Report

Evaluation of sunflower cultivars: 2014/2015 season

ARC–Grain Crops Institute in collaboration with the following seed companies:
Agricol, Pannar, Pioneer and Syngenta

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INTRODUCTION

Optimisation of processes in any industry is key to it's success. Sunflower cultivar trials, which are done since the early 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 initiative in South Africa that evaluates all the important cultivars in the main production areas. The information generated in 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 2014/2015 season with the voluntary collaboration of Agricol, Pannar, Pioneer and Syngenta. Seed companies entered 21 cultivars for evaluation (Table 1) and supplied seed to the ARC-GCI, 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. Seed germination from all cultivars exceeded the 80% requirement (Table 1). Seed from cultivars were packed according to trial plans and send to co-operators before the onset of the growing season.

Six of the 21 cultivars were Clearfield types on which the use of the post emergence broad leaf weed controlling herbicide, imazamox, is possible. These cultivars were treated in the same way as the regular cultivars and received no imazamox herbicide.

Each collaborating seed company undertook to conduct at least one trial for each cultivar entry. Four trials were done by the ARC-GCI, eight by Agricol, seven by Pannar, none by Pioneer and eight by Syngenta. Trial sites were selected by collaborators and the co-workers involved are listed in Table 2. Planting dates, amount of fertiliser applied, soil analyses and other agronomic details from some field trials are reported in Table 3. Grain yields were recorded on all trials, while the period from planting to 50% flowering was recorded on selected trials only.

Yield data and seed samples were sent by collaborators to ARC-GCI for analyses. Seed

from nine trials was analysed by SAGL for oil and protein content. Yield data from all field trials were subjected to analyses of variance and the regression line technique, as described by Loubser and Grimbeek (1984). From this analysis yield probabilities were calculated for cultivars at different yield potentials. Two of the 27 trials were not harvested due to damage by rodents and a thunder storm respectively. Results from a further four trials were rejected due to coefficients of variation exceeding the 20% limit. This report contains results of the 21 successful trials.

RESULTS

Days from planting to flowering

The mean number of days from planting to 50% flowering of cultivars at the various localities (Table 4) ranged from 56 (NK Tutti at Potchefstroom) to 73 days (PHB 65A25 at Marquart and Potchefstroom, and SY 3970 at Marquart). Calculated across cultivars and localities, this period was 65 days. Among cultivars, NK Tutti had the shortest period 62 days and PHB65A25 the longest period from planting to flowering at 68 days.

Oil and protein concentration

The moisture free 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 for cultivars at the various localities varied from 31 to 52% with an overall mean of 43%. Adjusted for a moisture content of 9% at which sunflower grain is traded, the overall mean would be about 39%.

The highest mean oil concentration among localities was at Potchefstroom (planting date 1st November 2014) with 45%. The locality with the lowest mean oil content of 37% was Marquart. The highest oil concentration among cultivars and calculated across localities, was SY 3979 CL at 47%.

The protein content varied from 13 to 24% among cultivars at the different localities. Among localities, Marquart had the highest and Bainsvlei the lowest protein content of 21 and 16% respectively. Calculated across localities, NK Adagio CL had the highest protein content (21%) and PAN 7057 the lowest (18%).

Seed yield

The mean seed yield of cultivars at the respective localities is presented in Table 7. The highest locality mean yield of 3.69 t ha^{-1} was obtained at Boskop planted on 30th October 2014 and the lowest of 0.70 t ha^{-1}, at Settlers.

The six best performing cultivars, in terms of average yield calculated over localities, were PAN 7098, PAN 7080, PAN 7102 CLP, PHB 65A70, PAN 7049, and PAN 7095 CL. The overall mean yield for 2014/2015 was 2.19 t ha^{-1}, 9% lower than that of the 2013/2014 season.

Only one high oleic cultivar, namely NK TUTTI, was entered for evaluation in 2014/15. Six Clearfield cultivars, NK ADAGIO CL, PAN 7031 CL, PAN 7095 CL, PAN 7102 CLP, PAN 7117 CL and SY 3970 CL were entered. Of these cultivars, PAN 7095 CL and PAN 7102 CLP had yields higher than the overall mean yield.

Oil yield

Oil yield per unit area is the product of grain yield and seed oil content and it is presented in Table 8. The performance of cultivars regarding oil yield is important to farmers who are compensated for seed oil concentration.

The oil yield for cultivars at the eight localities varied from 0.4 to 1.8 t ha^{-1} with an overall mean of 1.1 t ha^{-1}. The locality with the highest mean oil yield was Boskop at 1.6 t ha^{-1}. Among cultivars, PAN 7117 CL, PHB 65A70 and SY 4045 had equally high values of 1.2 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 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 consideration, but not the yield stability. These values are

therefore not reliable for cultivar selection. Individual regression lines for 2014/15 are shown in Figure 1 and for cultivars evaluated in 2013/14 and 2014/15 in Figure 2.

The yield stability of cultivars varied nearly nine fold among cultivars. Cultivars which had exceptionally high stabilities (D-parameter ≤ 0.03) were, AGSUN 5264, PAN 7049, PAN 7057, PAN 7102 CLP, PHB 65A25 AND SY 4065.

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 21 cultivars for 2014/15 are shown in Table 11. It takes into consideration both the cultivar X environment interaction and the yield stability and is therefore a reliable measure for cultivar choice. Yield probabilities higher than 60% are shown in bold print in Table 11 and indicates which cultivars would be a sensible choice at the various yield potentials.

The yield probabilities of 13 cultivars evaluated in 40 trials in 2013/14 and 2014/15, are shown in Table 12. Tables 11 and 12 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 germination rate and supplier company 2014/2015

Cultivar	Germinated (%)*			Company
	Normal	Abnormal	Dormant/dead	
AGSUN 5264	91	4	5	Agricol ♠
AGSUN 5271	91	2	7	
AGSUN 5272	99	1	0	
AGSUN 5278	99	1	0	
AGSUN 5279	98	2	0	
AGSUN 8251	96	2	2	
PAN 7031 CL	98	1	1	Pannar ●
PAN 7049	90	5	5	
PAN 7057	98	1	1	
PAN 7080	94	4	2	
PAN 7095 CL	97	2	1	
PAN 7098	98	1	1	
PAN 7102 CLP	97	3	0	
PAN 7117 CL	89	7	4	
PHB 65A25	97	2	1	Pioneer ø
PHB 65A70	95	4	1	
NK ADAGIO CL	94	4	2	Syngenta ◘
NK TUTTI	89	5	6	
SY 3970 CL	96	2	2	
SY 4045	98	2	0	
SY 4065	96	2	2	

* According to ISTA rules

Table 2 Collaborating company, trial localities and responsible co-workers 2014/2015

Company	Localities	Planting dates	Co-workers	Address of co-workers
Agricol ♠	Boskop x 2	30/10/2014 & 19/12/2014	J Swanepoel	PO Box 6645, Baillie Park, 2526
	Lichtenburg	26/11/2014		
	Ottosdal x 2	15/12/2014 & 02/01/2015		
	Viljoenskroon	17/11/2014		
ARC-GCI ▲	Potchefstroom	14/11/2014	W Deale & J Erasmus	P/Bag X1251, Potchefstroom, 2520
		01/12/2014		
		18/12/2014		
		14/01/2015		
PANNAR ●	Bainsvlei	18/11/2014	L Schoonraad & TC Lochner	PO Box 439, Delmas, 2210
	Bothaville	19/12/2014		
	Delmas	28/10/2014		
	Kroonstad	10/12/2014		
	Senekal	18/12/2014		
	Settlers x 2	16/01/2015		
Syngenta ◘	Bainsvlei	06/01/2015	F van Deventer J Viljoen	Private Bag X60, Halfway House, 1685
	Bothaville	26/11/2014		
	Kroonstad	30/12/2014		
	Marquart	05/01/2015		
	Ottosdal	18/12/2014		
	Roedtan	16/01/2015		
	Settlers	12/01/2015		
	Viljoenskroon	18/12/2014		

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 3 Trial site information 2014/2015

Locality*	Planting date	Plant population	Soil classi-fication	Top soil analysis (mg kg^{-1})					Fertiliser applied (Kg ha^{-1})	Row width (cm)	Weed contol and insecticides	Nett plot size (m^2)
				pH (KCl)	P	K	Ca	Mg				
Bainsvlei ●	18/11/14	-	-	-	-	-	-	-	-	-	-	17.29
Bainsvlei ◘	06/01/15	43 000	Bainsvlei	-	-	-	-	-		93	None	13.02
Boskop ♠	30/10/14	40 000	-	-	-	-	-	-	N 89, P 20.24, K 6.12	91	Mechanical	6.37
Boskop ♠	19/12/14	40 000	-	-	-	-	-	-	N 89, P 20.24, K 6.12	91	Mechanical	6.37
Bothaville ◘	26/11/14	43 333	Avalon	-	-	-	-	-	-	93	None	13.02
Bothaville ●	19/12/14	-	-	-	-	-	-	-	-	-	-	17.29
Delmas ●	28/10/14	-	-	-	-	-	-	-	-	-	-	13.65
Kroonstad ◘	30/12/14	-	Westleigh	-	-	-	-	-		93	None	13.02
Kroonstad ●	10/12/14	-	-	-	-	-	-	-	-	-	-	13.65
Lichtenburg ♠	26/11/14	40 000	-	-	-	-	-	-		91	Mechanical	5.92
Lichtenburg ●	13/01/15								6:2:1 (31) + Zn			
Marquart ◘	05/01/15	43 000	Clovelly	-	-	-	-	-		93	None	13.02
Ottosdal ♠	15/12/14	40 000	-	-	-	-	-	-		91	Mechanical	5.92
Ottosdal ♠	01/02/15	40 000	-	-	-	-	-	-		91	Mechanical	5.92
Ottosdal ◘	18/12/14	43 000	Clovelly	-	-	-	-	-		93	None	13.02
Potchefstroom ▲	14/11/14	28 000	Westleigh	6.03	41	183	873	405	N 50; P 8; K 4	90	Alanex 480 CS + Racer	14.40
Potchefstroom ▲	01/12/14	28 000	Westleigh	5.89	37	203	893	420	N 50; P 8; K 4	90	Alanex 480 CS + Racer	14.40
Potchefstroom ▲	18/12/14	28 000	Westleigh	5.89	37	203	893	420	N 50; P 8; K 4	90	Alanex 480 CS + Racer	14.40
Potchefstroom ▲	14/01/15	28 000	Westleigh	5.89	37	203	893	420	N 50; P 8; K 4	90	Alanex 480 CS + Racer	14.40
Roedtan ◘	16/01/15	43 000	Arcadia	-	-	-	-	-	-	93	None	13.02
Senekal ●	18/12/14	-	-	-	-	-	-	-	-	-	-	17.29
Settlers ●	16/01/15	-	-	-	-	-	-	-	-	-	-	13.65
Settlers ◘	12/01/15	43 000	Arcadia	-	-	-	-	-	-	93	None	13.02
Viljoenskroon ♠	17/11/14	40 000	-	-	-	-	-	-	-	91	Mechanical	15.92
Viljoenskroon ◘	04/12/14	43 000	Avalon	-	-	-	-	-	-	93	None	13.02

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 4 Number of days from planting to 50 percent flowering of cultivars at selected localities and planting dates 2014/2015

Cultivar	Locality and planting date*																
	Boskop 30/10/2014 ♠	Boskop 19/12/2014 ♠	Bothaville 26/11/2014 ◘	NKP Lichtenburg 15/12/2014	Marquard 05/01/2015 ◘	Ottosdal 5/12/2014 ♠	Ottosdal 18/12/2014 ◘	Ottosdal 01/02/2015 ♠	Potchefstroom 14/11/14 ▲	Potchefstroom 1/12/2014 ▲	Potchefstroom 18/12/2014 ▲	Potchefstroom 14/01/2015 ▲	Roedtan 16/01/2015 ◘	Settlers 01/12/2014 ◘	Viljoenskroon 17/11/2014 ♠	Viljoenskroon 04/12/2014 ◘	Mean
AGSUN 5264	67	64	64	65	66	67	63	64	67	64	59	59	63	67	65	61	64
AGSUN 5271	68	66	66	67	64	67	61	66	67	65	60	60	64	66	66	63	64
AGSUN 5272	69	69	68	68	70	69	65	66	72	66	65	65	65	64	68	67	67
AGSUN 5278	69	67	67	66	72	67	63	65	71	67	64	64	66	67	66	65	66
AGSUN 5279	67	65	65	65	72	67	63	64	67	63	58	58	63	63	65	63	64
AGSUN 8251	68	67	67	66	68	68	63	65	71	67	65	65	67	68	66	64	66
NK ADAGIO CL	67	64	64	65	65	66	61	64	69	63	62	62	66	67	65	63	64
NK TUTTI	64	61	59	63	61	64	61	62	64	63	56	56	64	67	63	61	62
PAN 7031 CL	68	64	64	66	68	65	61	63	67	63	61	61	66	67	66	64	64
PAN 7049	68	66	66	67	64	66	64	65	68	64	59	59	66	66	66	65	65
PAN 7057	68	66	65	65	68	67	64	65	67	63	60	60	66	66	65	62	64
PAN 7080	69	67	68	67	72	68	65	66	69	65	64	64	66	68	67	66	67
PAN 7095 CL	69	67	66	66	70	67	64	66	69	65	63	63	63	67	66	66	66
PAN 7098	69	64	66	67	66	67	62	65	69	63	62	62	65	65	66	65	65
PAN 7102 CLP	65	63	66	65	64	66	61	65	66	63	57	57	64	66	65	62	63
PAN 7117 CL	65	66	67	65	68	66	64	66	71	65	66	66	66	63	65	65	66
PHB 65A25	71	69	67	68	73	68	63	67	73	69	67	67	68	68	68	67	68
PHB 65A70	67	65	64	66	63	66	62	65	67	63	59	59	65	68	66	63	64
SY 3970 CL	69	67	68	66	73	66	64	66	71	67	63	63	67	66	66	66	67
SY 4045	65	63	62	64	64	65	60	63	67	62	57	57	66	67	65	61	63
SY 4065	70	67	68	67	72	68	64	66	72	67	63	63	67	67	67	64	67
Mean	68	66	66	66	68	67	63	65	69	65	61	61	65	66	66	64	

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 5 The moisture free seed oil concentration (%) of cultivars at selected localities 2014/2015

Cultivar	Locality and planting date								Mean
	Bainsvlei 06/01/2015 ◘	Boskop 19/12/2014 ♠	Delmas 28/10/2014 ●	Marquart 05/01/2015 ◘	Ottosdal 15/12/2014 ♠	Potchefstroom 1/12/2014 ▲	Settlers 12/01/2015 ◘	Viljoenskroon 04/12/2014 ◘	
AGSUN 5264	45.7	46.8	47.6	38.5	44.2	47.5	43.2	43.2	44.6
AGSUN 5271	40.6	39.7	43.2	37.2	41.1	44.3	44.5	42.2	41.6
AGSUN 5272	39.4	41.0	43.2	34.8	39.6	41.6	46.5	38.6	40.6
AGSUN 5278	41.1	38.8	42.4	42.2	39.5	39.8	42.1	37.5	40.4
AGSUN 5279	41.8	40.3	44.8	34.8	40.8	43.8	40.8	39.5	40.8
AGSUN 8251	42.2	40.1	42.0	34.7	40.7	38.9	44.9	36.6	40.0
NK ADAGIO CL	43.1	40.8	42.6	35.9	40.6	44.1	42.2	39.8	41.1
NK TUTTI	44.4	45.5	47.9	37.8	43.9	43.4	41.4	38.0	42.8
PAN 7031 CL	40.4	44.3	40.9	35.2	43.1	46.6	41.5	43.6	42.0
PAN 7049	40.1	41.6	36.3	33.4	40.5	43.1	47.2	42.3	40.6
PAN 7057	43.4	42.6	46.0	35.8	42.3	43.7	41.8	41.1	42.1
PAN 7080	40.1	40.6	43.9	33.2	41.7	44.5	45.6	43.7	41.7
PAN 7095 CL	41.7	41.7	42.6	33.1	40.0	43.7	41.6	43.1	40.9
PAN 7098	41.0	39.2	41.8	34.0	39.6	42.9	50.6	39.8	41.1
PAN 7102 CLP	40.9	41.6	42.5	31.1	39.9	44.0	40.0	37.6	39.7
PAN 7117 CL	46.1	47.1	47.6	41.2	47.0	50.7	41.2	48.0	46.1
PHB 65A25	45.0	45.2	48.4	40.9	46.6	47.7	48.8	44.9	45.9
PHB 65A70	40.8	42.6	45.5	36.3	42.8	44.9	49.6	41.7	43.0
SY 3970 CL	40.4	50.0	50.7	43.2	48.6	52.2	42.9	50.2	47.3
SY 4045	43.5	42.9	43.7	34.3	40.8	42.3	46.9	43.5	42.2
SY 4065	38.2	50.6	51.9	42.9	48.1	51.0	41.0	51.6	46.9
Mean	41.9	43.0	44.5	36.7	42.4	44.8	44.0	42.2	

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 6 The moisture free seed protein concentration (%) of cultivars at selected localities 2014/2015

Cultivar	Bainsvlei	Boskop	Delmas	Marquart	Ottosdal	Potchefstroom	Settlers	Viljoenskroon	Mean
	06/01/2015 ◘	19/12/2014 ♠	28/10/2014 ●	05/01/2015 ◘	15/12/2014 ♠	1/12/2014 ▲	12/01/2015 ◘	04/12/2014 ◘	
AGSUN 5264	16.2	20.8	16.4	21.3	21.6	20.3	16.6	22.8	19.5
AGSUN 5271	19.2	20.2	15.6	20.0	21.1	17.9	16.2	21.9	19.0
AGSUN 5272	17.6	21.5	16.2	21.0	20.5	18.6	18.1	21.5	19.4
AGSUN 5278	15.4	20.8	16.1	18.3	20.8	19.7	17.9	21.2	18.8
AGSUN 5279	15.8	21.5	15.8	22.9	21.3	20.2	16.9	22.7	19.6
AGSUN 8251	12.6	20.2	16.6	20.3	19.8	20.6	17.9	21.8	18.7
NK ADAGIO CL	17.7	23.6	19.3	23.2	22.7	21.5	17.4	21.9	20.9
NK TUTTI	13.5	18.6	15.8	21.2	18.8	19.4	17.7	21.1	18.3
PAN 7031 CL	16.9	19.3	15.9	21.3	19.8	20.3	15.7	22.8	19.0
PAN 7049	16.0	19.6	16.1	19.5	19.3	19.2	18.8	17.8	18.3
PAN 7057	13.3	18.7	15.6	19.5	19.0	19.3	17.4	18.7	17.7
PAN 7080	15.8	20.1	14.8	20.8	18.5	18.3	17.2	18.4	18.0
PAN 7095 CL	14.2	19.3	16.9	21.9	19.3	19.4	18.0	19.0	18.5
PAN 7098	15.0	20.6	15.2	19.6	19.1	17.2	17.7	19.8	18.0
PAN 7102 CLP	14.7	21.2	15.4	19.1	20.3	18.1	19.2	20.3	18.5
PAN 7117 CL	14.5	21.3	17.9	21.7	21.2	17.6	18.0	20.7	19.1
PHB 65A25	16.8	20.6	16.7	22.7	19.8	20.4	17.6	22.3	19.6
PHB 65A70	15.2	20.5	14.3	20.3	19.0	19.0	19.6	18.8	18.4
SY 3970 CL	18.2	19.1	16.0	22.0	19.8	19.3	17.2	19.3	18.9
SY 4045	13.6	20.0	18.0	21.1	20.7	21.7	19.9	15.6	18.8
SY 4065	19.2	18.9	14.9	21.4	18.8	18.4	17.8	15.9	18.2
Mean	15.8	20.3	16.2	20.9	20.1	19.3	17.7	20.2	

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 7 Mean seed yield (t ha^{-1}) of cultivars at each locality 2014/2015

Cultivar	Bainsvlei 18/11/2014 ●	Bainsvlei 06/01/2015 ◘	Boskop 30/10/2014 ♠	Boskop 19/12/2014 ♠	Bothaville 26/11/2014 ◘	Bothaville 19/12/2014 ●	Delmas 28/10/2014 ●	Kroonstad 10/12/2014 ●	Marquart 05/01/2015 ◘	Ottosdal 15/12/2014 ♠	Ottosdal 01/02/2015 ♠	Mean of all cultivars
AGSUN 5264	1.51	2.39	3.33	3.48	2.41	2.77	1.77	1.62	3.42	2.27	1.99	2.12
AGSUN 5271	1.54	2.75	3.38	4.02	2.69	2.65	1.66	1.80	2.88	2.30	2.20	2.19
AGSUN 5272	1.68	2.52	3.78	3.88	2.65	2.57	1.09	2.00	3.11	2.46	2.42	2.20
AGSUN 5278	1.70	2.84	3.98	3.93	2.22	2.75	1.46	1.67	3.60	2.76	2.39	2.23
AGSUN 5279	1.94	2.48	3.46	3.79	2.84	3.00	1.51	1.95	3.53	2.74	2.19	2.27
AGSUN 8251	1.64	2.76	3.89	3.81	3.00	2.90	1.47	1.82	3.52	2.74	2.30	2.22
NK ADAGIO CL	1.50	2.21	3.22	3.25	1.77	2.33	1.80	1.45	2.87	2.25	1.86	1.94
NK TUTTI	1.69	2.57	3.52	3.06	2.25	2.10	1.55	1.54	3.44	1.99	1.95	2.06
PAN 7031 CL	1.53	2.13	4.21	3.84	1.89	2.77	1.26	1.67	3.04	2.16	2.28	2.06
PAN 7049	1.69	2.58	4.00	3.81	2.65	2.82	1.66	1.89	3.48	2.88	2.38	2.33
PAN 7057	1.81	2.25	3.99	3.65	2.29	2.91	1.64	1.93	3.12	2.36	2.39	2.24
PAN 7080	1.93	2.61	3.84	4.04	3.29	2.93	1.78	2.11	3.18	2.70	2.70	2.37
PAN 7095 CL	1.98	2.43	3.76	3.55	2.60	3.35	2.35	1.80	2.92	2.68	2.22	2.32
PAN 7098	1.70	2.89	3.64	3.86	3.24	2.95	2.02	1.96	3.62	2.84	2.41	2.47
PAN 7102 CLP	1.61	3.00	3.81	3.79	2.49	2.82	1.81	2.03	3.58	2.51	2.39	2.34
PAN 7117 CL	1.52	2.29	3.75	3.57	2.51	2.34	1.86	1.37	2.91	2.97	2.00	2.11
PHB 65A25	1.73	2.54	3.77	3.72	2.17	2.41	1.69	1.62	3.49	2.42	2.32	2.13
PHB 65A70	1.94	2.14	3.99	3.66	2.18	2.87	2.18	1.86	3.60	2.42	2.38	2.33
SY 3970 CL	1.37	2.30	3.50	3.26	2.20	2.69	2.26	1.43	2.94	2.63	2.00	2.05
SY 4045	1.42	2.48	3.43	3.41	1.85	0.87	2.16	1.73	3.33	2.14	2.01	1.99
SY 4065	1.44	2.52	3.33	3.56	2.30	2.50	1.83	1.48	3.05	2.62	2.14	2.10
Mean	1.66	2.51	3.69	3.67	2.45	2.63	1.75	1.75	3.27	2.52	2.24	
CV%	8	13	9	8	16	11	15	10	9	17	13	

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Continue on page 12……..

Table 7 Continue

Cultivar	Potchefstroom 14/11/14 ▲	Potchefstroom 1/12/2014 ▲	Potchefstroom 18/12/14 ▲	Potchefstroom 14/01/2015 ▲	Roedtan 16/01/2015 ◘	Senekal 18/12/2014 ●	Settlers 12/01/2015 ◘	Settlers 16/01/2015 ●	Viljoenskroon 17/11/2014 ♠	Viljoenskroon 04/12/2014 ◘	Mean of all cultivars
AGSUN 5264	1.60	1.65	2.18	1.94	2.41	1.16	1.25	0.70	1.52	3.12	2.12
AGSUN 5271	1.93	1.97	2.16	2.02	2.20	1.36	1.32	0.73	1.35	3.04	2.19
AGSUN 5272	1.72	1.93	2.05	2.01	2.19	1.40	1.43	0.84	1.50	2.96	2.20
AGSUN 5278	1.75	1.63	2.18	1.91	2.31	1.04	1.11	0.81	1.48	3.21	2.23
AGSUN 5279	1.76	1.85	2.06	2.06	2.41	1.48	1.41	0.42	1.33	3.54	2.27
AGSUN 8251	1.55	1.68	1.98	1.92	2.01	1.02	1.15	0.89	1.57	3.06	2.22
NK ADAGIO CL	1.83	1.70	2.00	1.68	1.44	1.15	1.22	0.60	1.57	3.08	1.94
NK TUTTI	1.98	2.11	2.13	1.75	2.34	1.00	1.27	0.43	1.11	3.51	2.06
PAN 7031 CL	1.97	1.82	1.98	1.97	1.94	1.10	1.35	0.17	1.10	3.16	2.06
PAN 7049	2.05	1.90	2.25	2.01	2.44	1.44	1.32	0.77	1.33	3.58	2.33
PAN 7057	2.01	1.91	2.20	2.05	2.28	1.54	1.25	0.76	1.28	3.52	2.24
PAN 7080	1.82	1.78	2.34	2.01	2.06	1.59	1.21	0.97	1.24	3.72	2.37
PAN 7095 CL	1.90	1.99	2.36	1.74	2.25	1.65	1.25	0.86	1.41	3.57	2.32
PAN 7098	1.96	2.73	2.21	2.09	2.65	1.67	1.37	0.76	1.73	3.54	2.47
PAN 7102 CLP	2.07	2.03	2.58	2.14	2.35	1.38	1.10	0.93	1.22	3.51	2.34
PAN 7117 CL	1.57	1.90	2.12	1.81	1.91	1.36	1.25	0.61	1.65	3.04	2.11
PHB 65A25	1.75	1.89	1.81	1.71	1.87	1.37	1.16	0.62	1.22	3.54	2.13
PHB 65A70	2.06	2.05	2.36	1.99	2.69	1.39	1.22	0.72	1.29	3.84	2.33
SY 3970 CL	1.71	1.65	1.94	1.63	2.09	1.23	1.22	0.62	1.13	3.35	2.05
SY 4045	2.01	1.77	2.12	1.93	2.03	0.79	1.25	0.63	1.40	2.97	1.99
SY 4065	2.01	1.71	2.11	1.98	1.69	1.26	1.13	0.77	1.52	3.15	2.10
Mean	1.86	1.89	2.15	1.92	2.17	1.30	1.25	0.70	1.38	3.33	
CV%	10	13	11	8	14	8	11	18	19	10	

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 8 Oil yield (t ha^{-1}) of cultivars at selected localities 2014/2015

Cultivar	Bainsvlei	Boskop	Delmas	Marquart	Ottosdal	Potchefstroom	Settlers	Viljoenskroon	Mean
	06/01/2015 ◘	19/12/2014 ♠	28/10/2014 ●	05/01/2015 ◘	15/12/2014 ♠	1/12/2014 ▲	12/01/2015 ◘	04/12/2014 ◘	
AGSUN 5264	1.1	1.6	0.8	1.3	1.0	0.8	0.5	1.3	1.1
AGSUN 5271	1.1	1.6	0.7	1.1	0.9	0.9	0.6	1.3	1.0
AGSUN 5272	1.0	1.6	0.5	1.1	1.0	0.8	0.7	1.1	1.0
AGSUN 5278	1.2	1.5	0.6	1.5	1.1	0.6	0.5	1.2	1.0
AGSUN 5279	1.0	1.5	0.7	1.2	1.1	0.8	0.6	1.4	1.0
AGSUN 8251	1.2	1.5	0.6	1.2	1.1	0.7	0.5	1.1	1.0
CAP2000	1.0	1.3	0.8	1.0	0.9	0.7	0.5	1.2	0.9
NK ADAGIO CL	1.1	1.4	0.7	1.3	0.9	0.9	0.5	1.3	1.0
NK TUTTI	0.9	1.7	0.5	1.1	0.9	0.8	0.6	1.4	1.0
PAN 7031 CL	1.0	1.6	0.6	1.2	1.2	0.8	0.6	1.5	1.1
PAN 7049	1.0	1.6	0.8	1.1	1.0	0.8	0.5	1.4	1.0
PAN 7057	1.0	1.6	0.8	1.1	1.1	0.8	0.6	1.6	1.1
PAN 7080	1.0	1.5	1.0	1.0	1.1	0.9	0.5	1.5	1.1
PAN 7095 CL	1.2	1.5	0.8	1.2	1.1	1.2	0.7	1.4	1.1
PAN 7098	1.2	1.6	0.8	1.1	1.0	0.9	0.4	1.3	1.0
PAN 7102 CLP	1.1	1.7	0.9	1.2	1.4	1.0	0.5	1.5	1.1
PAN 7117 CL	1.1	1.7	0.8	1.4	1.1	0.9	0.6	1.6	1.2
PHB 65A25	0.9	1.6	1.0	1.3	1.0	0.9	0.6	1.6	1.1
PHB 65A70	0.9	1.6	1.1	1.3	1.3	0.9	0.5	1.7	1.2
SY 3970 CL	1.1	1.5	0.9	1.1	0.9	0.7	0.6	1.3	1.0
SY 4045	1.0	1.8	0.9	1.3	1.3	0.9	0.5	1.6	1.2
SY 4065	1.1	1.6	0.8	1.2	1.1	0.8	0.5	1.4	1.1
Mean	1.1	1.6	0.8	1.2	1.1	0.8	0.6	1.4	

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 9 Parameters calculated from the analysis of variance for yield data at each locality 2014/2015

Locality	Mean (t ha^{-1})	SE (t ha^{-1})	CV (%)	GCV	t	SE(t)	tn
Bainsvlei 18/11/2014 ●	1.66	0.08	8.1	9.9	0.60	0.114	0.82
Bainsvlei 06/01/2015 ◘	2.51	0.19	13.3	5.9	0.16	0.143	0.36
Boskop 30/10/2014 ♠	3.69	0.18	8.5	5.5	0.30	0.145	0.56
Boskop 19/12/2014 ♠	3.67	0.16	7.7	5.6	0.35	0.143	0.62
Bothaville 26/11/2014 ◘	2.45	0.22	15.8	14.3	0.45	0.135	0.71
Bothaville 19/12/2014 ●	2.63	0.16	10.6	17.6	0.73	0.086	0.89
Delmas 28/10/2014 ●	1.75	0.15	15.3	16.0	0.52	0.126	0.76
Kroonstad 10/12/2014 ●	1.75	0.10	9.6	11.0	0.57	0.119	0.80
Marquart 05/01/2015 ◘	3.27	0.17	9.2	6.7	0.35	0.143	0.62
Ottosdal 15/12/2014 ♠	2.52	0.25	17.2	4.1	0.05	0.135	0.14
Ottosdal 01/02/2015 ♠	2.24	0.17	13.4	5.0	0.12	0.141	0.29
Potchefstroom 14/11/14 ▲	1.86	0.11	9.9	6.9	0.32	0.144	0.59
Potchefstroom 1/12/2014 ▲	1.89	0.14	12.6	10.4	0.40	0.139	0.67
Potchefstroom 18/12/14 ▲	2.15	0.13	10.5	5.2	0.19	0.144	0.41
Potchefstroom 14/01/2015 ▲	1.92	0.09	8.4	5.8	0.32	0.144	0.59
Roedtan 16/01/2015 ◘	2.17	0.17	13.5	11.6	0.42	0.138	0.68
Senekal 18/12/2014 ●	1.30	0.06	8.4	17.1	0.81	0.064	0.93
Settlers 12/01/2015 ◘	1.25	0.08	11.3	3.6	0.09	0.139	0.23
Settlers 16/01/2015_1 ●	0.70	0.07	17.6	25.2	0.67	0.100	0.86
Viljoenskroon 17/11/2014 ♠	1.38	0.15	19.1	6.9	0.12	0.141	0.29
Viljoenskroon 04/12/2014 ◘	3.33	0.19	10.0	5.7	0.24	0.145	0.49

♠ Agricol; ▲ ARC-GCI; ● Pannar; ◘ Syngenta

Table 10 Regression line coordinates at different yield potentials 2014/2015

Cultivar	Yield potential (t ha^{-1})						Mean (t ha^{-1})	Intercept	Slope	D-parameter
	1	1.5	2	2.5	3	3.5				
AGSUN 5264	0.99	1.47	1.94	2.42	2.89	3.37	2.12	0.04	0.95	0.026
AGSUN 5271	1.07	1.54	2.01	2.48	2.95	3.42	2.19	0.13	0.94	0.034
AGSUN 5272	1.05	1.53	2.01	2.49	2.97	3.45	2.20	0.09	0.96	0.047
AGSUN 5278	0.88	1.44	2.00	2.56	3.12	3.68	2.23	-0.24	1.12	0.033
AGSUN 5279	1.01	1.54	2.06	2.59	3.11	3.64	2.27	-0.04	1.05	0.040
AGSUN 8251	0.93	1.47	2.01	2.55	3.09	3.63	2.22	-0.15	1.08	0.054
NK ADAGIO CL	0.93	1.35	1.77	2.19	2.61	3.03	1.94	0.09	0.84	0.034
NK TUTTI	0.89	1.38	1.87	2.36	2.85	3.34	2.06	-0.09	0.98	0.064
PAN 7031 CL	0.71	1.28	1.84	2.41	2.97	3.54	2.06	-0.42	1.13	0.062
PAN 7049	1.04	1.58	2.12	2.66	3.20	3.74	2.33	-0.04	1.08	0.009
PAN 7057	1.05	1.55	2.05	2.55	3.05	3.55	2.24	0.05	1.00	0.026
PAN 7080	1.11	1.64	2.17	2.70	3.23	3.76	2.37	0.05	1.06	0.058
PAN 7095 CL	1.20	1.67	2.14	2.61	3.08	3.55	2.32	0.26	0.94	0.058
PAN 7098	1.28	1.78	2.28	2.78	3.28	3.78	2.47	0.28	1.00	0.053
PAN 7102 CLP	1.08	1.61	2.13	2.66	3.18	3.71	2.34	0.03	1.05	0.026
PAN 7117 CL	0.97	1.45	1.92	2.40	2.87	3.35	2.11	0.02	0.95	0.046
PHB 65A25	0.85	1.39	1.92	2.46	2.99	3.53	2.13	-0.22	1.07	0.023
PHB 65A70	1.07	1.60	2.13	2.66	3.19	3.72	2.33	0.01	1.06	0.054
SY 3970 CL	0.91	1.39	1.86	2.34	2.81	3.29	2.05	-0.04	0.95	0.041
SY 4045	0.95	1.39	1.82	2.26	2.69	3.13	1.99	0.08	0.87	0.177
SY 4065	1.01	1.47	1.93	2.39	2.85	3.31	2.10	0.09	0.92	0.025

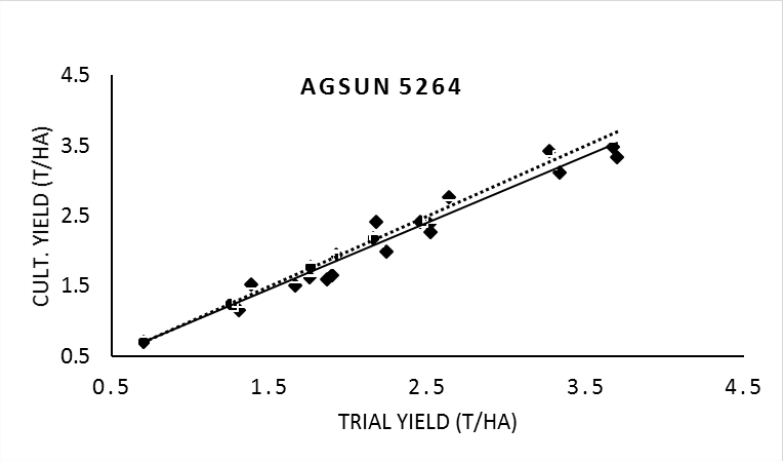
Table 11 Yield probability (%) of cultivars 2014/15 at different yield potentials

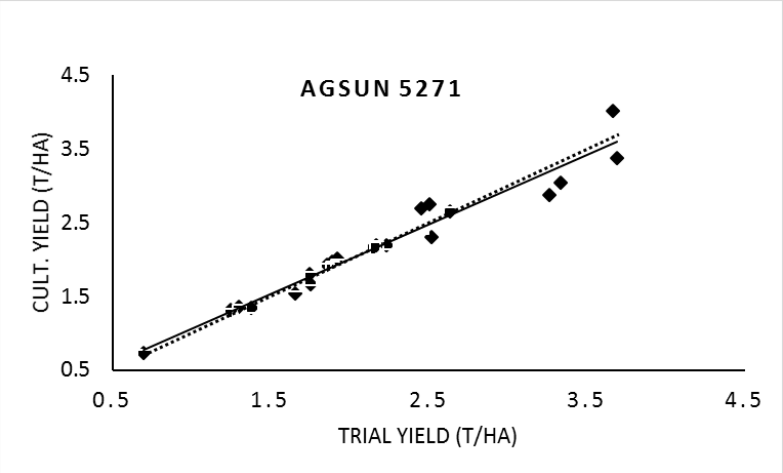
Cultivar	Yield potential (t ha^{-1})					
	1	1.5	2	2.5	3	3.5
AGSUN 5264	48	43	36	31	26	23
AGSUN 5271	**64**	58	52	46	40	34
AGSUN 5272	59	55	52	48	45	42
AGSUN 5278	27	38	50	**63**	**74**	**82**
AGSUN 5279	52	58	**62**	**67**	**70**	**74**
AGSUN 8251	39	45	52	58	**64**	**70**
NK ADAGIO CL	36	22	11	5	2	1
NK TUTTI	34	32	31	30	29	28
PAN 7031 CL	14	20	27	36	45	56
PAN 7049	**65**	**79**	**89**	**95**	**98**	**99**
PAN 7057	**61**	**62**	**62**	**62**	**62**	**61**
PAN 7080	**66**	**71**	**75**	**79**	**82**	**84**
PAN 7095 CL	**78**	**75**	**71**	**67**	**62**	58
PAN 7098	**87**	**88**	**88**	**88**	**88**	**87**
PAN 7102 CLP	**68**	**74**	**78**	**83**	**86**	**88**
PAN 7117 CL	45	41	36	32	28	26
PHB 65A25	18	24	30	40	47	57
PHB 65A70	**61**	**66**	**71**	**75**	**78**	**81**
SY 3970 CL	34	30	25	22	19	17
SY 4045	46	40	34	29	24	21
SY 4065	52	43	33	25	18	13

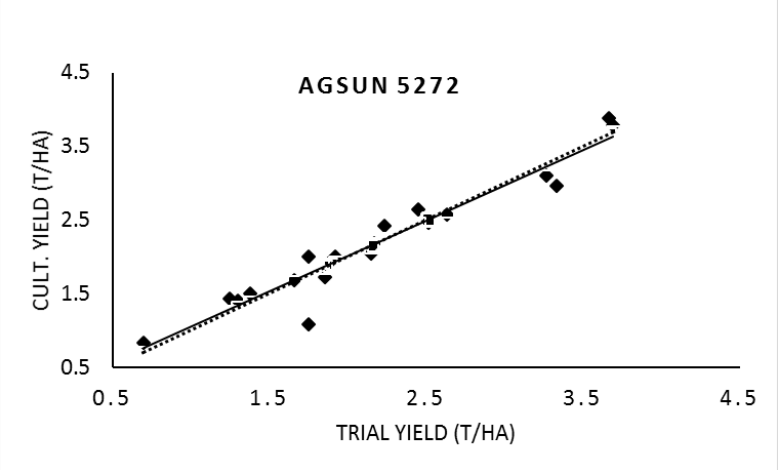
Table 12 Yield probability (%) of cultivars 2013/14 and 2014/15 at different yield potentials

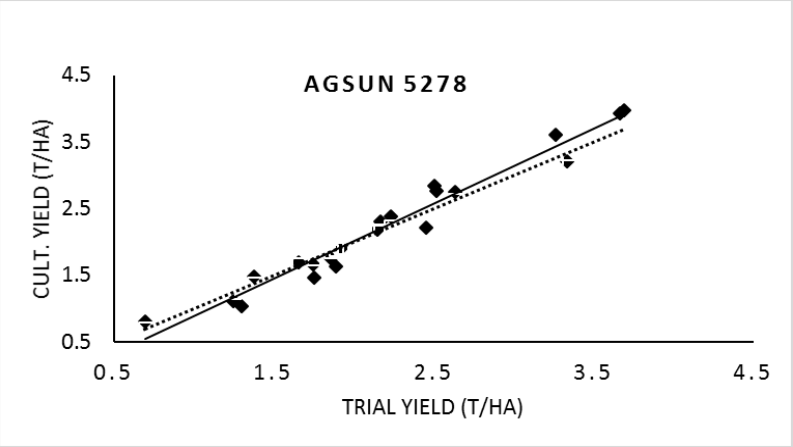
Cultivar	Yield potential (t ha^{-1})					
	1	1.5	2	2.5	3	3.5
Agsun 5264	34	31	27	24	22	20
Agsun 5271	38	41	43	47	48	52
Agsun 5278	27	35	42	52	**60**	**68**
Agsun 5279	47	50	54	57	**61**	**64**
Agsun 8251	29	38	48	58	**68**	**76**
PAN 7049	**67**	**71**	**74**	**78**	**79**	**82**
PAN 7057	53	52	50	48	46	45
PAN 7080	**62**	**69**	**73**	**78**	**81**	**85**
PAN 7098	**69**	**72**	**75**	**78**	**80**	**81**
PAN 7095 CL	**64**	**63**	**60**	59	56	54
PAN 7102 CLP	59	57	52	50	46	43
PHB 65A25	30	29	29	29	29	30
PHB 65A70	58	57	54	52	48	47
SY 4045	55	44	32	23	15	10

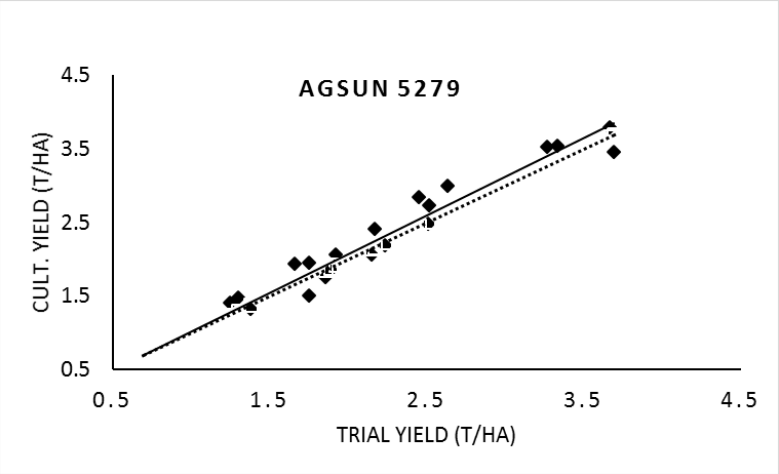
Figure 1 Regression lines for cultivars 2014/2015. Regression and mean shown as solid and dotted lines respectively








AGSUN 5278
CULT. YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5
TRIAL YIELD (T/HA)


AGSUN 5279
CULT. YIELD (T/HA)
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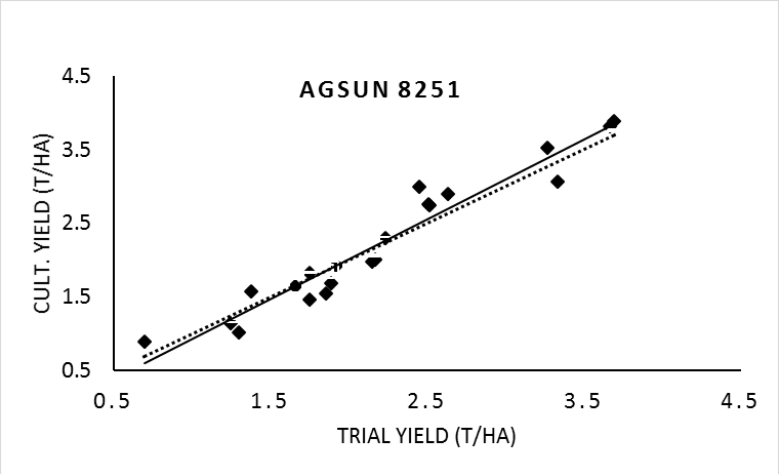
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5
TRIAL YIELD (T/HA)


AGSUN 8251
CULT. YIELD (T/HA)
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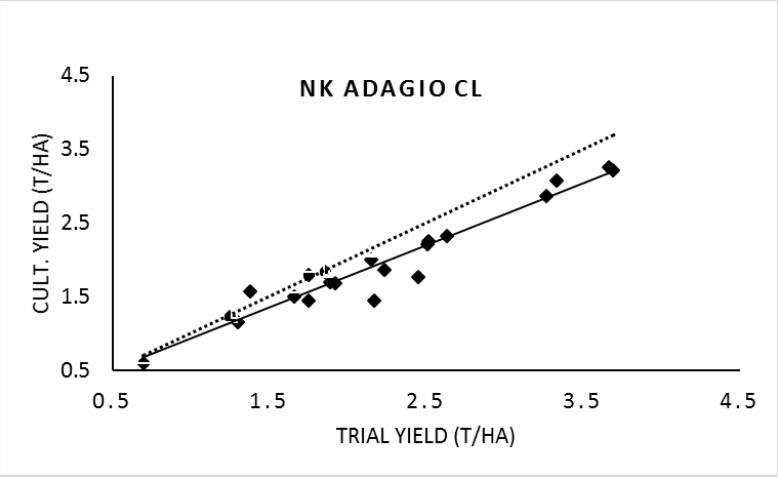
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5
TRIAL YIELD (T/HA)


NK ADAGIO CL
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
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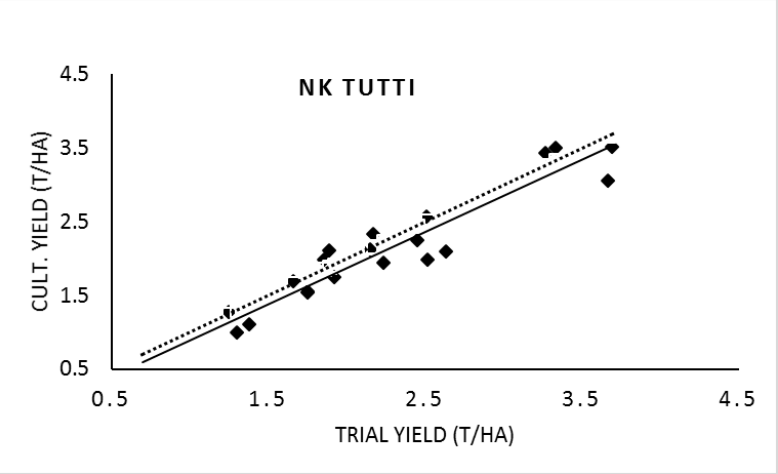
1.5
2.5
3.5
4.5


NK TUTTI
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
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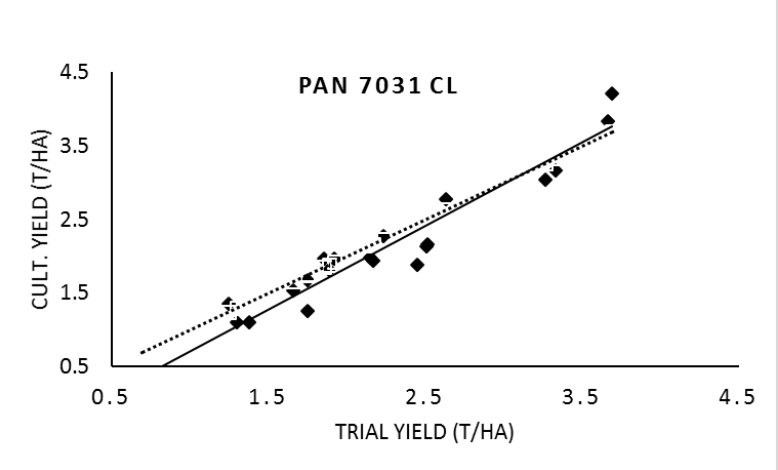
1.5
2.5
3.5
4.5


PAN 7031 CL
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
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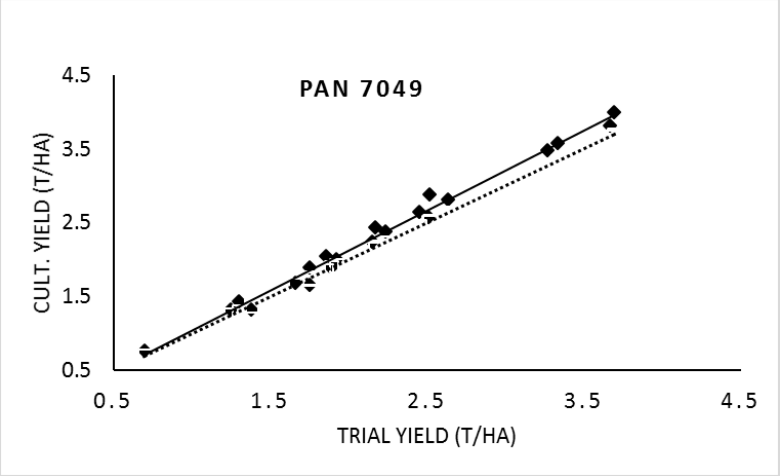
2.5
3.5
4.5


PAN 7049
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
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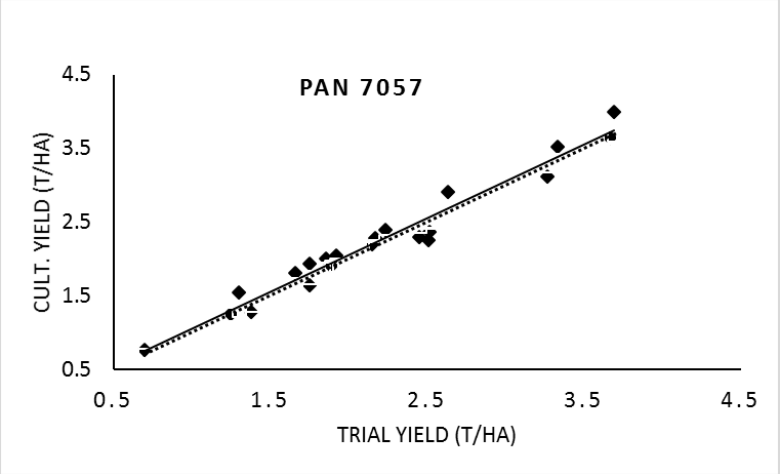
1.5
2.5
3.5
4.5


PAN 7057
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
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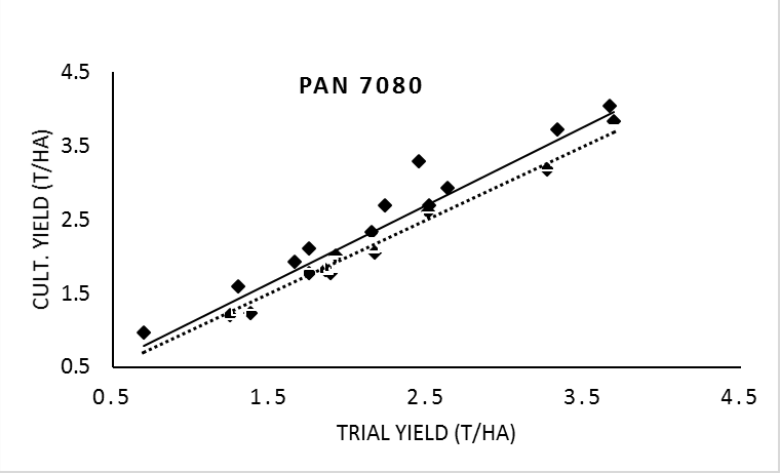
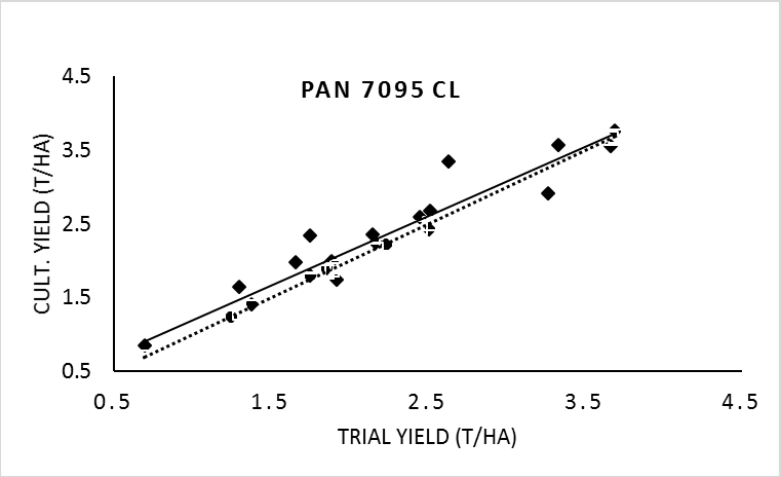
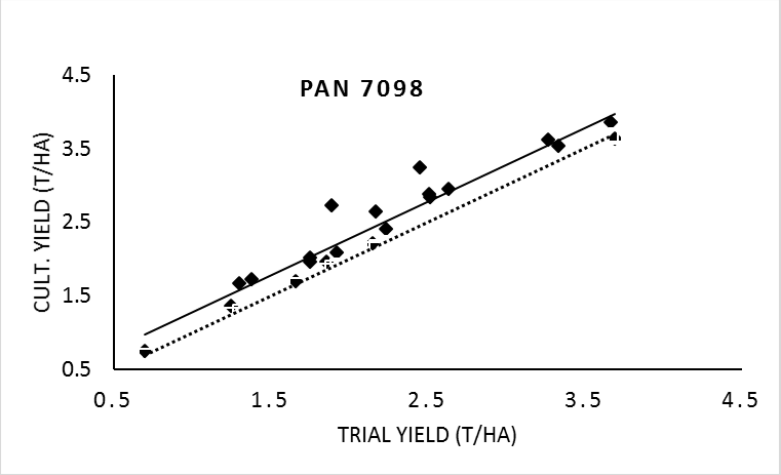
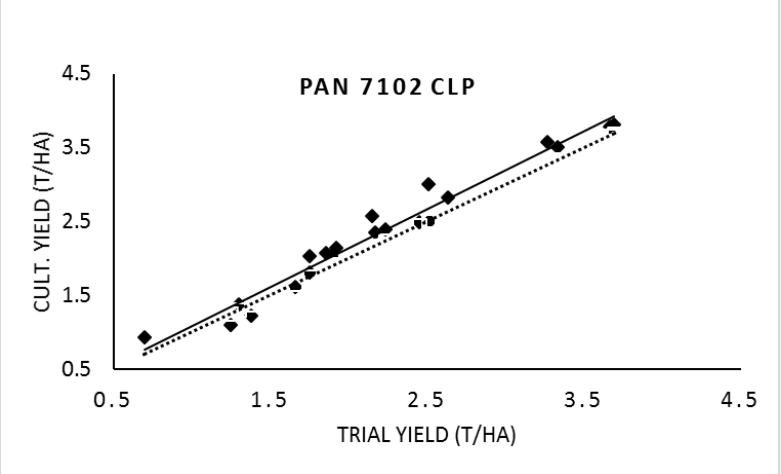
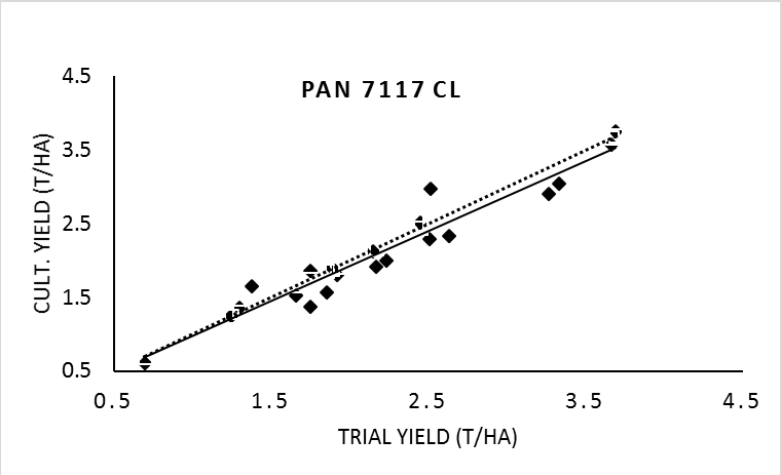
1.5
2.5
3.5
4.5

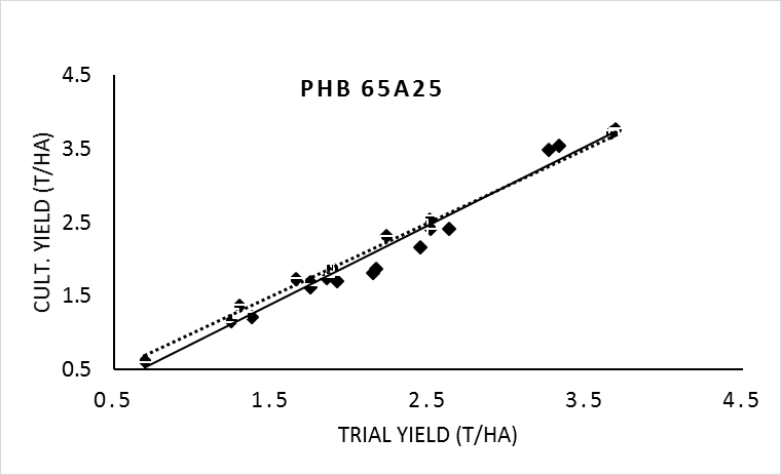

PAN 7080
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5

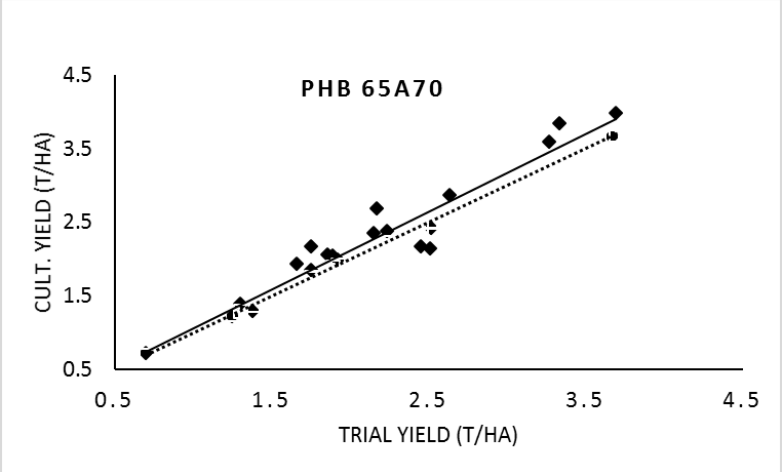

PAN 7095 CL
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5

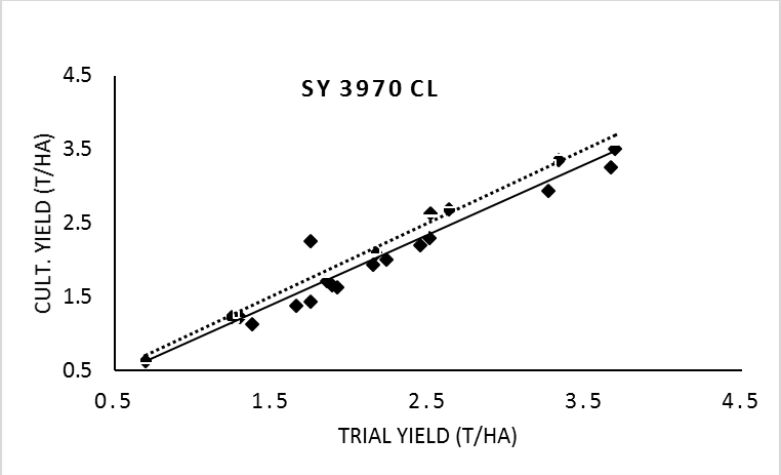

PAN 7098
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5

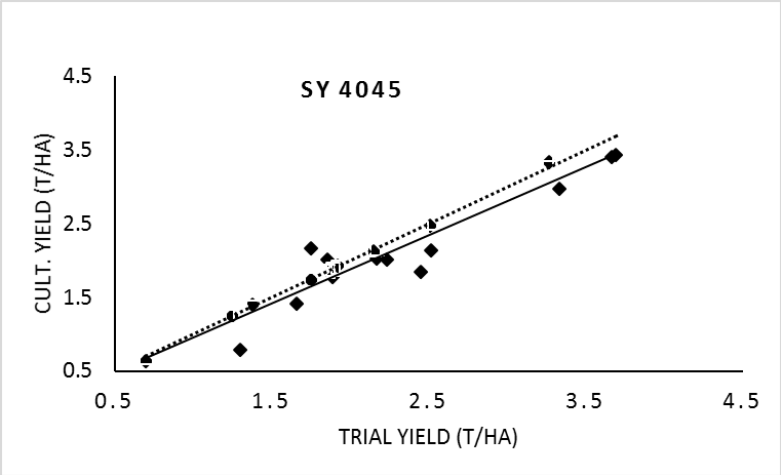

PAN 7102 CLP
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5


PAN 7117 CL
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


PHB 65A25
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


PHB 65A70
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


SY 3970 CL
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5


SY 4045
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5

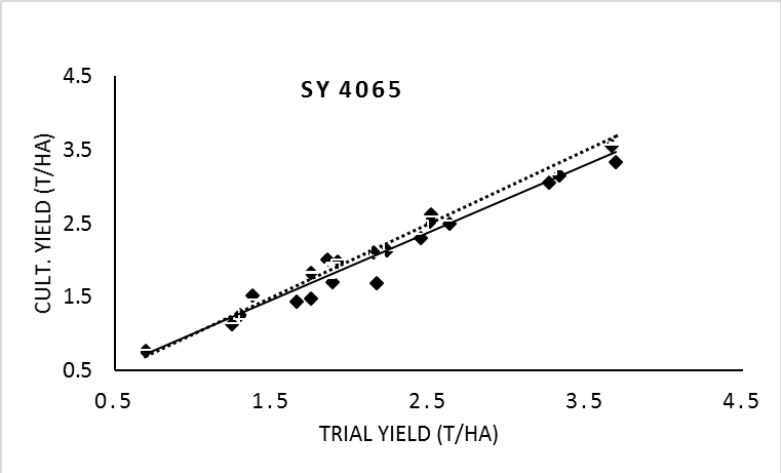
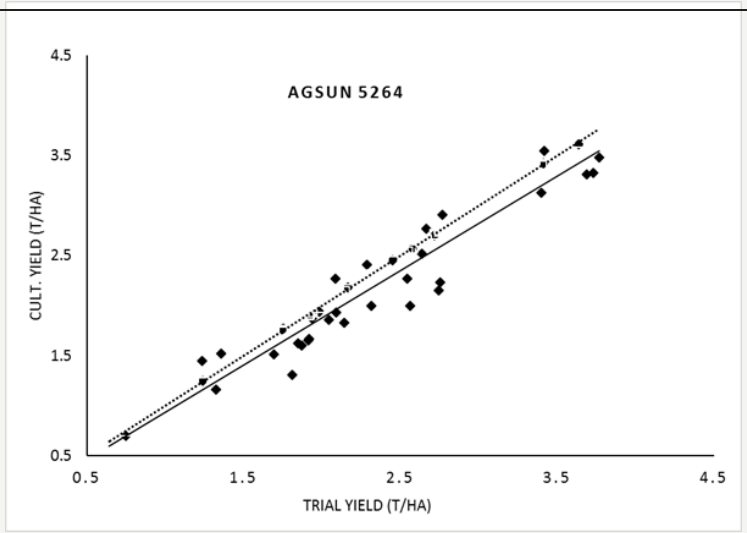
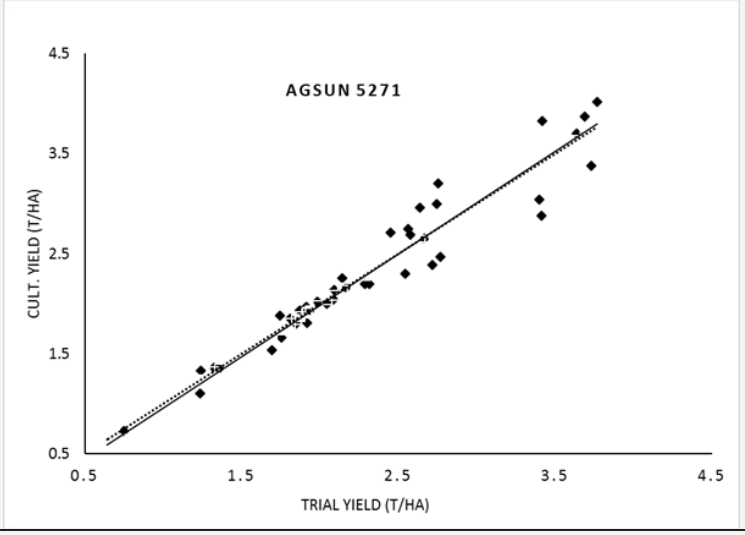
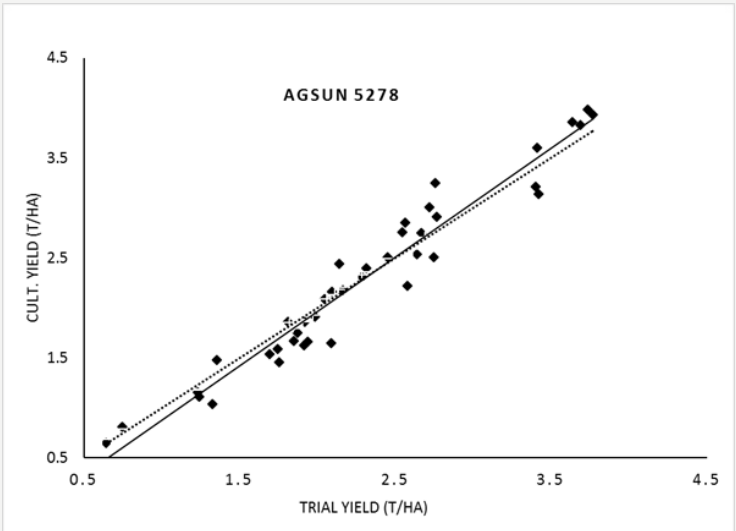
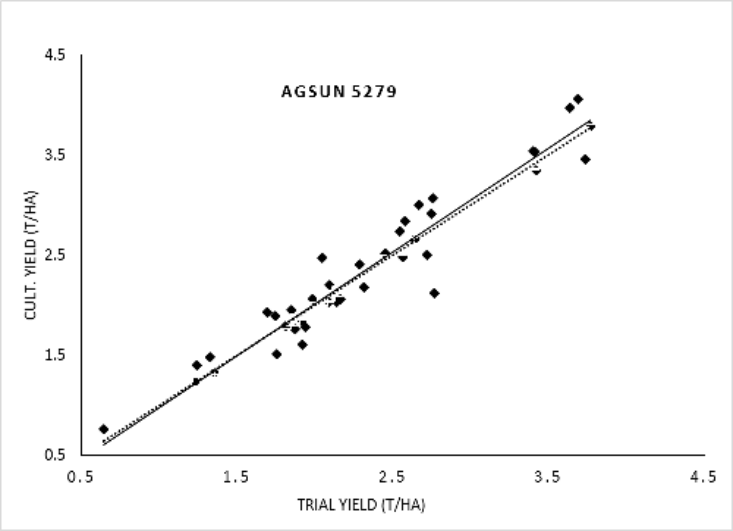

SY 4065
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5

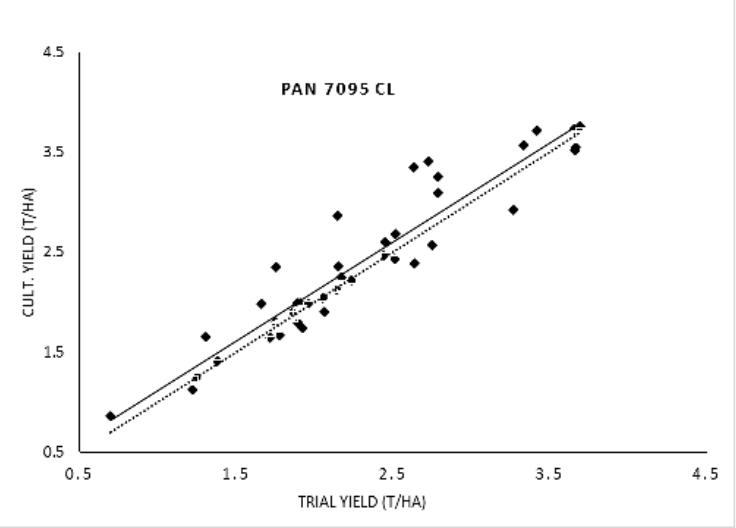
Figure 2 Regression lines for cultivars 2013/2014 and 2014/2015. Regression and mean shown as solid and dotted lines respectively

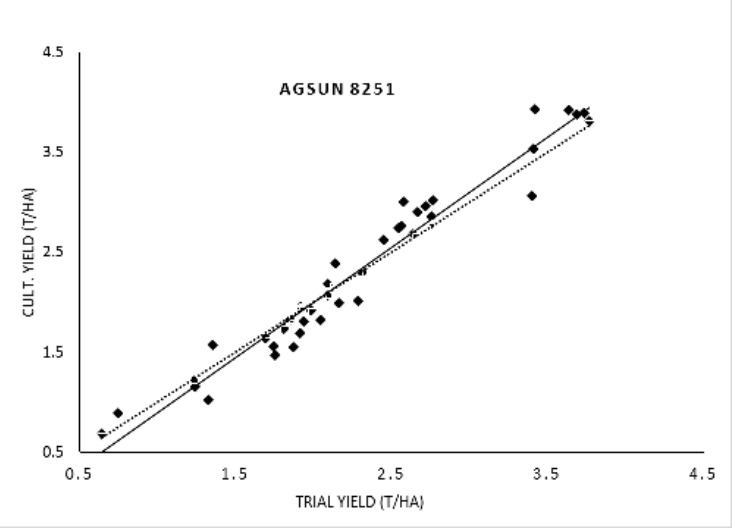


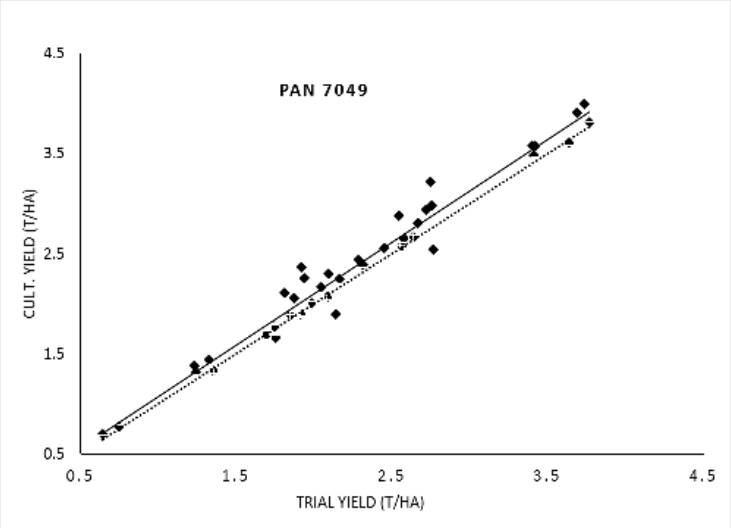


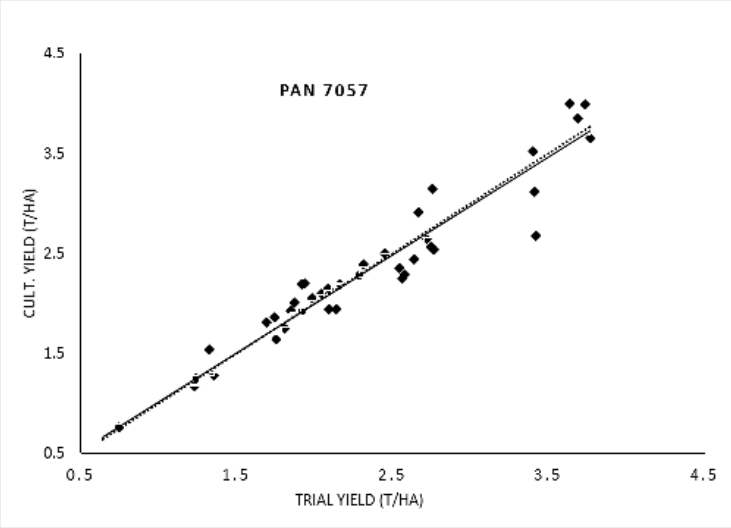


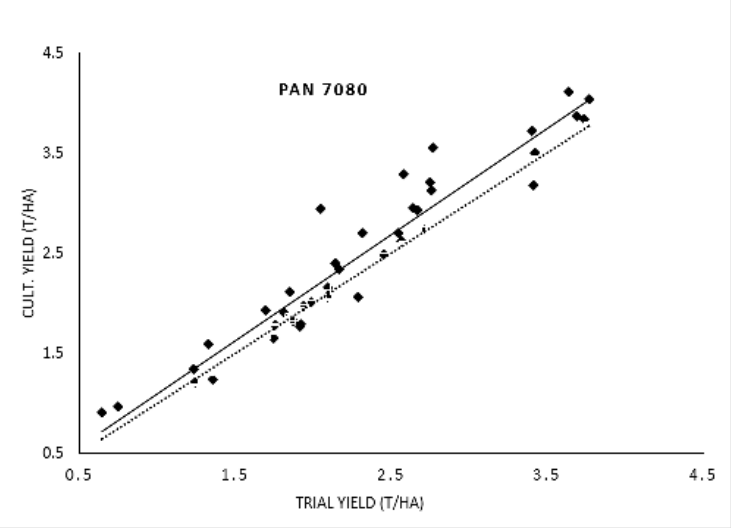

AGSUN 5279
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5

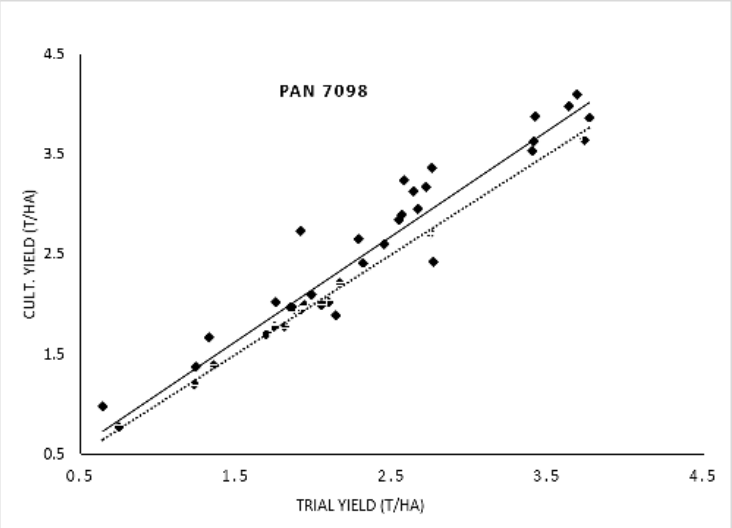

PAN 7095 CL
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5

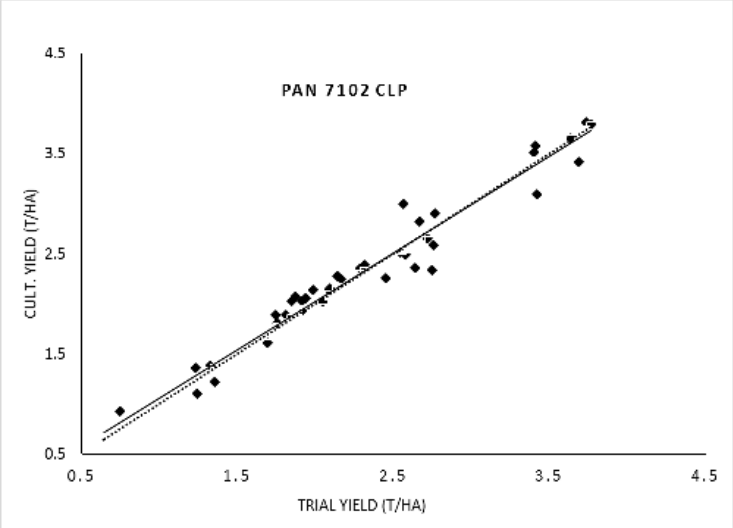

AGSUN 8251
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
4.5
3.5
2.5
1.5
0.5
0.5
1.5
2.5
3.5
4.5

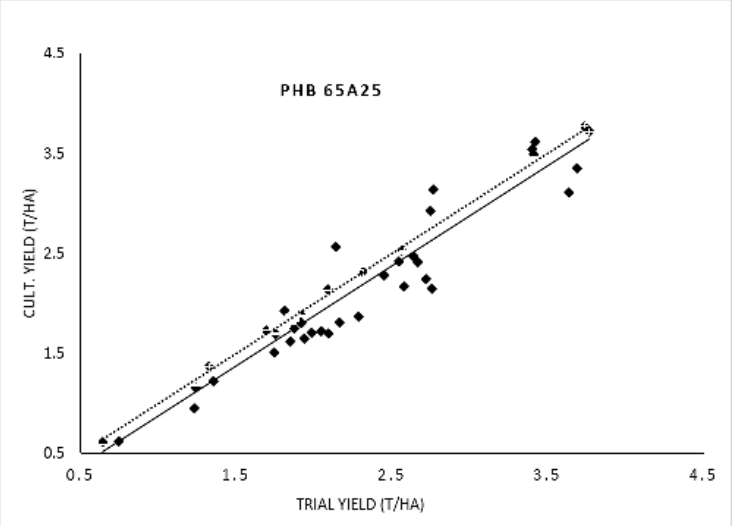

PAN 7049
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5

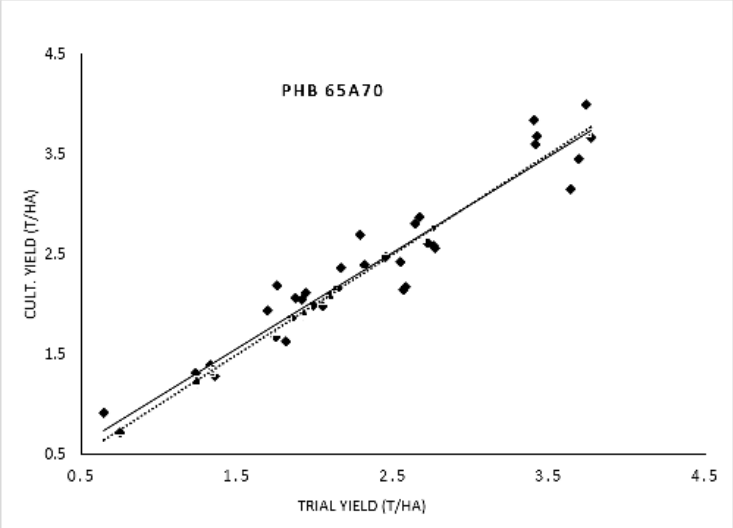

PAN 7057
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5

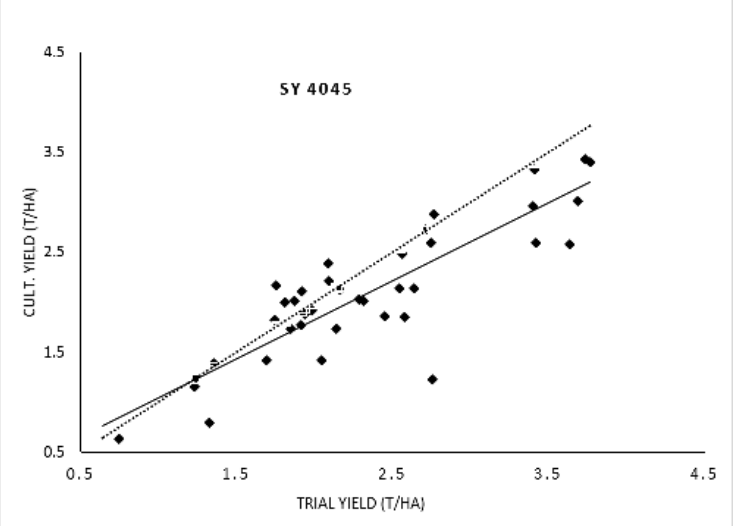

PAN 7080
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


PAN 7098
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


PAN 7102 CLP
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


PHB 65A25
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


PHB 65A70
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5


SY 4045
CULT. YIELD (T/HA)
TRIAL YIELD (T/HA)
0.5
1.5
2.5
3.5
4.5