Final Technical Results Report

2024

NGN- Winter wheat investigation on the Southcoast of WA

Project code: FAR2403-001SAX

Prepared by: Nick Poole, Deeptangshu Das & Darcy Warren

Nick.poole@faraustralia.com.au
Deep.das@faraustralia.com.au
Darcy.warren@faraustralia.com.au

Field Applied Research (FAR) Australia
Website: http://www.faraustralia.com.au

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Values in tables and figures with different letters are statistically different. Non-significant LSD figures displayed as 'ns'.

PROJECT OBJECTIVES

This one-year project was set to evaluate the role of winter wheat in WA M-HRZ farming systems of the south coast (Esperance and Albany Port Zones). Specifically, the project looked to evaluate the performance and profitability of winter wheat sown in the late March/early April sowing window. Individual objectives of the project were as follows:

- To examine the role of winter wheat in rotations along the south coast of WA in the Esperance and Albany Port Zones compared to spring wheat germplasm.
- To explore this possible role of winter wheat in relation to sowing date and spring wheat germplasm with different phenology (quicker and slower developing spring wheats).
- At the different sow dates covering late March/early April and late April/May comparing profitability and performance of these wheats to spring barley germplasm.
- To evaluate the different management needs of winter wheat in relation to the other cereal groups being tested.

METHODOLOGY

To address the objectives of the project four sowing date trials were established across the south coast of WA, two in the Albany port zone and two in the Esperance port zone.

In the Esperance port zone, the main site was in the high rainfall zone (HRZ) at Gibson on sandplain with the satellite site at Scaddan in the medium rainfall zone (MRZ) on sand over clay. In the Albany port zone HRZ, the main site was established at Frankland River on a forest gravel over clay with a satellite site in South Stirling.

At each site six wheat varieties based on winter and spring types were compared to the performance of two spring barley varieties. At all sites these comparisons were made at two times of sowing (TOS); late March/early April and late April. At the Gibson site a third sowing date was established in mid-May.

Winter wheats tested – RGT Waugh (long season – slow winter), Illabo (short season - quick winter), Mowhawk (short season - quick winter).

Spring wheats tested – Denison (slow spring), RockStar (mid-slow spring), Scepter (mid maturity spring). Vixen (quick spring) was only tested in TOS 3 at Gibson.

Spring barley tested – Neo CL (mid-season type), RGT Planet (mid-season type)

i) Locations, sowing date details, emergence, plot dimensions & row spacing and irrigation for establishment

Exceptionally dry conditions across the entire WA south coast region resulted in all four trials being irrigated for the first sowing date in late March/early April so that emergence was relevant to that sowing date. All subsequent sowing dates at the four trial sites were not irrigated.

Trial 1. Esperance Port Zone Main (FAR WAE W24-01)

Trial Location:	**Gibson**	
Sowing Dates:	**TOS 1:**	26-Mar (emergence 2 April)
	TOS 2:	23-April (emergence 4-10 May)
	TOS 3:	10-May (emergence 20-25 May)
Irrigation	15mm (TOS 1)	
Rainfall Zone:	HRZ	
Seed rate:	All plots established at 200 seeds/m2	

Image 1. Gibson TOS 1 plots. GS 31 growth stage, taken on 1 June 2024. Variety: Scepter TOS 3 (10 May) had not fully emerged.

Image 2. Gibson TOS 2 plots. Tillering growth stage, taken on 1 June 2024. Variety: Scepter

Trial 2. Esperance Port Zone Satellite (FAR WAE W24-02)

Trial Location:	**Scaddan**
Sowing Dates:	**TOS 1:** 26-Mar (approx. emergence 2 April)
	TOS 2: 23-April (emergence 4-10 May)
Irrigation	15mm (TOS 1)
Rainfall Zone:	MRZ
Seed rate:	All plots established at 200 seeds/m2

Image 3. Scaddan TOS 1 plots. GS39 growth stage, taken on 1 June 2024.Variety: Scepter

Image 4. Scaddan TOS 2 plots. GS14 growth stage, taken on 1 June 2024.Variety: Scepter

Trial 3. Albany Port Zone Main (FAR WAA W24-03)

Trial Location	**Frankland River**
Sowing Dates:	**TOS 1:** 2-Apr (emergence 9-10 April)
	TOS 2: 29- April (emergence 17-20 May)
Irrigation	15mm (TOS 1)
Rainfall Zone:	HRZ
Seed rate:	All plots established at 200 seeds/m2

Image 5. Frankland River TOS 1 plots. Tillering growth stage, taken on 28 May 2024.

Image 6. Frankland River TOS 2 plots. GS13, taken on 28 May 2024.

Trial 4. Albany Port Zone Satellite (FAR WAA W24-04)

Trial Location	**Green Range**
Sowing Dates:	**TOS 1:** 3-Apr (approx. emergence 9-11 April)
	TOS 2: 29-April (emergence 17 - 20 May)
Irrigation	15mm (TOS 1)
Rainfall Zone:	HRZ
Seed rate:	All plots established at 200 seeds/m2

Image 7. Green Range TOS 1 plots. Tillering growth stage, taken on 27 May 2024.

Image 8. Green Range TOS 2 plots. GS 14 growth stage, taken on 27 May 2024.

ii) Crop management

All sowing dates in the four trials were subject to the same level of agronomic input in terms basal fertiliser, overall nitrogen and agrichemical input, although the enormous range in phenology (see results section) meant the timings of products varied on occasions, particularly disease management. However, with an extremely dry season foliar disease was not a key factor in the overall results, although net form net blotch (NFNB) was particularly prevalent in the early sown barley. See Appendix for overall inputs applied to the four trial sites.

RESULTS

Site 1. Gibson

Sown: TOS 1- 26 March 2024 TOS 2- 23 April 2024 TOS 3- 10 May 2024
Harvested: Barley- 4 November Wheat- 29 November 2024
R**otation position:** 2023 Canola
Soil type: Loamy Sand (Deep ripped 2022)
FAR code: FAR WAE W24-01

Key Points

- *With extremely dry conditions until late May this site despite its location in the HRZ this site was the lowest yielding with generally lower plant numbers established from the first two sowings.*
- *Mowhawk winter wheat was the highest yielding wheat at the late March sowing date and although it was not significantly better than the longer season spring wheats RockStar and Denison all were significantly better than Illabo.*
- *The grain yield of both spring barley varieties was significantly better than all the wheat types tested with Neo CL giving a yield 2t/ha better than wheat.*
- *As was found in previous studies with RGT Accroc, the longer season wheat RGT Waugh was not suitable for planting in the EPZ flowering a month after the optimum flowering window.*
- *There was a significant interaction ($p<0.001$) between sowing date and variety with late April sowings (23 April) being higher yielding than late March sowings, except Mowhawk.*
- *The third time of sowing (10 May) gave similar yields to those crops established in late April.*
- *Higher yields of barley were reflected in higher harvest dry matters and harvest indices.*
- *Neither spring barley nor spring wheat was adapted to the early sowing date with crops flowering in the middle of winter (June/July), compared to winter wheats, which flowered much later in mid-late August.*
- *However, although main stem growth was poor because of the early sowing, good rainfall in August underpinned renewed tillering in the spring germplasm (both wheat and barley) that compensated and ultimately supported crops that were higher yielding and had a phenology that was more suited to optimum flowering windows.*
- *The tiller compensation in spring wheat produced head numbers that were not dissimilar to winter wheat crops sown at the same time.*
- *In contrast the compensation observed in spring barley that led to higher harvest dry matter and harvest indices was manifest in significantly higher head numbers than those produced by the wheat types tested.*
- *Grain quality produced primarily feed grain quality products, with test weights being primarily responsible for poorer grades in both wheat and barley.*
- *Spring barley despite its poor adaptation to late March sowing in terms of phenology was the more profitable crop sown at this site, although its overall profitability was better when sowing was delayed until late April or mid-May.*

Table 1. Influence of time of sowing (TOS 1 and 2) and variety on grain yield (t/ha). Harvested: Barley- 4 November Wheat- 29 November 2024.

	Management Level		
Variety	**TOS 1**	**TOS 2**	**Mean**
	Yield (t/ha)	**Yield (t/ha)**	**Yield (t/ha)**
Illabo	2.06 h	2.68 ef	**2.37 d**
Mowhawk	2.92 ef	3.01 e	**2.97 c**
Denison	2.52 fg	3.72 d	**3.12 c**
RGT Waugh	0.62 j	1.45 i	**1.04 e**
Scepter	2.17 gh	3.84 cd	**3.01 c**
RockStar	2.59 efg	3.85 cd	**3.22 c**
Neo CL (spring barley)	4.95 b	5.77 a	**5.36 a**
RGT Planet (spring barley)	4.23 c	4.86 b	**4.54 b**
Mean	**2.76 b**	**3.65 a**	**3.20**
LSD Variety p = 0.05	0.25	**P value**	<0.001
LSD TOS p = 0.05	0.55	**P value**	0.014
LSD Variety x TOS. p = 0.05	0.44	**P value**	<0.001

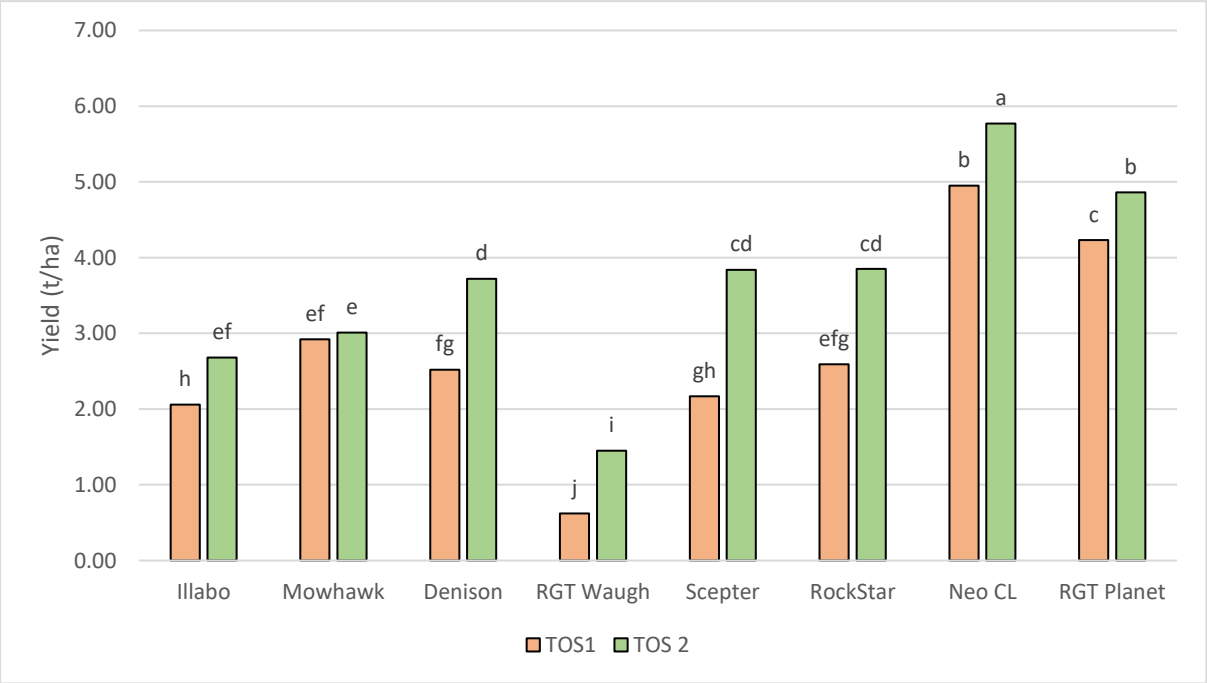

Figure 1. Influence of Time of sowing (TOS1 and TOS2) and variety on yield (t/ha). Harvested: Barley- 4 November, Wheat- 29 November 2024.

Table 2. Influence of time of sowing (TOS 1, TOS 2 and TOS 3) and variety on grain yield (t/ha). Harvested: Barley- 4 November Wheat- 29 November 2024.

	Management Level			
Variety	**TOS 1**	**TOS 2**	**TOS 3**	**Mean**
	Yield (t/ha)	**Yield (t/ha)**	**Yield (t/ha)**	**Yield (t/ha)**
Mowhawk	2.92 ef	3.01 e	2.51 gh	**2.81 d**
Denison	2.52 g	3.72 d	3.62 d	**3.29 c**
Scepter	2.17 h	3.84 d	3.86 d	**3.29 c**
RockStar	2.59 fg	3.85 d	3.95 cd	**3.46 c**
Neo CL (spring barley)	4.95 b	5.77 a	5.87 a	**5.53 a**
RGT Planet (spring barley)	4.23 c	4.86 b	5.15 b	**4.75 b**
Mean	**3.23 b**	**4.18 a**	**4.16 a**	**3.85**
LSD Variety p = 0.05	0.20	**P value**	<0.001	
LSD TOS p = 0.05	0.39	**P value**	0.003	
LSD Variety x TOS. p = 0.05	0.35	**P value**	<0.001	

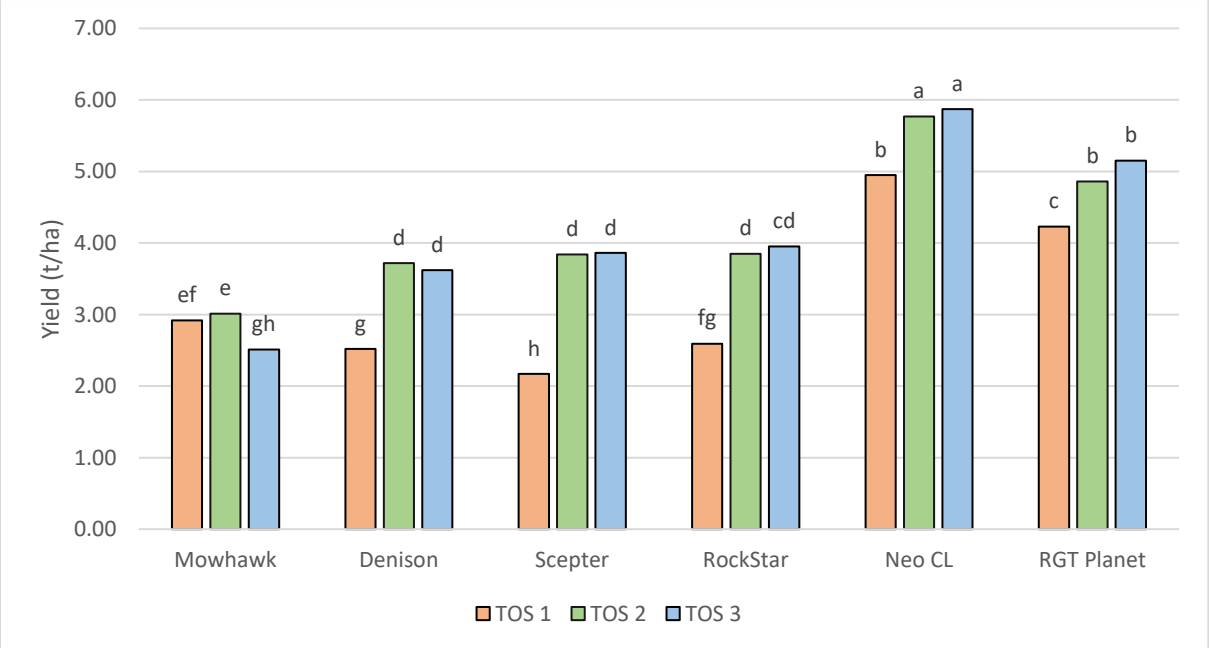

Figure 2. Influence of time of sowing (TOS1, TOS2 and TOS3) and variety on yield (t/ha). Harvested: Barley- 4 November Wheat- 29 November 2024. Note Vixen yield at TOS was 3.89t/ha.

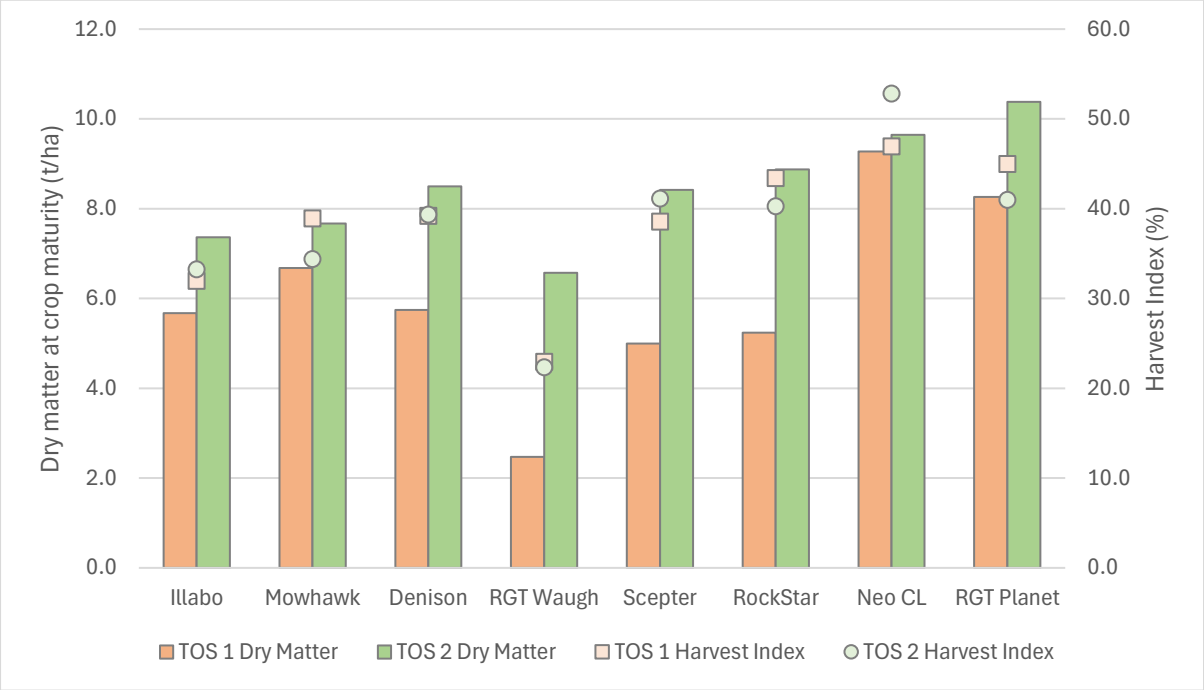

Figure 3. Influence of time of sowing (TOS) and variety on dry matter production (t/ha) assessed at crop maturity (GS 89) and harvest index (%).

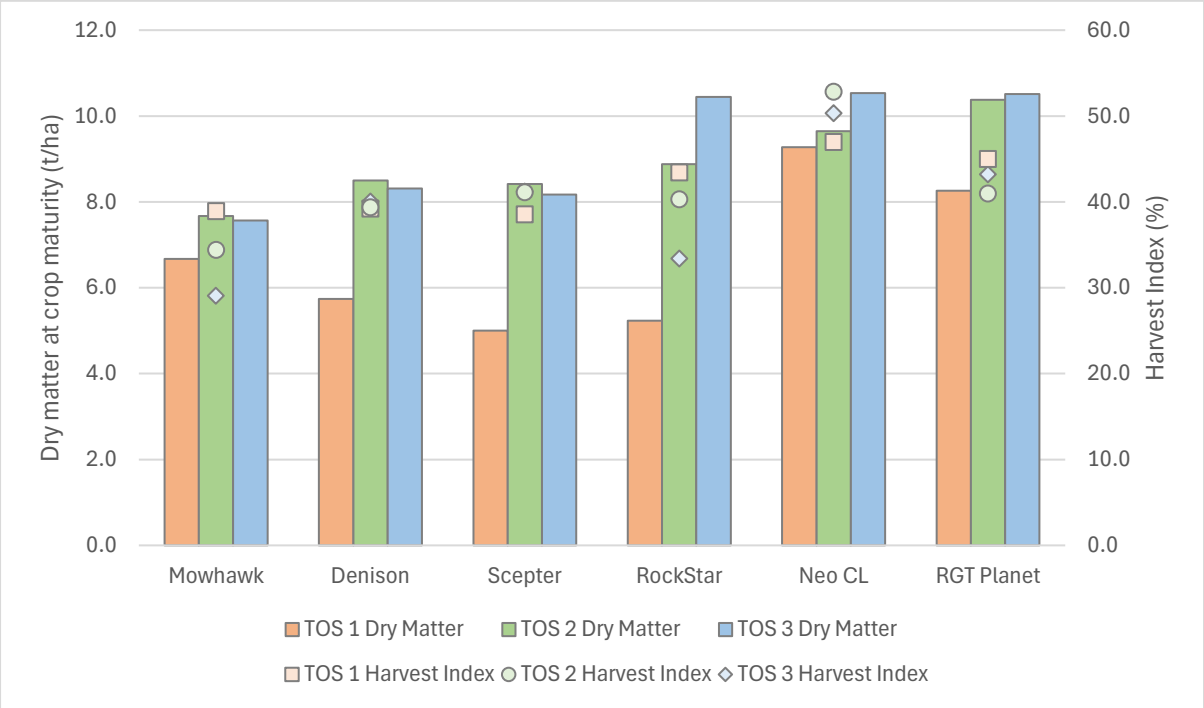

Figure 4. Influence of time of sowing (TOS) and variety on dry matter production (t/ha) assessed at crop maturity (GS 89) and harvest index (%).

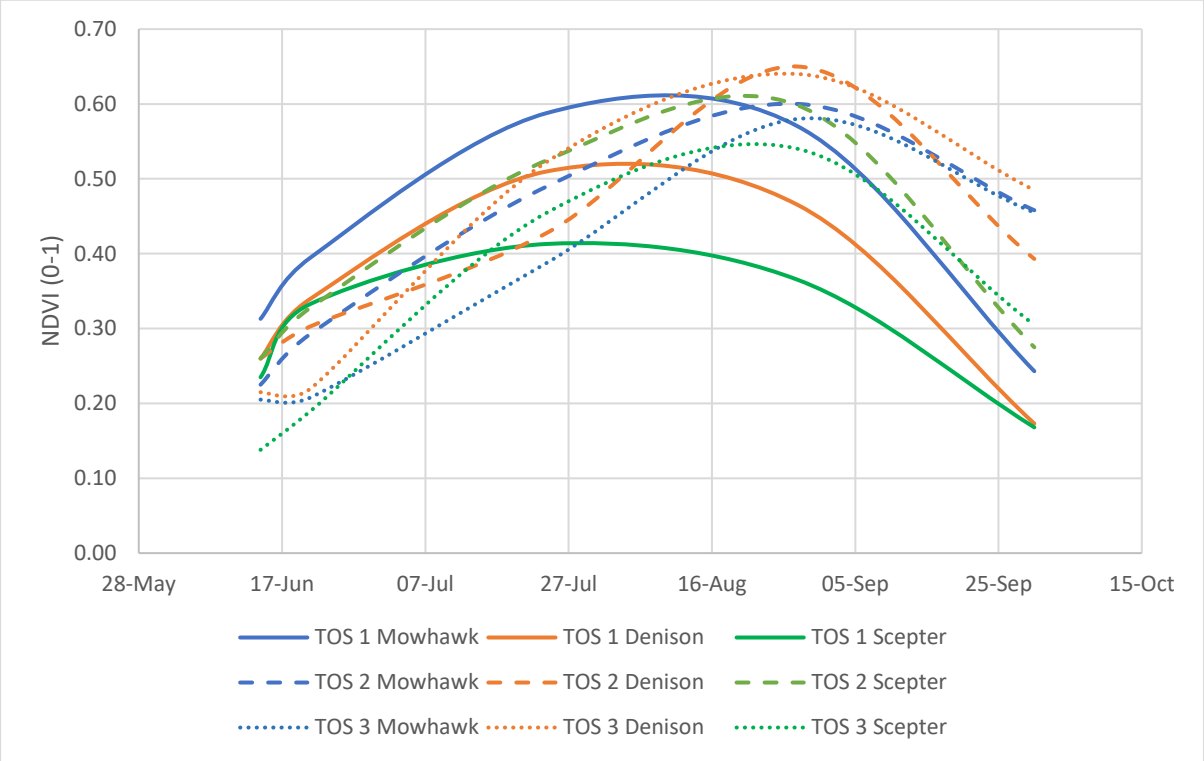

Figure 5. Influence of time of sowing (TOS) and variety on Normalized Difference Vegetation Index (NDVI) (0-1).

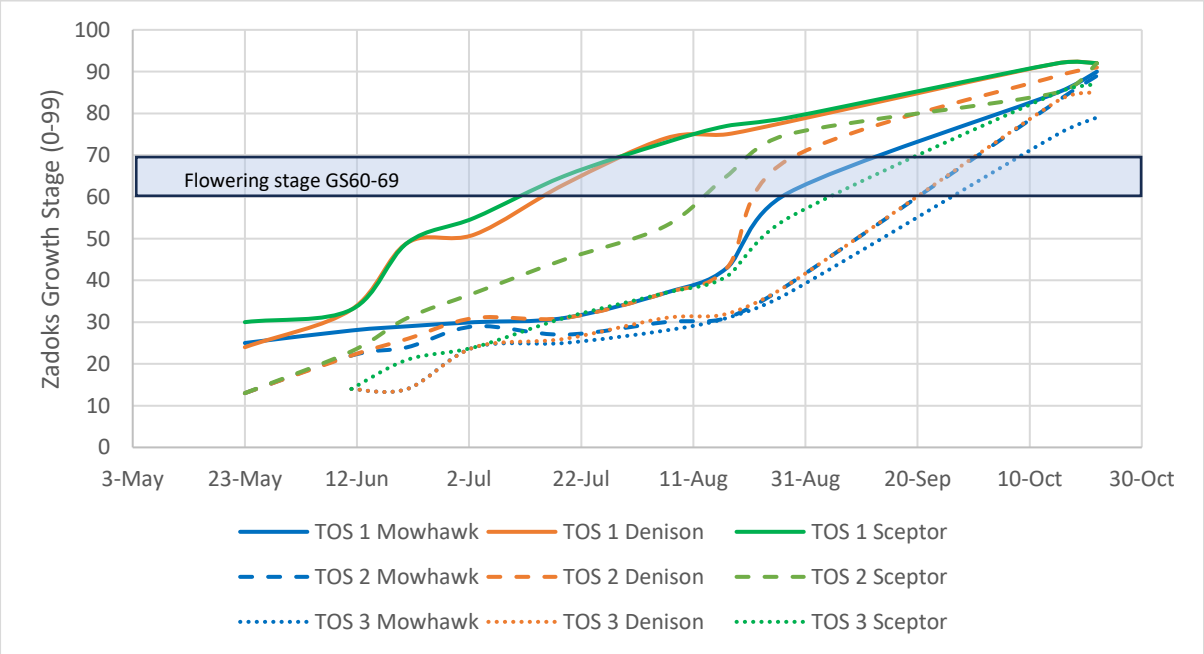

Figure 6. Influence of time of sowing (TOS) and variety on phenology (Zadoks Growth Stage 0-99)

Table 3. Influence of time of sowing (TOS) and variety on crop emergence, number of tillers and number of mature heads (LSD P=0.05).

		Management Level		
		Plants (m^2)	**Tillers (m^2)**	**Heads (m^2)**
TOS 1(26 March)	Mowhawk	41.1 -	274.4 bcd	250.0 cde
	Denison	49.4 -	240.6 cd	224.4 cde
	Scepter	49.4 -	191.1 d	221.7 cde
	RockStar	42.8 -	212.8 d	229.4 cde
	Neo CL	41.1 -	436.1 ab	501.1 a
	RGT Planet	48.9 -	516.7 a	517.8 a
	Mean	**45.5 b**	**311.9 -**	**324.1 -**
TOS 2(23 April)	Mowhawk	24.4 -	450.6 ab	240.7 cde
	Denison	27.8 -	185.6 d	277.8 c
	Scepter	37.8 -	187.4 d	199.4 de
	RockStar	36.7 -	179.4 d	198.5 de
	Neo CL	34.4 -	442.2 ab	503.9 a
	RGT Planet	38.9 -	316.3 bcd	508.9 a
	Mean	**33.3 b**	**293.6 -**	**321.5 -**
TOS 3(10 May)	Mowhawk	51.7 -	283.3 bcd	183.3 e
	Denison	113.3 -	400.6 abc	280.6 c
	Scepter	85.2 -	279.3 bcd	235.6 cde
	RockStar	89.4 -	399.4 abc	261.1 cd
	Neo CL	107.2 -	415.0 abc	376.1 b
	RGT Planet	88.3 -	345.6 a-d	467.2 a
	Mean	**89.2 a**	**353.9 -**	**300.6 -**
Variety LSD (p=0.05)		14.6	101.9	43.4
TOS LSD (p=0.05)		14.1	ns	ns
Var. x TOS. LSD (p=0.05)		ns	176.5	75.3
Variety P Value		0.025	0.001	<0.001
TOS P Value		<0.001	0.179	0.679
Var. x TOS.P Vale		0.077	0.026	0.019

Table 4 Influence of Time of sowing (TOS) and variety on the grain protein (%) and test weights (kg/hL).

	Management Level		
Variety	**TOS 1**	**TOS 2**	**Mean**
	Protein (%)	**Protein (%)**	**Protein (%)**
Illabo	12.6 -	11.6 -	**12.1 bc**
Mowhawk	12.2 -	11.9 -	**12.0 bc**
Denison	14.3 -	10.8 -	**12.5 bc**
RGT Waugh	14.1 -	14.0 -	**14.0 a**
Scepter	13.2 -	11.1 -	**12.2 bc**
RockStar	12.3 -	10.8 -	**11.5 c**
Neo CL	12.8 -	12.9 -	**12.9 b**
RGT Planet	12.8 -	12.8 -	**12.8 b**
Mean	**13.0 a**	**12.0 b**	**12.5**
LSD Variety p = 0.05	1.1	**P value**	0.025
LSD TOS p = 0.05	0.8	**P value**	0.028
LSD Variety x TOS. p = 0.05	ns	**P value**	0.090

Table 5. Influence of Time of sowing (TOS) and variety on the grain test weights (kg/hL).

	Management Level		
Variety	**TOS 1**	**TOS 2**	**Mean**
	Test weights (kg/hL)	**Test weights (kg/hL)**	**Test weights (kg/hL)**
Illabo	62.0 -	65.8 -	**63.9 b**
Mowhawk	65.2 -	71.1 -	**68.1 a**
Denison	65.8 -	70.8 -	**68.3 a**
RGT Waugh	57.5 -	67.0 -	**62.3 bc**
Scepter	63.8 -	69.4 -	**66.6 a**
RockStar	64.0 -	71.0 -	**67.5 a**
Neo CL	58.8 -	60.1 -	**59.4 d**
RGT Planet	59.2 -	61.3 -	**60.3 cd**
Mean	**62.0 -**	**67.1 -**	**64.5**
LSD Variety p = 0.05	2.5	**P value**	<0.001
LSD TOS p = 0.05	ns	**P value**	0.066
LSD Variety x TOS. p = 0.05	ns	**P value**	0.184

Table 6. Influence of Time of sowing (TOS) and barley variety on retention (% > 2.5mm).

		Management Level		
Variety	TOS 1	TOS 2	TOS 3	Mean
	Retention (%)	**Retention (%)**	**Retention (%)**	**Retention (%)**
Neo CL	82.9 -	87.1 -	85.5 -	**85.2 a**
RGT Planet	77.7 -	77.6 -	70.9 -	**75.4 b**
Mean	**62.0 b**	**67.1 a**	**67.9 a**	**66.0**
LSD Variety p = 0.05	5.4	**P value**		0.003
LSD TOS p = 0.05	ns	**P value**		0.540
LSD Var. x TOS. p = 0.05	ns	**P value**		0.328

Table 7. Influence of Time of sowing (TOS) and variety screenings (% < 2.2mm).

	Management Level		
Variety	TOS 1	TOS 2	Mean
	Screenings (%)	**Screenings (%)**	**Screenings (%)**
Illabo	3.0 -	2.3 -	**2.7 d**
Mowhawk	4.9 -	4.0 -	**4.4 ab**
Denison	4.3 -	3.3 -	**3.8 bc**
RGT Waugh	4.5 -	1.5 -	**3.0 cd**
Scepter	3.6 -	2.5 -	**3.0 cd**
RockStar	4.0 -	2.6 -	**3.3 cd**
Neo CL	4.5 -	3.0 -	**3.8 bc**
RGT Planet	6.1 -	4.3 -	**5.2 a**
Mean	**4.4 a**	**2.9 b**	**3.7**
LSD Variety p = 0.05	0.8	**P value**	<0.001
LSD TOS p = 0.05	1.0	**P value**	0.020
LSD Variety x TOS. p = 0.05	ns	**P value**	0.438

Table 8. Influence of Time of sowing (TOS) and variety on phenology (Zadoks Growth stage 00-99).

		23-May	11-Jun	21-Jun	3-Jul	19-Jul	6-Aug	17-Aug	28-Aug	15-Oct	22-Oct
TOS 1 (26 March)	Illabo	25	28	30	31	31	37	41	57	85	91
	Mowhawk	25	28	29	30	31	37	43	61	85	90
	Denison	24	33	49	51	63	74	75	78	92	92
	RGT Waugh	24	28	30	30	30	30	30	30	63	65
	Scepter	30	33	49	55	65	73	77	79	92	92
	RockStar	30	33	49	56	59	71	73	79	92	92
	Neo CL	30	33	51	55	55	73	75	77	92	92
	RGT Planet	31	44	45	51	55	73	73	77	92	92
TOS 2 (23 April)	Illabo	13	23	25	28	28	30	31	37	83	85
	Mowhawk	13	22	24	29	27	30	31	39	83	89
	Denison	13	22	26	31	31	37	43	69	89	91
	RGT Waugh	13	22	28	29	29	29	29	30	51	57
	Scepter	13	23	31	37	45	53	65	75	85	92
	RockStar	13	23	26	31	31	43	55	73	87	89
	Neo CL	13	24	27	30	32	43	53	71	91	92
	RGT Planet	13	22	27	30	32	37	45	61	92	92
TOS 3 (10 May)	Mowhawk	-	14	14	24	25	28	31	37	75	79
	Denison	-	14	14	24	26	31	32	39	83	85
	Vixen	-	14	21	30	32	39	53	71	85	89
	Scepter	-	14	21	24	31	37	41	55	85	87
	RockStar	-	14	21	24	25	31	32	45	85	87
	Neo CL	-	14	21	25	31	33	41	55	90	92
	RGT Planet	-	14	22	25	31	32	41	51	85	91

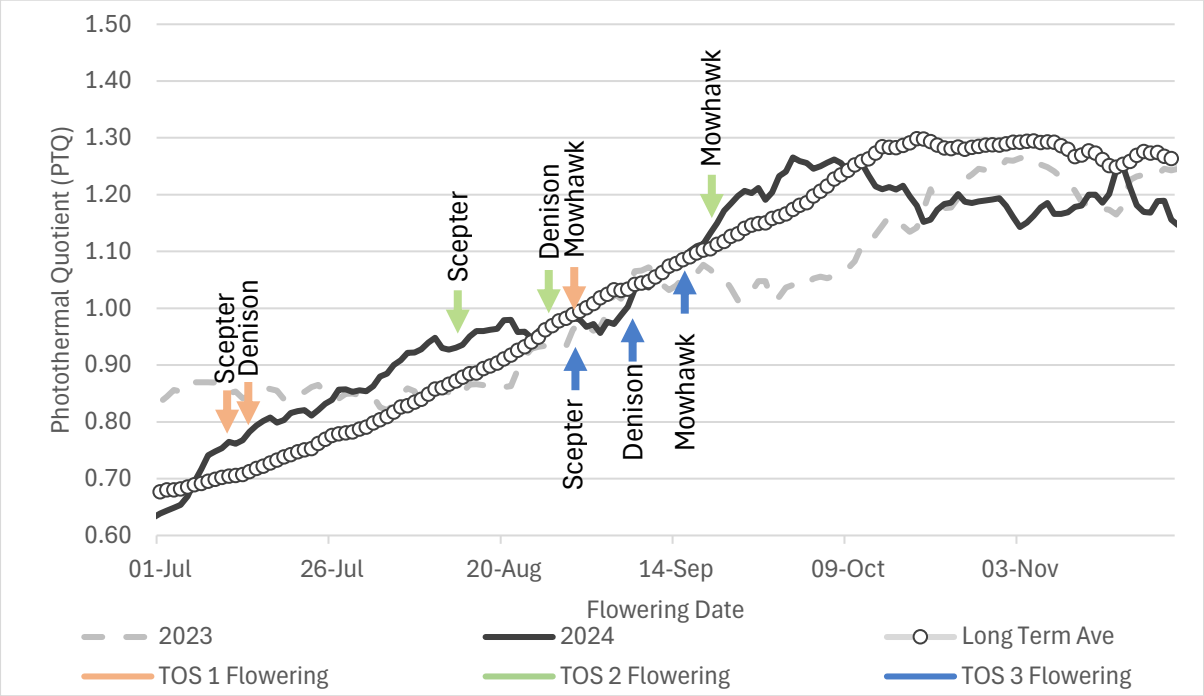

Figure 7. Photothermal Quotient (PTQ) for 2024, 2023 and the long-term average at Esperance Aero (1991-2024) in relation to the 2024 estimated flowering dates of Scepter, Denison and Mowhawk at all three times of sowing.

Note: If soil water is non limiting higher PTQ values (solar radiation divided by mean daily temperature) are associated with more crop growth which in the period of approximately three weeks prior to flowering is associated higher grain number and as a consequence higher yield potential. Therefore higher PTQ equal higher yields provided other stresses don't override the realtionship e.g.heat stress, frost, drought stress.

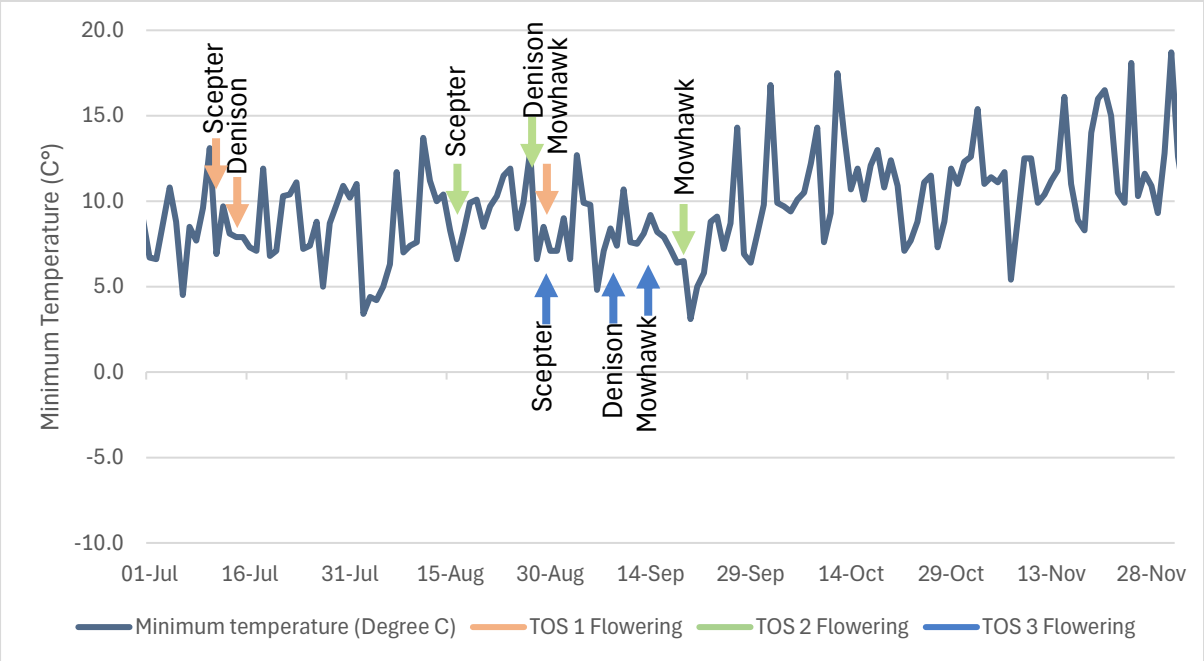

Figure 8. Daily minimum temperature (C°) in 2024 at Esperance Aero (1991-2024) in relation to the 2024 estimated flowering dates of Scepter, Denison and Mowhawk at all three times of sowing.

Table 9. Influence of time of sowing (TOS) and variety on partial gross margin and total input & application costs. Grain prices (FED1 $320, AUH1 $335, AUN1 $335, ANW1 $335 & BFED1 $328) based off Cargill 2024/25 season Esperance zone rates.

		Yield (t/ha)	Grade	Income ($)	Cost ($)	Partial Gross margin ($/ha)
TOS 1	Illabo	2.06	FED1	$659	$580	$79
	Mowhawk	2.92	FED1	$934	$577	$358
	Denison	2.52	FED1	$807	$578	$229
	RGT Waugh	0.62	FED1	$199	$579	-$380
	Scepter	2.17	FED1	$695	$579	$116
	RockStar	2.59	FED1	$827	$579	$248
	Neo CL	4.95	BFED1	$1,625	$580	$1,044
	RGT Planet	4.23	BFED1	$1,386	$579	$807
TOS 2	Illabo	2.68	FED1	$859	$580	$279
	Mowhawk	3.01	AWW2	$1,009	$577	$433
	Denison	3.72	AWW2	$1,245	$578	$666
	RGT Waugh	1.45	FED1	$464	$579	-$115
	Scepter	3.84	AWW2	$1,287	$579	$708
	RockStar	3.85	AWW2	$1,288	$579	$709
	Neo CL	5.77	BFED1	$1,893	$580	$1,312
	RGT Planet	4.86	BFED1	$1,595	$579	$1,016
TOS 3	Mowhawk	2.51	AWW2	$839	$577	$262
	Denison	3.62	AWW2	$1,213	$578	$634
	Scepter	3.86	AWW2	$1,292	$579	$713
	RockStar	3.95	AWW2	$1,324	$579	$745
	Neo CL	5.87	BFED1	$1,924	$580	$1,343
	RGT Planet	5.15	BFED1	$1,689	$579	$1,110

Table 10. Trial input and management details (kg, g, ml/ha).

Sowing date:		**TOS 1- 26 March 2024; TOS 2- 23 April 2024; TOS 3- 10 May 2024**	
Harvest date:		**Barley- 4 November; Wheat- 29 November 2024**	
Seed rate:		200 seeds/m2	
Irrigation at sowing:	TOS 1	15mm	
Basal fertiliser:	10 May	125 kg MAP (28.5kg P/ha & 13.75kg N/ha)	
		Product	**Active ingredient and rate**
Pre-em herbicide:	9 May	TriflurX 2.00 L/ha	Trifluralin 960 g ai/ha
		Overwatch 1.25 L/ha	Bixlozone 500 g ai/ha
Post-em herbicide:	31 July	LVE MCPA 570 0.4 L/ha	MCPA 228 g ai/ha
		Clopyralid 750 SG 40 g/ha	Clopyralid 30 g ai/ha
Insecticide:	31 July	Trojan 0.012 L/ha	Gamma-Cyhalothrin 1.8 g ai/ha
Fungicide:	GS31	Prosaro 0.3 L/ha	Prothioconazole 63 g ai/ha
			Tebuconazole 63 g ai/ha
	GS39	Aviator Xpro 0.5 L/ha	Bixafen 37.5 g ai/ha
			Prothioconazole 75 g ai/ha
Nutrition:	18 June	140 kg urea/ha (64.4 kg N/ha)	
	31 July	Verno Copper 10 g/ha	
	20 July	160 kg urea/ha (73.6 kg N/ha)	

Site 2. Scaddan

Sown: TOS 1: 26-March TOS 2: 23-April
Harvested: Barley:12-Nov; Main Season Wheat: 13-Nov; RGT Waugh:18-Dec
Rotation position: 2023 Field peas
Soil type: Shallow sand over clay duplex soil (Deep ripped 2020)
FAR code: FAR WAE W24-02

Key Points

- *A similar season was experienced at the Scaddan research site with dry conditions until the last days of May and the first sowing date established with 15mm of irrigation.*
- *The second sowing date on 23 April was in general higher yielding and more profitable than 26 March but the significant interaction (p=0.001) between variety and sowing date illustrated that varieties responded differently to later sowing.*
- *Winter wheat yields did not improve at the second sowing date that emerged in May, whilst in contrast spring barley and wheat gave generally higher yields at the second sowing.*
- *Winter wheat (Mowhawk) yielded similarly (4.45t/ha) to the longer season spring types RockStar (4.31t/ha) and Denison (4.38t/ha) when sown in late March and gave similar profitability (note the winter wheat was not grazed in these experiments).*
- *Spring barley was again higher yielding than the wheat at both sowing dates, but the advantage of barley was smaller and profitability differences much smaller at both sowing dates.*
- *With the drier season at Scaddan compared to Gibson (April to October 196mm vs. 278.6mm) head numbers were slightly lower overall but spring barley tiller regrowth again led to significantly higher head numbers with RGT Planet and Neo CL than those observed in wheat.*
- *In general phenology observations illustrated that spring germplasm both barley and wheat were poorly adapted to late March sowing with flowering of the main stems occurring in June and July.*
- *However, results illustrated that these spring types compensated with their later forming tillers and had a protracted period of flowering that led to a "secondary crop" that was more in synchrony with the season in terms of light interception and spring temperatures.*
- *Grain quality was in general better at Scaddan than Gibson was higher test weights leading to better bin grades as a consequence the profitability of wheat and barley was better matched at this site.*
- *Although slower developing spring types such as Denison was later to flower than Scepter when planted in late March, it was still flowering too early (late July) and was equally just as dependent on the compensatory later tillers to support the grain yields produced.*
- *The long season wheat RGT Waugh did not flower until mid-October and with exceptionally dry conditions and above average temperatures in October produced less than 1t/ha.*
- *Overall, the highest yielding and most profitable cereal crop was Neo CL sown 23 April (emerging in mid-May) because of yields that were 0.76t/ha higher than the best wheat (Scepter 5.08t/ha).*
- *The margin advantage of Neo CL over Scepter at this second sowing date was relatively small ($27/ha) since the bin grade of Neo CL was classed as feed whilst the Scepter made APW1.*

Table 1. Influence of time of sowing (TOS) and variety on grain yield (t/ha). Harvested: Barley- 12 November; Main Season Wheat- 13-November; RGT Waugh- 18 December.

Variety	TOS 1	TOS 2	Mean
	Yield (t/ha)	Yield (t/ha)	Yield (t/ha)
Illabo*	3.40		
Mowhawk	4.45 de	3.51 f	**3.98 d**
Denison	4.38 de	4.46 de	**4.42 c**
RGT Waugh	0.87 g	0.90 g	**0.89 e**
Scepter	3.98 ef	5.08 bc	**4.53 c**
RockStar	4.31 de	4.57 cde	**4.44 c**
Neo CL (spring barley)	5.07 bc	5.84 a	**5.46 a**
RGT Planet (spring barley)	4.78 bcd	5.25 ab	**5.01 b**
Mean	**3.91 b**	**4.23 a**	**4.10**
LSD Variety p = 0.05	0.42	**P value**	<0.001
LSD TOS p = 0.05	0.23	**P value**	0.046
LSD Variety x TOS. p = 0.05	0.60	**P value**	0.001

**Illabo data excluded from statistical analysis*

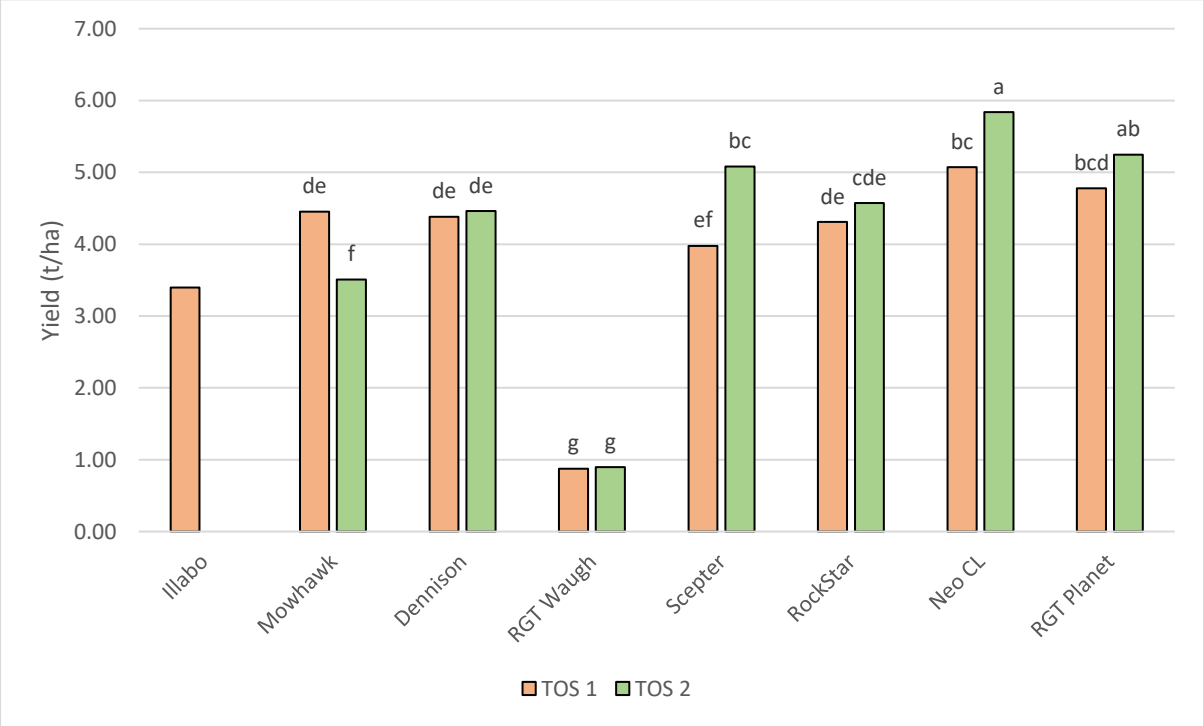

Figure 1. Influence of Time of sowing (TOS) and variety on yield (t/ha). Harvested: Barley- 12 November; Main Season Wheat- 13-November; RGT Waugh- 18 December.

Table 2. Influence of Time of sowing (TOS) and variety on plant emergence (m^2) as GS12 and head numbers (m^2) assessed at crop maturity (GS 89).

		Management Level			
		Plants (m^2)		Tillers (m^2)	
TOS 1(26 March)	Mowhawk	51.7 -		231.7	e
	Denison	66.7 -		202.2	e
	RGT Waugh	63.3 -		136.7	f
	Scepter	46.7 -		185.0	ef
	RockStar	49.4 -		211.1	e
	Neo CL	63.3 -		512.2	a
	RGT Planet	65.0 -		496.7	a
	Mean	**58.0**	**b**	**282.2**	**b**
TOS 2(23 April)	Mowhawk	93.3 -		336.7	cd
	Denison	126.1 -		337.8	cd
	RGT Waugh	106.1 -		193.9	ef
	Scepter	112.8 -		348.3	cd
	RockStar	98.9 -		322.2	d
	Neo CL	127.8 -		416.1	b
	RGT Planet	113.9 -		395.0	bc
	Mean	**111.3**	**a**	**335.7**	**a**
Variety		**LSD** ns	**P Val** 0.111	**LSD** 45.9	**P Val** <0.001
TOS		**LSD** 15.9	**P Val** 0.002	**LSD** 47.4	**P Val** 0.044
Var. x TOS.		**LSD** ns	**P Val** 0.799	**LSD** 64.9	**P Val** <0.001

Table 3 Influence of Time of sowing (TOS) and variety on the grain protein (%) and test weights (kg/hL).

	TOS 1	TOS 2	Mean	TOS 1	TOS 2	Mean
Variety	**Protein (%)**	**Protein (%)**	**Protein (%)**	**Test weight (kg/hL)**	**Test weight (kg/hL)**	**Test weight (kg/hL)**
Illabo*	10.9	.	**.**	66.7		
Mowhawk	10.1 -	11.8 -	**10.9 b**	79.2 -	78.3 -	**78.7 a**
Denison	10.8 -	10.6 -	**10.7 b**	80.6 -	77.5 -	**79.1 a**
RGT Waugh	13.0 -	14.0 -	**13.5 a**	56.7 -	57.8 -	**57.2 c**
Scepter	10.9 -	10.6 -	**10.7 b**	79.3 -	78.6 -	**78.9 a**
RockStar	10.6 -	10.9 -	**10.7 b**	79.3 -	77.0 -	**78.1 a**
Neo CL	12.9 -	13.2 -	**13.1 a**	62.7 -	62.5 -	**62.6 b**
RGT Planet	13.0 -	13.2 -	**13.1 a**	63.0 -	63.5 -	**63.2 b**
Mean	11.5 -	12.0 -	**11.8**	70.9 -	70.7 -	**71.7**
Variety	**LSD p = 0.05** 0.7	**P val** <0.001		**LSD p = 0.05** 2.9	**P val** <0.001	
TOS	**LSD p = 0.05** ns	**P val** 0.075		**LSD p = 0.05** ns	**P val** 0.282	
Var. x TOS.	**LSD p = 0.05** ns	**P val** 0.085		**LSD p = 0.05** ns	**P val** 0.791	

**Illabo data excluded from statistical analysis.*

Table 4. Influence of Time of sowing (TOS) and barley variety on retention (% > 2.5mm).

Variety	TOS 1		TOS 2		Mean	
	Retention (%)		Retention (%)		Retention (%)	
Neo CL	92.9	-	88.3	-	**90.6**	-
RGT Planet	90.9	-	72.5	-	**81.7**	-
Mean	90	-	86.3	-	**86.1**	
LSD Variety p = 0.05	ns		**P value**		0.160	
LSD TOS p = 0.05	4.3		**P value**		0.024	
LSD Variety x TOS. p = 0.05	ns		**P value**		0.261	

Table 5. Influence of Time of sowing (TOS) and variety on screenings (% < 2.2mm).

	TOS 1		TOS 2		Mean	
Variety	**Screenings (%)**		**Screenings (%)**		**Screenings (%)**	
Illabo*	4.7				**.**	
Mowhawk	3.1	-	5.0	-	**4.1**	**ab**
Denison	1.4	-	5.0	-	**3.2**	**bc**
RGT Waugh	5.8	-	4.6	-	**5.2**	**a**
Scepter	1.5	-	3.3	-	**2.4**	**c**
RockStar	2.3	-	4.0	-	**3.1**	**bc**
Neo CL	2.3	-	2.2	-	**2.2**	**c**
RGT Planet	2.1	-	4.1	-	**3.1**	**bc**
Mean	2.9	-	4.0	a	**3.3**	
Variety	**LSD p = 0.05**		1.6	**P val**	0.007	
TOS	**LSD p = 0.05**		1.1	**P val**	0.035	
Var. x Man.	**LSD p = 0.05**		ns	**P val**	0.088	

**Illabo data excluded from statistical analysis.*

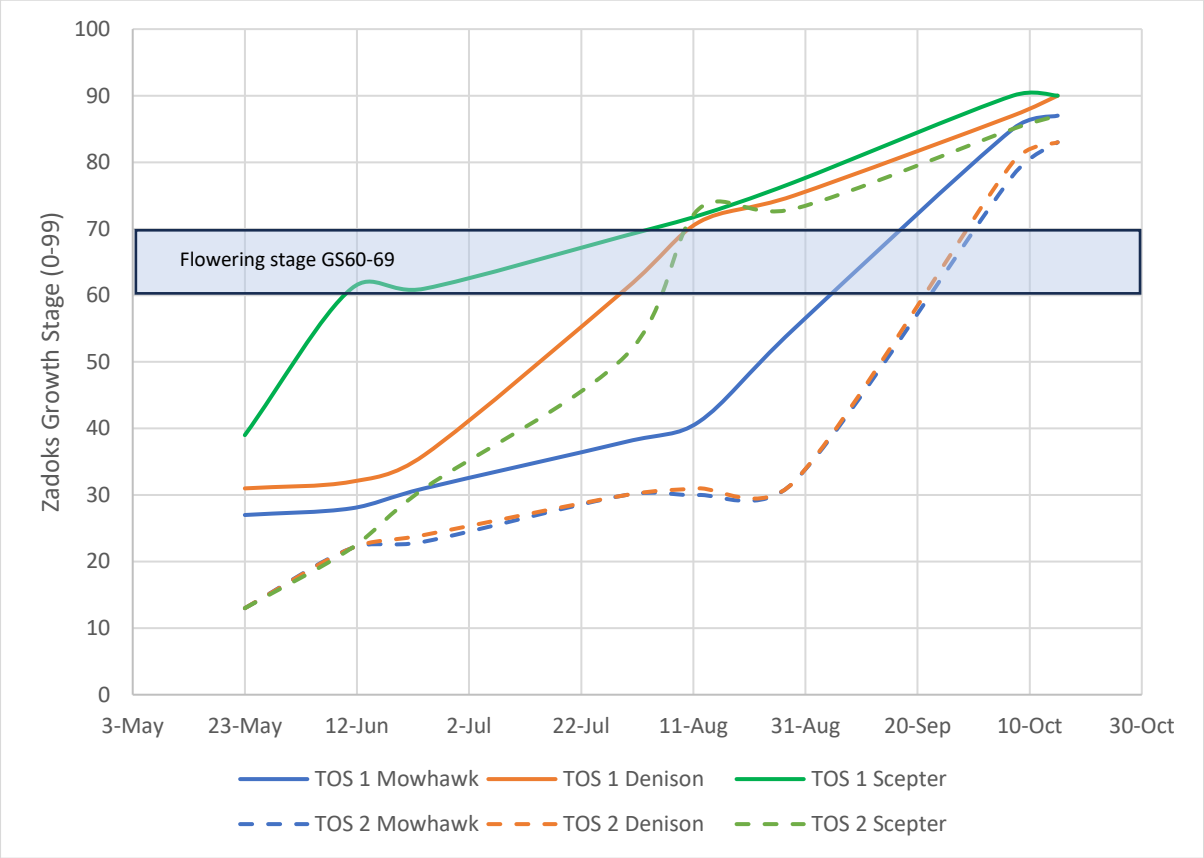

Figure 2. Influence of time of sowing (TOS) and variety on phenology (Zadoks Growth Stage 0-99)

Table 6. Influence of Time of sowing (TOS) and variety on phenology (Zadoks Growth stage 00-99).

		23-May	11-Jun	24-Jun	30-Jul	12-Aug	29-Aug	7-Oct	15-Oct
TOS 1 (26 March)	Illabo	28	31	33	39	43	57	85	89
	Mowhawk	27	28	31	38	41	55	85	87
	Denison	31	32	37	61	71	75	87	90
	RGT Waugh	24	26	29	29	29	30	52	70
	Scepter	39	61	61	69	72	77	90	90
	RockStar	32	54	61	71	73	77	89	91
	Neo CL	30	39	53	78	79	77	90	92
	RGT Planet	31	49	61	69	74	85	90	92
TOS 2 (23 April)	Mowhawk	13	22	23	30	30	32	78	83
	Denison	13	22	24	30	31	32	80	83
	RGT Waugh	13	22	23	29	29	30	42	49
	Scepter	13	22	31	51	73	73	85	87
	RockStar	13	22	24	30	31	39	83	90
	Neo CL	13	22	25	32	49	68	85	91
	RGT Planet	13	22	25	33	53	71	88	91

Table 7. Influence of time of sowing (TOS) and variety on partial gross margin and total input & application costs. Grain prices (FED1 $320, APW1 $375, APW2 $370 & BFED1 $328) based off Cargill 2024/25 season Esperance zone rates.

		Yield (t/ha)	Grade	Income ($)	Cost ($)	Partial Gross margin ($/ha)
TOS 1	Illabo	3.40	FED1	$1,087	$362	$726
	Mowhawk	4.45	APW2	$1,648	$358	$1,289
	Denison	4.38	APW1	$1,644	$360	$1,283
	RGT Waugh	0.87	FED1	$279	$361	-$82
	Scepter	3.98	APW1	$1,492	$361	$1,131
	RockStar	4.31	APW1	$1,616	$361	$1,255
	Neo CL	5.07	BFED1	$1,664	$342	$1,322
	RGT Planet	4.78	BFED1	$1,567	$341	$1,227
TOS 2	Mowhawk	3.51	APW1	$1,316	$358	$957
	Denison	4.46	APW1	$1,674	$360	$1,313
	RGT Waugh	0.90	FED1	$287	$361	-$74
	Scepter	5.08	APW1	$1,906	$361	$1,545
	RockStar	4.57	APW1	$1,715	$361	$1,354
	Neo CL	5.84	BFED1	$1,915	$342	$1,573
	RGT Planet	5.25	BFED1	$1,721	$341	$1,381

Table 8. Trial input and management details (kg, g, ml/ha).

Sowing date:		**TOS 1: 26-March TOS 2: 23-April**	
Harvest date:		**Barley:12-Nov; Main Season Wheat: 13-Nov; RGT Waugh:18-Dec**	
Seed rate:		200 seeds/m2	
Irrigation at sowing:	TOS 1	15mm	
Basal fertiliser:	26 March	125 kg MAP (28.5kg P/ha & 13.75kg N/ha)	
		Product	**Active ingredient and rate**
Pre-em herbicide:	26 March	TriflurX 2.0 L/ha	Trifluralin 960 g ai/ha
		Overwatch 1.25 L/ha	Bixlozone 500 g ai/ha
Post-em herbicide:	30 July	Priority 0.025 L/ha	Florasulam 5 g ai/ha
Fungicide:	GS31	Prosaro 0.3 L/ha	Prothioconazole 63 g ai/ha
			Tebuconazole 63 g ai/ha
	GS39 (Wheat)	Aviator Xpro 0.5 L/ha	Bixafen 37.5 g ai/ha
			Prothioconazole 75 g ai/ha
	GS39 (Barley)	Amistar Xtra 0.5 L/ha	Azoxystrobin 120 g ai/ha
			Cyproconazole 48 g ai/ha
Nutrition:	8 July	100kg/ha of Urea (46 kg N/ha)	
	25 August	87kg/ha of Sustain Urea (40 kg N/ha)	

Site 3. Frankland River

Sown: TOS 1- 2 April 2024 TOS 2- 29 April 2024
Harvested: 29 November 2024
Rotation position: 2023 Canola
Soil type: Forest gravel
FAR code: FAR WAE W24-03

Key Points

- *The Frankland River research site is typically characterised with higher growing season rainfall (2024 372mm v 278mm (Gibson) GSR April - Oct) and lower average temperatures during grain fill than the EPZ (3.3^{0}C lower average maximum temperature in October 2024*).
- *However, the summer and autumn were equally dry in southwest WA with the first sowing date 2 April established with 15mm of irrigation and the autumn break (25-30mm) not occurring until 9 May.*
- *On average there was no difference in yield between the first (2 April) and second (29 April) sowing dates (p=0.211), a possible indication of the poor conditions for emergence following the first sowing and lower overall plant counts relative to the later sowing.*
- *The winter wheat Mowhawk yielded over 5t/ha sown 2 April and was higher yielding than the spring wheats tested, although the yield differences were not significant.*
- *The late April sowing showed no yield advantage to Mowhawk over longer season spring wheats such as Denison, but both types were superior to Scepter in these two sowing windows.*
- *On average the spring barley Neo CL was over 1.2t/ha higher yielding than the highest yielding wheat, although the advantage over Mowhawk was 1t/ha early April sown and 0.8t/ha better than Denison late April sown.*
- *Because of the yield differences and bin grades achieved Neo CL was more profitable than winter or spring wheat germplasm sown in either early or late April.*
- *Unlike the Gibson and Scaddan sites the longer season spring types, such as Denison, did not develop as quickly at Frankland River with flowering dates nearer the optimum but still earlier than Mowhawk which was nearer the regarded optimum of late September/early October.*
- *Scepter as found in previous studies was not suited to April sowing as it develops too quickly.*
- *Higher rainfall at this site resulted in foliar disease being a bigger issue, particularly in Planet barley where fungicide resistant net form net blotch was not properly controlled by a two-spray fungicide programme.*
- *Final harvest dry matters (DM) from the highest yielding wheats and barleys were approximately 10t/ha but harvest indices and head numbers were higher in the barley.*
- *Frost does not appear to have been a feature in the results of this trial.*

Table 1. Influence of time of sowing (TOS) and variety on grain yield (t/ha), harvested 29 November.

Variety	TOS 1		TOS 2		Mean	
	Yield (t/ha)		Yield (t/ha)		Yield (t/ha)	
Illabo*	4.72		.		**.**	
Mowhawk	5.11	-	4.44	-	**4.77**	**b**
Denison	4.40	-	5.01	-	**4.71**	**b**
RGT Waugh**	5.04	-	4.42	-	**4.73**	**b**
Scepter	2.86	-	4.06	-	**3.46**	**c**
RockStar	4.14	-	4.86	-	**4.50**	**b**
Neo CL (spring barley)	6.11	-	5.81	-	**5.96**	**a**
RGT Planet (spring barley)	5.64	-	5.25	-	**5.21**	**b**
Mean	**4.69**	**-**	**4.69**	-		
LSD Variety p = 0.05	0.71		**P value**		<0.001	
LSD TOS p = 0.05	ns		**P value**		0.211	
LSD Variety x TOS. p = 0.05	ns		**P value**		0.099	

**Illabo data excluded from statistical analysis, **RGT Waugh yield derived from quadrant harvest cut (1m x 4) and so comparisons with other varieties should be treated with caution.*

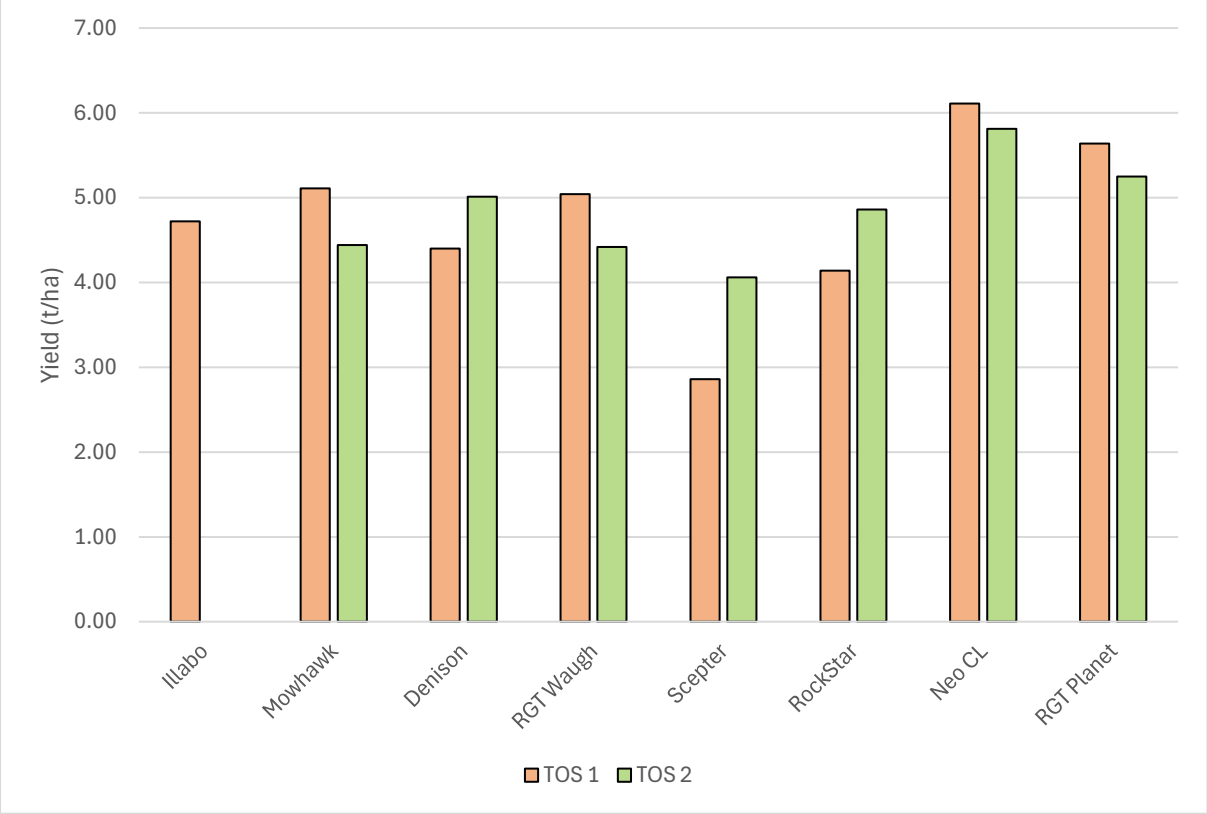

Figure 1. Influence of Time of sowing (TOS) and variety on yield (t/ha), harvested 29 November.

Table 2. Influence of Time of sowing (TOS) and variety on phenology (Zadoks Growth stage 00-99).

		28-May	28-Jun	16-Jul	1-Aug	20-Aug	5-Sep	16-Sep	9-Oct
TOS 1 (2 April)	Illabo	14	23	23	30	32	42	59	72
	Mowhawk	23	24	23	30	32	45	57	76
	Denison	21	23	23	32	37	49	65	80
	RGT Waugh	13	23	23	29	29	30	32	49
	Scepter	23	39	42	49	62	67	71	78
	RockStar	22	30	31	39	60	69	71	84
	Neo	24	26	30	37	55	61	71	87
	RGT Planet	13	29	30	32	49	55	71	87
TOS 2 (29 April)	Mowhawk	13	24	23	30	32	41	51	78
	Denison	13	24	23	32	37	49	57	78
	RGT Waugh	13	23	23	29	29	30	53	43
	Scepter	13	31	37	45	55	65	71	85
	RockStar	13	30	31	39	49	61	71	85
	Neo	24	30	30	37	49	59	72	85
	RGT Planet	23	30	31	37	49	59	71	85

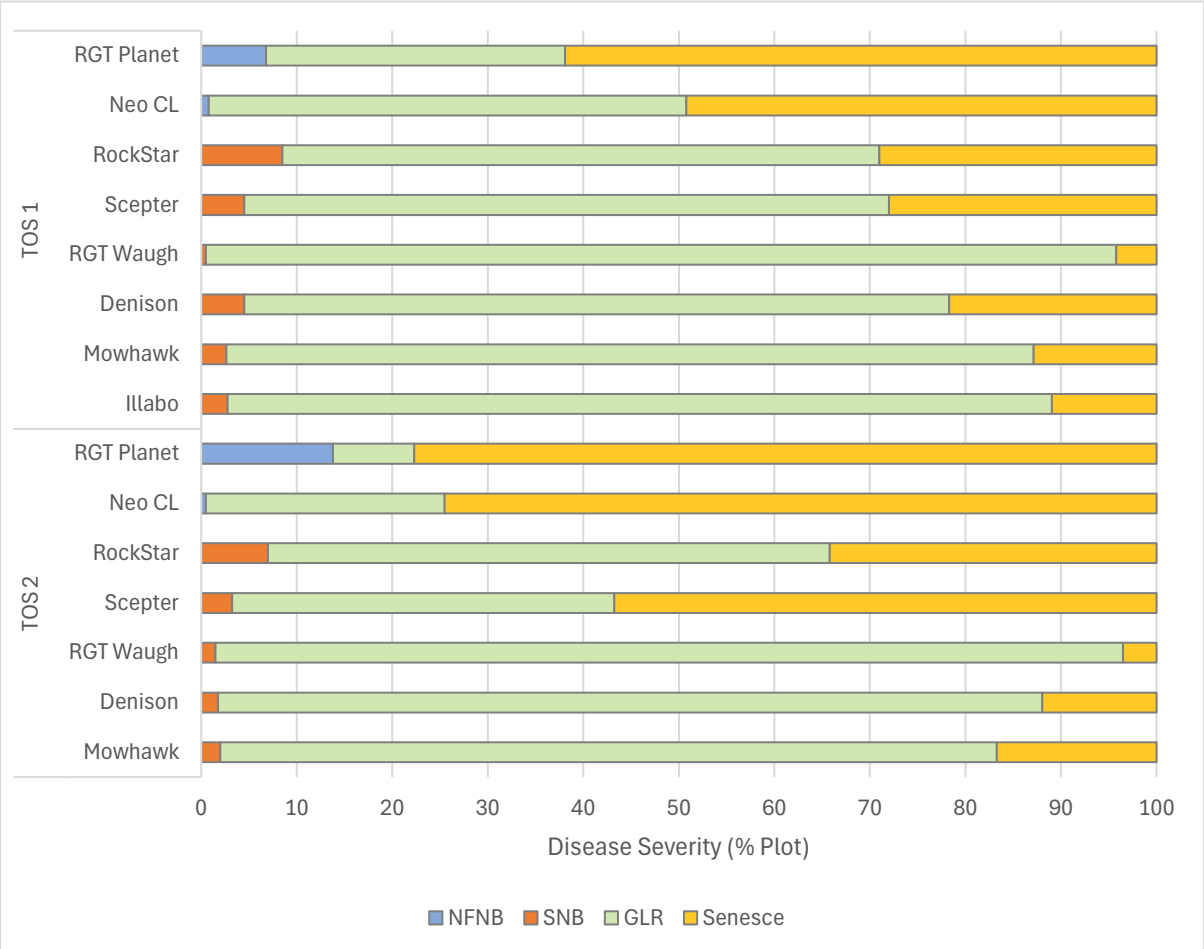

Figure 2. Influence of variety and time of sowing on net form net blotch (NFNB) severity in barley, septoria nodorum blotch (SNB) severity in wheat and green leaf retention (GLR). Assessed 9 October 2024.

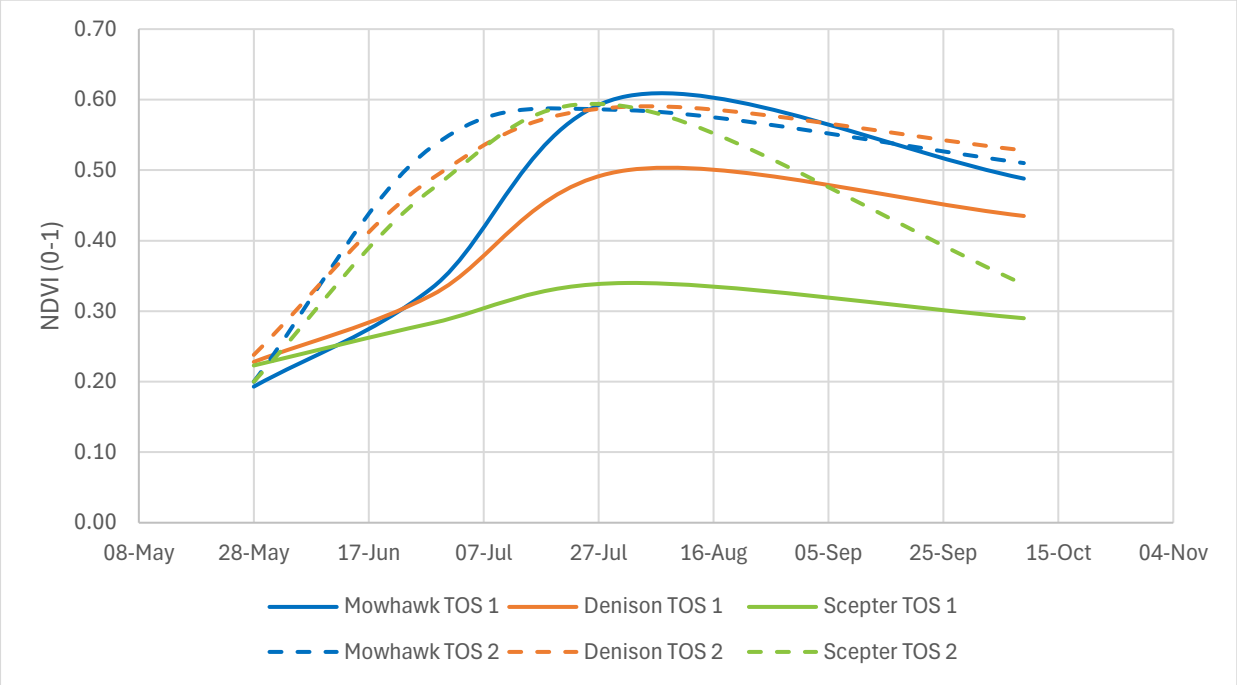

Figure 3. Influence of time of sowing (TOS) and variety on Normalized Difference Vegetation Index (NDVI) (0-1)

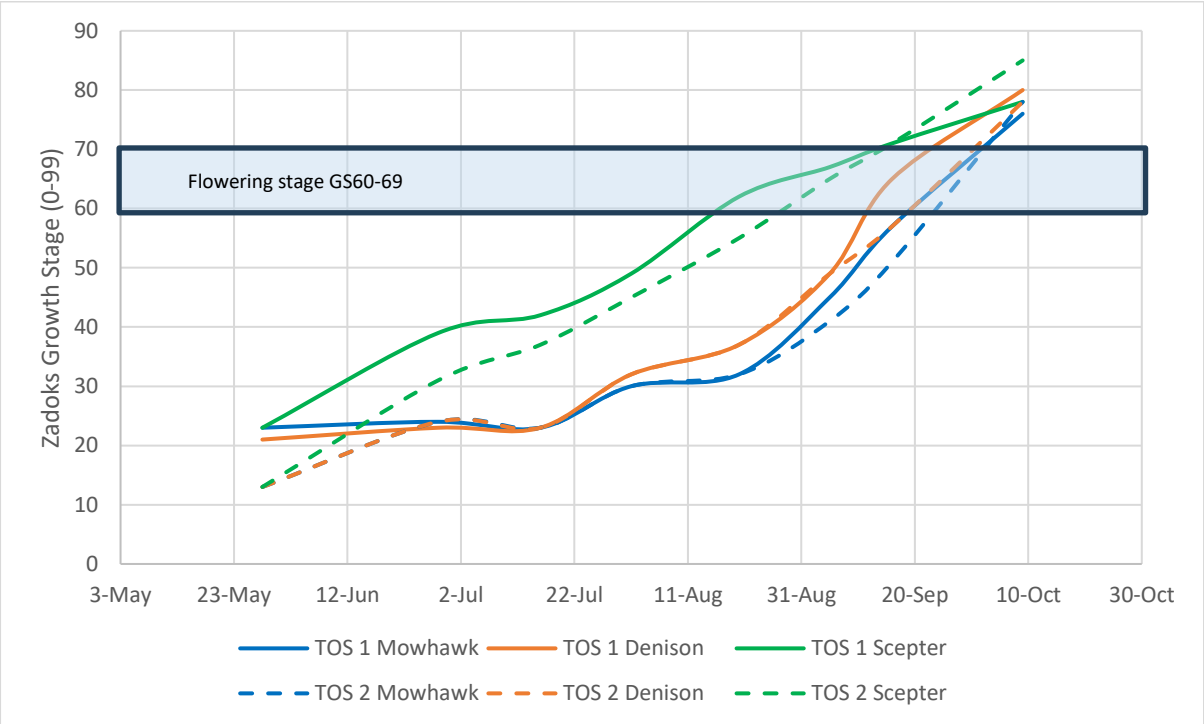

Figure 4. Influence of time of sowing (TOS) and variety on phenology (Zadoks Growth Stage 0-99)

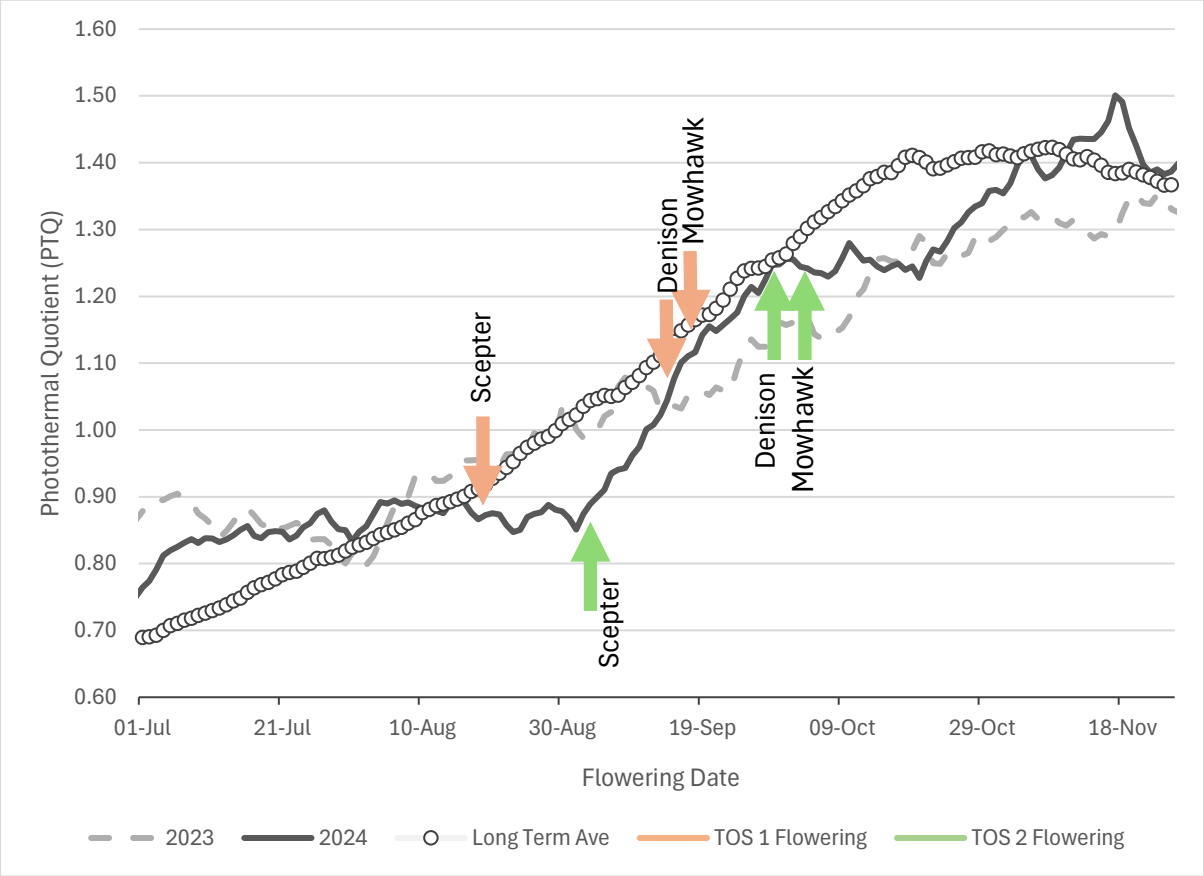

Figure 5. Photothermal Quotient (PTQ) for 2024, 2023 and the long-term average at Rocky Gully (1996-2024) in relation to the 2024 estimated flowering dates of Scepter, Denison and Mowhawk at both times of sowing.

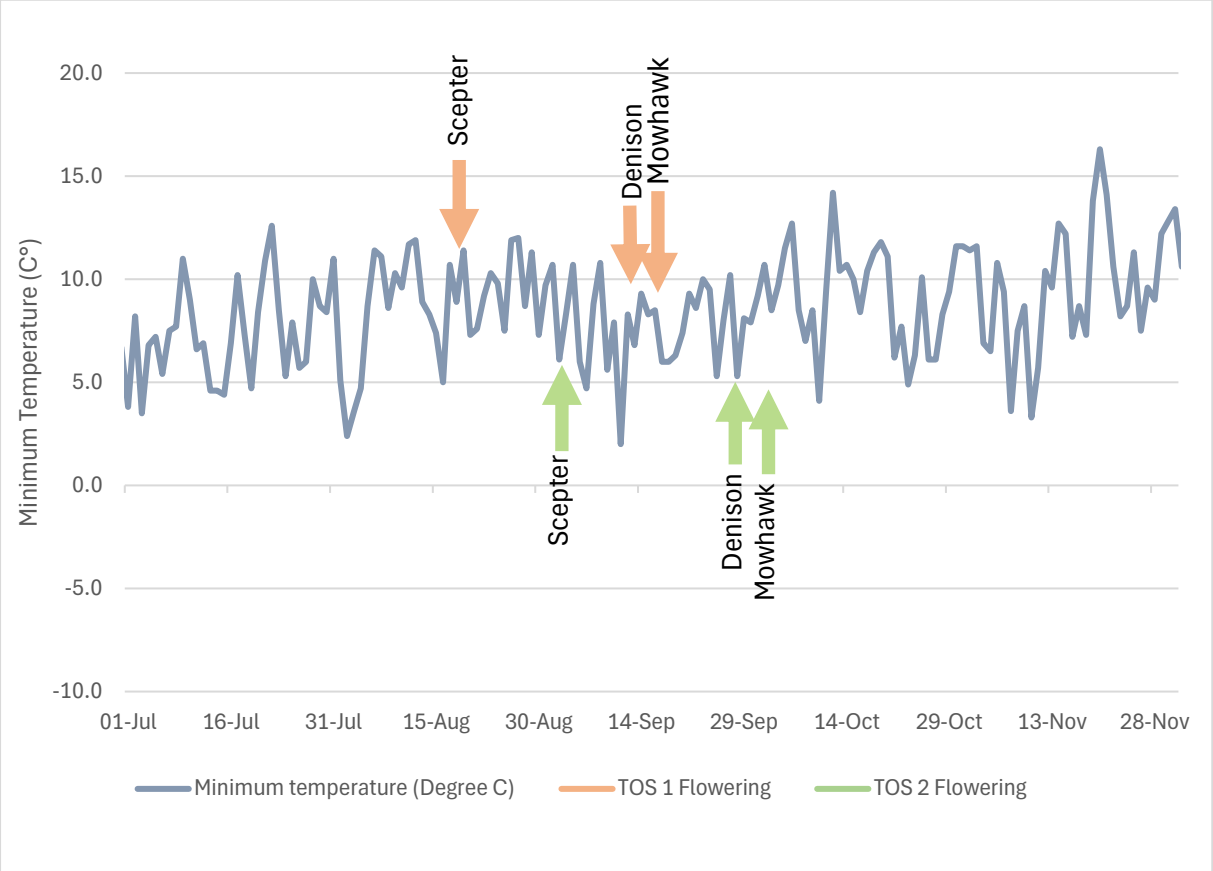

Figure 6. Daily minimum temperature (C°) in 2024 at Rocky Gully (1995-2024) in relation to the 2024 estimated flowering dates of Scepter, Denison and Mowhawk at both times of sowing.

Table 3 Influence of Time of sowing (TOS) and variety on the grain protein (%) and test weights (kg/hL).

	Management Level											
	TOS 1	TOS 2	Mean		TOS 1	TOS 2	Mean	
Variety	Protein (%)	Protein (%)	Protein (%)		Test weight (kg/hL)	Test weight (kg/hL)	Test weight (kg/hL)	
Illabo*	11.7	.	.		69.6	.	.	
Mowhawk	11.3 -	10.4 -	**10.8**	**c**	68.7 -	75.2 -	**71.9**	**b**
Denison	11.4 -	10.4 -	**10.9**	**c**	72.6 -	74.5 -	**73.6**	**b**
RGT Waugh	12.0 -	12.7 -	**12.3**	**ab**	80.0 -	85.8 -	**82.9**	**a**
Scepter	12.5 -	12.3 -	**12.4**	**ab**	72.8 -	72.9 -	**72.8**	**b**
RockStar	11.5 -	11.9 -	**11.7**	**b**	73.9 -	71.3 -	**72.6**	**b**
Neo CL	12.5 -	12.7 -	**12.6**	**a**	62.0 -	61.2 -	**61.6**	**c**
RGT Planet	12.6 -	12.7 -	**12.7**	**a**	62.1 -	59.2 -	**60.3**	**c**
Mean	**11.9** -	**11.9** -	**11.9**		**70.7** -	**70.2** -	**70.6**	
Variety	**LSD p = 0.05**	0.8	**P val**	<0.001	**LSD p = 0.05**	4.3	**P val**	<0.001
TOS	**LSD p = 0.05**	ns	**P val**	0.704	**LSD p = 0.05**	ns	**P val**	0.420
Var. x TOS.	**LSD p = 0.05**	ns	**P val**	0.296	**LSD p = 0.05**	ns	**P val**	0.198

**Illabo data excluded from statistical analysis.*

Table 4. Influence of Time of sowing (TOS) and barley variety on retention (% > 2.5mm).

Variety	TOS 1		TOS 2		Mean	
	Retention (%)		Retention (%)		Retention (%)	
Neo CL	91.9	-	88.3	-	**90.1**	-
RGT Planet	90.7	-	84.3	-	**87.5**	-
Mean	91.3	a	86.3	b	**88.8**	
LSD Variety p = 0.05	ns		**P value**		0.267	
LSD TOS p = 0.05	0.8		**P value**		0.002	
LSD Variety x TOS. p = 0.05	ns		**P value**		0.535	

Table 5. Influence of Time of sowing (TOS) and variety on retention (% > 2.5mm) and screenings (% < 2.2mm).

	TOS 1		TOS 2		Mean	
Variety	Screenings (%)		Screenings (%)		Screenings (%)	
Illabo*	5.8		.		.	
Mowhawk	5.4	bc	5.5	bc	5.5	b
Denison	7.0	ab	5.0	c	6.0	ab
RGT Waugh	1.3	f	1.3	f	1.3	d
Scepter	5.9	bc	7.9	a	6.9	a
RockStar	5.5	bc	4.6	cd	5.0	b
Neo CL	2.0	ef	3.2	de	2.6	c
RGT Planet	2.4	ef	3.0	e	2.7	c
Mean	4.4	-	4.4	-	**4.3**	
Variety	**LSD p = 0.05**		1.1	**P val**	<0.001	
TOS	**LSD p = 0.05**		ns	**P val**	0.623	
Var. x Man.	**LSD p = 0.05**		1.5	**P val**	0.012	

**Illabo data excluded from statistical analysis.*

Table 6. Influence of variety on plant emergence/m^2 at time of sowing 1. Assessed on 29 April, GS12.

	TOS 1	
Variety	Plants (m^2)	
Illabo	48.5	-
Mowhawk	79.8	-
Denison	109.0	-
RGT Waugh	70.0	-
Scepter	55.8	-
RockStar	49.3	-
Neo CL	23.3	-
RGT Planet	44.3	-
Mean	60.0	
LSD (p = 0.05)	ns	
P Value	0.439	

Table 7. Influence of time of sowing (TOS) and variety on tiller number (m^2) assessed on 28 June at early stem elongation (GS 32) and head numbers (m^2) assessed at crop maturity (GS 89).

	Management Level											
	TOS 1		TOS 2		Mean		TOS 1		TOS 2		Mean	
Variety	Tillers (m^2)		Tillers (m^2)		Tillers (m^2)		Heads (m^2)		Heads (m^2)		Heads (m^2)	
Mowhawk	265.8	-	271.3	-	**268.5**	**b**	227.0	d	359.5	ab	**293.3**	**b**
Denison	230.5	-	244.3	-	**237.4**	**b**	304.5	c	222.5	d	**263.5**	**b**
RGT Waugh	.		.		**.**		206.0	d	233.5	d	**219.8**	**c**
Scepter	102.5	-	211.3	-	**156.9**	**b**	145.5	e	211.0	d	**178.3**	**d**
RockStar	61.8	-	255.0	-	**158.4**	**b**	185.5	de	210.0	d	**197.8**	**cd**
Neo CL	188.3	-	159.5	-	**173.9**	**b**	347.5	abc	366.0	ab	**356.8**	**a**
RGT Planet	328.0	-	566.0	-	**447.0**	**a**	326.5	bc	378.5	a	**352.5**	**a**
Mean	196.1	-	284.5	-	**240.4**		248.9	b	283.0	a	**266**	
Variety	**LSD p = 0.05**		145.7		**P val**	0.002	**LSD p = 0.05**		36.7		**P val**	<0.001
TOS	**LSD p = 0.05**		ns		**P val**	0.101	**LSD p = 0.05**		28.9		**P val**	0.039
Var. x TOS.	**LSD p = 0.05**		ns		**P val**	0.342	**LSD p = 0.05**		51.9		**P val**	<0.001

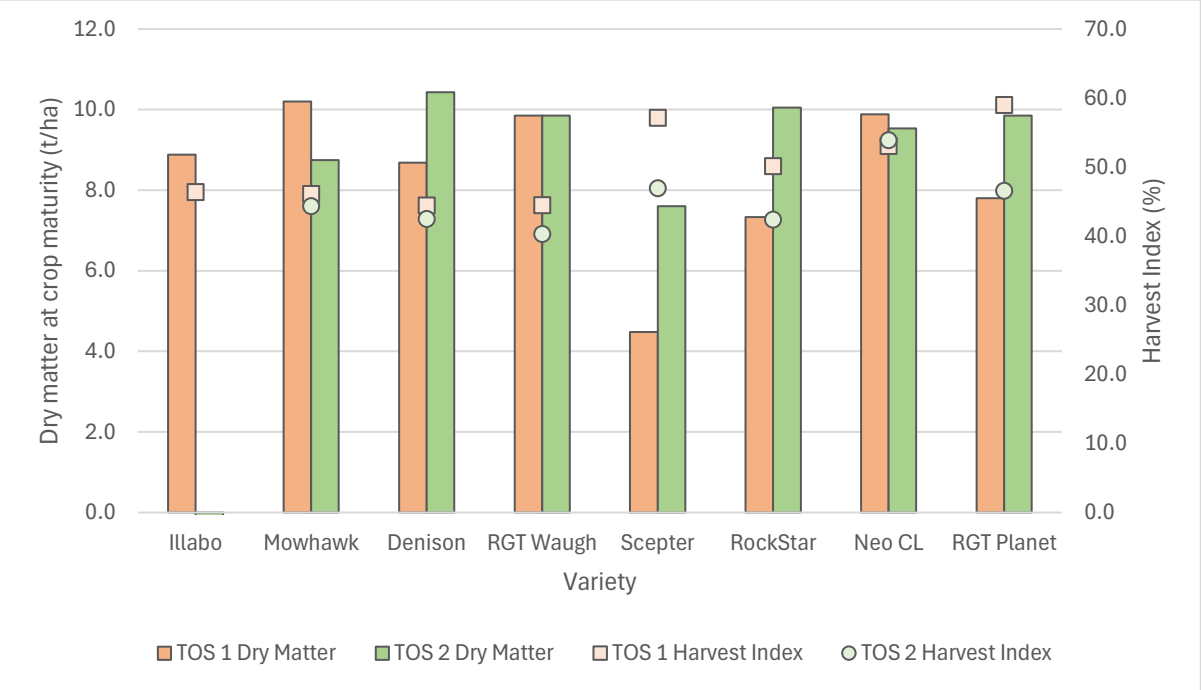

Figure 7. Influence of time of sowing (TOS) and variety on dry matter production (t/ha) assessed at crop maturity (GS 89) and harvest index (%).

Table 8. Influence of time of sowing (TOS) and variety on partial gross margin (total input & application costs. Grain prices (FED1 $330, ANW2 $345, AUN1 $345, APW2 $345 & BAR1 $330) based off Cargill 2024/25 season Albany zone rates.

		Yield (t/ha)	Grade	Income ($)	Cost ($)	Partial Gross margin ($/ha)
TOS 1 (2 April)	Illabo	4.72	AUN1	$1,627	$752	$874
	Mowhawk	5.11	AUN1	$1,762	$749	$1,013
	Denison	4.40	ANW2	$1,519	$751	$768
	RGT Waugh	5.04	FED1	$1,662	$752	$910
	Scepter	2.86	ANW2	$987	$752	$235
	RockStar	4.14	ANW2	$1,428	$752	$677
	Neo CL	6.11	BFED1	$2,017	$753	$1,264
	RGT Planet	5.17	BFED1	$1,705	$751	$954
TOS 2 (29 April)	Mowhawk	4.44	ANW2	$1,532	$749	$783
	Denison	5.01	APW2	$1,728	$751	$978
	RGT Waugh	4.42	FED1	$1,460	$752	$708
	Scepter	4.06	ANW2	$1,399	$752	$647
	RockStar	4.86	ANW2	$1,677	$752	$925
	Neo CL	5.81	BFED1	$1,918	$753	$1,165
	RGT Planet	5.25	BFED1	$1,733	$751	$981

Table 9. Trial input and management details (kg, g, mL/ha, L/ha).

Sowing date:		**TOS 1- 2 April 2024 TOS 2- 29 April 2024**	
Harvest date:		**29 November 2024**	
Seed rate:		180 seeds/m^2	
Irrigation at sowing:	TOS 1	15mm	
Basal fertilizer:	2 & 29 April	117 kg/ha MAP/MOP (80/20) with Impact (400 ml/ha)	
		Product	**Active ingredient and rate**
Pre-em herbicide:	1 April	TriflurX 2.0L/ha	Trifluralin 960 g ai/ha
		Overwatch 1.25 L/ha	Bixlozone 500 g ai/ha
Post-em herbicide:	5 July	LVE MCPA 570 0.4 L/ha	MCPA 228 g ai/ha
		Jaguar 0.8 L/ha	Bromoxynil 200 g ai/ha
			Diflufenican 20 g ai/ha
Insecticide:	31 July	Trojan 0.012 L/ha	Gamma-Cyhalothrin 1.5 g ai/ha
Fungicide:	GS31	Prosaro 0.3 L/ha	Prothioconazole 63 g ai/ha
			Tebuconazole 63 g ai/ha
	GS39	Aviator Xpro 0.5L/ha	Bixafen 37.5 g ai/ha
			Prothioconazole 75 g ai/ha
Nutrition:	24 June	220kg/ha Urea (40%)/MOP (60%) blend (40.5 kg N/ha)	
	5 July	Zinc sulphate mono 35% 0.5 kg/ha	
		Magnesium sulphate 20 kg/ha	
	20 July	160 kg urea/ha (73.6 kg N/ha)	
	4 August	50 kg/ha urea (23 kg N/ha)	

Site 4. South Stirling

Sown: TOS 1: 3-Apr TOS 2: 29-April
Harvested: 29 November
Rotation position: 2023 LR Canola
Soil type: Grey brown Loamy Sand (Clayed about 10 years ago, approx. 350t/ha, cultivated to 20cm)
FAR code: FAR WAE W24-04

Key Points

- *The South Stirling site had similar growing season rainfall to Frankland River but was characterised by higher temperatures during the grain fill stage in October.*
- *Yields were significantly higher when cereal crops were sown on 29 April rather than 3 April, although the advantage was greatest with the longer season spring wheats Denison and RockStar and smallest with the winter wheat Mowhawk.*
- *Mowhawk was slightly higher yielding than Denison at the earlier sowing date (3 April) and Denison was slightly higher yielding than Mowhawk at the second sowing date (29 April), resulting in both varieties giving a similar performance averaged over the two sow dates.*
- *RGT Planet benefited more from later April sowing as a result of lower infection levels of net form net blotch at the second sow date (data not shown).*
- *Spring barley yields were supported by higher head numbers that were significantly higher than the wheat head numbers recorded.*
- *As noted at other research sites the yield performance of the spring germplasm (both wheat and barley) was the result of compensatory growth in later developing side tillers that developed more in synchrony with better spring conditions of light and temperature (photothermal quotient).*
- *The poor adaptation of spring wheat germplasm to early April sowing was exemplified by the fact that RockStar, Scepter and Denison had main stems flowering in the second half of July.*
- *The growth of these main stems was poor, and the compensatory growth of the side tillers resulted in crops that had two crop canopies, the older main stems in the lower canopy and the later tillers in the upper canopy.*
- *It was the compensatory growth of these "recovery tillers" growth that underpinned the yields produced from sowing dates that were not idea for the germplasm being planted.*
- *Although the yields are significantly superior at the later sowing, it is the South Stirling and Frankland River sites that show the clearest benefit to winter wheat over long season spring wheats, such as Denison, when sowing very early, however at both sites the yield performance of winter wheat is eclipsed by growing spring barley.*
- *The "Achilles heel" of the spring barley at this site as grain quality in particular test weight that resulted in a feed barley grade for both RGT Planet and Neo CL.*
- *Again, the results have generated in a season where frost was not regarded as a factor influencing the results.*

Table 1. Influence of time of sowing (TOS) and variety on grain yield (t/ha).

Variety	TOS 1		TOS 2		Mean	
	Yield (t/ha)		Yield (t/ha)		Yield (t/ha)	
Illabo*	4.28					
Mowhawk	4.56	-	4.84	-	**4.70**	**b**
Denison	4.29	-	5.03	-	**4.66**	**b**
RGT Waugh**	3.95	-	4.53	-	**4.24**	**c**
Scepter	3.45	-	3.97	-	**3.71**	**d**
RockStar	3.93	-	4.70	-	**4.31**	**c**
Neo CL (spring barley)	5.30	-	5.62	-	**5.46**	**a**
RGT Planet (spring barley)	4.50	-	5.07	-	**4.78**	**b**
Mean	**4.28**	**b**	**4.82**	**a**	**4.55**	
LSD Variety p = 0.05	0.26		**P value**		<0.001	
LSD TOS p = 0.05	0.22		**P value**		0.005	
LSD Variety x TOS. p = 0.05	ns		**P value**		0.425	

**Illabo data excluded from statistical analysis **RGT Waugh yield derived from quadrant harvest cut (1m x 4) and so comparisons with other varieties should be treated with caution.*

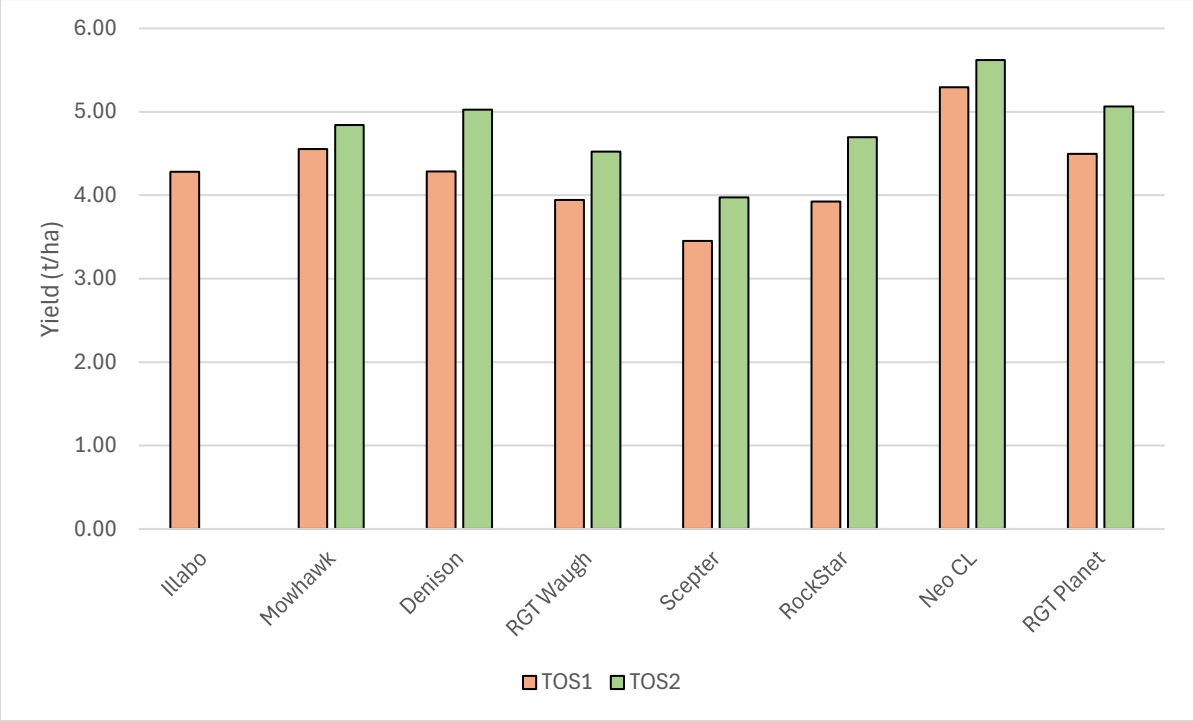

Figure 1. Influence of Time of sowing (TOS) and variety on yield (t/ha), harvested 29 November.

Table 2. Influence of variety and crop type (mean of time of sowing) on plant emergence (m^2) at GS12 and head numbers (m^2) assessed at crop maturity (GS 89).

Variety	Plants (m^2)		Heads (m^2)	
Mowhawk	110.8	-	320.3	c
Denison	124.4	-	307.8	c
RGT Waugh	97.2	-	212.5	d
Scepter	101.7	-	249.2	d
RockStar	119.7	-	333.6	c
Neo CL	97.5	-	690.8	a
RGT Planet	130.6	-	533.1	b
Variety	**LSD** ns	**P Val** 0.46	**LSD** 50.5	**P Val** <0.001
TOS	**LSD** ns	**P Val** 0.12	**LSD** ns	**P Val** 0.087
Var. x TOS.	**LSD** ns	**P Val** 0.466	**LSD** ns	**P Val** 0.748

Table 3. Influence of Time of sowing (TOS) and variety on the grain protein (%) and test weights (kg/hL).

	TOS 1	TOS 2	Mean	TOS 1	TOS 2	Mean
Variety	Protein (%)	Protein (%)	Protein (%)	Test weight (kg/hL)	Test weight (kg/hL)	Test weight (kg/hL)
Illabo*	12.8	.	**.**	71.4	.	**.**
Mowhawk	11.3 -	11.3 -	**11.3 d**	75.4 -	75.5 -	**75.5 b**
Denison	11.7 -	11.5 -	**11.6 cd**	76.2 -	75.7 -	**75.9 b**
RGT Waugh	13.8 -	13.0 -	**13.4 a**	77.6 -	84.7 -	**81.1 a**
Scepter	12.7 -	12.4 -	**12.5 b**	76.6 -	75.4 -	**76.0 b**
RockStar	12.2 -	11.9 -	**12.0 bc**	75.3 -	74.8 -	**75.0 b**
Neo CL	12.8 -	12.3 -	**12.6 b**	58.6 -	60.0 -	**59.3 c**
RGT Planet	12.8 -	12.5 -	**12.7 b**	56.3 -	60.9 -	**58.6 c**
Mean	**12.5** -	**12.1** -	**12.3**	**70.9** -	**72.4** -	**71.7**
Variety	**LSD p = 0.05** 0.7	**P val** <0.001		**LSD p = 0.05** 3.7	**P val** <0.001	
TOS	**LSD p = 0.05** ns	**P val** 0.247		**LSD p = 0.05** ns	**P val** 0.144	
Var. x TOS.	**LSD p = 0.05** ns	**P val** 0.946		**LSD p = 0.05** ns	**P val** 0.226	

**Illabo data excluded from statistical analysis.*

Table 4. Influence of Time of sowing (TOS) and barley variety on retention (% > 2.5mm).

Variety	TOS 1	TOS 2	Mean
	Retention (%)	Retention (%)	Retention (%)
Neo CL	87.7 -	83.4 -	85.6 -
RGT Planet	82.4 -	86.7 -	84.6 -
Mean	85.1 -	85.0 -	**85.1**
LSD Variety p = 0.05	ns	**P value**	0.525
LSD TOS p = 0.05	ns	**P value**	0.982
LSD Variety x TOS. p = 0.05	5.4	**P value**	0.034

Table 5. Influence of Time of sowing (TOS) and variety on retention (% > 2.5mm) and screenings (% < 2.2mm).

	TOS 1		TOS 2		Mean	
Variety	**Screenings (%)**		**Screenings (%)**		**Screenings (%)**	
Illabo	4.2				.	
Mowhawk	7.0	-	6.7	-	6.9	a
Denison	5.4	-	6.7	-	6.0	a
RGT Waugh	1.2	-	4.9	-	3.0	b
Scepter	6.8	-	7.2	-	7.0	a
RockStar	5.9	-	5.5	-	5.7	a
Neo CL	3.0	-	4.1	-	3.5	b
RGT Planet	3.5	-	3.8	-	3.6	b
Mean	4.6	-	5.6	-	**5.1**	
Variety	**LSD p = 0.05**	1.5	**P val**		<0.001	
TOS	**LSD p = 0.05**	ns	**P val**		0.127	
Var. x Man.	**LSD p = 0.05**	ns	**P val**		0.138	

**Illabo data excluded from statistical analysis.*

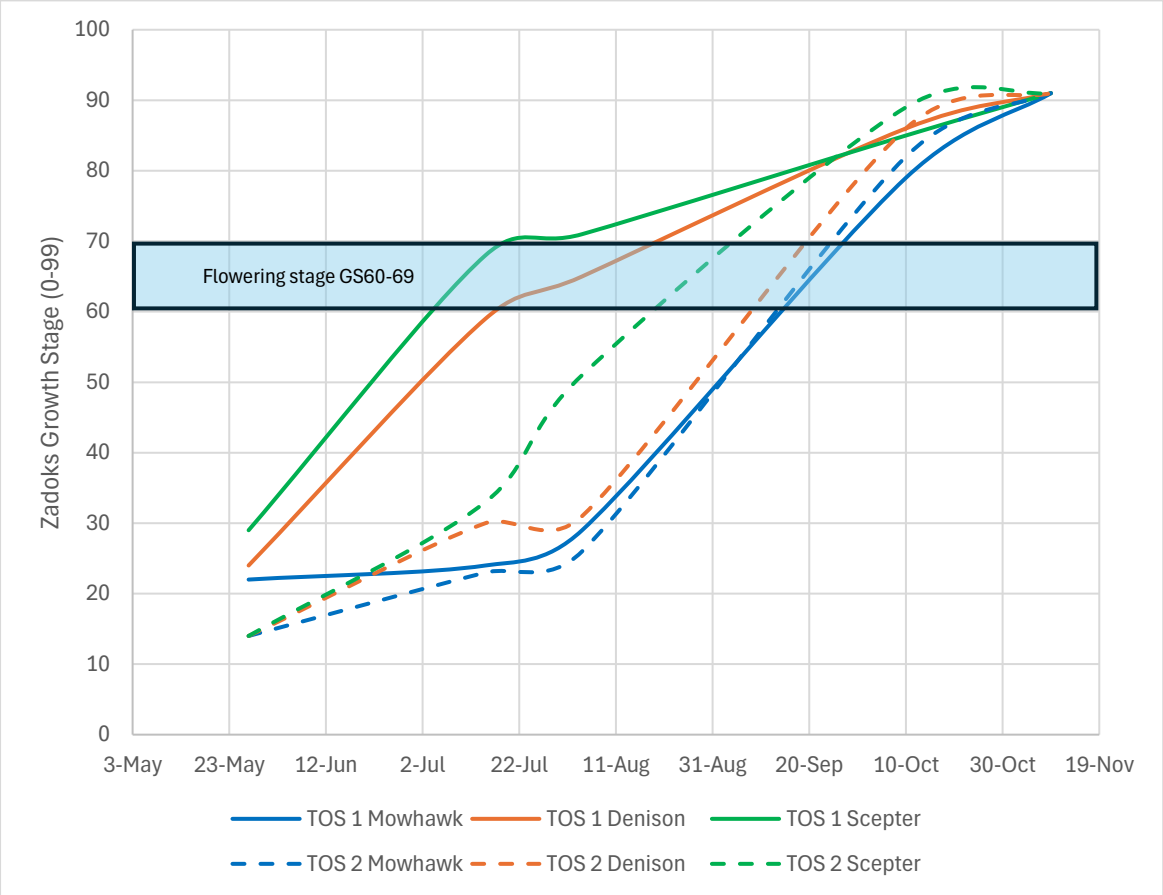

Figure 2. Influence of time of sowing (TOS) and variety on phenology (Zadoks Growth Scale 0-99)

Table 6. Influence of Time of sowing (TOS) and variety on phenology (Zadoks Growth stage 00-99).

		27-May	15-Jul	4-Aug	10-Oct	9-Nov
TOS 1 (3 April)	Illabo	23	23	31	76	89
	Mowhawk	22	24	29	79	91
	Denison	24	59	65	86	91
	RGT Waugh	24	24	26	49	75
	Scepter	29	68	71	85	91
	RockStar	25	58	65	85	91
	Neo CL	25	24	37	87	91
	RGT Planet	26	32	37	87	91
TOS 2 (29 April)	Mowhawk	14	23	26	82	91
	Denison	14	30	31	86	91
	RGT Waugh	14	22	29	48	71
	Scepter	14	33	51	89	91
	RockStar	14	32	37	84	91
	Neo CL	14	23	29	88	91
	RGT Planet	14	30	32	90	91

Table 7. Influence of time of sowing (TOS) and variety on partial gross margin and total input & application costs. Grain prices (AWW2 $345, FED1 $330, BFED1 $330) based off Cargill 2024/25 season

		Yield (t/ha)	Grade	Income ($)	Cost ($)	Partial Gross margin ($/ha)
TOS 1	Illabo	4.28	AWW2	$1,478	$431	$1,047
	Mowhawk	4.56	AWW2	$1,571	$428	$1,144
	Denison	4.29	AWW2	$1,478	$430	$1,049
	RGT Waugh	3.95	FED1	$1,302	$430	$872
	Scepter	3.45	AWW2	$1,191	$430	$761
	RockStar	3.93	AWW2	$1,354	$430	$924
	Neo CL	5.30	BFED1	$1,747	$431	$1,316
	RGT Planet	4.50	BFED1	$1,483	$430	$1,053
TOS 2	Mowhawk	4.84	AWW2	$1,671	$428	$1,243
	Denison	5.03	AWW2	$1,734	$430	$1,304
	RGT Waugh	4.53	FED1	$1,493	$430	$1,063
	Scepter	3.97	AWW2	$1,371	$430	$940
	RockStar	4.70	AWW2	$1,621	$430	$1,190
	Neo CL	5.62	BFED1	$1,855	$431	$1,423
	RGT Planet	5.07	BFED1	$1,671	$430	$1,241

Table 8. Trial input and management details (kg, g, mL/ha, L/ha).

Sowing date:		**TOS 1: 3-Apr; TOS 2: 29-April**	
Harvest date:		**29 November**	
Seed rate:		180 seeds/m^2	
Irrigation at sowing:	TOS 1	10mm	
Basal fertiliser:	2 & 27 April	108kg/ha MAP	
		Product	**Active ingredient and rate**
Pre-em herbicide:	2 & 27 April	TriflurX	Trifluralin 960 g ai/ha
		Overwatch	Bixlozone 500 g ai/ha
Post-em herbicide:	15 July	Velocity 1.00 L/ha	Bromoxynil 210 g ai/ha
			Pyrasulfotole 37.5 g ai/ha
Fungicide:			
	GS31	Prosaro	Prothioconazole 63 g ai/ha
			Tebuconazole 63 g ai/ha
	GS39	Aviator Xpro	Bixafen 37.5 g ai/ha
			Prothioconazole 75 g ai/ha
Nutrition:	15 June	90 kg/ha NS61 (35.1 kg N/ha & 5.9 kg S/ha)	

DISCUSSION OF RESULTS

The somewhat surprising results from this one-year study are that spring barley germplasm is more productive than winter wheat sown in an early commercial sowing window of late March/early April that did not suit the phenology of spring germplasm (barley or wheat). Poor adaptation to very early sowing resulting in rapid development of both spring wheat and barley germplasm results in poor growth conditions (lower solar radiation and average temperatures) coinciding with stem elongation and in the lead up to flowering. However, in these four research trials, despite this poor growth (or related to it), the spring germplasm compensated with greater growth in the side tillers that develop later than the main stem. This compensatory growth in the Esperance Port Zone trials at Scaddan and Gibson was sufficient to ensure that spring wheat germplasm was equally if not more profitable than winter wheat (note, research was purely based on grain yield and not the additional grazing productivity).

With generally wetter and slightly cooler growing conditions in the Albany Port Zone there was more evidence to support the use of winter wheats sown in the late March/early April sowing window, however in this region spring barley was just as, if not more, profitable than winter wheat, with evidence of better harvest indices lying behind the improved productivity.

Overall, with the exception of the Frankland River site all trials illustrated that it was more profitable to plant cereals in the traditional late April/early May sowing window, however irrespective of sowing date it was spring barley that was more profitable than wheat in four scenarios where barley was compared to wheat as the first cereal crop after a break crop of canola at three sites and field peas at Scaddan.

APPENDIX A: Meteorological Data

Site 1. Gibson

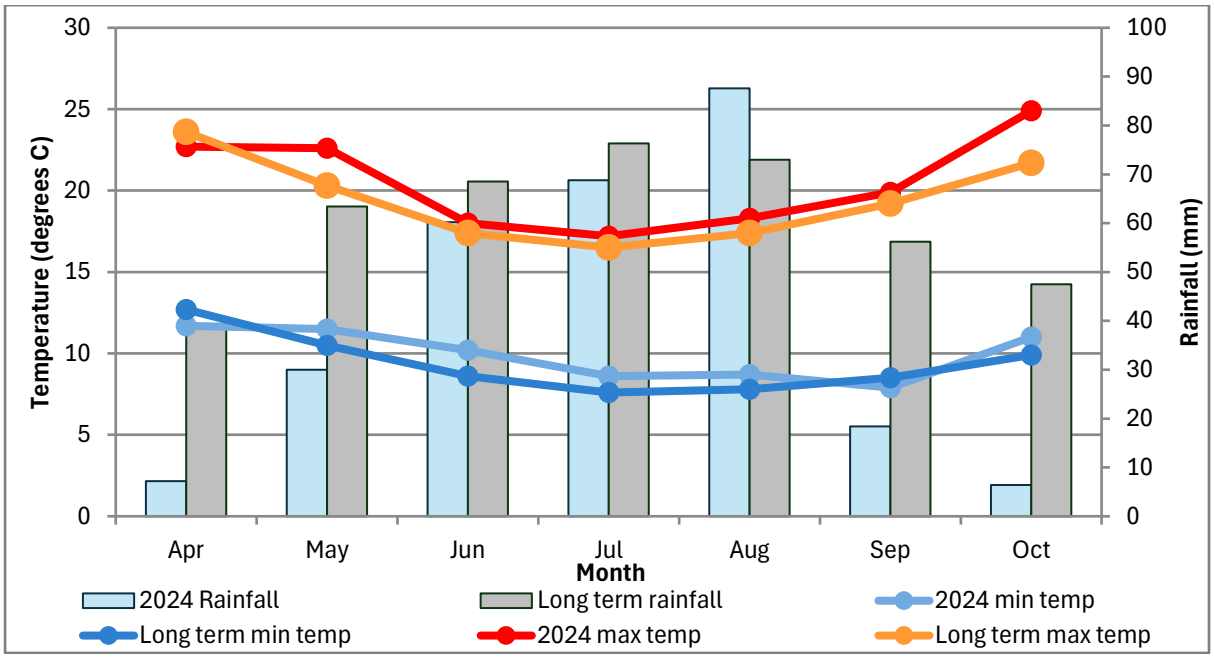

Figure 1. 2024 growing season rainfall and long-term rainfall recorded at Gibson (1991-2024). 2024 min and max temperatures, and long-term temperatures recorded at Esperance Aero (1991-2024). *Growing season rainfall April to October= 278.6 mm.*

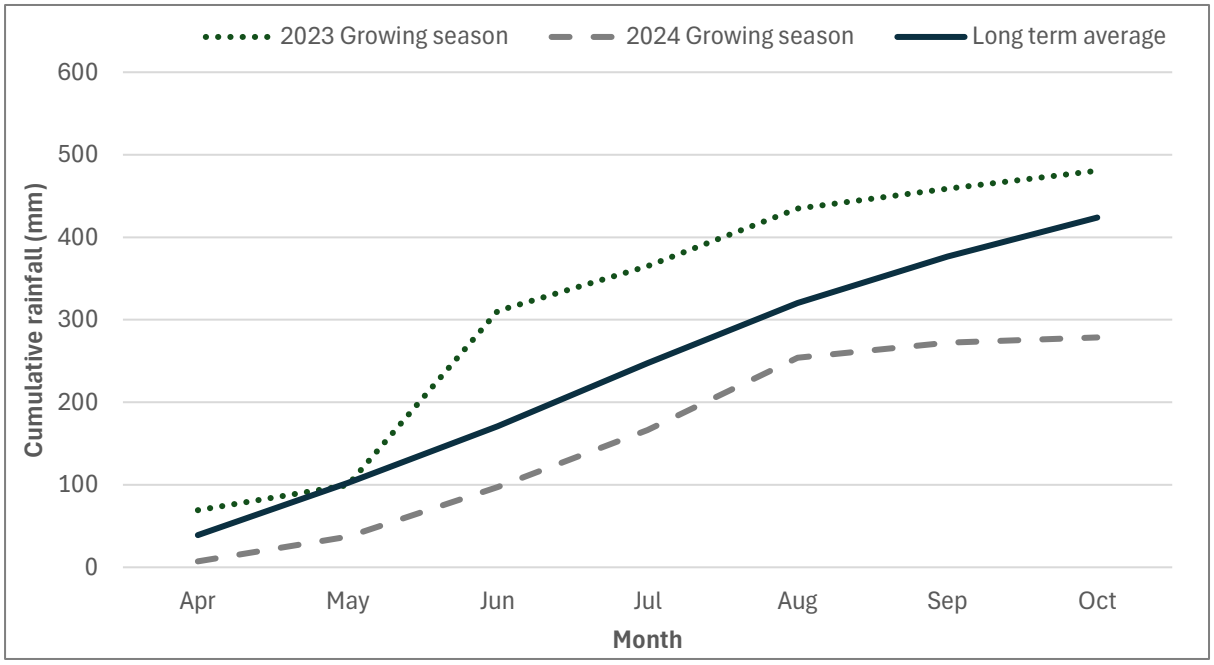

Figure 2. Cumulative growing season rainfall for 2023, 2024 and the long-term average for the growing season (April-October).

Site 2. Scaddan

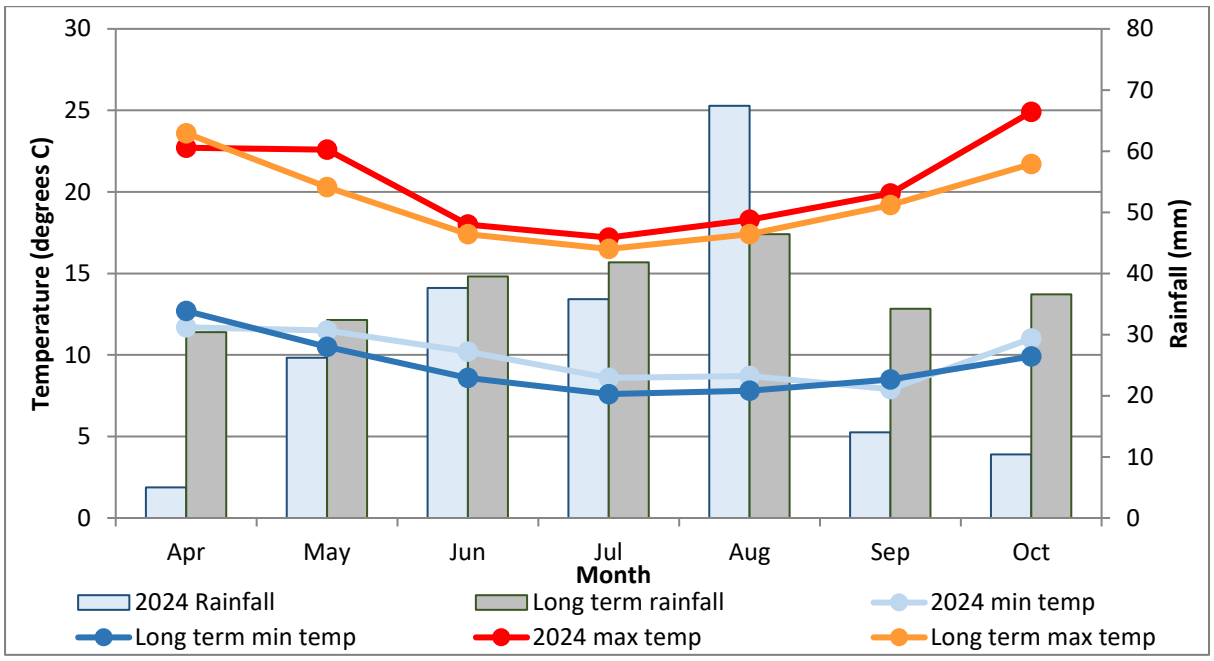

Figure 1. 2024 growing season rainfall and long-term rainfall recorded at Scaddan (2002-2024). 2024 min and max temperatures, and long-term temperatures recorded at Esperance Aero (1950-2024). *Growing season rainfall April to October= 196 mm.*

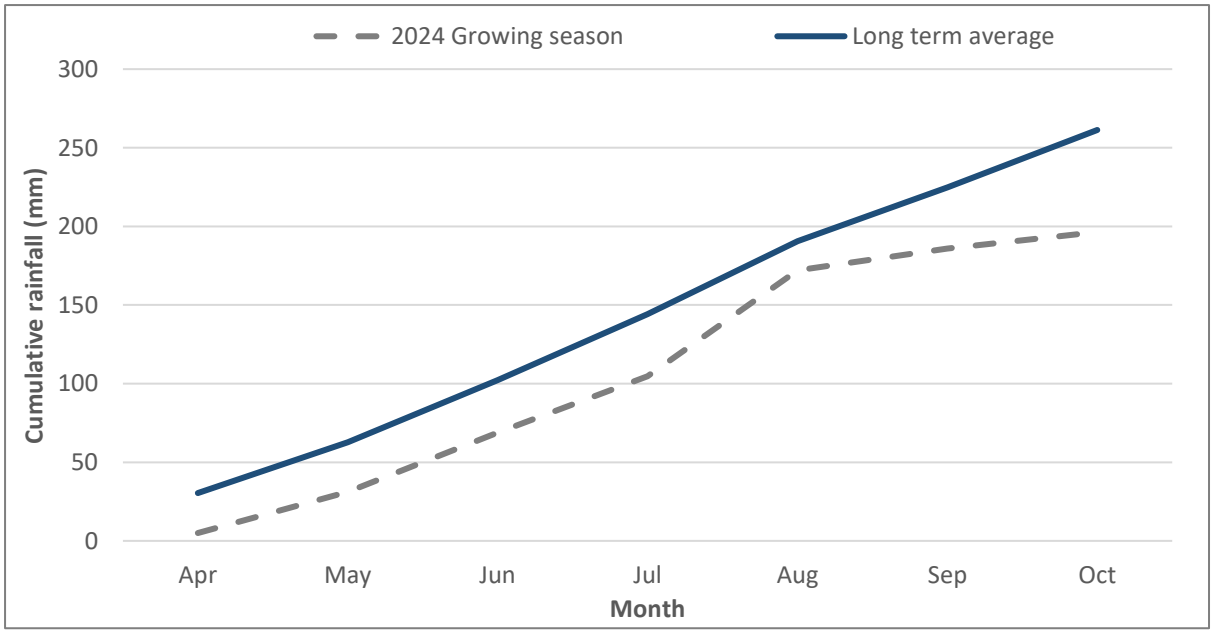

Figure 2. Cumulative growing season rainfall for 2024 and the long-term average for the growing season (April- October).

Site 3. Frankland River

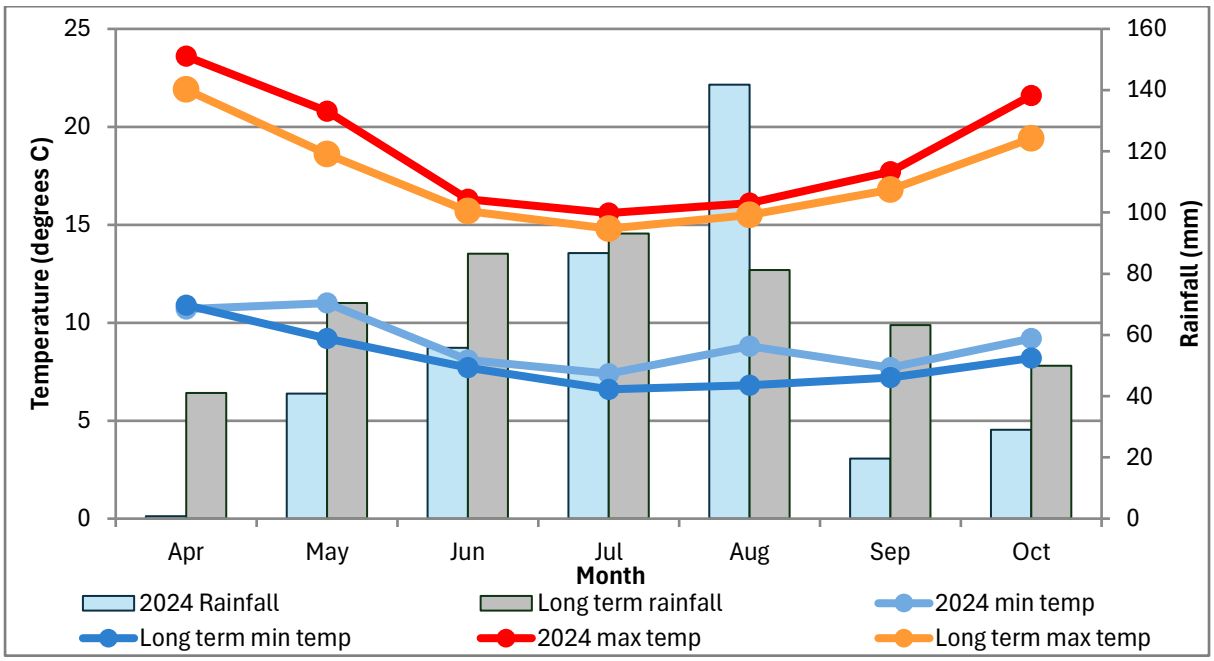

Figure 1. 2024 growing season rainfall and long-term rainfall recorded at Frankland (1923-2024). 2024 min and max temperatures, and long-term temperatures recorded at Rocky Gully (1995-2024). *Growing season rainfall April to October= 372 mm.*

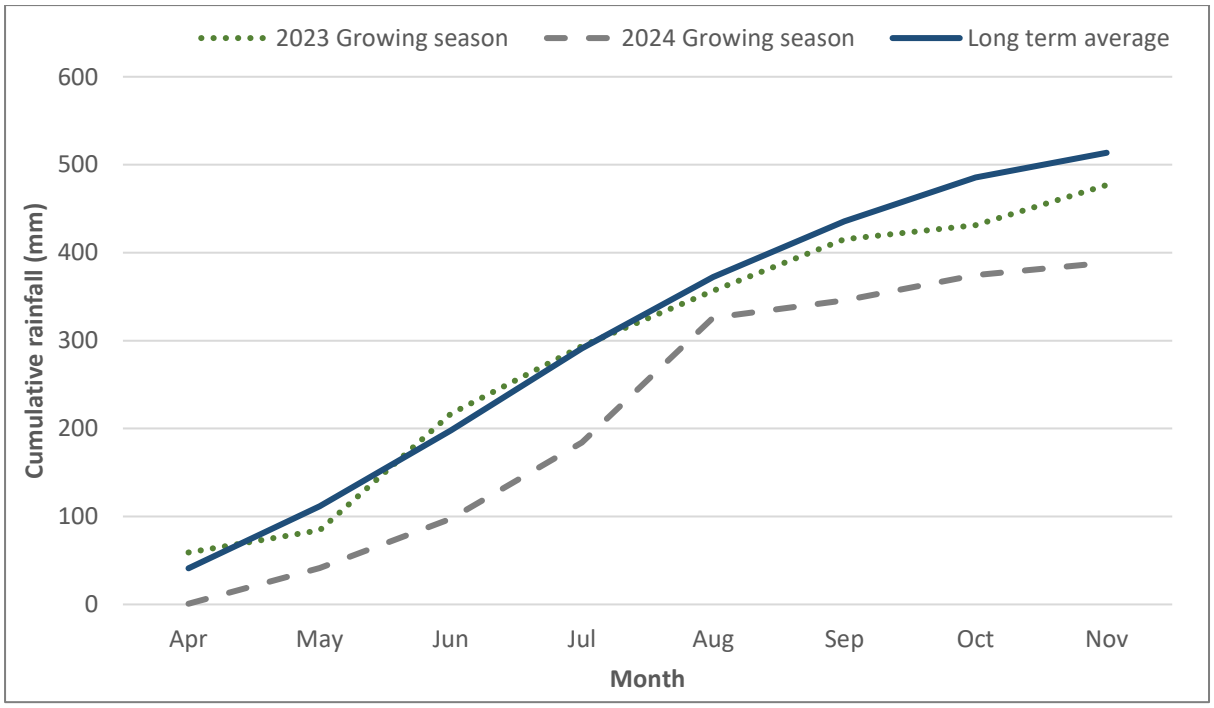

Figure 2. Cumulative growing season rainfall for 2023, 2024 and the long-term average for the growing season (April-October).

Site 4. South Stirling

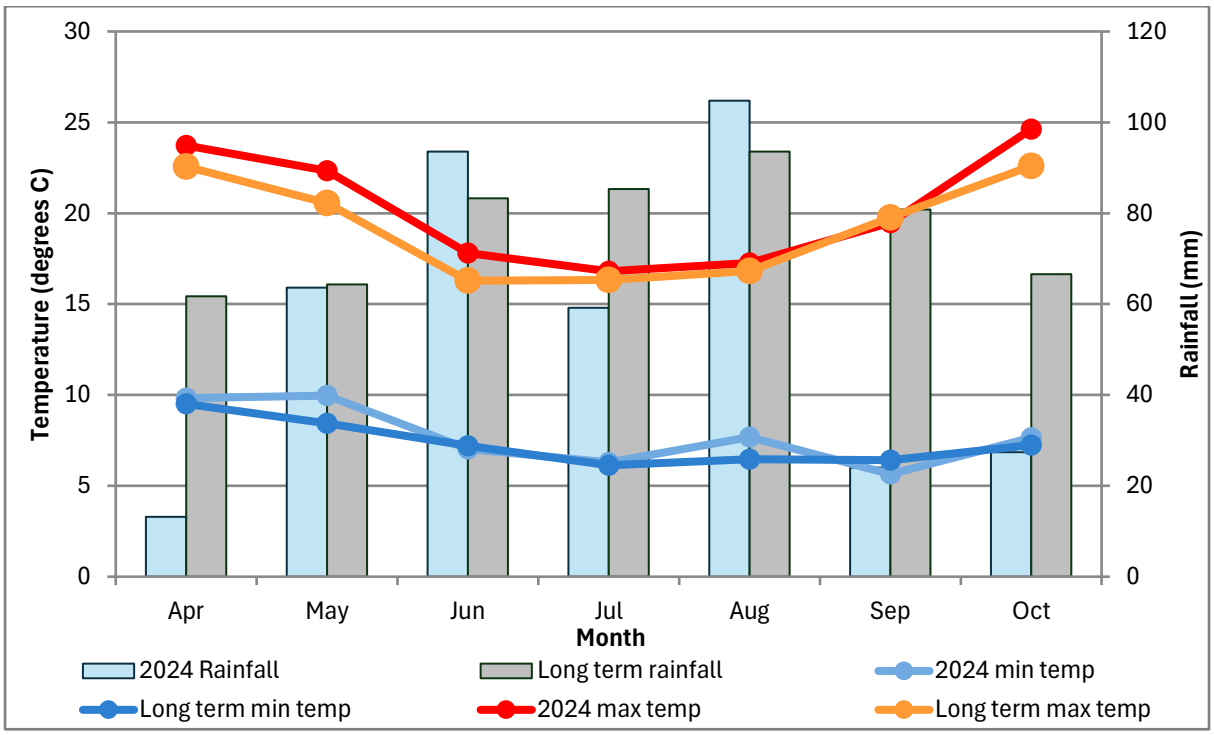

Figure 1. 2024 growing season rainfall and long-term rainfall recorded at Porongurups (2007-2024). 2024 min and max temperatures, and long-term temperatures recorded at Stirling South (2016-2024). *Growing season rainfall April to October= 385.8 mm.*

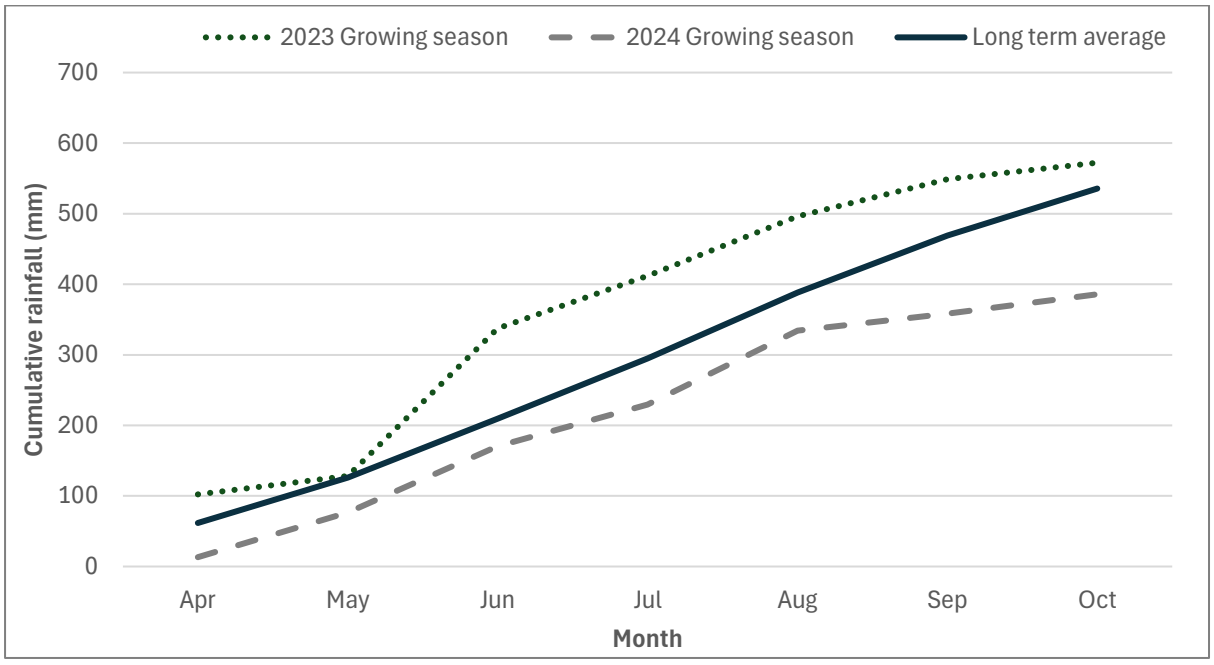

Figure 2. Cumulative growing season rainfall for 2023, 2024 and the long-term average for the growing season (April- October).

APPENDIX C: Supporting Trial Data

Site 1. Gibson

Table 1. Summary of input and application costs used in partial gross margin analysis.

	Cost ($)	Unit
Seed Treatment		
Cruiser	$9.9	/100 kg seed
Rancona Dimension	$3.6	/100 kg seed
Herbicide		
TriflurX	$52.0	/ha
Overwatch	$43.4	/ha
LVE MCPA 570	$5.3	/ha
Clopyralid 750 SG	$4.5	/ha
Insecticide		
Trojan	$1.2	/ha
Fungicide		
Prosaro	$22.4	/ha
Aviator Xpro	$27.3	/ha
Nutrition		
Urea	$720.0	/t
MAP	$1,050	/t
Verno Copper	$0.2	/ha
Applications		
Spraying (per application)	$12.0	/ha
Spreading (per application)	$8.5	/ha

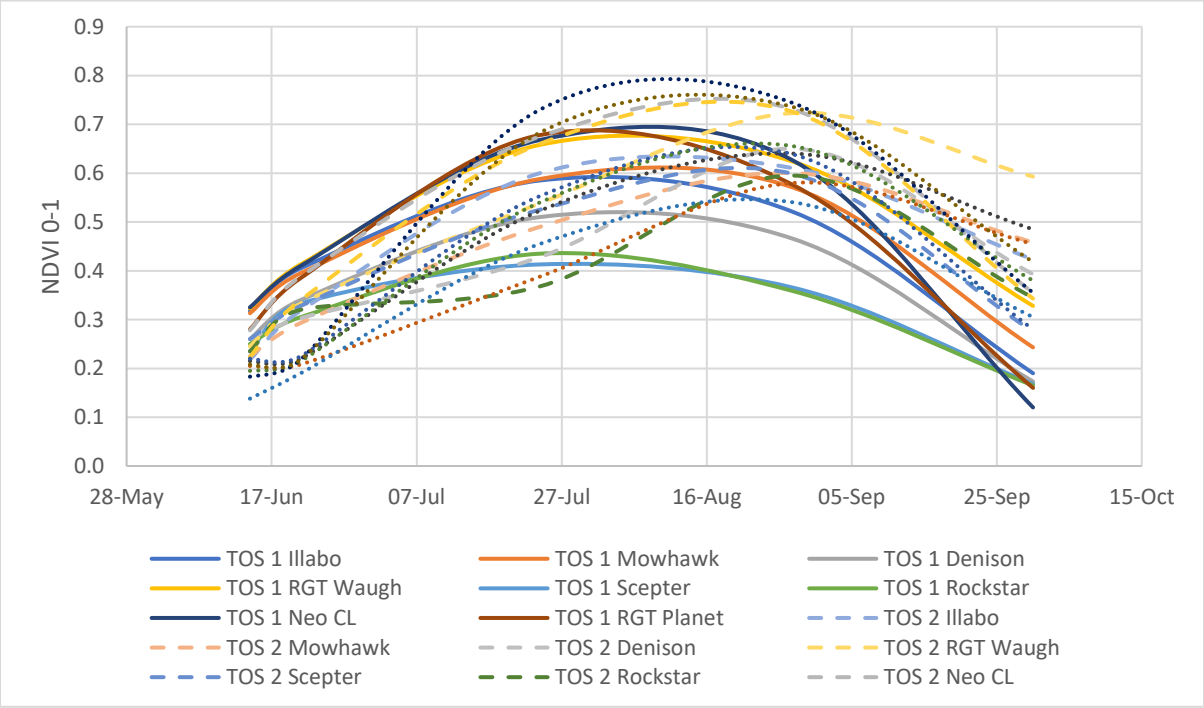

Figure 3. Influence of time of sowing (TOS) and variety on Normalized Difference Vegetation Index (NDVI) (0-1).

Site 2. Scaddan

Table 1. Summary of input and application costs used in partial gross margin analysis.

	Cost ($)	**Unit**
Seed Treatment		
Cruiser	$9.9	/100 kg seed
Rancona Dimension	$3.6	/100 kg seed
Herbicide		
TriflurX	$52.0	/ha
Overwatch	$43.4	/ha
Priority	$5.4	/ha
Fungicide		
Prosaro	$22.4	/ha
Aviator Xpro	$27.3	/ha
Amistar Xtra	$7.2	/ha
Nutrition		
Urea	$665.0	/t
Urea + Sustain	$715.0	/t
MAP	$1050.0	/t
Applications		
Spraying (per application)	$12.0	/ha
Spreading (per application)	$8.5	/ha
Aerial application (per application)	$20.0	/ha

Site 3. Frankland River

Table 1. Summary of input and application costs used in partial gross margin analysis.

	Cost ($)	Unit
Seed Treatment		
Cruiser	$9.9	/100 kg seed
Rancona Dimension	$3.6	/100 kg seed
Herbicide		
TriflurX	$52.0	/ha
Overwatch	$43.4	/ha
LVE MCPA 570	$5.3	/ha
Jaguar	$17.2	/ha
Insecticide		
Trojan	$1.2	/ha
Fungicide		
Prosaro	$22.4	/ha
Aviator Xpro	$27.3	/ha
Nutrition		
Urea	$720.0	/t
MAP/MOP/MnSO4 (66/29/5) blend	$144.2	/ha
Urea/MOP (40/60) blend	$160.9	/ha
Zinc sulphate mono 35%	$3.5	/ha
Magnesium sulphate	$30.4	/ha
Applications		
Spraying (per application)	$12.0	/ha
Spreading (per application)	$8.5	/ha

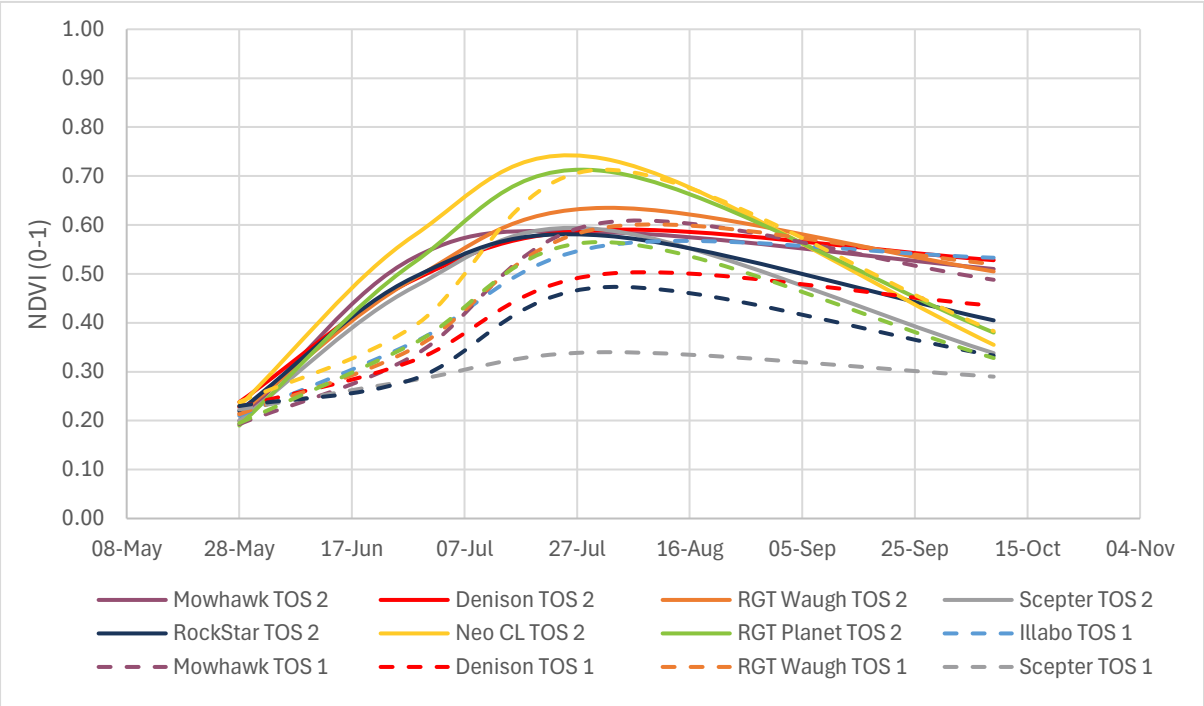

Figure 3. Influence of time of sowing (TOS) and variety on Normalized Difference Vegetation Index (NDVI) (0-1)

Site 4. South Stirling

Table 1. Summary of input and application costs used in partial gross margin analysis.

	Cost	Unit
Seed Treatment		
Cruiser	$9.9	/100 kg seed
Rancona Dimension	$3.6	/100 kg seed
Herbicide		
TriflurX	$52.0	/ha
Overwatch	$43.4	/ha
Velocity	$35.0	/ha
Fungicide		
Prosaro	$22.4	/ha
Aviator Xpro	$27.3	/ha
Nutrition		
NS61	$640.0	/t
MAP	$1,050	/t
Applications		
Spraying (per application)	$12.0	/ha
Spreading (per application)	$8.5	/ha

Appendix D: Photos

Image 1. Location of Gibson trial within the FAR Australia Esperance Crop Technology Centre. Taken at the main field day on 12 September 2024.

Image 2. Spring wheat tiller compensation TOS 1 (sown 26 March) at the Gibson trial. Sept 2024

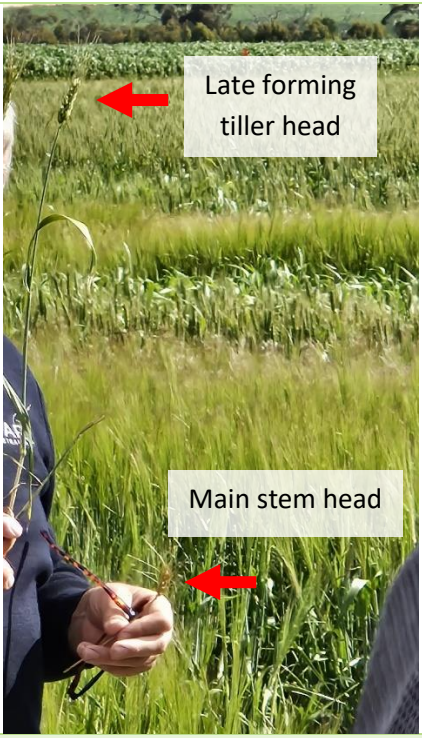

Image 3. Demonstration of late forming tillers vs main tillers at the Frankland River field day. Taken 19 September 2024.

Image 4. Location of Frankland River trial within the FAR Australia Albany Crop Technology Centre. Taken at the main field day on 19 September 2024.

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