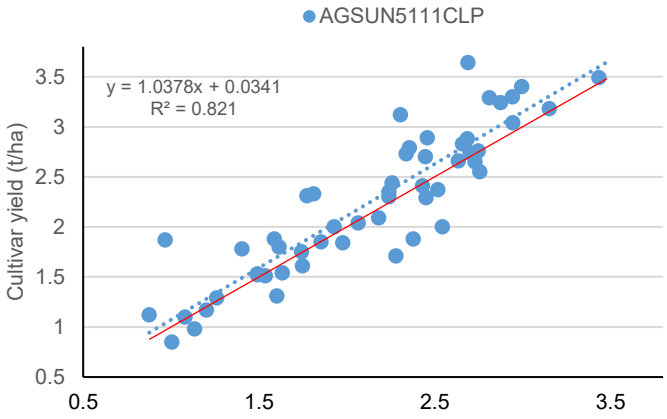
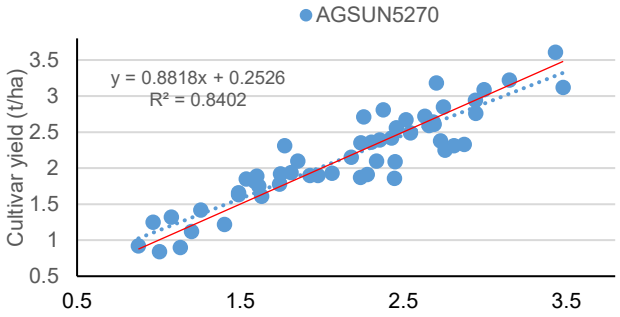
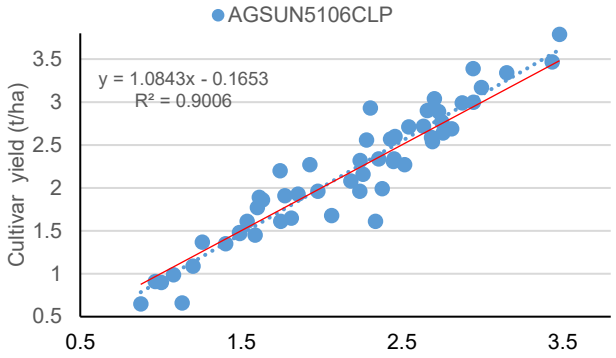

SNK 242CL
y = 1.0309x - 0.1059
R² = 0.8454
Cultivar yield (t/ha)
0.5
1
1.5
2
2.5
3
3.5
0.5
1.5
2.5
3.5

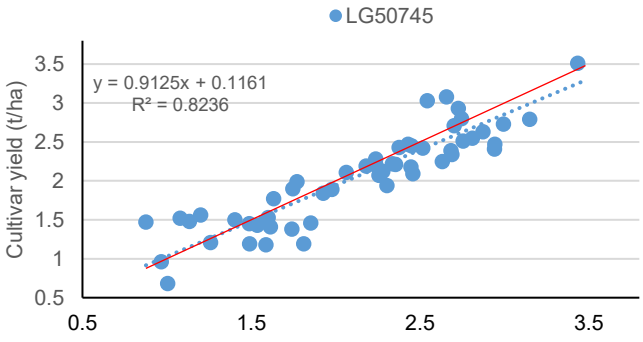
Figure 2: Regression lines for cultivars 2023/2024 & 2024/2025

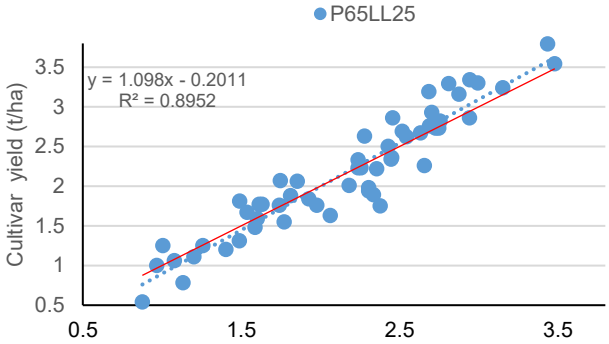


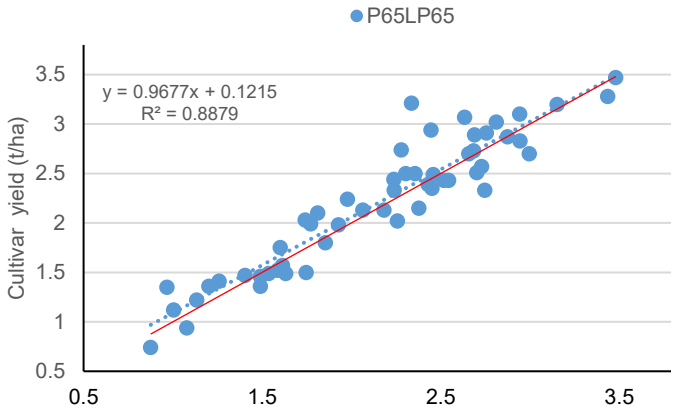


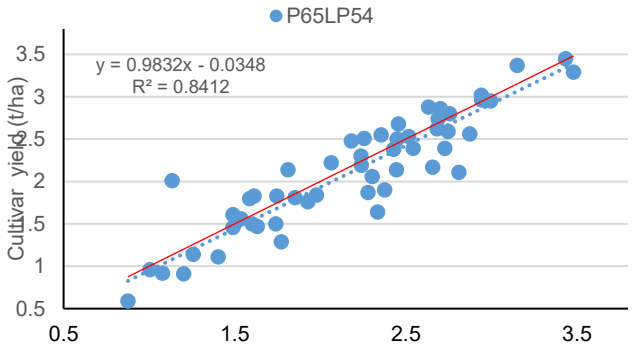


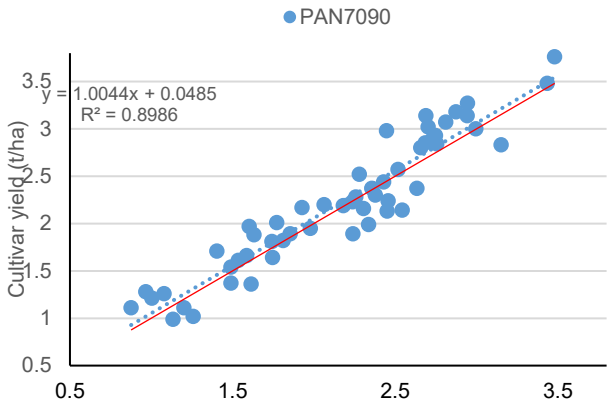








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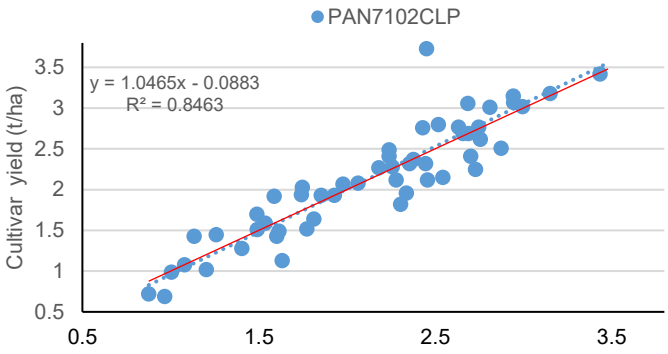
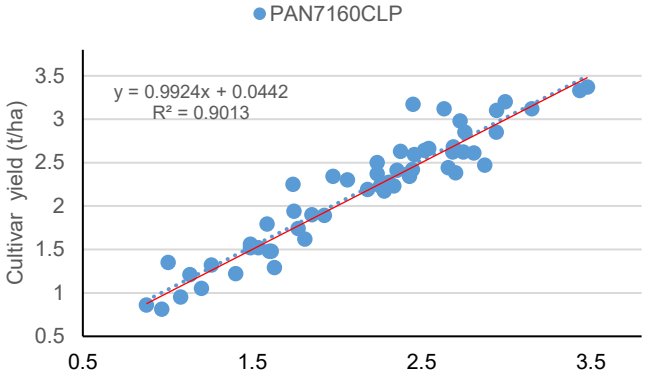
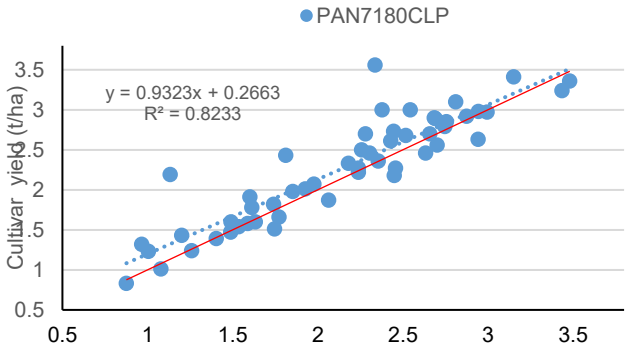
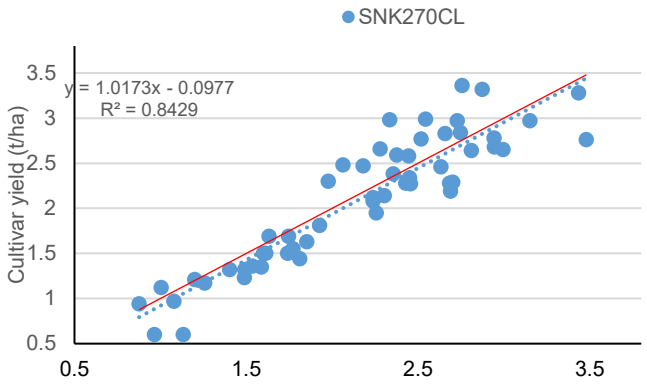
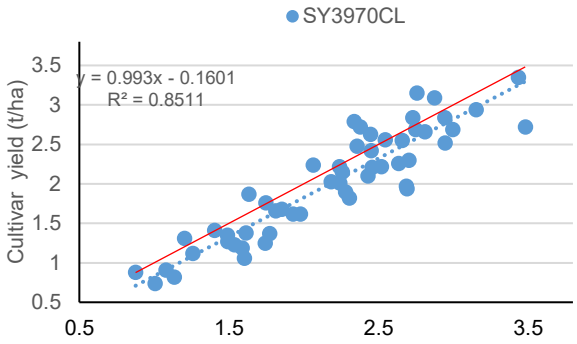
y = 1.0044x + 0.0485
R² = 0.8986
Cultivar yield (t/ha)


PAN7102CLP
y = 1.0465x - 0.0883
R² = 0.8463
Cultivar yield (t/ha)


PAN7160CLP
y = 0.9924x + 0.0442
R² = 0.9013
Cultivar yield (t/ha)


PAN7180CLP
y = 0.9323x + 0.2663
R² = 0.8233
Cultivar yield (t/ha)


SNK270CL
y = 1.0173x - 0.0977
R² = 0.8429
Cultivar yield (t/ha)


SY3970CL
y = 0.993x - 0.1601
R² = 0.8511
Cultivar yield (t/ha)