

Comparison of wheat varieties

Rebekah Allen and Kaidy Morgan
Hart Field-Site Group

Key findings

- The average grain yield was 3.75 t/ha for all wheat varieties at Hart in 2023, with individual yields ranging from 3.35 – 4.26 t/ha.
- APH variety Sunblade CL Plus performed well, yielding 4.26 t/ha alongside AH varieties Ballista, Calibre, Kingston, Scepter, Vixen and APW varieties Denison and LRPB Trojan.
- Grain quality for most varieties tested low for screenings (%) and protein (%) and high for test weight (> 76 kg/hL).
- Despite below average annual rainfall at Hart in 2023, reasonable grain yields were achieved, with several varieties exceeding > 4 t/ha in a Decile 4 (40th percentile) season for both growing season rainfall (GSR) and annual rainfall.
- Although not highest yielding, the only variety to meet maximum receival standards within its grain classification was APW variety Chief CL Plus.

Aim

To compare the performance of new wheat varieties alongside current commercial standards.

Methodology

A trial was implemented at Hart, SA to evaluate wheat variety performance (Table 1). The trial was a randomised block design with three replicates and 29 wheat varieties comprising of both bread and durum wheat. New lines trialed at Hart in 2023 were Soaker (LRPB19-6184) LRPB Matador, LRPB Dual, Genie (IGW6754), Dozer CL Plus (IGW6783) and Mowhawk. This trial was managed with the application of pesticides to ensure a weed, insect and disease-free canopy. All plots were assessed for grain yield (t/ha), protein (%), test weight (kg/hL) and screenings (%). All data was analysed using a REML spatial model (Regular Grid) in Genstat 23rd edition.

Table 1. Trial details for 2023 wheat variety comparison at Hart, SA.

Plot size	1.75 m x 10.0 m	Soil N	105 kg N/ha
Seeding date	May 12, 2023	Fertiliser	Seeding: DAP (18:20) Zn 1% + Impact @ 80 kg/ha
Location	Hart, SA		
Harvest date	November 3, 2023		July 21: 74 kg N/ha (applied as urea @ 160 kg/ha)
Previous crop	Oaten hay		
Growing season rainfall	Decile 4 (236 mm)		

Pre-seeding available nitrogen (N) (0 – 90 cm) at Hart was 105 kg N/ha following an oaten hay crop in 2022. In-season nitrogen (N) decisions considered existing soil organic N, Yield Prophet® (based on Scepter wheat), Bureau of Meteorology (BoM) climate outlooks and simple economics.

At the time of N application, the site was highly responsive to N (Figure 1) and given the BoM forecast, it was clear that even a Decile 5 season would require significant N input to achieve water-limited yield potential (PYw). The BoM forecast a week prior to N application showed a 70% chance of El Niño developing, with the three-month outlook (August – October) showing a 47% chance of falling into a Decile 1 or 2 rainfall category at Hart and a 27% chance of Decile 3 – 4. Combined, this information showed us that the likelihood of receiving above average rainfall from August - October was low (22%).

Based on Figure 1 (Graph A) there was no significant benefit to applying further N if Decile 2 occurred, however from Decile 3 and above, there was potential for significant yield to be left in the paddock due to insufficient N. The difference between YPw and nitrogen limited yield (YP_N) at Decile 5 was approximately 0.9 t/ha. Based on the rule of thumb of 40 kg N/ha per tonne of grain, this gap could be covered by adding an additional 36 kg of N/ha (HART BEAT, 2023).

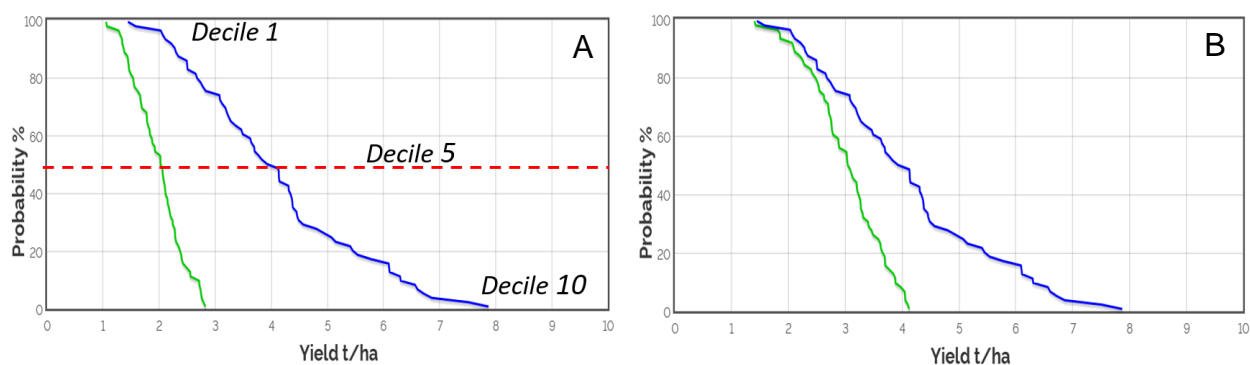


Figure 1. Yield Prophet® Output 1 (Graph A) for the Hart field site on July 14, 2023 for Scepter wheat with no in-crop N applied. This graph shows N responsiveness across all decile outcomes with PYw ranging from 1.5 – 8 t/ha. This output accounts for starting soil N (105 kg N/ha) and seeding N (14.4 kg N/ha). Graph B shows predicted yields after an application of 44 kg N/ha was added.

When a forecasted 22% chance of exceeding average rainfall was considered, the chance of drier deciles increased. The worst-case and best-case scenarios didn't change (-\$67 to +\$283), but the average income (\$/ha) across deciles reduced from \$180/ha to \$113/ha and the chance of a negative partial budget was 18%.

Taking the information above into account, the variety trial received an additional 30 kg N/ha, totalling 74 kg N in nitrogen inputs. In a scenario where more N would be applied, the forecast of 22% chance of below average rainfall reduced profits to only 20% of the time with high downside risk (carry over N not accounted for) (HART BEAT, 2023).

Results and Discussion

Grain yield

Below average spring rainfall was received at Hart in 2023 reducing yield potential, however early moisture received in April and above average rainfall across June (68.4 mm) was favourable to early crop growth. The average grain yield was 3.75 t/ha for all wheat varieties at Hart in 2023, with individual yields ranging from 3.35 – 4.26 t/ha. A number of Australian Premium Hard (APH), Australian Hard (AH) and Australian Premium White (APW) varieties yielded well at Hart, ranging from 3.94 – 4.26 t/ha. This is in contrast to the 2022 season, where durum wheat varieties Bitalli, DBA-Aurora and Patron yielded highest, ranging from 4.61 – 5.14 t/ha in a Decile 8 growing season.

APH variety Sunblade CL Plus performed well, yielding 4.26 t/ha alongside AH varieties Ballista, Calibre, Kingston, Scepter, Vixen and APW varieties Denison and LRPB Trojan. Long-term yield data at Hart shows that Scepter continues to perform well across multiple seasons, yielding similarly or above the annual trial average (Table 3). Newer varieties Sunblade CL Plus, Calibre and Brumby have also performed well across three seasons at Hart. All durum varieties and Australian Standard White (ASW) variety Razor CL Plus performed similarly with yields ranging from 3.63 – 3.68 t/ha. Long-term yield data for Bitalli and DBA-Aurora from 2019 – 2023 at Hart shows these two varieties have performed well across all years trialed (not all data shown).

Grain quality

Wheat grain protein was low at Hart in 2023 with a trial average of 10.5% (Table 2). No varieties met Australian Premium Durum (ADR) or AH receival standards of $\geq 13\%$ (DR1 receival ranges is 13 – 13.5%). Durum varieties Bitalli and DBA-Aurora were the best performing for protein, ranging from 11.5 – 11.8%. Test weights were high, with all varieties achieving > 76 kg/hL. Highest test weights came from AH varieties Kingston, Reilly, Scepter and APW varieties Soaker (LRPB19-6184) and LRPB Trojan achieving 86.2 – 87.1 kg/hL. Screenings were low across the trial with ADR variety Bitalli and AH variety Grenade CL Plus achieving the lowest screenings of 1.6 and 2.4%, respectively, while new APW variety Soaker (LRPB19-6184), in addition to Genie (IGW6754), LRPB Matador, RockStar and Scepter exceeded 5% and did not meet H1 or APW 1 receival standards.

Summary

Despite below average rainfall at Hart in 2023, reasonable grain yields were achieved, with several varieties achieving > 4 t/ha in a Decile 4 (40th percentile) season for both GSR and annual rainfall. In general screenings and protein were low, however test weight was high with all varieties exceeding 76 kg/hL. The only variety meeting maximum receival standards was APW classified variety Chief CL Plus (APW1).



Photo: Hart's 2023 wheat variety trial.

Table 2. Wheat grain yield (t/ha) and quality results at Hart in 2023. Values shaded indicate the best performing varieties in each column.

Quality	Variety	Grain yield (t/ha)	% of site average	Protein %	% of site average	Test weight (kg/hL)	% of site average	Screenings (%)	% of site average
APH	Sunblade CL Plus [Ⓛ]	4.26 ^l	114	10.2 ^{bcd}	96	85.3 ^{d-h}	100	6.6 ⁿ	165
	LRPB Anvil CL Plus [Ⓛ]	3.26 ^a	87	11.0 ^{kl}	104	86.1 ^{lmn}	101	3.9 ^{hij}	99
	Ballista [Ⓛ]	3.99 ^{f-i}	106	9.8 ^a	93	85.9 ^{jm}	101	4.4 ^{jk}	110
	Calibre [Ⓛ]	4.04 ^{g-i}	108	10.1 ^{bcd}	96	85.1 ^{c-i}	100	3.5 ^{c-j}	89
	Catapult [Ⓛ]	3.79 ^{c-h}	101	10.2 ^{b-e}	97	85.2 ^{d-k}	100	3.4 ^{c-i}	84
	LRPB Dual [Ⓛ]	3.72 ^{c-h}	99	11.1 ^{lm}	105	85.9 ^{jm}	101	3.7 ^{g-j}	93
	Grenade CL Plus [Ⓛ]	3.59 ^{a-e}	96	10.7 ^{h-k}	102	83.5 ^a	98	2.4 ^{ab}	60
	Hammer CL Plus [Ⓛ]	3.51 ^{abc}	94	10.7 ^{f-j}	101	86.1 ^{lmn}	101	4.2 ^l	106
	Kingston [Ⓛ]	3.95 ^{f-i}	106	10.5 ^{e-i}	100	87.0 ^o	102	2.6 ^{bcd}	66
	LRPB Scout [Ⓛ]	3.67 ^{b-f}	98	10.0 ^{ab}	95	84.2 ^{ab}	99	4.2 ^l	106
	Reilly [Ⓛ]	3.83 ^{c-h}	102	10.9 ^{kl}	103	87.1 ^o	102	2.7 ^{bcd}	67
	Genie [Ⓛ] (IGW6754)	3.56 ^{a-d}	95	10.7 ^{g-j}	102	85.8 ^{h-m}	100	9.0 ^o	225
	LRPB Matador [Ⓛ]	3.89 ^{d-h}	104	10.3 ^{b-e}	98	84.3 ^{abc}	99	6.0 ^{mn}	150
RockStar [Ⓛ]	3.57 ^{a-d}	95	10.0 ^{ab}	95	84.2 ^{abc}	99	5.1 ^{kl}	128	
Scepter [Ⓛ]	4.06 ^{nl}	108	10.1 ^{abc}	96	86.8 ^{no}	102	5.1 ^{kl}	127	
Valiant CL Plus [Ⓛ]	3.55 ^{a-d}	95	10.9 ^{kl}	104	85.0 ^{b-h}	100	2.6 ^{bc}	66	
Vixen [Ⓛ]	3.94 ^{e-i}	105	10.4 ^{d-h}	99	84.8 ^{b-g}	99	4.0 ^{ij}	102	
<i>H1</i> <i>receiving standard</i>									
APW	Brumby [Ⓛ]	3.89 ^{g-h}	104	≥ 13	97	≥ 76	99	≤ 5	90
	Chief CL Plus [Ⓛ]	3.55 ^{a-d}	95	10.2 ^{bcd}	102	84.7 ^{b-f}	99	3.6 ^{fj}	79
	Dozer CL Plus [Ⓛ] (IGW6783)	3.67 ^{b-f}	98	10.8 ^l	99	84.6 ^{bcd}	99	3.1 ^{b-h}	106
	Soaker [Ⓛ] (LRPB19-6184)	3.70 ^{b-g}	99	10.4 ^{c-g}	98	83.7 ^a	98	4.2 ^l	133
	Denison [Ⓛ]	3.94 ^{e-i}	105	10.3 ^{b-e}	98	87.1 ^o	102	5.3 ^{lm}	90
	LRPB Trojan [Ⓛ]	3.95 ^{f-i}	106	10.2 ^{b-e}	97	85.5 ^{e-m}	100	3.6 ^{fj}	70
	Sheriff CL Plus [Ⓛ]	3.35 ^{ab}	89	10.1 ^{ad}	96	86.2 ^{mno}	101	2.8 ^{b-f}	76
	Mowhawk [Ⓛ]	3.76 ^{c-h}	100	10.3 ^{b-f}	98	85.2 ^{dj}	100	3.0 ^{b-g}	67
<i>APW1</i> <i>receiving standard</i>									
ASW	Razor CL Plus [Ⓛ]	3.68 ^{b-f}	98	≥ 10.5	96	≥ 76	101	≤ 5	102
	ASW1 <i>receiving standard</i>			10.1 ^{abc}		86.1 ^{lmn}		4.1 ^{ij}	
ADR	DBA-Aurora [Ⓛ]	3.67 ^{b-f}	98	NA	109	≥ 76	99	≤ 5	91
	Bitalli [Ⓛ]	3.63 ^{b-f}	97	11.5 ^{no}	112	84.7 ^{b-f}	101	3.6 ^{fj}	40
	Patron [Ⓛ]	3.66 ^{b-f}	98	11.8 ^o	107	86.0 ^{k-n}	99	1.6 ^a	78
	ADR1 <i>receiving standard</i>			11.3 ^{mn}		84.7 ^{b-e}		3.1 ^{b-h}	
<i>Site average</i>									
		3.75	100	10.5	100	85.4	100	4.0	100

Table 3. Long-term wheat variety performance at Hart for 2019 – 2023 seasons (expressed as a % of trial average).

Quality	Variety	% Trial average					Grain yield (t/ha)	
		2019	2020	2021	2022	2023	2023	
APH	Sunblade CL Plus ^(D)			105	111	114	4.26	
	LRPB Anvil CL Plus ^(D)			105	81	87	3.26	
	Ballista ^(D)		95	100	108	106	3.99	
	Calibre ^(D)			112	99	108	4.04	
	Catapult ^(D)	97	107	96	105	101	3.79	
	LRPB Duak ^(D)					99	3.72	
	Grenade CL Plus ^(D)	93	93	93	97	96	3.59	
	Hammer CL Plus ^(D)		106	108	89	94	3.51	
	AH	Kingston ^(D)			101	95	106	3.95
		LRPB Scout ^(D)	107	106	86	101	98	3.67
		Reilly ^(D)				102	102	3.83
		Genie ^(D) (IGW6754)					95	3.56
		LRPB Matador ^(D)					104	3.89
		RockStar ^(D)	104	108	80	107	95	3.57
		Scepter ^(D)	106	101	113	100	108	4.06
		Valiant CL Plus ^(D)			93	100	95	3.55
Vixen ^(D)		111	109	130	96	105	3.94	
APW		Brumby ^(D)			115	104	104	3.89
	Chief CL Plus ^(D)	85	113	102	85	95	3.55	
	Dozer CL Plus ^(D) (IGW6783)					98	3.67	
	Soaker ^(D) (LRPB19-6184)					99	3.70	
	Denison ^(D)			86	110	105	3.94	
	LRPB Trojan ^(D)	102	94	93	105	106	3.95	
	Sheriff CL Plus ^(D)	96	100	107	96	89	3.35	
	Mowhawk ^(D)					100	3.76	
ASW	Razor CL Plus ^(D)	109	98	111	94	98	3.68	
ADR	DBA-Aurora ^(D)				109	98	3.67	
	Bitalli ^(D)				106	97	3.63	
	Patron ^(D)				124	98	3.66	
Trial average yield t/ha		1.50	2.50	2.03	4.40	3.75		
Sowing date		May 15	May 6	May 3	May 5	May 12		
Apr-Oct rain (mm)		162	336	232	355	236		
Annual rain (mm)		189	503	401	519	355		

Acknowledgements

The Hart Field-Site Group would like to acknowledge the generous support of our sponsors who provide funding that allows us to conduct this trial. Proceeds from Hart's ongoing commercial crop also support Hart's research and extension program.

We would also like to thank InterGrain, AGT, LongReach and Seednet for providing seed to conduct this trial.



References

HART BEAT (2023). Available online: www.hartfieldsite.org.au