GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

HYPER YIELDING CROPS

2021 Results

Prepared by:

FAR AUSTRALIA

Department of Primary Industries and Regional Development · MFMG · CSIRO · RiverinePlains · FAR AUSTRALIA · CeRDI | Federation University Australia · BRILLAG Agronomy & Research · TechCrop · Stirlings to Coast Farmers · SFS

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2021 growing season

Barley Results

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2021 SA Crop Technology Centre
Millicent, South Australia

Time of Sowing 1

Sown: 21 April 2021
Harvested: 14 December 2021 (2nd harvest date for Trial 5 on 4 January 2022)
Rotation position: 1st cereal after faba beans, 2019 canola
Soil type & management: Neutral-slightly alkaline Organosol (Peat soil) – high organic matter (0-30cm)
Soil Mineral N (NO_3): 151.0 ppm on 1 June 2021

Trial 2. HYC Elite Screen

Objective: To examine the yield potential of new winter and spring germplasm grown under HYC Management packages against spring and winter controls in the traditional late April/early May sowing window.

Key Messages:

- Maximum yields achieved in early sown spring cultivars was 8.24 and 7.77t/ha in high rainfall control cultivars RGT Planet and Rosalind, and other experimental spring lines topped 8.49t/ha.
- Pixel a 6 row winter barley achieved 10.5t/ha, and 2 row winter cultivars achieved 9.2 and 9.4t/ha.
- Defoliation to delay development did not improve yield in Rosalind and Planet.
- Grain quality (table 3) of high yielding winter lines achieved malt specifications, whereas spring cultivars had lower test weights and higher grain screenings.
- This is an exciting development in earlier sowing barley systems to achieve yields >10t/ha and suggests this sowing date is unsuited to current and experimental spring barley cultivars.
- Head loss and lodging was minimal in this experiment.

Treatments: 10 elite lines tested under HYC High input management including disease and lodging control along with N supply for 10t/ha (see treatment notes).

Table 1. Grain yield (t/ha) and variety type tested under high yielding management conditions[1]

Variety		Type	Grain yield (t/ha)
1.	Planet	2 Row Spring (Control)	8.24
2.	Rosalind	2 Row Spring (Control)	7.77
Experimental Lines[2]			
3.	AGTB0244	2 Row Spring	7.70
4.	Laureate	2 Row Spring	8.49
5.	Cassiopee	2 Row Winter	8.31
6.	Madness	2 Row Winter	8.28
7.	Newton	2 Row Winter	9.22
8.	Memento	2 Row Winter	9.41
9.	Pixel	6 Row Winter	10.50
10.	Visual	6 Row Winter	7.68

11.	Rosalind defoliated[3]	2 Row Spring		4.17
12.	Planet defoliated[3]	2 Row Spring		7.16
			Mean	8.10
			LSD	0.64
			P Val	<0.001

^Treatment footnotes:

1. Treatments: 12 elite lines tested under high yielding management conditions (full foliar fungicide program (Systiva & 3 foliar fungicides – GS31, GS39 & GS61) and PGR management applied as Moddus 200ml @ GS30 - GS32.
2. Experimental lines are yet to be commercially available in Australia and the first evaluation of longer season winter lines suited to the HRZ.
3. These spring lines were mechanically defoliated (mower) below the first visible node (GS31 – GS32) during early stem elongation to delay crop development.

Table 2. Trial input and management details (kg, g, ml/ha).
All inputs of insecticides and herbicides were standard across the trial.

Plant population		200 seeds/m^2
Seed treatment:		Vibrance, Gaucho & Systiva
Defoliation:		Planet and Rosalina Reset only
Basal Fertiliser:	18 April	100kg MAP
Nitrogen:	4 August	87 kg Urea (40 N)
	5 October	175 kg Urea (80.5 N)
PGR:	3 August	Moddus Evo 200mL/ha
Fungicide:	3 August	Prosaro 300mL/ha
	26 September	Radial 840mL/ha
	17 October	Opus 500mL/ha

Table 3. Grain Quality parameters of barley cultivars

Variety		**Quality Parameters**			
		Protein	Test weight	Screenings	Retention
		%	Kg/hL	%	%
1.	Planet	11.5 bc	65.9 bcd	4.7 ef	85.6 b
2.	Rosalind	11.1 c	64.1 de	11.4 b	64.5 d
3.	AGTB0244	11.2 c	65.4 cd	6.0 de	80.3 c
4.	Laureate	10.6 c	62.4 e	7.5 cd	80.8 c
5.	Cassiopee	13.4 a	69.7 a	2.3 h	92.1 a
6.	Madness	13.4 a	69.7 a	4.3 efg	88.9 ab
7.	Newton	12.5 ab	67.7 ab	3.3 fgh	91.3 a
8.	Memento	12.6 ab	67.9 ab	2.9 gh	91.6 a
9.	Pixel	11.4 bc	67.3 bc	2.7 gh	89.9 a
10.	Visual	10.8 c	67.9 ab	2.9 gh	90.2 a
11.	Rosalind defoliated	11.8 bc	63.0 e	16.0 a	56.3 e
12.	Planet defoliated	11.0 c	63.2 e	8.2 c	77.5 c
	Mean	11.78	66.19	6.00	82.41
	LSD	1.24	2.13	1.77	3.76
	P Val	<0.001	<0.001	<0.001	<0.001

Trial 3. HYC G.E.M Trial series

Objective: To assess the performance of winter (2 and 6 row) and spring (2 row) barley germplasm managed under six different management strategies.

Key Messages:

- Disease resistance of Pixel was far superior to Planet, management significantly influenced grain yield in the disease susceptible cultivar Planet.
- RGT Planet responded the most to intensifying fungicide inputs achieving 3.98t/ha under standard inputs and 6.48t/ha under higher inputs. The addition of PGR and or more N did not further increase yield in Planet.
- Madness a 2 row winter barley achieved yields in the range of 5.35 – 6.14t/ha across all management and demonstrates its improved disease resistance. There was no yield penalty from grazing.
- Pixel a 6 row winter barley achieved yields in the range of 7.45 – 8.72t/ha across all management combinations. The addition of a PGR in both standard and high input systems resulted in the highest yields of 8.66 and 8.72t/ha.
- The improved disease resistance of winter barley shows it can be farmed with less intensive fungicide strategies when early sowing, Planet is less suited to this system as the disease pressure is too high.
- Tests weights and retention were lower, and screenings higher in Planet compared to the winter varieties which highlights the significant effect of disease (even under high inputs).
- Proteins were all above 11% and suggests yield was non limited by N
- Net form of Net Blotch was the main disease which affected up to 80% of the canopy in Planet under standard conditions.

Treatments:

Treatment ID	Fungicide*	Canopy Intervention	Kg Nitrogen
1. Standard (Std) Fungicide & no intervention (NI)	Standard (cheaper)	Untreated	180
2. Standard (Std) Fungicide & PGR	Standard (cheaper)	PGR	180
3. Higher input Fungicide & no intervention (NI)	Higher input	Untreated	180
4. Higher input Fungicide & PGR	Higher input	PGR	180
5. Hyper - yield system	Higher input	PGR	Extra N 260
6. Dual - purpose system*	Higher input	Defoliation	Extra N 260

[1] Standard Management Control – 2 x cheaper foliar fungicide propiconazole (Tilt® 250 EC at 500mL/ha) @GS31 and tebuconazole (Folicur® 430 SC 290 mL/ha) @GS39-49.
[2] Increased disease management – Systiva® seed treatment, 2 x foliar fungicides including QoI (strobilurin) & SDHI combinations with DMIs) with third fungicide if required.
[3,4] Plant growth regulators (PGR) (Moddus® Evo 200 mL/ha @GS30 & Moddus Evo 200mL/ha @GS33-37).
Defoliation was done mechanically (mower) prior to the GS30

Table 1. Influence of management strategy and cultivar on grain yield (t/ha).

	Cultivar							
	Planet		**Madness**		**Pixel**		**Mean**	
Management	**Yield t/ha**		**Yield t/ha**		**Yield t/ha**			
1. Std & NI	3.98	f	5.35	e	8.32	ab	**5.89**	**-**
2. Std & PGR	3.79	f	5.57	cde	8.66	a	**6.00**	**-**
3. High & NI	6.48	c	5.71	cde	7.93	ab	**6.70**	**-**
4. High & PGR	6.33	cd	6.14	cde	8.72	a	**7.06**	**-**
5. Hyper-yield system	5.48	de	5.80	cde	8.69	a	**6.66**	**-**
6. Dual-purpose system	5.90	cde	5.79	cde	7.45	b	**6.38**	**-**
Mean	**5.33**	**c**	**5.73**	**b**	**8.29**	**a**		

LSD Cultivar p = 0.05	0.37	**P val**	0.123
LSD Management p = 0.05	0.94	**P val**	<0.001
LSD Cultivar x Man. P = 0.05	0.91	**P val**	<0.001

Table 2. Influence of management strategy and cultivar on retention (% >2.2 mm).

	Cultivar							
	Planet		**Madness**		**Pixel**		**Mean**	
Management	**Retention % >2.2 mm**		**Retention % >2.2 mm**		**Retention % >2.2 mm**			
1. Std & NI	76.2	fg	86.2	bcd	89.8	ab	**84.1**	**ab**
2. Std & PGR	68.9	h	73.7	g	82.4	de	**75.0**	**c**
3. High & NI	84.0	d	86.3	bcd	90.8	a	**87.0**	**a**
4. High & PGR	78.6	ef	76.4	fg	84.3	d	**79.8**	**b**
5. Hyper-yield system	77.6	f	77.1	fg	84.9	cd	**79.9**	**b**
6. Dual-purpose system	83.9	d	88.5	abc	89.6	ab	**87.4**	**a**
Mean	**78.2**	**c**	**81.4**	**b**	**87.0**	**a**		
LSD Cultivar p = 0.05	1.6		**P val**		<0.001			
LSD Management p = 0.05	4.7		**P val**		<0.001			
LSD Cultivar x Man. P = 0.05	3.9		**P val**		0.001			

Table 3. Influence of management strategy and cultivar on screenings (% <2.2 mm).

	Cultivar							
	Planet		**Madness**		**Pixel**		**Mean**	
Management	**Screenings % <2.2 mm**		**Screenings % <2.2 mm**		**Screenings % <2.2 mm**			
1. Std & NI	7.2	bc	5.1	de	2.0	f	**4.8**	**b**
2. Std & PGR	9.3	a	9.1	a	4.5	e	**7.6**	**a**
3. High & NI	4.6	e	5.2	de	2.0	f	**3.9**	**b**
4. High & PGR	6.5	cd	8.9	a	4.8	e	**6.8**	**a**
5. Hyper-yield system	7.1	bc	8.6	ab	4.3	e	**6.7**	**a**
6. Dual-purpose system	5.1	de	4.2	e	2.2	f	**3.8**	**b**

Mean	**6.7**	**a**	**6.9**	**a**	**3.3**	**b**

LSD Cultivar p = 0.05	0.6	**P val**	<0.001
LSD Management p = 0.05	1.6	**P val**	<0.001
LSD Cultivar x Man. P = 0.05	1.6	**P val**	0.006

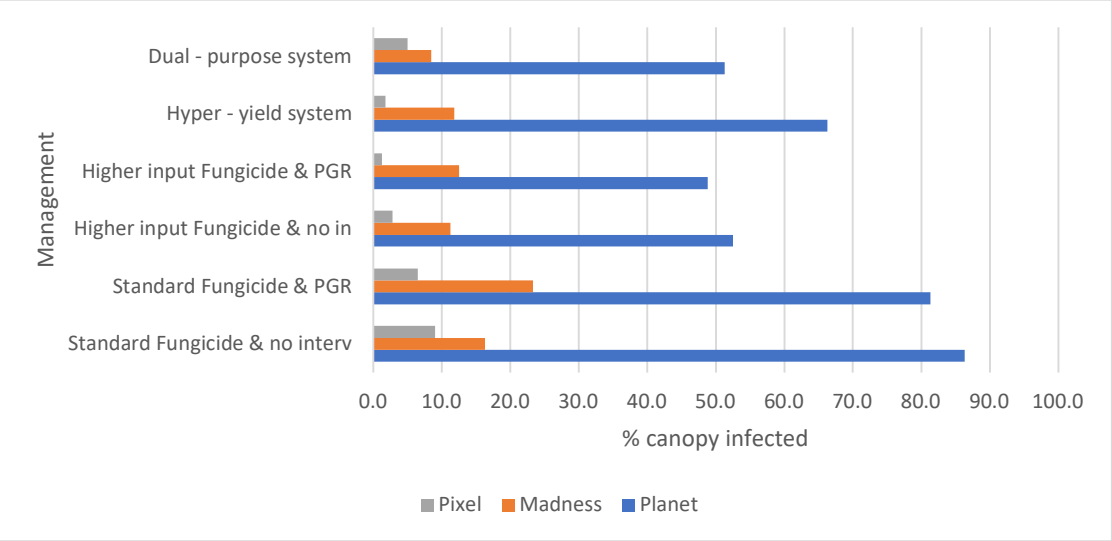

Figure 1. Influence of management strategy and cultivar on net form of net blotch infection (% canopy infected), 22 October 2021. LSD (p = 0.05) = 12.6, P value = 0.004 for the 2-way interaction between management and cultivar.

Trial 4. HYC Disease Management germplasm interaction

Objective: To develop profitable and sustainable approaches to disease management in HRZ barley.

Key messages:

- Yields ranged from 2.75 to 6.16t/ha under different disease management strategies.
- The addition of an SDHI to fungicide program had the largest impact on yield in Planet.
- The application of Systiva on the seed under high disease pressure in this example suggests it is still having good efficacy in the lower SE.
- Quality results also were affected, disease managed plots had higher grain screenings than unmanaged plots.

Treatments: 16 fungicide management levels applied to Planet.

Table 1. Fungicide treatments applied to Planet sowing date 1 at Millicent 2021.

	Target application timing and product					
	Sow	**GS31**	**GS39-49**	**GS59**	**Grain Yield t/ha**	
1	---	---	---	---	2.75	g
2	Systiva	Prosaro 300 mL/ha	Radial 840 mL/ha	---	5.47	a b
3	Systiva	Prosaro 300 mL/ha	Radial 840 mL/ha	Opus 500 mL/ha	4.93	bc

4	---	Prosaro 300 mL/ha	Aviator Xpro 420 mL/ha	---	4.42	cd
5	---	---	Aviator Xpro 420 mL/ha	---	3.95	d e
6	---	---	FAR F1-19 750ml/ha	---	4.02	d e
7	---	---	Radial 840 mL/ha	---	3.10	fg
8	---	Prosaro 300 mL/ha	---	---	4.01	d e
9	---	Tilt 500 250 mL/ha	---	---	3.11	fg
10	Systiva	---	Radial 840 mL/ha	---	5.15	bc
11	---	Prosaro 300 mL/ha	Radial 840 mL/ha	---	4.04	d e
12	---	Prosaro 300 mL/ha	Aviator Xpro 420 mL/ha	Opus 500 mL/ha	4.58	cd
13	---	Aviator Xpro 420 mL/ha	Radial 840 mL/ha	---	4.90	bc
14	---	Prosaro 300 mL/ha	Radial 420 mL/ha	---	3.61	ef
15	Systiva	Prosaro 300 mL/ha	Aviator Xpro 420 mL/ha	Opus 500 mL/ha	6.16	a
				Mean	4.20	
				LSD	0.76	
				P Val	<0.001	

Table 2. Grain yield and quality (protein (%), test weight (kg/hL), retention (%) and screenings (%))

		Protein	**Test weight**	**Retention**	**Screenings**
	Fungicide Management	**%**	**Kg/hL**	**%>2.2mm**	**%<2.2mm**
1.	**Untreated**	11.1 -	62.7 -	70.7 bc	10.2 ab
2.		12.1 -	67.1 -	83.5 ab	5.3 ef
3.		12.0 -	66.6 -	82.6 ab	5.5 ef
4.		11.8 -	65.4 -	81.1 ab	6.3 de
5.		8.9 -	46.6 -	58.9 c	5.6 ef
6.		12.2 -	61.2 -	80.9 ab	6.5 de
7.		11.6 -	61.9 -	74.7 ab	9.1 abc
8.		11.5 -	65.5 -	72.1 abc	9.3 abc
9.		12.5 -	65.6 -	73.3 abc	9.0 bc
10.		11.8 -	67.3 -	84.3 ab	4.8 ef
11.		11.8 -	65.3 -	75.7 ab	8.1 cd
12.		11.9 -	66.0 -	81.7 ab	5.9 ef
13.		11.8 -	65.7 -	80.8 ab	6.4 de
14.		12.3 -	65.5 -	75.0 ab	8.5 bc
15.		11.3 -	66.4 -	86.5 a	4.3 f
	Mean	11.6	63.8	77.0	7.2
	LSD	2.4	11.2	14.6	1.8
	P Val	0.472	0.109	0.049	<0.001

Trial 5. HYC PGR x harvest date interaction

Objective: To assess the value of PGRs with delayed harvest in HRZ regions on maintaining yield and reducing head loss, brackling and lodging.

Key messages:

- Planet harvested on time yielded 4.79t/ha and 1t less at 3.75 when harvest was delayed by 21 days.
- Pixel yielded 9.25t/ha when harvested on time, and 2t less when harvest was delayed by 21 days at 7.37t/ha.
- PGRs had a significant impact on plant architecture, however there was minimal lodging in this experiment.
- PGR yield responses were variable but never yielded lower than untreated when harvest was delayed.
- This highlights the differences in yield loss to head loss and shattering in different cultivars and suggests harvest logistics are likely to be more effective than PGRs in managing yield losses.
- A single application of a PGR Moddus @GS31 did not reduce height in Pixel and Planet despite significantly reducing the first internode height demonstrating some evidence of bounce back.
- A two-spray approach of a PGR Moddus @GS31 and Moddus @GS39 significantly reduced height from 108cm to 99cm in Pixel, and from 85cm to 80cm in Planet.
- A two-spray approach of a PGR Moddus @GS31 and Ethephon @GS39 significantly reduced height similar to the Moddus combination.
- Peduncle length was shortened from 25.6 to 21.8cm in Pixel, and from 21.4 to 16.7cm in Planet when the second application of a Moddus PGR was applied at GS39, the ethephon PGR reduced peduncle length to a greater degree down to 19.8cm in pixel, and 11.9cm in Planet.

Treatments: 4 PGR management approaches applied to two cultivars, to be harvested at two harvest dates (on time: 14 December 2021, delayed: 4 January 2022).

Plant growth regulators (PGR) treatments

1. Untreated
2. GS31 PGR (Moddus® Evo 200 mL/ha @GS31) & Moddus Evo 200mL/ha @GS33-37).
3. GS31 + GS39 PGR (Moddus® Evo 200 mL/ha @GS31 & Moddus Evo 200mL/ha @39).
4. GS31 + G39 PGR (Europe Style) - (Moddus® Evo 200 mL/ha @GS31 & Ethephon 500mL/ha @39).

Cultivars:
Pixel (6 row Winter) and Planet

Table 1. Influence of harvest date, variety and canopy management regime on grain yield (t/ha).

		RGT Planet	***Pixel***	***Mean***
Variety		4.27	8.31	
	LSD	***0.26***	***P-Value***	***<0.001***
Harvest Date				
On time		4.79	9.25	7.02
Delayed 3 weeks		3.75	7.37	5.56

Harvest Date Management	***LSD***	***0.31***	***P-Value***	***<0.001***
Harvest Date x Variety	***LSD***	***0.38***	***P-Value***	***<0.001***
Canopy Management Regime				
Untreated		4.56	8.07	6.32
GS31 PGR		4.20	8.32	6.26
GS31 + GS39 PGR		4.41	8.73	6.57
GS31 + GS39 PGR (Ethephon)		3.92	8.11	6.02
Canopy Management Regime	***LSD***	***0.31***	***P-Value***	***0.230***
Variety x Canopy Mgmt Regime	***LSD***	***0.48***	***P-Value***	***0.485***
Harvest Date. x Canopy Mgmt. Regime				
On Time				
Untreated		5.03	9.07	7.05
GS31 PGR		4.80	9.34	7.07
GS31 + GS39 PGR		5.01	9.48	7.25
GS31 + GS39 PGR (Ethephon)		4.32	9.11	6.72
Delayed 3 weeks				
Untreated		4.09	7.08	5.59
GS31 PGR		3.60	7.29	5.45
GS31 + GS39 PGR		3.80	7.98	5.89
GS31 + GS39 PGR (Ethephon)		3.51	7.12	5.32
Harvest Date x Canopy Mgmt	***LSD***	***0.49***	***P-Value***	***0.966***
Harvest Date x Canopy Mgmt x Variety	***LSD***	***0.71***	***P Value***	***0.894***

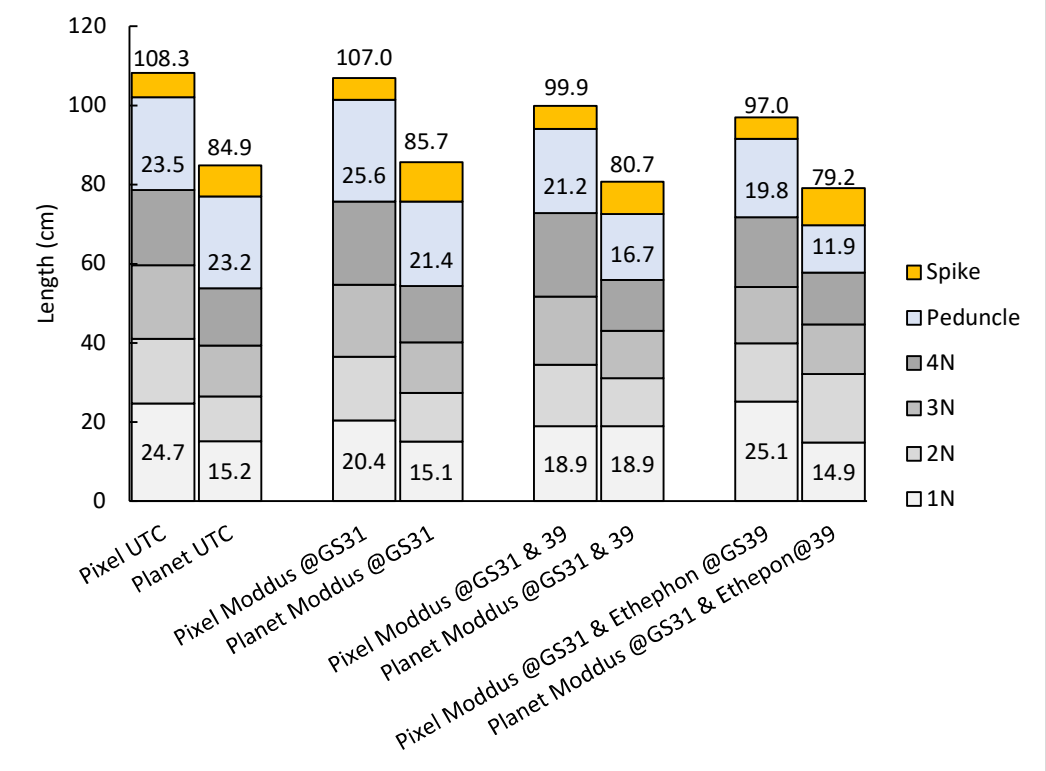

Figure 1. Influence of harvest date, variety and canopy management regime on spike, peduncle and internode lengths (cm) at harvest (GS89).

Time of Sowing 2

Sown: 12 May 2021
Harvested: Trial 2, 3, 6 on 4 January 2022, trial 9 on 10 January 2022
Rotation position: 1st cereal after faba beans, 2019 canola
Soil type & management: Neutral-slightly alkaline Organosol (Peat soil) – high organic matter (0-30cm)
Soil Mineral N (NO_3): 151.0 ppm on 1 June 2021

Trial 2. HYC Elite Screen

Objective: To examine the yield potential of new winter and spring germplasm grown under HYC Management packages against spring and winter controls in the traditional late April/early May sowing window.

Key Messages:

- RGT Planet and Rosalind both yielded 7.85 and 8.02t/ha respectively.
- Minotaur and IGB1844 were the highest yield cultivars yielding 9.03t/ha and 9.33t/ha respectively.
- Cultivars that had superior head retention yielded higher such as the erect plant type observed in IGB1844.
- Water logging tolerant Planet yielded similar to Planet under non water logged conditions suggesting it has similar yield potential.
- Fandaga barley yielded less than all other cultivars and appears unsuited to the peat soils around Millicent for the second season in a row.
- Winter cultivars Cassiopee and Pixel yielded 6.73t/ha and 6.14t/ha respectively less than the best performing spring cultivars.
- Cultivars differed in quality, protein levels were all above 11.8% and other grain quality parameters were within malt quality receival standards.

Treatments: 16 elite lines tested under HYC High input management (full foliar fungicide program (Systiva & 3 foliar fungicides – GS31, GS39 & GS61) and PGR management.

Table 1. Grain yield and quality (protein (%) and test weight (kg/hL), retention (%) and screenings (%)).

Variety		Grain yield and quality									
		Yield		Protein		Test weight		Retention		Screenings	
		t/ha		%		Kg/hL		% >2.2mm		%<2.2mm	
1.	**RGT Planet**	7.85	abc	12.2	ef	71.0	de	85.7	de	3.8	def
2.	**Rosalind**	8.02	abc	12.9	cde	71.6	cd	70.5	i	6.3	bc
3.	**Minotaur**	9.03	a	13.1	bcd	73.4	b	93.5	ab	2.3	gh
4.	**AGTB0244**	6.16	d	11.8	f	69.2	f	80.2	gh	5.0	cd
5.	**HV8 Nitro**	8.34	ab	12.2	ef	73.0	b	90.0	bcd	2.9	efg
6.	**Laperouse**	8.11	abc	13.4	bc	74.7	a	95.1	a	1.2	h
7.	**Laureate**	8.35	ab	12.7	cde	70.3	e	88.5	cde	3.2	efg
8.	**GSP-18-44-B**	7.12	bcd	12.7	cde	71.1	d	81.0	fg	4.8	d
9.	**IGB1844**	9.33	a	13.9	b	72.8	b	76.5	h	6.8	ab
10.	**Alestar**	8.17	abc	12.3	ef	72.0	c	86.3	de	3.8	def
11.	**Fandaga**	2.65	e	12.9	cde	70.8	de	76.8	gh	8.0	a
12.	**Sunshine**	8.09	abc	13.4	bc	72.8	b	91.5	abc	2.2	gh

13.	**Bottler**	7.14	bcd	12.4	def	73.5	b	89.8	bcd	2.5	fgh
14.	**Cassiopee**	6.73	cd	15.5	a	72.9	b	95.4	a	1.3	h
15.	**Pixel**	6.14	d	12.2	ef	70.2	e	91.5	abc	1.9	gh
16.	**Planet (waterlog tolerant)**	7.95	abc	12.5	def	70.3	e	84.9	ef	4.1	de
	Mean	7.45		12.9		71.9		86.1		3.8	
	LSD	1.48		0.8		0.8		4.4		1.5	
	P Val	<0.001		<0.001		<0.001		<0.001		<0.001	

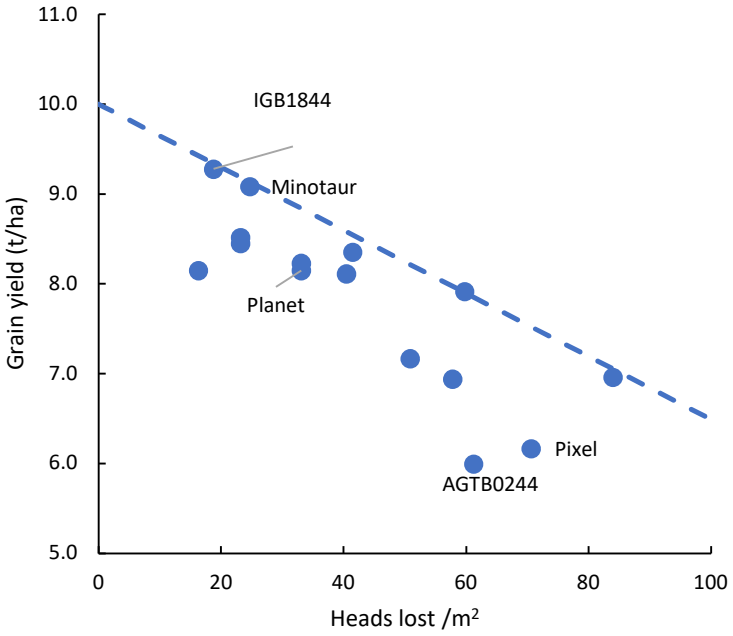

Figure 1. Relationship between heads lost and grain yield at Millicent in sowing date 2 in 2021

Trial 3. HYC G.E.M Trial series

Objective: To assess the performance of winter and spring barley germplasm managed under four different management intensities (mid-April to early May sown) at two levels of fungicides.

Key Messages:

- Laureate and Rosalind had superior disease resistance to Net form of net blotch to Planet, this meant lower fungicide strategies could be used in Laureate and Rosalind.
- The addition of PGR to Laureate increased yield from 6.63 under standard management to 8.11t/ha, and 7.88t/ha in the higher fungicide inputs.
- Laureate was the highest yielding treatment in the yper yielding system at 8.87t/ha, compared to Rosalind at 8.11 and Planet at 8.28.
- The Planet data highlights it requires less intensive management when sowing dates are later than April (compared to TOS 1 GEM).

Treatments:

Treatment ID	Fungicide*	Canopy Intervention	Kg Nitrogen
1. Standard (Std) Fungicide & no intervention (NI)	Standard (cheaper)	Untreated	180
2. Standard (Std) Fungicide & PGR	Standard (cheaper)	PGR	180
3. Higher input Fungicide & no intervention (NI)	Higher input	Untreated	180
4. Higher input Fungicide & PGR	Higher input	PGR	180
5. Hyper - yield system	Higher input	PGR	Extra N 260

[1] Standard Management Control – 2 x cheaper foliar fungicide propiconazole (Tilt® 250 EC at 500mL/ha) @GS31 and tebuconazole (Folicur® 430 SC 290 mL/ha) @GS39-49.
[2] Increased disease management – Systiva® seed treatment, 2 x foliar fungicides including QoI (strobilurin) & SDHI combinations with DMIs) with third fungicide if required.
[3,4] Plant growth regulators (PGR) (Moddus® Evo 200 mL/ha @GS30 & Moddus Evo 200mL/ha @GS33-37).

Table 1. Influence of management strategy and cultivar on grain yield (t/ha).

	Cultivar							
	Planet		**Rosalind**		**Laureate**		**Mean**	
Management	**Yield t/ha**		**Yield t/ha**		**Yield t/ha**			
Standard Fungicide & no intervention	6.24	-	6.94	-	6.63	-	**6.60**	-
Standard Fungicide & PGR	6.12	-	7.44	-	8.11	-	**7.22**	-
Higher input Fungicide & no intervention	7.33	-	7.21	-	7.59	-	**7.38**	-
Higher input Fungicide & PGR	7.46	-	7.55	-	7.88	-	**7.63**	-
Hyper-yield system	8.28	-	8.11	-	8.87	-	**8.42**	-
Mean	**7.08**	**b**	**7.45**	**ab**	**7.81**	**a**		
LSD Cultivar p = 0.05		0.39		**P val**		0.003		
LSD Management p = 0.05		1.32		**P val**		0.109		
LSD Cultivar x Man. P = 0.05		0.87		**P val**		0.008		

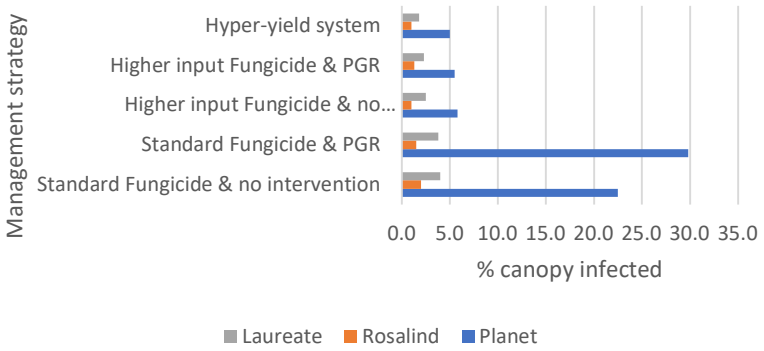

Figure 1. Influence of management strategy and cultivar on net form of net blotch infection (% canopy infected), 22 October 2021. LSD (p = 0.05) = 5.7, P value = <0.001 for the 2-way interaction between management and cultivar.

Trial 4: HYC Nutrition for Hyper Yielding Barley

Objectives: To assess the value of higher nutrition input for barley and to investigate the relationship between N and yield constraints such as lodging and brackling.

Key messages:

- The10 kg N treatment yielded significantly higher than all other treatments except 50kg N, and was the only treatment to yield >8 t/ha.
- Yield declined with additional Nitrogen.
- 10 units of N achieved 8.21t/ha and 290kg N achieved 7.27t/ha, this yield decline was not due to haying off but due to excessive biomass production early in the season resulting in lodging and brackling.
- Protein levels were above 11.8% in all treatments and suggests N was not limiting yield in all treatments.
- Other grain quality parameters were not influenced by N.

Treatments: Six nutrition treatments on cultivar RGT Planet

Table 1. Nitrogen input (kg N) and application timings.

Treatment	Basal fertiliser - 100 kg MAP (kg N)	4 weeks after sowing (kg N)	Tillering (kg N)	GS30-32 (kg N)	GS37 (kg N)	Total kg N
1	10	0	0	0	0	10
2	10	10	10	10	10	50
3	10	20	25	25	15	95
4	10	30	50	50	20	160
5	10	40	75	75	25	225
6	10	50	100	100	30	290

Table 2. Grain yield and quality (protein (%) and test weight (kg/hL), retention (%) and screenings (%)).

Nutrition		Grain yield and quality				
		Yield	Protein	Test weight	Retention	Screenings
		t/ha	%	Kg/hL	% >2.2mm	%<2.2mm
1.	**10 kg N**	8.21 a	12.1 -	69.9 -	85.3 -	4.0 -
2.	**50 kg N**	7.84 ab	11.8 -	69.9 -	85.7 -	3.9 -
3.	**95 kg N**	7.64 bc	11.9 -	70.2 -	87.0 -	3.6 -
4.	**160 kg N**	7.17 c	12.1 -	70.0 -	85.5 -	4.0 -
5.	**225 kg N**	7.32 bc	12.5 -	70.4 -	88.0 -	3.3 -
6.	**290 kg N**	7.27 c	12.7 -	70.0 -	87.5 -	3.5 -
	Mean	7.58	12.2	70.1	86.5	3.7
	LSD	0.53	0.7	0.5	2.1	0.6
	P Val	0.005	0.108	0.363	0.059	0.130

Trial 5: HYC Planet Seeding Rate Trial

Objectives: To assess effects of seeding rate in RGT Planet barley.

Key messages:

- Yield began to decline under seeding rates less than 160 seeds/m2.
- Increasing seeding rates up to 300 seeds m^2 did not further improve yield.
- These results confirm that seeding densities should remain above 150 seeds/m^2 in barley in the HRZ.

Treatments: Nine seeding rates in cultivar RGT Planet.

Table 1. Grain yield and quality (protein (%) and test weight (kg/hL), retention (%) and screenings (%)).

Seeding rate		Grain yield and quality									
		Yield		Protein		Test weight		Retention		Screenings	
		t/ha		%		Kg/hL		% >2.2mm		%<2.2mm	
1.	60 Seeds	4.28	de	12.5	a	69.3	-	71.2	cd	9.6	ab
2.	90 Seeds	3.74	e	12.1	abc	69.3	-	70.1	d	10.2	a
3.	120 Seeds	4.74	cd	11.8	a-d	69.8	-	73.2	bcd	8.0	abc
4.	150 Seeds	4.80	bcd	11.5	cd	69.1	-	75.9	abc	7.3	bcd
5.	180 Seeds	5.11	abc	11.5	cd	70.2	-	77.7	ab	6.3	cd
6.	210 Seeds	5.47	abc	11.5	cd	69.9	-	80.9	a	5.2	d
7.	240 Seeds	5.74	a	11.8	bcd	70.0	-	79.9	a	5.7	d
8.	270 Seeds	5.55	ab	12.3	ab	70.2	-	80.6	a	5.2	d
9.	300 Seeds	5.07	abc	11.3	d	70.2	-	78.5	ab	5.8	cd
	Mean	4.94		11.8		69.8		76.4		7.0	
	LSD	0.78		0.7		0.8		5.4		2.3	
	P Val	0.001		0.031		0.054		0.003		0.001	

2021 TAS Crop Technology Centre
Hagley, Victoria

Experimental Details

Sown: 8 September 2021
Harvested: 20 January (1st Harvest Date) to 4 February 2022 (2nd Harvest Date)
Rotation position: 1st cereal after Poppies
Soil Type: Chromosol

Spring sown barley summary:

- Peak yield of 10.98t/ha was achieved in 2021, 10t/ha can be consistently achieved across diverse management regimes in Planet.
- Further evidence that harvest index rapidly declines in barley at 16t/ha of dry matter.
- Laureate has high yield potential but is more prone to lodging and brackling.
- Higher N rates increased brackling and Lodging.
- Evidence to suggest harvest indices approaching 60% are possible in irrigated spring sown barley.
- Fungicide management is easier in spring sown barley compared to Autumn sowing barley.
- PGR responses were variable for lodging and brackling, but later applications reduced head loss.
- A 14 day harvest delay did not result in significant yield loss in 2021 and PGR treatment had little impact.

The key feature of the Tasmania HYC Barley site is the fact it is spring sown and supplemented with irrigation. This presents different challenges to growing barley such as a greater chance of heat risk during grain fill, and brackling from rapid growth during stem extension. Cultivars that are less responsive to longer days (photoperiod) are also required to ensure they do not develop too early and build insufficient biomass.

Trial 1. HYC 1st Stage Screen

Objective: To examine the phenology, disease resistance and standing power of new barley germplasm established at the start of spring.

Key Messages:

- Plant height varied from 59cm in Minotaur to 95cm in Crescendo.
- Data highlights the increased lodging incidence in Laureate and this will need to be managed.
- Shorter cultivars in this trial were also less prone to lodging.
- The incidence of brackling was less in 2021 than 2020.
- Lodging and brackling were not always correlated suggesting they are genetically independent and may require different management solutions.
- These data highlight plant heights lower than 80cm, lodging and brackling can all be reduced with genetic solutions.
- Spring lines such as Laureate, and Crescendo developed later than Planet.
- Laperouse and Rosalind developed earlier than Planet.

Treatments: 20 lines sown in small plots (5m in length depending on site) with standard nitrogen management but no fungicide or no PGR input, not taken to yield.

Table 1. Canopy structure at crop maturity (GS99)

Variety	Crop Height (cm)		Lodging Index (0-500)		Brackling (% Plot)	
RGT Planet	75.5	def	0.0	-	10.0	-
Rosalind	78.0	c-f	2.5	-	10.0	-
Minotaur	59.0	g	0.0	-	6.0	-
AGTB0244	81.5	b-e	0.0	-	3.0	-
HV8 Nitro	85.5	bc	180.0	-	10.0	-
Laperouse	75.0	ef	0.0	-	0.0	-
Laureate	77.5	c-f	195.0	-	17.5	-
GSP-18-44-B	80.0	c-f	0.0	-	5.0	-
Planet + WL	81.0	b-f	5.0	-	65.0	-
Sure	72.0	f	5.0	-	7.5	-
PNA 1-1	84.5	bcd	0.0	-	3.5	-
Crescendo	95.0	a	240.0	-	35.0	-
Bottler	80.0	c-f	15.0	-	37.5	-
AGFBA007618	81.5	b-e	25.0	-	27.5	-
AGFBA007718	74.5	ef	20.0	-	7.5	-
Fatima	80.0	c-f	0.0	-	42.5	-
Westminster	90.0	ab	210.0	-	30.0	-
Leabrook	85.0	bc	85.0	-	47.5	-
AGTB0245	73.0	ef	0.0	-	1.0	-
Sanette	80.0	c-f	250.0	-	32.5	-
Mean	79.4		61.6		19.9	
LSD 0.05	9.3		ns		ns	
P Val	<0.001		0.190		0.412	

Table 2. Details of the management levels (kg, g, ml/ha).

Sowing date:		**8 September**
Seed Rate:		300 seeds/m^2
Sowing Fertiliser:		100kg MAP/ha
Seed Treatment:		Pontiac
Nitrogen:	1 Oct	160kg N/ha
Fungicide:		Nil

Trial 2. HYC Elite Screen

Objective: To examine the yield potential of new spring germplasm grown under HYC Management packages against spring controls in an early spring sowing window.

Key Messages:

- The highest yielding cultivar was RGT Planet at 10.84t/ha while many other spring cultivars yielded similarly including Rosalind.
- Day length sensitive cultivars such as Laperouse and Minotaur yielded 8.24 and 9.65t/ha respectively.
- The older cultivar Westminster 8.65t/ha is now significantly outclassed.
- Laureate's performance was lower than 2020 at 9.93t/ha in 2021, however this was likely due to increased Nitrogen and lodging which will be discussed in the G*E*M trial.
- Other new variety commercial releases such as Fandaga yielded competitive with Planet.
- Grain protein levels were all above 11% except for AGTB0244.

Treatments: (20 elite lines tested under HYC High input management (full foliar fungicide program (Systiva & 2 foliar fungicides – GS30 & GS49).

Table 1. Grain yield of the variety evaluation trial (t/ha, % site mean) and grain quality results.

	Grain Yield			Grain Quality							
Variety	Yield		Site Mean	Protein		Test wt		Retention		Screenings	
	(t/ha)		(%)	%		kg/HL		%		%	
RGT Planet	10.84	a	108.2	11.6	cde	69.4	a-d	88.3	a-d	2.8	cde
Rosalind	10.55	ab	105.4	12.6	bc	70.2	ab	93.5	abc	1.9	de
Minotaur	9.65	c-f	96.3	11.8	cd	69.6	a-d	95.1	ab	2.1	de
AGTB0244	10.28	a-d	102.6	10.5	e	65.7	gh	79.3	d	5.1	a
HV8 Nitro	10.31	a-d	103	11.7	cde	69.9	ab	88.2	a-d	3.2	a-e
Laperouse	8.24	h	82.3	14.6	a	68.5	a-e	96.3	a	1.7	e
Laureate	9.93	b-e	99.2	11.5	cde	67.4	d-g	86.7	a-d	3.3	a-e
GSP-18-44-B	10.19	a-e	101.7	11.2	de	68.1	b-f	79.9	d	4.7	abc
IGB1844	8.97	fgh	89.6	13.5	ab	69	a-e	93.5	abc	2.5	de
Alestar	10.31	a-d	103	11.8	cd	69.9	ab	91.5	abc	2.4	de
Fandaga	10.69	ab	106.8	11.7	cde	67.6	c-g	93.5	abc	2.2	de
Crescendo	9.41	efg	93.9	11.7	cde	66.9	e-h	90.7	abc	2.9	b-e
Bottler	10.11	a-e	101	12	cd	69.8	abc	92.9	abc	2.3	de
Maximus CL	10.42	abc	104.1	11.8	cd	64.8	h	84.5	cd	3	b-e
Buff	10.53	ab	105.2	11.5	cde	66.1	fgh	79.2	d	4.9	ab
Sure	9.5	def	94.8	12	cd	64.8	h	79.5	d	4.7	abc
Westminster	8.65	gh	86.4	12.3	cd	70.4	a	89.8	abc	2.7	cde
Leabrook	10.67	ab	106.6	11.7	cde	69.4	a-d	96	ab	1.4	e
Sanette	10.59	ab	105.8	11.5	cde	68	b-f	84.3	cd	3.8	a-d
Water logging tolerant Planet	10.43	abc	104.2	10.5	e	67.5	d-g	86.5	bcd	3.4	a-e
Mean	10.01		100	11.86		68.15		88.47		3.05	
LSD 0.05	0.84		8.43	1.2		2.27		9.74		2.1	
P Val	<0.001		0.000	<0.001		<0.001		0.003		0.017	

Table 2. Details of the management levels (kg, g, ml/ha).

Sowing date:		8 September
Seed Rate:		300 seeds/m^2
Sowing Fertiliser:		100kg MAP/ha
Seed Treatment:		Pontiac
Nitrogen:	1 Oct	160kg N/ha
Fungicide:	GS00	Systiva
	GS30	Radial 840ml/ha
	GS49	Aviator Xpro 420ml/ha

Trial 3. HYC G.E.M Trial series

Objective: To assess the performance of new spring barley germplasm managed under different canopy structures which includes plant density, fungicide and Nitrogen rate. This includes a spring sown wheat for comparison.

Key Points:

- The best managed treatments in Laureate, RGT Planet, Rosalind and the Wheat Zanzibar yielded 10.7, 10.7, 10.5, and 8.2t/ha respectively, highlighting spring sown barley out yields spring sown wheat by up to 2t/ha (table 1)
- Increasing fungicide inputs had little impact on grain yield in the cultivars Rosalind, Laureate and the wheat Zanzibar – this highlights the robustness of spring sowing for disease management and the fact high yields can be achieved with cheaper (without the SDHIs) and less fungicide inputs than Autumn sowing.
- Laureate: Canopy management was important in Laureate, lower nitrogen rates had a bigger influence on grain yield in Laureate than higher seeding and N rates due to increased lodging (figure 1)
    - High seeding density (360 seeds/m^2), and high N rate (140kg N) yielded 8.2t/ha,
    - Lower density (150 seeds/m^2) and low N rate (70 kg N/ha) yielded 10.3 t/ha.
- Planet: Highest yields were achieved at higher plant densities and high fungicide inputs irrespective of N strategy, highlighting Planet is less disease resistant but more tolerant to lodging than Laureate.
- Rosalind: Higher yields were achieved at higher plant densities irrespective of N and fungicide strategy, this highlights the importance of higher seeding densities in shorter faster developing cultivars under spring sown conditions.
- Test weights, screenings, and retention were all with malt specifications despite the heat during grain fill. Grain proteins ranged from 10.6 – 11.5 at low N in the malt cultivars Laureate and Planet, whereas at high N they ranged from 11.3 – 12.4 and were above malt specification in Laureate (Table 3)

Treatments: Lever 1 – Level of fungicide inputs (Standard input & high input).
Lever 2 – Level of Nitrogen Inputs 70kg N/ha upfront, and 140 kg N/ha upfront.
Lever 3 – Seeding Density (standard 150 seeds/m2 versus 360 seeds/m^2).
Lever 3 –Germplasm (3 spring barleys - Laureate, RGT Planet & Rosalind, 1 spring wheat- Zanzibar).

Table 1. Details of the management levels (kg, g, ml/ha).

Sowing date:		**8 September**	
Seed Rate:		As per treatment list	
Sowing Fertiliser:		100kg MAP/ha	
Seed Treatment:		Pontiac	
Nitrogen:		As per treatment list	
Fungicide:		**Standard Input**	**High Input**
	GS00	----	Systiva
	GS30	Opus 500ml/ha	Radial 840ml/ha
	GS49	Prosaro 300ml/ha	Aviator Xpro 420ml/ha

Table 2. Influence of fungicide management strategy, variety and canopy management regime on grain yield (t/ha).

Management			**Laureate**		**RGT Planet**		**Rosalind**		**Zanzibar**		**Mean**	
Fungicide Input	**Seed rate (m^2)**	**Nitrogen (kg N/ha)**	**Yield (t/ha)**		**Yield (t/ha)**		**Yield (t/ha)**		**Yield (t/ha)**		**Yield (t/ha)**	
Standard	150	140	9.50	fgh	9.80	b-f	9.50	fgh	7.40	lm	**9.10**	**c**
Standard	360	140	8.50	ij	9.80	c-g	10.10	a-f	7.50	klm	**9.00**	**c**
High	150	140	9.10	ghi	9.70	d-g	10.50	a	7.30	m	**9.10**	**bc**
High	360	140	8.20	jk	10.20	a-e	10.30	a-d	7.70	klm	**9.10**	**bc**
Standard	150	70	10.00	a-f	9.80	b-f	9.00	hi	7.30	m	**9.00**	**c**
Standard	360	70	10.70	a	10.50	ab	10.10	a-f	8.00	jkl	**9.80**	**a**
High	150	70	10.30	a-d	10.20	a-f	9.60	e-h	7.50	klm	**9.40**	**b**
High	360	70	10.40	abc	10.70	a	10.30	a-e	8.20	jk	**9.90**	**a**
Mean			**9.60**	**b**	**10.10**	**a**	**9.90**	**a**	**7.60**	**c**	**9.30**	
LSD Variety p = 0.05			0.30				**P Value**		<0.001			
LSD Management p=0.05			0.20				**P Value**		<0.001			
LSD Var.x Man. P=0.05			0.70				**P Value**		<0.001			

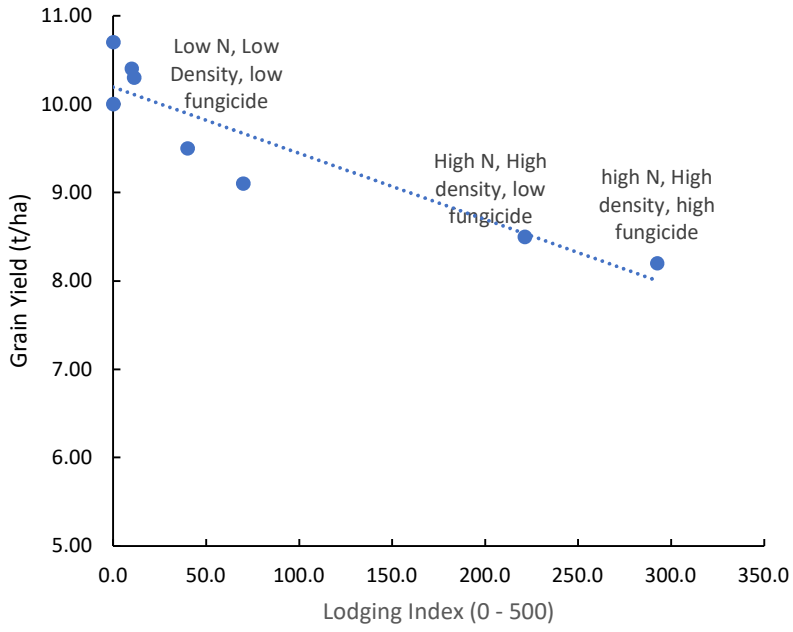

Figure 1. Relationship between lodging and grain yield in Laureate under different management intensities at Hagley, 2021

Table 3. Influence of fungicide management strategy, variety and canopy management regime on grain quality (note the wheat data has been omitted but can be available upon request).

	Fungicide	Seed rate	Nitrogen	Protein		Test wt		Retention		Screenings	
Var.	Input	m^2	kg N/ha	%		Kg/hl		%		%	
Laureate	Standard	150	140	12.3	-	66.3	-	89.3	de	2.6	a-d
	Standard	360	140	12.2	-	65.5	-	82.0	f	3.4	a
	High	150	140	12.4	-	66.7	-	90.0	cde	2.5	b-e
	High	360	140	12.1	-	66.3	-	87.4	e	2.3	c-g
	Standard	150	70	10.6	-	68.1	-	95.1	a	1.7	f-i
	Standard	360	70	11.4	-	66.5	-	93.2	abc	1.6	ghi
	High	150	70	11.5	-	67.6	-	93.6	abc	1.8	e-i
	High	360	70	11.3	-	67.0	-	93.4	abc	1.8	e-i
			Mean	**11.7**	**c**	**66.8**	**d**	**90.5**	**c**	**2.2**	**ab**
RGT Planet	Standard	150	140	12.0	-	68.7	-	92.3	a-d	2.4	b-f
	Standard	360	140	11.8	-	67.9	-	90.0	cde	2.1	c-h
	High	150	140	11.8	-	68.2	-	93.1	abc	2.2	c-h
	High	360	140	11.3	-	68.7	-	91.0	b-e	2.0	c-i
	Standard	150	70	10.8	-	69.6	-	95.7	a	1.6	ghi
	Standard	360	70	11.1	-	68.9	-	94.2	ab	1.7	f-i
	High	150	70	10.8	-	69.8	-	95.4	a	1.5	ghi
	High	360	70	10.6	-	68.9	-	93.8	ab	1.8	d-i
			Mean	**11.3**	**d**	**68.8**	**b**	**93.2**	**b**	**1.9**	**b**
Rosalind	Standard	150	140	12.9	-	67.8	-	95.9	a	1.4	hi
	Standard	360	140	12.7	-	69.1	-	95.6	a	1.5	ghi
	High	150	140	12.9	-	67.9	-	95.0	a	1.9	d-i
	High	360	140	13.1	-	68.3	-	95.7	a	1.2	i
	Standard	150	70	12.3	-	66.8	-	95.1	a	1.7	e-i
	Standard	360	70	11.9	-	69.4	-	95.0	a	1.6	f-i
	High	150	70	11.9	-	66.5	-	94.8	a	1.9	d-i
	High	360	70	12.0	-	68.7	-	95.0	a	1.7	f-i
			Mean	**12.1**	**b**	**79.5**	**a**	**---**	**-**	**2.4**	**a**
	Grand Mean			**11.9**		**70.8**		**93.0**		**2.0**	
	LSD Management p=0.05			0.4		ns		1.3		0.3	
	LSD Variety p = 0.05			0.3		0.7		1.2		0.3	
	LSD Var.x Man. P=0.05			ns		ns		3.5		0.8	
	P Value Management			<0.001		0.588		<0.001		0.001	
	P Value Variety			<0.001		<0.001		<0.001		<0.001	
	P Value Var.x Man.			0.685		0.289		<0.001		0.046	

Trial 4. HYC Disease Management germplasm interaction

Objective: To develop profitable and sustainable approaches to disease management in HRZ barley.

Key Messages:

- There was no significant response to fungicide for grain yield or grain quality from spring sowing (table 1 and table 2).
- Disease levels were low, but despite up to 20% of the leaf area affected with net form of net blotch and scald there was no yield response (figure 1).
- Spring sown barley is incredibly robust, the canopy develops rapidly and disease develops later and has less impact on grain yield.

- This is a similar finding to 2020, and demonstrates intensive fungicide inputs, and more expensive SDHI chemistries may not be required to the same degree as autumn sown systems (see Millicent results 2021).

Treatments: 12 Fungicide management strategies (cultivar- RGT Planet)

Table 1. Influence of fungicide management on grain yield (t/ha).

Treatment				Yield	% of mean
	GS00	GS30	GS39-49	t/ha	%
1	---	---	---	10.57 -	98.7
2	Systiva	Prosaro 300ml/ha	Radial 840ml/ha	10.77 -	100.5
3	---	Prosaro 300ml/ha	Aviator Xpro 420ml/ha	10.82 -	100.9
4	---	---	Aviator Xpro 420ml/ha	10.57 -	98.6
5	---	---	FAR F1-19 750ml/ha	10.61 -	99.0
6	---	---	Radial 840ml/ha	10.59 -	98.8
7	---	Prosaro 300ml/ha	----	10.82 -	100.9
8	--	Tilt 500 250ml/ha	----	10.76 -	100.4
9	Systiva	---	Radial 840ml/ha	10.66 -	99.5
10	---	Prosaro 300ml/ha	Radial 840ml/ha	10.73 -	100.1
11	---	Aviator Xpro 420ml/ha	Radial 840ml/ha	10.92 -	101.9
12	--	Prosaro 150ml/ha	Radial 420ml/ha	10.81 -	100.9
			Mean	10.72	100.0
			LSD 0.05	ns	ns
			P Val	0.256	0.251

Table 2. Influence of fungicide management on grain quality.

	Protein	Test weight	Retention	Screenings
Trt.	(%)	(kg/HL)	(%)	(%)
1	10.2 -	71.3 -	94.8 -	1.5 -
2	10.5 -	71.6 -	95.3 -	1.4 -
3	10.2 -	71.8 -	95.6 -	1.3 -
4	10.2 -	71.5 -	95.2 -	1.4 -
5	10.4 -	71.5 -	95.4 -	1.4 -
6	10.3 -	71.5 -	95.1 -	1.5 -
7	10.4 -	71.5 -	95.1 -	1.4 -
8	10.0 -	71.7 -	95.5 -	1.3 -
9	10.7 -	71.6 -	95.3 -	1.6 -
10	10.5 -	71.6 -	95.5 -	1.3 -
11	10.0 -	71.6 -	95.7 -	1.3 -
12	10.2 -	71.6 -	95.3 -	1.3 -
Mean	10.3	71.5	95.3	1.4
LSD (p=0.05)	ns	ns	ns	ns
P Val	0.741	0.955	0.942	0.945

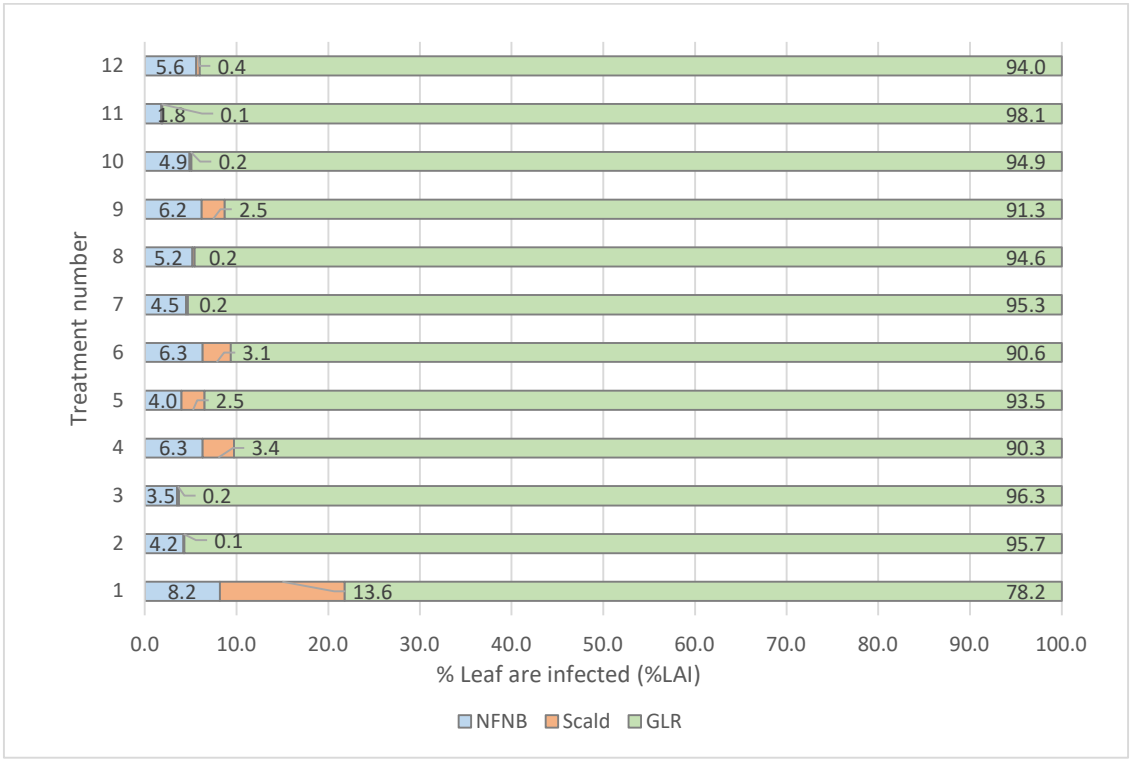

Figure 1. Disease severity and green leaf retention of the flag-2 leaf, assessed 21 January, GS75 (see table 1 for treatment details).

Table 3. Details of the management levels (kg, g, ml/ha).

Varieties:		**RGT Planet**
Sowing date:		**8 September**
Seed Rate:		300 seeds/m^2
Sowing Fertiliser:		100kg MAP/ha
Seed Treatment:		Pontiac
Nitrogen:	1 Oct	80kg N/ha
Fungicide:		As per treatment list

Trial 5. HYC Spring Barley PGR Evaluation

Objective: To assess the value of PGRs with spring sown barley in HRZ regions to increase yield and reduce lodging, brackling and head loss. A harvest delay will be imposed to exacerbate treatment differences.

Key Messages:

- Despite high yields and a 14 day delay in harvest further yield losses and a higher incidences of brackling, lodging, and headloss did not occur from later harvest.
- Irrespective of harvest timing PGRs increased yield in Rosalind by 0.5t/ha across all timings, were as yields were the same in Planet (Table 2).
- Brackling and Lodging responses to PGRs were variable and not consistent.
- Later applications od PGRs reduced headloss in both cultivars, however numbers were low and too insignificant to reduce yield.

Treatments: 4 PGR management approaches applied to two cultivars, to be harvested at two harvest dates. At total of 400ml/ha of Moddus Evo is applied at either 1 or 2 growth stages.

Table 1. Growth stage timings and rates of the plant growth regulator Moddus Evo.

Treatment ID	GS31	GS37
PGR GS31/37	Moddus Evo 200ml/ha	Moddus Evo 200ml/ha
PGR GS31	Moddus Evo 400ml/ha	---
PGR GS37	---	Moddus Evo 400ml/ha
Untreated	---	---

2 harvest dates:
Ontime: 20th of January
Delayed: 4th of February
2 Cultivars: Rosalind and Planet

Table 2. Grain yield, lodging, brackling, and head loss responses to PGR, and harvest delay in Planet and Rosalind.

	Grain Yield (t/ha)		Lodging Index		Brackling Index		Head loss (heads/m2)	
	Planet	Rosalind	Planet	Rosalind	Planet	Rosalind	Planet	Rosalind
Ontime Harvest								
untreated	10.5	9.9	6.7	20.0	12.5	16.7	13.6	8.3
GS31	10.4	10.5	11.7	0.0	7.0	1.7	4.2	10.6
GS31/37	10.5	10.4	4.2	15.0	0.8	20.0	8.4	6.7
GS37	10.6	10.6	4.2	0.0	7.0	0.0	5.9	5.5
Delayed Harvest								
untreated	10.5	10.2	2.9	0.0	6.4	7.5	8.8	7.5
GS31	10.5	10.6	5.0	3.8	7.1	10.5	6.0	6.7
GS31/37	10.7	10.6	4.3	1.3	7.9	6.3	9.3	3.8
GS37	10.6	10.9	9.3	0.0	16.4	6.3	8.1	4.2
PGR Effect (P val/LSD)	0.001/0.45		ns		0.01/7.5		0.001/ 6.1	
Harvest Date	ns		ns		ns		ns	

Table 3. Details of the management levels (kg, g, ml/ha).

Varieties:		**RGT Planet**
Sowing date:		**8 September**
Seed Rate:		300 seeds/m^2
Sowing Fertiliser:		100kg MAP/ha
Seed Treatment:		Pontiac
Nitrogen:	1 Oct	80kg N/ha
Fungicide:		As per treatment list

Trial 6: Nutrition for Hyper Yielding Barley

Objectives: To assess the value of higher nutrition input for barley and its relationship with yield and biomass accumulation. This will help to assess whether growers are currently under fertilising barley crops in the region and N requirements required to reach target yields of 10–12t/ha within each region.

Key Messages:

- Peak yields of 10.98t/ha were achieved at 90kg N/ha, whereas 10kg of applied N yielded 9.98t/ha (1 t less), and at 290kg N/ha yields achieved were 10.2t/ha (table 1).
- Yield responses match NDVI responses during the critical period reaffirming growth and crops intercepting light during this period is the key to higher yields (figure 1).
- Crop biomass increased with Nitrogen rate from 16.1–20.5t/ha, however harvest index declined due to increased lodging and brackling (figure 2).
- These results are consistent with other HYC sites in that once crop biomass at maturity in barley exceeds 16t/ha it is difficult to achieve a harvest index above 50%.
- Screenings increased and test weight declined at the highest N rates, likely due to lodging and or brackling.

Treatments: Five nutrition treatments

Table 1. Detailed treatment list, grain yield (t/ha) & % Site Mean.

	Nitrogen Rate	**Yield**	**% of Mean**	**Protein**	**Test weight**	**Retention**	**Screenings**
Trt.	**Kg N/ha**	**t/ha**	**%**	**(%)**	**(kg/HL)**	**(%)**	**(%)**
1	10	9.98 b	94.9	11.3 c	67.5 a	87.1 a	4.6 bc
2	50	10.55 ab	100.3	11.0 c	68.1 a	89.7 a	3.5 c
3	90	10.98 a	104.4	11.6 bc	67.0 ab	86.9 a	4.4 bc
4	150	10.84 a	103.1	11.6 bc	67.2 ab	87.5 a	3.9 bc
5	210	10.55 ab	100.3	12.3 ab	66.1 b	82.3 b	5.2 b
6	290	10.20 b	97.0	12.9 a	64.9 c	75.9 c	6.6 a
Mean		10.51	100.0	11.77	66.78	84.87	4.68
LSD (p=0.05)		0.61	5.8	0.69	1.16	3.11	1.29
P Val		0.028	0.028	<0.001	<0.001	<0.001	0.002

NOTE: MAP was applied at a rate of 100kg/ha

Table 2. Influence of nitrogen rate on canopy structure at harvest.

	Nitrogen Rate	Brackling	Lodging Index	Height	Harvest Biomass	Harvest Index
Trt.	**Kg N/ha**	**% Plot**	**0-500**	**cm**	**t/ha**	**%**
1	10	2.3 b	3.8 bc	70.8 b	16.1 c	54.8 a
2	50	4.3 b	0.0 c	70.8 b	17.2 bc	53.7 ab
3	90	6.3 b	1.3 bc	79.5 a	19.6 a	49.6 abc
4	150	2.5 b	9.8 bc	76.7 a	20.1 a	47.3 bc
5	210	11.3 b	36.3 b	79.9 a	20.5 a	45.4 c
6	290	23.8 a	82.5 a	78.5 a	19.1 ab	46.8 c
Mean		8.38	22.25	76.03	18.76	49.58
LSD (p=0.05)		9.68	35.73	5.42	2.12	6.55
P Val		0.002	0.001	0.005	0.003	0.037

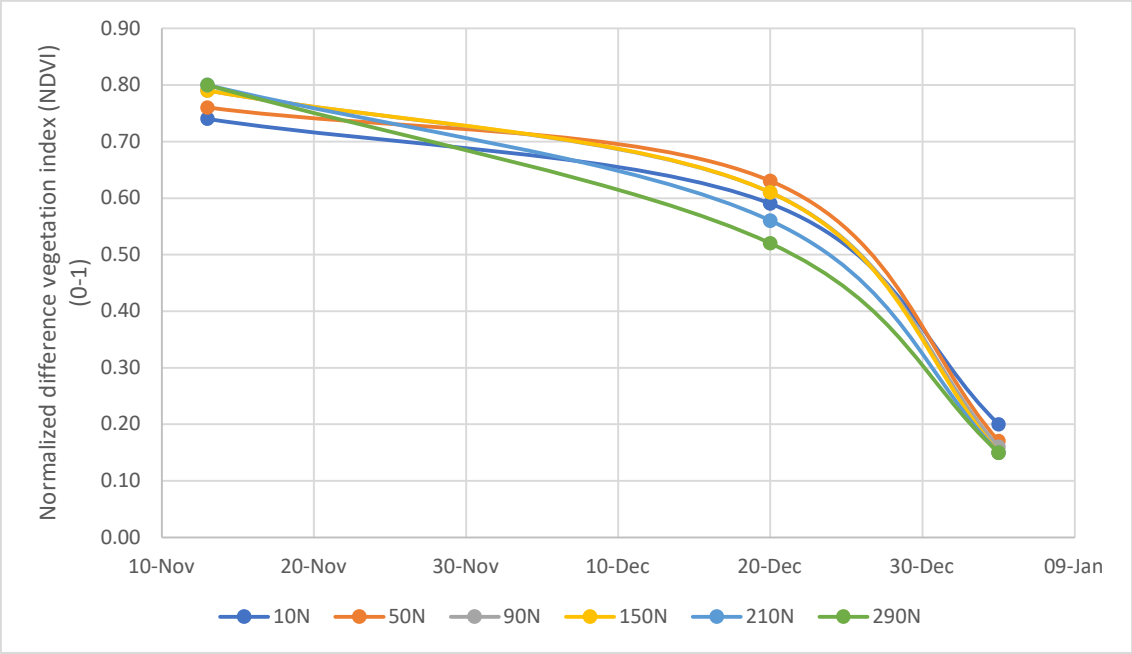

Figure 1. Normalized difference vegetation index (NDVI) (0-1) of RGT Planet nitrogen rates.

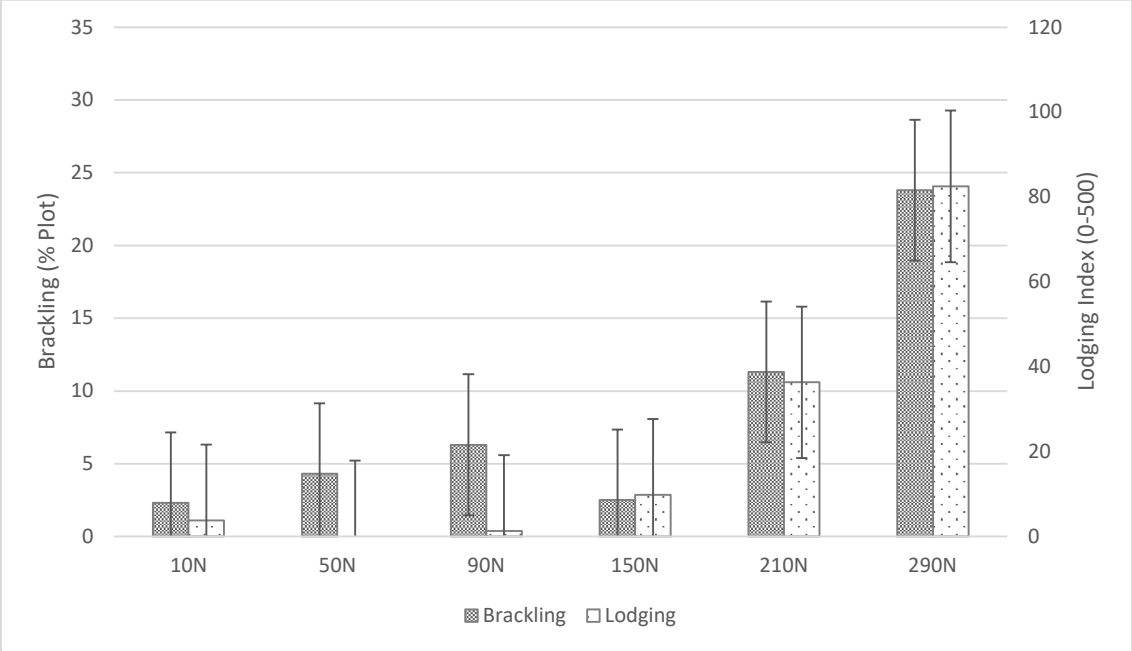

Figure 2. Brackling and lodging responses to increases in applied Nitrogen Rate (kg/ha).

Table 3. Details of the management levels (kg, g, ml/ha).

Variety:		**RGT Planet**
Sowing date:		**8 September**
Seed Rate:		300 seeds/m^2
Sowing Fertiliser:		100kg MAP/ha
Seed Treatment:		Pontiac
Nitrogen:		As per treatment list
Fungicide:	GS30	Radial 840ml/ha
	GS49	Aviator Xpro 420ml/ha

Trial 7: Spring Sown Barley seed rate trial

Objective: Evaluate whether higher seeding rates are required for spring sown barley to increase head number and yield.

Key Messages:

- Established plant densities ranged from 75 plants/m^2 to 277 plants/m^2.
- Yield ranged from 9.28 at 75plants/m^2 to 10.69t/ha at 227 plants/m^2.
- Yields were lower at plant densities less than 160 plants/m^2, and therefore the recommendation to ensure >150 plants/m^2 for spring sown barley remains true in line with published and previous HYC data.
- Similar yields have been achieved from different plant yield component structures highlighting how plastic and compensatory barley can be.
- In this experiment similar biomass was achieved across all seeding densities, however there is evidence in this trial that harvest indices approaching 60% maybe possible in the HRZ

Treatments: Six seed rate treatments, established plant densities can be found in table 2.

Table 1. Influence of plant population on grain yield (t/ha) and grain quality.

	Seed rate	Yield	% Mean	Protein	Test weight	Retention	Screenings
Trt.	**Seeds/m^2**	**t/ha**	**%**	**(%)**	**(kg/HL)**	**(%)**	**(%)**
1	75	9.28 c	90.1	11.7 -	68.9 a	88.0 -	4.9 -
2	150	10.26 b	99.7	11.6 -	69.6 a	90.6 -	3.3 -
3	225	10.53 ab	102.2	11.3 -	69.3 a	88.4 -	3.4 -
4	300	10.6 a	102.9	11.5 -	68.8 a	86.1 -	3.4 -
5	375	10.69 a	103.8	11.5 -	68.6 ab	85.4 -	3.6 -
6	450	10.43 ab	101.2	11.5 -	67.4 b	82.0 -	4.3 -
Mean		10.29	100.0	11.5	68.7	86.7	3.8
LSD (p=0.05)		0.28	2.7	ns	1.2	ns	ns
P Val		<0.001	<0.001	0.711	0.030	0.089	0.056

Yield figures followed by the same letter are not considered to be statistically different (p=0.05).
Plot yields: To compensate for edge effect a full row width (22.5cm) has been added to either side of the plot area (equal to plot centre to plot centre measurement in this case).

Table 2. Influence of plant population on canopy measurements

	Seed rate	Plants	Tillers	Heads	Height at maturity	Harvest Dry Matter	Harvest Index
Trt.	**Seeds/m^2**	**m^2**	**m^2**	**m^2**	**cm**	**t/ha**	**%**
1	75	70.6 e	581.9 c	902.4 ab	78.7 -	16.5 -	49.3 d
2	150	106.3 d	656.9 c	932.8 ab	79.8 -	16.3 -	55.3 c
3	225	165.6 c	858.8 b	666.7 c	79.2 -	14.8 -	62.5 a
4	300	238.8 b	865.0 b	825.5 b	80.6 -	15.3 -	60.9 ab
5	375	227.5 b	953.8 ab	978.3 a	79.3 -	16.0 -	58.6 abc
6	450	277.5 a	1058.8 a	902.8 ab	78.8 -	16.2 -	56.4 bc
LSD (p=0.05)		25.44	105.16	118.4	ns	ns	5.2
P Val		<0.001	<0.001	0.001	0.716	0.205	0.001

Table 3. Details of the management levels (kg, g, ml/ha).

Variety:		**RGT Planet**
Sowing date:		**8 September**
Seed Rate:		As per treatment list
Sowing Fertiliser:		100kg MAP/ha
Seed Treatment:		Pontiac
Nitrogen:	1 Oct	160kg N/ha
Fungicide:	GS30	Radial 840ml/ha
	GS49	Aviator Xpro 420ml/ha

2021 WA Crop Technology Centre
Frankland River, Western Australia

Sown: 29, 30 April, 1 May 2021
Harvested: 10 – 22 December 2021
R**otation position:** 1st Cereal after canola, 2019 Hay oats, 2018 canola, 2017 wheat
Soil type: Forest gravel loam

Trial 1: HYC 1st Stage Screen

Objective: To examine the phenology, disease resistance and standing power of new barley germplasm established in the traditional late April sowing window relative to current practice.

Key Messages:

- New spring introductions such as Laureate and Fatima offered slower developing alternatives to RGT Planet, while Rosalind was the quickest cultivar.
- There was a larger gap in the development speed of spring cultivars and winter cultivars in WA compared to the eastern states.
- The incidence of disease was very low in 2021 at this site and there were minimal differences between cultivars.
- A number of these cultivars were evaluated for yield in stage 2 elite screen presented below.

Treatments: 24 lines sown in small plots (5m in) with standard nitrogen management but no fungicide or no PGR input and not taken to yield.

Table 1. Phenology evaluation, Zadoks growth stage recorded at key points in the season (Zadoks GS00-99).

Variety	Type	21 June	16 Aug	15 Sept (% grain fill)		19 Oct	8 Nov
Minotaur	2 row, Spring	VE	43	71	60%	78	87
Rosalind	2 row, Spring	31	47	71	40%	85	87-89
RGT Planet	2 row, Spring	VE	43	71	50%	82	89
Visuel	6 row, Winter	VE	31	37	---	70.5	75-77
Laureate	2 row, Spring	VE	39	71	10%	78	87
Fandaga	2 row, Spring	VE	47	71	30%	85	89
Laperouse	2 row, Spring	30	43	71	60%	82	87-89
IGB1844	2 row, Spring	30	45	71	30%	82	89
Maximus CL	2 row, Spring	31	45	71	80%	85	89
Memento	2 row, Winter	VE	V	32	---	70.5	73
Fatima	2 row, Spring	30	39	71	10%	82	89
Madness	2 row, Winter	VE	30	41	---	71	77
Oxford	2 row, Spring	VE	37	71	10%	82	89
AGFBA007718	2 row, Spring	30	39	71	10%	78	87
Pixel	6 row, Winter	VE	31	41	---	72	77-83
AGFBA007618	2 row, Spring	30	39	71	30%	82	89
Sunshine	2 row, Spring	30	41	71	50%	78	87-89
Buff	2 row, Spring	VE	45	71	40%	82	89
Bottler	2 row, Spring	VE	43	71	50%	78	89

Alestar	2 row, Spring	30	39	71	10%	78	89
Westminster	2 row, Spring	VE	37	71	10%	78	87-89
Newton	2 row, Winter	VE	30	37	---	70.8	73-75
AGTB0244	2 row, Spring	VE	31	43	---	71	75-77
HV8 Nitro	2 row, Spring	VE	41	71	40%	82	89

*VE = Vegetative / Tillering

% = % Grain formed

Table 2. Details of the management levels (kg, g, ml/ha).

Sowing date:		**30 April**
Seed Rate:		200 Seeds/m^2
Sowing Fertiliser:		139 kg MAP/MOP Blend
Seed Treatment:		Nil
Grazing:		Nil
Nitrogen:	June	52 kg N/ha
	July	32 kg N/ha
	August	32 kg N/ha
PGR:		Nil
Fungicide:		Nil

Trial 2. HYC Elite Screen

Objective: To examine the yield potential of new winter and spring germplasm grown under HYC Management packages against spring and winter controls in the traditional late April/early May sowing window.

Key Messages:

- Significant variability in yields were likely due to frost events around flowering and some head loss.
- Evidence of early flowering and grain fill cold stress is reflected in lower test weights.
- Yields ranged from 5.5-7t/ha more exploration into the variability needs to be conducted and reliable conclusions cannot be established from the data.
- Similar yields achieved between early and late flowering cultivars.

Trial 3. HYC G.E.M Trial series

Authors Jeremy Curry, James Rollason, Dr Kenton Porker

Key Messages:

- RGT Planet and Rosalind were the only varieties to achieve yields of over 7t/ha.
- Crop canopy management treatments were significant and ranged from 5.77 through to 6.55t/ha
- Despite producing adequate biomass for higher yields, harvest indices at this site were low and the cause of this needs to be explored further.
- Two DMI fungicides were sufficient to control disease with no benefit of a higher input (including SDHI and QoI actives) fungicide regime.
- The largest spread in yields from management was observed in Planet highlighting the importance of management in this cultivar,This is consistent with other HYC data.

- Given the absence of significant yield loss to disease, lodging or head loss, the response to management treatments was generally insignificant, with increasing N from 126N to 219N showing the greatest benefit.
- Defoliation did not significantly reduce yields in Planet and Rosalind and highlights that delayed flowering and canopy management was potentially an advantage in 2021.
- There is evidence of higher grain screenings in the winter cultivars with screenings over 4%, whereas below 2% in the springs
- However, even with a wet and cool grain filling, the 2 row winter barley Madness tested in this trial matured too late and was not competitive for yield.
- Faster winter barleys are likely to be required for WA's high rainfall zone, however the 6 row winter Pixel achieved similar yields to Laperouse in 2021, but less than Rosalind and Planet.

Background

Compared to the high rainfall zones of the eastern states, Western Australia's high rainfall zone is typified by soils of lower water holding capacity and warmer temperatures. As a result, crop development rate is advanced and is likely to limit resource capture during critical periods, while the onset of terminal drought will limit the duration of grain filling. Therefore, the challenge of achieving biomass exceeding 20t/ha in order to meet aspirational yield targets of over 10t/ha will require management strategies that balance this trade-off between resource capture and yield formation and the ability to convert this into grain.

Over recent years there has been increasing acknowledgement that the strategies to maximise yield in the high rainfall zone will differ quite markedly from that of the low and medium rainfall zones. The benefits from adoption of alternative germplasm (such as alternative phenology types or international genetics), increased disease management implications, and acknowledgement that nitrogen demands of high yielding crops will require increasingly fertile systems have all been demonstrated through recent research programs.

RGT Planet is the predominate variety grown in WA's high rainfall zone based on its yield potential in high yielding environments. When considering improvements to the current system for growing barley in the HRZ, longer maturity varieties, improved disease management (through genetics and fungicides), removing the sink limitation of barley through use of six-row types, or increasing fertilisation may improve grain yields. Additionally, given the importance of conversion of biomass into yield in the HRZ, canopy management through PGRs or defoliation may provide benefits. The treatments included in this trial address these avenues for potential yield improvement compared to the current system to determine the critical management factors for HRZ barley production in WA.

Aim

To increase yield of barley in the high rainfall zone with improvements in barley crop management that considers all aspects of canopy management (genotype, PGR, Fungicide, Nitrogen, and Defoliaton).

Sown: 29 April 2021
Harvested: 22 December 2021
Rotation position: 2020 – canola, 2019 – oaten hay, 2018 – canola.

Trial details

The five varieties comprised three two-row spring types (Rosalind, RGT Planet and Laperouse), one two-row winter type (Madness), and one six-row winter type (Pixel). The six management treatments consisted of combinations of nitrogen (N) rate, fungicides applied, plant growth regulators (PGR) and mechanical defoliation as per Table 1.

All seed was treated with 180ml/100kg Vibrance (66g/L difenoconazole + 16.5g/L metalaxyl-M + 13.8g/L sedaxane) and 240ml/100kg Gaucho 600 (600g/L imidacloprid) and was packed (based on germination (%) and grain weight) to sow at a rate of 200 seeds/m^2 (equivalent to 70-90kg/ha seeding rate). The trial was sown at approximately 3cm depth on 29 April 2021 into wet topsoil with 139kg/ha of a blend of MAP, MOP and $MnSO_4$ banded at seeding to apply a total of 10N, 21P, 20K, 2S and 2Mn.

Table 1: Fungicide package, canopy intervention and nitrogen (N) rate applied to each of the six management treatments.

Management Treatment	Fungicide[1]	Canopy Intervention[2]	Total N applied[3]
1. Standard fungicide & no intervention	Standard	None	126 kg N/ha
2. Standard fungicide & PGR	Standard	PGR	126 kg N/ha
3. Higher input fungicide & no intervention	Higher input	None	126 kg N/ha
4. Higher input fungicide & PGR	Higher input	PGR	126 kg N/ha
5. Hyper-yield system	Higher input	PGR	219 kg N/ha
6. Dual-purpose system	Higher input	Defoliation	219 kg N/ha

[1]Standard: GS31 – 500ml/ha Tilt (500g/L propiconazole), GS39 – 290ml/ha Folicur (430g/L tebuconazole).
Higher input: Seed dressing – 150ml/100kg Systiva (333g/L fluxapyroxad), GS31 – 300ml/ha Prosaro (210g/L prothioconazole + 210g/L tebuconazole), GS39 – 840ml/ha Radial (75 g/L azoxystrobin + 75g/L epoxiconazole).
[2]Plant growth regulator (PGR): GS31 – 200ml/ha Moddus Evo (250g/L trinexapac-ethyl).
Defoliation: Prior to GS31 – defoliation with lawn mower to height of 6cm.

Nitrogen top-ups were applied as urea, with all treatments receiving 52N on 01 June and 32N applied on 03 July and 17 August for a total (including seeding) of 126N. Management treatments 5 and 6 also received an additional 41N on 22 June and 52N on 13 July taking their total nitrogen applied to 219kg N/ha.

The spring barley varieties were defoliated at the start of stem elongation (GS30-31) on 22 June, ensuring that the growing points were not removed. The winter barleys received their defoliation during tillering on 01 July.

Results

Phenology

The five varieties showed distinctly different development rates throughout the season (Figure 1). Rosalind was the fastest developing variety, reaching first node (GS31) within eight weeks of sowing (mid-June), awn emergence (GS49) by mid-August, and maturity by early November. The other two spring varieties, RGT Planet and Laperouse, were slightly later to develop, reaching each of these stages 1-2 weeks after Rosalind. The vernalisation requirement of the winter barley varieties (Madness and Pixel) delayed their onset of stem elongation into August which meant they did not reach awn emergence until early October and maturity until late November.

In-season growth

Disease was assessed opportunistically but did not proliferate to an extent that was expected to cause high levels of yield loss, although both Laperouse and Rosalind showed reduced net-form net blotch compared to RGT Planet. High levels of disease in untreated plots in a co-located trial suggest that the standard fungicide package used in this trial was successful in controlling disease. There was no obvious increase in green leaf area retention from the higher input fungicide package.
Rosalind achieved the highest end of season biomass (20.8t/ha of dry matter), significantly higher than the other varieties (16.9-17.5t/ha), while biomass responses to management were inconsistent

and not significant. This was despite there being a significant variety by management interaction for plant height, with Laperouse (significant increase with hyper-yield) and Rosalind (significant decrease with PGR) showing the greatest plant height responses to management.

Figure 1: Image taken 19 August showing the delayed development of the winter barleys (start of stem elongation) compared to the spring types (booting). From L to R: Laperouse, RGT Planet, Rosalind, Pixel, Madness.

Grain yield

The highest yielding varieties in the trial were RGT Planet and Rosalind, achieving 6.7-6.8t/ha (averaged across management treatments), followed by Laperouse (6.2t/ha) and Pixel (6.1t/ha). Madness (4.9t/ha) was significantly lower yielding than the other varieties. The different pathways to achieve yield between Rosalind and RGT Planet were evident at this site, with Rosalind producing over 900 heads/m^2 compared to RGT Planet at 750 heads/m^2. In high yielding environments, RGT Planet typically produces more grains per ear with a higher grain weight and this appears to have been the case at this site, with RGT Planet having heavier grains with more grains per ear than Rosalind (data not shown).

There was a significant management effect at this site, with the hyper-yield system having the highest grain yield (6.6t/ha) and being significantly higher than the dual-purpose (6.0t/ha) and standard input treatments (5.8t/ha). Although not significant at the 5% level (p=0.08), there were indications of a variety by management interaction, with the spring varieties being much more responsive to management (particularly to the higher N provided by the hyper-yield system) than the winter varieties (Figure 2). Indications from yield component data is that the increase in yield in the hyper-yield system was more likely due to grain number per ear than head number or grain weight.

The grain yields achieved at this site were lower than expected given the generally soft growing conditions throughout the year and the high biomass produced. This was reflected in harvest indices (ratio of grain yield to total biomass) of less than 40% across the site (data not shown). Despite its early maturation, Rosalind (29%) had a lower harvest index than RGT Planet (34%). As is to be expected with their later maturation, the harvest index of Pixel (25%) and Madness (20%) were lower than the spring varieties, despite the cool and wet spring conditions. There was no influence of management on harvest index.

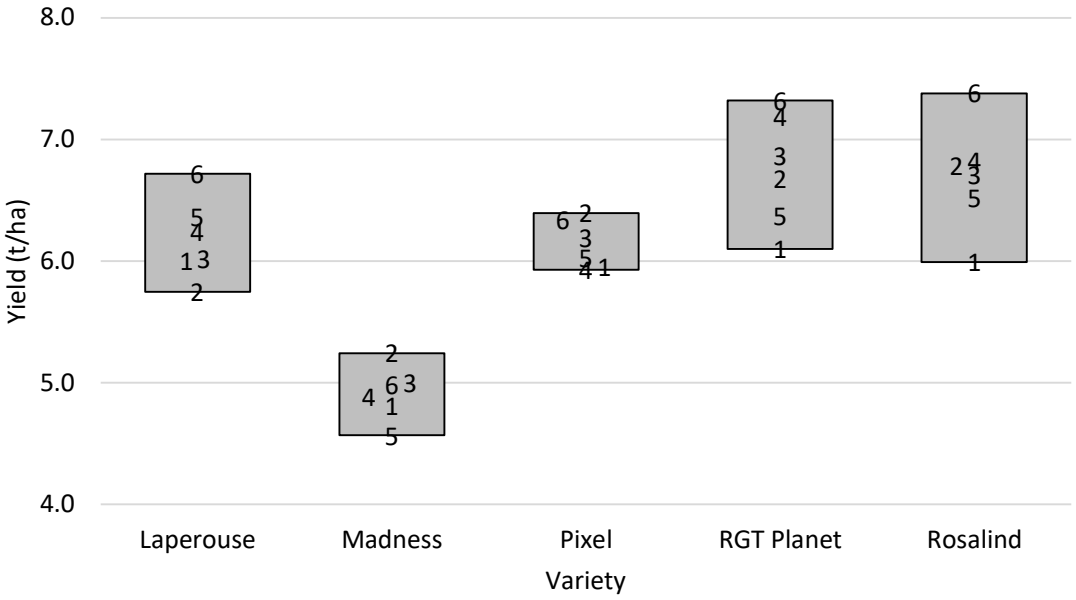

Figure 2: Grain yield of five barley varieties at Frankland in 2021. Shaded area represents range of yields for each variety across the six management treatments which are indicated by treatment number (as per Table 1).

Grain quality

Grain protein varied from 9.7-12.4% across the treatments and was influenced by both variety and management. Laperouse (12.1%) had higher grain protein than the other varieties, with Pixel the lowest (10.5%), while the hyper-yield and dual-purpose management treatments were 1.3-1.9% higher than the other management treatments. When taking yield into account through calculating total protein produced per hectare, it was clear that the spring varieties had a higher total protein production than the winter varieties, and this goes some way to explaining the modest relationship between yield and protein at this site.

Although there was a significant ($p<0.001$) interaction between variety and management for screenings (% < 2.0mm), all treatments were well below receival standards (max. 20%). The dual-purpose and hyper-yield treatments increased screenings relative to other management treatments, and this was most significant in Madness and Pixel which had the highest screenings of the five varieties. Hectolitre weight was particularly low for Pixel (ave. 60.1kg/hL) and high for Laperouse (68.2kg/hL) with no impact from management.

Discussion

The combination of varieties and management treatments tested within this trial produced yields in the range of 4.3t/ha to 7.6t/ha. Considering biomass (dry matter) produced ranged from 15-22t/ha and given the high level of rainfall throughout the season and the cool and wet finish to the season, it drives us to consider why yields were not higher at the site. The harvest indices at this site were quite poor (17-37%), reflecting a poor conversion of growth into final yield. This is important as it has also been found at other HYC sites that when barley dry matter exceeds 16t/ha the harvest index declines.

It is increasingly being recognised that in high rainfall zones of Australia, light rather than water may be limiting yield. Calculations of yield potential based on the photothermal quotient (ratio of solar radiation to temperature) in the critical period (three weeks preceding flowering) at this site indicate

that yields may be constrained to below 7t/ha from crops flowering at the end of August, and under 8.5t/ha for crops flowering at the end of September. Given the spring barleys were estimated to have flowered in early September, it is possible that light limited their grain number.

Table 2: Grain yield and quality for the main factors of variety and management at Frankland in 2021.

	Yield		Protein		Hectolitre wt.		Screenings	
Variety	(t/ha)		(%)		(kg/hL)		(% <2.0mm)	
Laperouse	6.18	b	12.06	a	68.18	a	0.66	d
Madness	4.91	c	10.83	cd	64.02	c	6.81	a
Pixel	6.14	b	10.54	d	60.13	d	4.45	b
RGT Planet	6.75	a	10.99	c	64.81	bc	1.52	c
Rosalind	6.70	a	11.40	b	65.65	b	1.60	c
P-value	<0.001		<0.001		<0.001		<0.001	
LSD	0.24		0.33		0.87		0.78	
Management								
Std. fungicide	5.77	c	10.76	b	64.72	-	2.20	c
Std. fungicide & PGR	6.17	abc	10.36	b	63.97	-	2.41	c
Higher fungicide	6.16	abc	10.44	b	64.77	-	2.40	c
Higher fung. & PGR	6.21	ab	10.90	b	64.29	-	2.74	c
Dual-purpose	5.97	bc	12.24	a	65.43	-	4.67	a
Hyper-yield	6.55	a	12.27	a	64.17	-	3.64	b
P-value	<0.001		<0.001		n.s.		<0.001	
LSD	0.43		0.57				0.89	

Within the spring varieties, Rosalind and RGT Planet significantly outyielded Laperouse, while the winter barleys (Madness and Pixel) were significantly lower yielding than the spring barleys. As opposed to winter wheats currently grown in WA, the winter barleys were significantly later maturing than the spring barleys and ended up flowering in October. 2021 was a season with wet and cool grain filling conditions, the poorer performance of the winter liens are consistent with 2020 results and suggests they are not suitable for WA until faster winter barleys that flower in the optimum period (mid-September) are available.

The higher N rate associated with the hyper-yield system treatment appeared to have the greatest impact on yield. Disease did not proliferate to the extent that the higher input fungicide package was required to control the prevalent diseases. Untreated plots at the same site that showed significant disease suggest that the standard package of Tilt and Folicur applied in this trial were enough to keep the net-type net blotch and scald at the site from compromising yield significantly.

The addition of the plant growth regulator (200ml/ha Moddus Evo) had minimal impacts on height and yield. PGRs typically provide benefits in situations of high yield loss due to lodging and head loss, however these were not evident at this site. All varieties were able to compensate with extra N application for the biomass removed through defoliation, with the dual-purpose treatment having a similar biomass and yield to most of the other treatments.

Conclusion

RGT Planet and Rosalind have been the two highest yielding varieties in WA's high rainfall zone for a number of years and they were once again the highest yielding in this trial. While adoption of varieties with better disease resistance (e.g. Laperouse) would provide a benefit in terms of disease

management. In this trial, the standard fungicide regime was sufficient to suppress disease, while lodging and head loss were minimal at the site, negating the need for canopy management through plant growth regulators or defoliation. While the 6 row barley showed promise, the winter barleys that were tested have a maturity that is too long for WA and need to flower earlier in a WA environment.

Trial 4. HYC Disease Management germplasm interaction

Objective: To develop profitable and sustainable approaches to disease management in HRZ barley.

Key Messages:

- Fungicide management had little to no influence on grain quality and yield in Planet in 2021 despite low levels of disease in the plots.
- These data is in contrast to cool longer season HRZ environments where the addition of an SDHI or more robust chemistry is providing large yield increases.
- Caution should be taken when interpreting single site data. Planet is very susceptible to disease and single site data needs to be combined with other sites and environments to determine where and when we are most likely to achieve a yield response to increased fungicide inputs.

Treatments: 4 fungicide management levels applied to RGT Planet.

Table 3. Influence of management strategy of wheat grain yield (t/ha) and Protein (%).

Treatment					Yield		Protein	
	GS00	GS31	GS39-49	GS59	t/ha		%	
1	---	---	---	---	7.27	-	9.6	-
2	Systiva	Prosaro 300ml	Radial 840ml	---	7.41	-	9.7	-
3	Systiva	Prosaro 300ml	Radial 840ml	Opus 500ml	7.80	-	9.6	-
4	---	Prosaro 300ml	Aviator Xpro 420ml	---	7.52	-	9.7	-
5	---	---	Aviator Xpro 420ml	---	7.55	-	9.5	-
6	---	---	FAR F1-19 750ml/ha	---	7.68	-	9.7	-
7	---	---	Radial 840ml	---	7.48	-	9.8	-
8	---	Prosaro 300ml	---	---	7.45	-	9.9	-
9	---	Tilt 500mL	---	---	7.84	-	10.0	-
10	Systiva	---	Radial 840ml	---	7.27	-	9.6	-
11	---	Prosaro 300ml	Radial 840ml	---	7.67	-	10.0	-
12	---	Prosaro 300ml	Aviator Xpro 420ml	Opus 500ml	8.39	-	9.5	-
13	---	Aviator Xpro 420ml	Radial 840ml	---	8.24	-	9.6	-
14	---	Prosaro 150ml	Radial 420ml	---	8.32	-	9.6	-
15	Systiva	Prosaro 300ml	Aviator Xpro 420ml	Opus 500ml	8.14	-	9.7	-
16	---	Prosaro 300ml	---		7.82	-	9.6	-
					7.74		**9.7**	
	LSD Yield P=0.05			0.78	***P Value***		ns	
	LSD Protein P=0.05			10.1	***P Value***		ns	

Trial 5. HYC PGR x harvest date interaction

Objective: To assess the value of PGRs with delayed harvest in HRZ regions for its effect on grain yield losses due to harvest timing, lodging, head loss and brackling.

Key points

- RGT Planet yielded higher (7.03t/ha) than Buff (5.34t/ha).
- Harvest timing had a significant effect on grain yield reducing yield by 1t/ha in both Planet and Buff with a 12 day after harvest ripe.
- Moddus applied at GS31 only, and the combination of 200ml/ha at GS31 and GS37, yielded similar to the treatment which included Ethephon at GS49.
- All PGR timings yielded similar to untreated irrespective of harvest date, however this has not been the case in previous experiments. In previous seasons harvest delays of greater than 14 days has resulted in greater yield losses in untreated plots compared to PGR treatments.

Treatments: 4 PGR management approaches applied to two cultivars and harvested at two harvest dates.

Plant growth regulators (PGR) treatments

1. Untreated
2. GS31 PGR (Moddus® Evo 200 mL/ha @GS31) & Moddus Evo 200mL/ha @GS33-37).
3. GS31 + GS37 PGR (Moddus® Evo 200 mL/ha @GS31 & Moddus Evo 200mL/ha @37).
4. GS31 + G49 PGR (Europe Style) - (Moddus® Evo 200 mL/ha @GS31 & Ethephon 500mL/ha @49).

Table 1. Influence of fungicide management strategy, variety and canopy management regime on grain yield (t/ha).

		RGT Planet		***Buff***		***Mean***	
Variety		7.03	A	5.34	B	**6.19**	
	LSD	0.46		***P-Value***		0.001	
Harvest Date							
On time		7.52	-	5.80	-	6.66	a
Delayed (12 days later)		6.53	-	4.89	-	5.71	b
Harvest Date Management	***LSD***	0.08		***P-Value***		<0.001	
Harvest Date x Variety	***LSD***	0.11		***P-Value***		ns	
Canopy Management Regime							
Untreated		6.96	-	5.31	-	6.13	-
GS31 PGR		7.04	-	5.23	-	6.13	-
GS31 + GS37 PGR		7.11	-	5.66	-	6.39	-
GS31 + GS49 PGR (Europe style)		7.00	-	5.16	-	6.08	-
Canopy Management Regime	***LSD***	0.34		***P-Value***		ns	
Variety x Canopy Mgmt Regime	***LSD***	0.48		***P-Value***		ns	
Harvest Date. x Canopy Mgmt. Regime							
On Time							
Untreated		7.55	-	5.87	-	6.71	-
GS31 PGR		7.54	-	5.72	-	6.63	-
GS31 + GS37 PGR		7.53	-	6.06	-	6.79	-
GS31 + GS49 PGR (Europe style)		7.47	-	5.55	-	6.51	-
Delayed							
Untreated		6.36	-	4.76	-	5.56	-

GS31 PGR		6.53	-	4.75	-	5.64 -
GS31 + GS37 PGR		6.70	-	5.27	-	5.98 -
GS31 + GS49 PGR (Europe style)		6.54	-	4.77	-	5.66 -
Harvest Date x Canopy Mgmt	***LSD***	0.48		***P-Value***		ns
Harvest Date x Canopy Mgmt x Variety	***LSD***	0.67		***P Value***		ns

Trial 6: Nutrition for Hyper Yielding Barley

Objectives: To assess the value of higher nutrition input for barley

Key Points:

- There was no additional yield benefit of applying N above 126kg/ha in 2021.
- Extra Nitrogen applications increased grain protein, every additional 20 units of N above 126kg/ha increased protein by 0.4% suggesting the N was taken up but nor converting to yield.
- There was little evidence of extra biomass being achieved at any growth stage with extra N.
- Other grain quality parameters were not influenced by N.

Table 1. Nitrogen application rates and timings per treatment (kg N/ha).

	Sowing	June	July	August	Total N
Trt.	**Kg N / ha**	**Kg N / ha**	**Kg N / ha**	**Kg N / ha**	**Kg N / ha**
1	10	52	32	32	**126**
2	10	67	35	32	**144**
3	10	84	40	32	**167**
4	10	107	48	32	**198**
5	10	130	56	32	**228**
6	10	153	64	32	**259**

NOTE: MOP was applied at a rate of 48kg/ha

Table 2. Detailed treatment list, grain yield (t/ha) & % Site Mean.

Trt.	Nitrogen rate	Yield	Mean
	kg N/ha	**(t/ha)**	**(%)**
1	126	8.19 -	101
2	144	8.37 -	103
3	167	7.79 -	97
4	198	7.98 -	99
5	228	8.16 -	101
6	259	8.10 -	100
Mean		**8.10**	**100**
LSD (p=0.05)		**0.50**	**6.26**
P Val		**ns**	**ns**

Table 3. Influence of nitrogen rate on grain quality, protein (%), test weight (kg/HL), screenings (%) and retention (%).

	Nitrogen Rate	Protein	Test weight	Screenings	Retention
Trt.	**Kg N/ha**	**(%)**	**(kg/HL)**	**%**	**(%)**
1	126	10.6 d	66.1 -	1.2 -	93.5 -
2	144	11.5 c	66.1 -	1.2 -	94.2 -
3	167	12.2 b	65.8 -	1.4 -	93.3 -
4	198	12.5 b	66.1 -	1.2 -	94.0 -

5	228	13.2	a	65.1	-	1.3	-	92.8	-
6	259	13.4	a	65.4	-	1.3	-	93.1	-

Mean	12.2	65.8	1.3	93.5
LSD (p=0.05)	0.52	1.42	0.43	1.68
P Val	<0.001	0.567	0.906	0.493

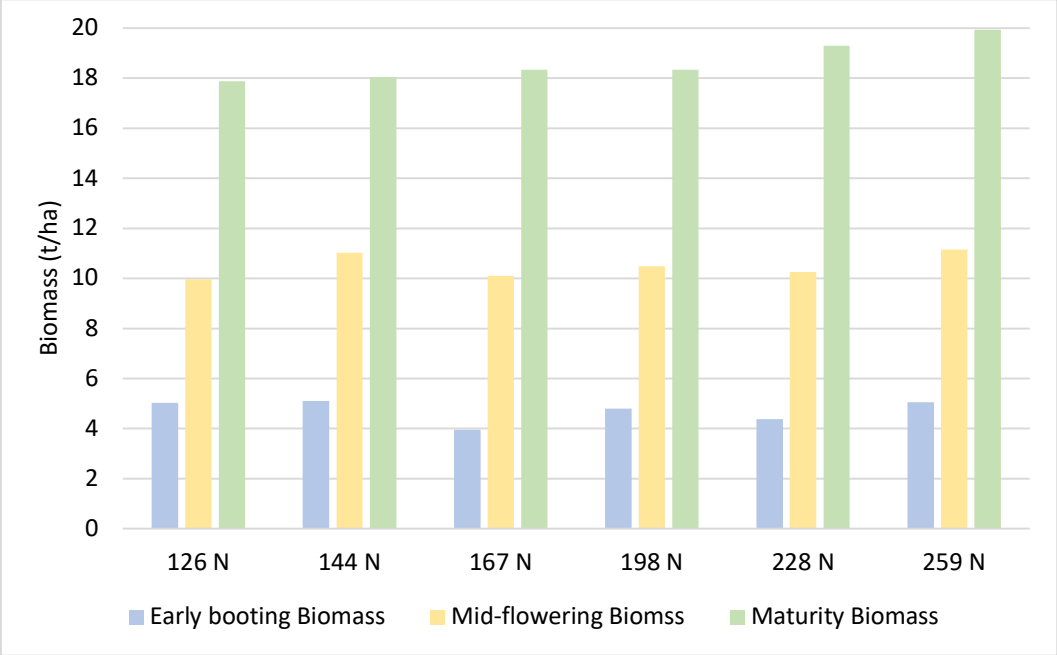

Figure 1. Treatment effect on total biomass (t/ha) taken at Early booting (GS41), Mid-flowering (GS65) and Maturity (GS89)

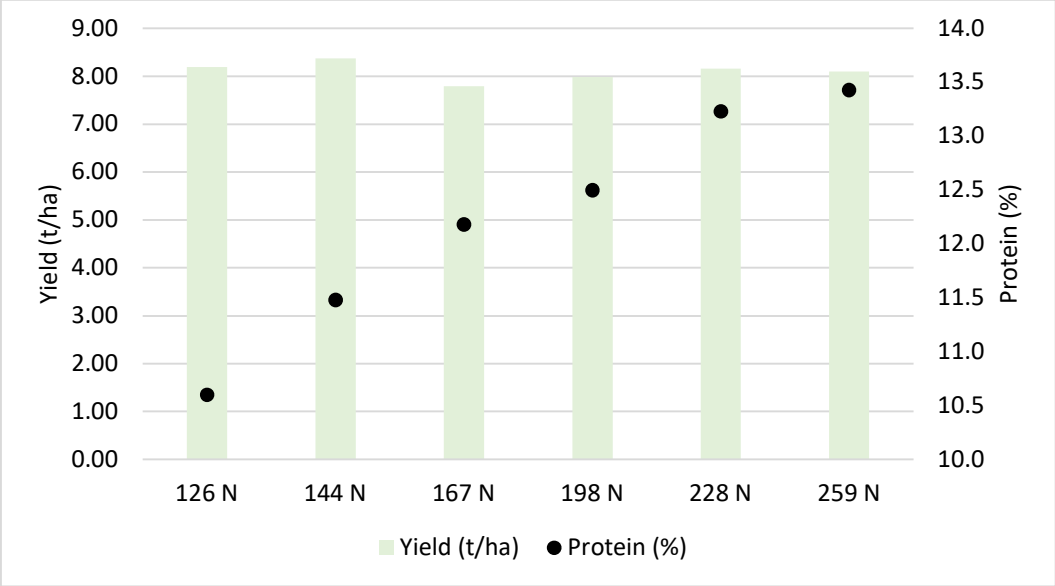

Figure 2. Treatment influence on grain yield (t/ha) and Protein levels (%).

Acknowledgements
This experiment has been conducted through the *Hyper Yielding Crops (FAR2004-002SAX)* project, funded by GRDC and led by FAR Australia. Project staff gratefully acknowledge the investment support of the GRDC in order to generate this research, the input from host farmer Kellie Shields and farm manager Terry Scott in managing the research trial, Living Farm for spraying and grain quality testing, and DPIRD's Research Support Unit for harvest.

APPENDIX

METEOROLOGICAL DATA

WA Crop Technology Centre (Albany)

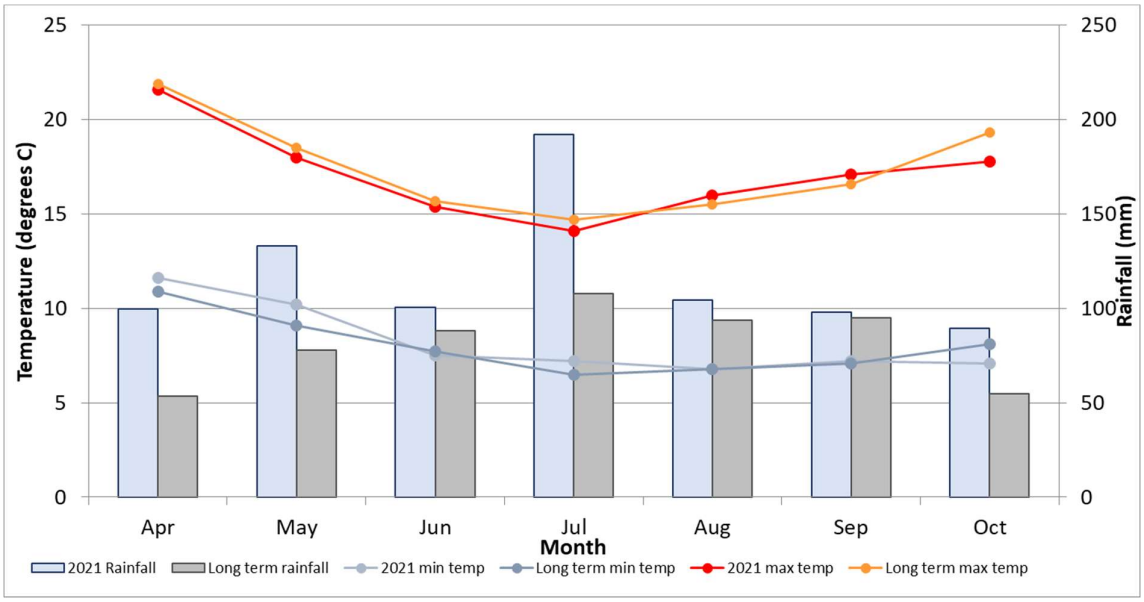

Figure 1. 2021 growing season rainfall and long-term rainfall, 2021 min and max temperatures and long-term min and max temperatures recorded at **Rocky Gully** (1995 to 2021) for the growing season (April to October).

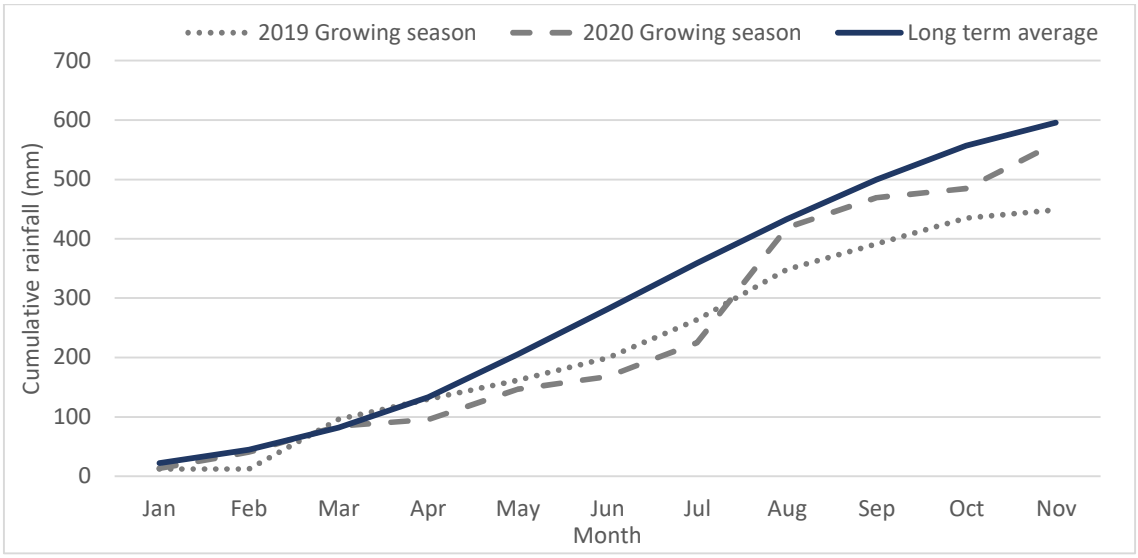

Figure 2. 2020 rainfall, 2021 rainfall and long-term average rainfall for Rocky Gully (1995 to 2021).

2021 Victoria Crop Technology Centre
Gnarwarre, Victoria

Barley Waterlogging Damage: What can we learn?

- Water logging during late stem elongation (the critical period) reduced grain number significantly in early sown Planet barley and severe stress resulted in complete crop failure.
- 6 row slower developing winter barley had more viable stems and more grains per spike making recovery better from waterlogging.
- 6 row winter barley achieved 9.9t/ha in the absence of significant water logging and 3.1t/ha under severe water logging stress.
- RGT Planet yielded 7.8t/ha in the absence of significant water logging and 0.3t/ha under severe water logging stress.
- Apart from sowing earlier and using slower developing genetics, there was little evidence of genetic differences in field waterlogging tolerance.
- Water logging was more detrimental to barley than wheat on site.
- Little evidence to suggest more N recovered yield from water logging and/or later sowing, the lowest N treatment (10 units of N) yielded 5.65, 50 Units of N yielded 7.11 and the highest N treatment (290 units of N) yielded 6.32t/ha.

Trials at the Victoria Crop Technology Centre were badly affected by waterlogging throughout the winter of 2021 making yield results variable and interpretation more difficult. Unfortunately, most of the barley experiments were completely submerged. However, there were sections of the site that were slightly elevated and it was possible to evaluate enough replicates of a 6 row winter variety Pixel and RGT Planet side by side in non-water logged conditions through to completely stressed and submerged. This enables us to test what yields were possible in the absence of water logging and what yields are possible when subject to different water logging stress levels. The plots were scored based on % plot affected based on water submersion and visual symptoms during stem elongation and the peak period of damage (Table 1). All plots were harvested by machine harvest and hand cuts were taken for yield components.

Table 1. Summary of treatments used for yield analysis of water logging damage from 27 April sowing, side by side analysis of Winter vs Planet spring barley.

Water Log Scale	1 Non limited	2 Mild Stress	3 Moderate Stress	4 Severe Stress
% Plot Affected	<20%	20-40%	40-60%	>60%
No of Reps per variety*	4	4	6	6
Winter Barley vs Spring Barley Planet				

Figure 1 demonstrates the difference in growth responses reflecting different development types and sowing times. Early sown (27 April) Planet reached stem elongation earlier than the winter barley or the later sown Planet. Treatments that developed later and remained vegetative during waterlogging survived waterlogging better.

Winter barley sown 27 April | Planet barley sown 27 April | Planet barley sown 28 May

Figure 1. Picture of Severely stressed waterlogged plots at the start of October at Gnarwarre.
The differences in response to water logging were reflected in biomass, % viable stems, the number of grains per spike and final grain yield. Grain weights were similar across all water logging stresses in Planet and slightly lower in Pixel when waterlogged. The majority of yield loss differences came from the proportion of stems that had a viable head and the number of grains per spike. Increasing water logging stress decreased grains per spike significantly as this coincided with the critical period for grain number determination (30 days prior to flowering). The 6 row winter barley had more grains per spike under all conditions and highlights the importance of delayed development and more potential grain sites (Table 2).

Table 2. Differences in yield components in 6 row Pixel barley and Planet barley under moderate and non- limited conditions

	Viable Heads/m^2	Actual Grains/spike	Grain Weight	Grain Yield (t/ha)
Non Limited				
Planet	646a	27.9b	44.9a	7.8b
Pixel	481c	53.5a	44.3a	9.9a
Moderate Stress				
Pixel	506bc	29.6b	42.3b	5.7c
Planet	448cd	7.5c	44.9a	1.5d

Biomass numbers were similar between cultivars under mild and moderate stress levels, however slow developing barley had greater biomass under significant stress. 6 row winter barley achieved greater yields of 9.9t/ha when water logging was absent and 3.1t/ha under severe water logging stress. Whereas RGT Planet yielded 7.8t/ha when water logging was absent and 0.3t/ha under sever water logging stress (Figure 2 and Figure 3).

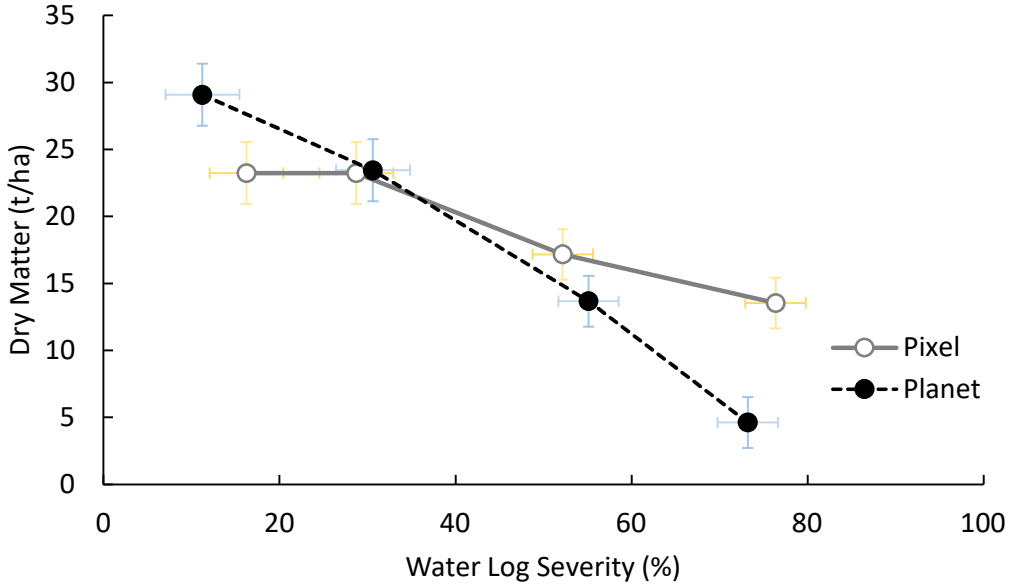

Figure 2. Relationship between dry matter and water logging severity in Pixel (6 row winter barley) and Planet barley.

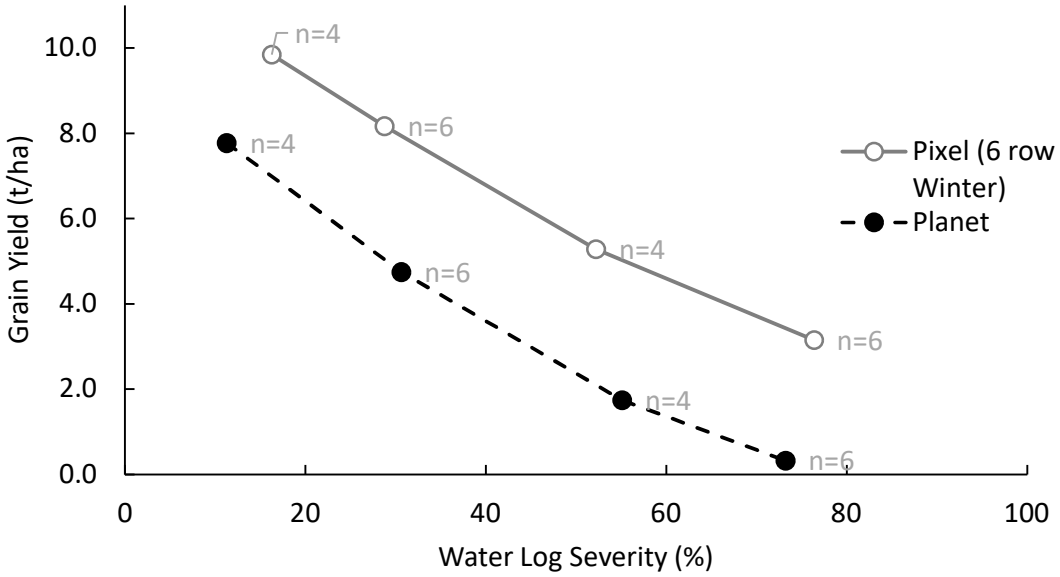

Figure 3. Relationship between dry matter and water logging severity in Pixel (6 row winter barley) and Planet barley.

What about delaying sowing and more N?

A separate experiment was located on the site that was sown to RGT Planet barley later (28 May) see Figure 1. This experiment also suffered significant water logging stress and extra N was applied as Urea. 100kg MAP was drilled at sowing (to supply 10 kg N) to the lowest N treatment and in crop applications included 50% at tillering and 50% at the onset of stem elongation. While results were variable, the lowest N treatment yielded 5.65t/ha, and an additional 40 units of N yielded 7.11t/ha. However, increasing N application over and above 50 units to 290 units of N did not further increase yield under water logging conditions Table 3. There was no significant effect on grain quality parameters.

Table 3. Responses to increasing N application in RGT Planet sown later at Gnarwarre (28 May 2021)

Nitrogen Applied (kg/ha)	Yield t/ha,	Protein %	Test Weight kg/hl	Retention %,	Screenings %
1 10N	5.65 c	11.7 -	66.6 -	89.4 -	3.4 -
2 50N	7.11 a	11.7 -	68.0 -	89.5 -	3.1 -
3 95N	6.32 ab	12.1 -	67.0 -	88.2 -	3.7 -
4 160N	6.23 ab	11.3 -	67.7 -	91.1 -	2.7 -
5 225N	6.23 ab	11.7 -	67.2 -	89.6 -	3.3 -
6 290N	6.32 ab	11.5 -	67.7 -	90.1 -	3.0 -
LSD P=.05	0.87	1.1	1.2	3.7	1.4
Treatment Prob(F)	0.050	0.750	0.232	0.728	0.761
CV	10.5	6.95	1.39	3.15	33.88

Genetic differences in tolerance to water logging?

For less severe waterlogging, the use of nitrogen can sometimes help mitigate the damage. When waterlogging is very severe, sometimes delaying sowing is the only option such as in spring, this has been shown to work well in Tasmania. The most obvious and effective methods is to use different engineering solutions to improve drainage, including the use of raised bed, surface drainage, controlled traffic farming and tillage. Combining genetic solutions and some of the ideas of winter barley with the engineering controls have the potential to assist in reducing waterlogging damage. We also included the waterlogging tolerant Planet (Planet WL) developed by Prof Meixue Zhou, Tasmanian Institute of Agriculture, University of Tasmania. The trial was significantly damaged by water logging and plots were harvested by hand to get a dry matter and yield estimate, the yield component data has not yet been processed. However, based on the dry matter data, the slower developing winter cultivars had more biomass, and there was no difference between spring cultivars and the waterlogging tolerant Planet (Planet WL). At other sites less exposed to waterlogging this line has yielded similar to Planet.

Table 4. Final maturity dry matter of selected cultivars in the elite variety screening trial sown on 28 May and subjected to water logging at Gnarwarre. (P value <0.05, LSD 2.1).

Cultivar	Maturity Dry Matter (t/ha)
Cassiopee (winter)	11.75a
Laureate (Spring)	10.35ab
Pixel (winter)	12.76a
Planet (spring)	8.42b
Planet WL (spring)	**9.73b**
Rosalind (spring)	9.44b

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

HYPER YIELDING CROPS

2021 growing season

Canola Results

Prepared by:

FAR AUSTRALIA

Department of Primary Industries and Regional Development · MFMG · CSIRO · RiverinePlains · FAR AUSTRALIA · CeRDI | Federation University Australia · BRILLAG Agronomy & Research · TechCrop · Stirlings to Coast Farmers · SFS

2021 NSW Crop Technology Centre - Wallendbeen

Winter canola sown: March 30
Winter canola harvested: January 5
2020 Crop: Pasture
Soil type & management: Red Ferrosol
Available Nitrogen (kg/ha) 0-60 cm: 340
Colwell P 0-10 cm: 63 mg/kg
pH (CaCl2) 0-10 cm: 5.2
Organic Carbon 0-10 cm: 2.0

Spring canola sown: April 30
Spring canola harvested: December 22

Trial 1: HYC Winter canola screen

Objectives: To examine the suitability of elite commercial and unreleased winter canola cultivars for hyper yielding regions.

Key Messages:

- There were large differences in the standability of the canola cultivars at this site. The winter canola got very tall (some cultivars ~210 cm) before lodging, partly due driven by the very high fertility of the paddock.
- The cultivars with the least lodging included RGT Nizza CL, SF-056-CL and AGFCA014120.
- AGFCA014120 was the highest yielding (grain only) cultivar, significantly higher than most other commercial cultivars including Hyola Feast CL, Hyola 970CL and RGT Nizza. CL.
- AGFCA014120 also had the highest oil concentration.
- Highly vigorous cultivars such as Hyola Feast CL are likely better suited to dual purpose canola production rather than grain only.

Treatments: 12 cultivars sown in small plots (half of normal plot length) with 'High input' treatment as per Trial 3.

Table 1. Yield, oil and lodging of the winter canola variety evaluation trial.

Variety	Grain yield (t/ha)	Oil (%)	Lodging (1 = standing, 9 = flat)
Hyola Feast CL	4.43	42.9	7.8
Hyola 970 CL	4.28	44.7	3.5
RGT Nizza CL	3.93	44.5	1.8
Phoenix CL	4.65	43.9	4.3
CL214103	4.38	44.4	8.5
CL214006	4.6	45.2	3.5
SF65-056-CL	3.78	43.7	1.8
AGFCA014120	5.33	45.7	2.8
AGFCA014320	4.55	43.6	7.0
AGFCA014420	5.15	44.6	4.5
Mean	*4.51*	*44.3*	*4.3*
l.s.d. p=0.05	*0.77*	*0.83*	*1.7*
p value	*0.01*	*<0.001*	*0.01*

Table 2. Start of flowering date.

Variety	Start of flowering date
Hyola Feast CL	28 September
Hyola 970 CL	6 October
SF Nizza CL	29 September
Phoenix CL	30 September
CL214103	25 September
CL214006	30 September
SF65-056-CL	4 October
AGFCA014120	28 September
AGFCA014320	26 September
AGFCA014420	1 October

Table 3. Trial management details.

Sowing date:		**30 April**
Target plant density:		45 plants/m^2
Sowing Fertiliser:		130kg MAP (in-furrow) & 180kg single super (broadcast pre-sowing).
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed	Saltro Duo
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 2: HYC Spring canola screen

Objectives: To examine the suitability of elite commercial and unreleased spring cultivars for hyper yielding regions.

Key Messages:

- 45Y95 CL was the highest yielding cultivar in the CLF trial with a yield of 6.51t/ha.
- Hyola Blazer TT was the highest yielding cultivar in the TT trial with a yield of 6.59t/ha.
- In the conventional trial, Quartz was higher yielding than the two European spring cultivars.
- There was some shattering caused by a storm close to harvest. Generally, cultivars with the highest yield had low shattering scores.
- There was less of an impact of lodging on yield, with some of the higher yielding cultivars also being scored high for lodging.

Treatments: 15 cultivars sown in small plots (half of normal plot length)

Table 1. Grain yield of CLF, RR/Truflex, TT and Conventional spring variety evaluation trials.

CLF		RR/Truflex		TT		Conventional	
45Y93 CL	5.95	**NCH20Q729**	4.76	**HyTTec Trifecta**	5.04	**Quartz**	5.37
45Y95 CL	6.51	**AN20RR002**	5.58	**ATR Wahoo**	3.89	**AGFCA014620**	3.56
PS-21CL211	5.51	**45Y28 RR**	5.03	**Hyola Blazer TT**	6.59	**AGFCA014720**	3.74
AGFCA014520	3.50	**Condor TF**	5.17	**SF Ignite TT**	5.01		

Mean	*5.37*		*5.14*		*5.13*		*4.51*
l.s.d.	*0.77*		*0.84*		*0.94*		*1.1*
p value	*<0.001*		*n.s.*		*<0.001*		*0.04*

Table 2. Grain oil concentration of CLF, RR/Truflex, TT and Conventional spring variety evaluation trials.

CLF		RR/Truflex		TT		Conventional	
45Y93 CL	45.2	**NCH20Q729**	47.6	**HyTTec Trifecta**	46.4	**Quartz**	46.4
45Y95 CL	45.1	**AN20RR002**	46.5	**ATR Wahoo**	44.8	**AGFCA014620**	46.8
PS-21CL211	48.1	**45Y28 RR**	48.4	**Hyola Blazer TT**	45.9	**AGFCA014720**	49.0
AGFCA014520	45.8	**Condor TF**	48.5	**SF Ignite TT**	45.4		
Mean	*46.1*		*47.7*		*45.63*		*47.0*
l.s.d.	*0.62*		*1.02*		*0.75*		*1.01*
p value	*<0.001*		*0.03*		*0.016*		*<0.001*

Table 3. Start of flowering date, lodging at maturity, and shattering pre-harvest of all cultivars in the spring screen trials (data not yet analysed).

Variety	Start of flowering date	Lodging (1= standing, 9 = flat)	Shattering (1= no shattering, 9 = completely shattered pods)
45Y28 RR	6 September	2.0	2.7
45Y93 CL	7 September	4.0	1.7
45Y95 CL	5 September	4.7	2.0
AGFCA014520	12 September	2.7	3.0
AGFCA014620	13 September	2.0	1.7
AGFCA014720	5 September	2.3	4.0
AN20RR002	31 August	4.3	2.3
ATR Wahoo	9 September	2.7	3.3
Hyola Blazer TT	5 September	4.3	1.7
HyTTec Trifecta	7 September	3.7	3.0
NCH20Q729	5 September	4.0	3.3
PS-21CL211	4 September	6.3	2.3
Quartz	5 September	5.0	2.7
SF Ignite TT	9 September	2.7	2.3
Condor TF	4 September	4.0	2.7

Table 4. Trial management details.

Sowing date:		**30 April**
Target plant density:		45 plants/m^2
Sowing Fertiliser:		130kg MAP (in-furrow) & 180kg single super (broadcast pre-sowing).
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed	Saltro Duo

	6-leaf	Prosaro 0.45 L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 3: HYC Winter G.E.M Trial series

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) on two commercial winter canola cultivars.

Key Messages:

- Hyola Feast CL was 0.5t/ha higher yielding than Hyola 970CL (averaged across treatments).
- The high input management was higher yielding than both the Low and Medium management.
- The trial was badly lodged. Like the winter screen trial, lodging was worse in Hyola Feast CL than Hyola 970CL (data not shown).
- Lodging made the trial difficult to score for disease but there was infection of sclerotinia stem rot that was reduced by the late Prosaro in the High input management (more data available on fungicide response in winter disease management trial).

Treatments: Three management levels (combination of nitrogen and fungicide) applied to winter canola varieties (Hyola 970 CL & Hyola Feast CL).

Table 1. Influence of management strategy and variety on grain yield (t/ha).

Cultivar	Low input	Medium input	High input	Mean
		Grain yield (t/ha)		
Hyola 970CL	3.28	3.03	3.67	*3.33*
Hyola Feast CL	3.76	3.60	4.13	*3.83*
Mean	*3.52*	*3.31*	*3.90*	
LSD Management	0.33	**p value**	0.038	
LSD Cultivar	0.28	**p value**	<0.001	
LSD Management * Cultivar	n.s.	**p value**	n.s.	

Table 2. Influence of management strategy and variety on oil concentration (%).

Cultivar	Low input	Medium input	High input	Mean
		Grain yield (t/ha)		
Hyola 970CL	44.4	44.3	44.4	*44.3*
Hyola Feast CL	43.8	44.6	45.1	*44.5*
Mean	*44.1*	*44.4*	*44.7*	
LSD Management	n.s.	**p value**	n.s.	
LSD Cultivar	n.s.	**p value**	n.s.	
LSD Management * Cultivar	n.s.	**p value**	n.s.	

Table 3. Trial management details.

Sowing date:		**30 March**
Varieties:		Hyola 970 CL & Hyola Feast CL
Target plant density		45 plants/m^2
Basal Fertiliser:		130 kg/ha MAP (in-furrow) & 180 kg/ha Single Super (broadcast pre-sow).

		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	75kg N/ha	113kg N/ha	113kg N/ha
	Bud visible	75kg N/ha	113kg N/ha	113kg N/ha
Total N Applied:		**150kg N/ha**	**226kg N/ha**	**226kg N/ha**
Fungicide:	GS00	Maxim XL	Maxim XL	Saltro Duo
	6 Leaf	---	---	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha
	50% Bloom			0.45 L/ha Prosaro

Trial 4: HYC Spring G.E.M Trial series

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) of a range of spring canola variety types.

Key Messages:

- 45Y95 CL was the standout variety in this trial with a mean yield (across treatments) of 6.43t/ha. This was 78% higher yielding than the open pollinated ATR Wahoo.
- 45Y95 CL grew very high biomass (18.65 t/ha) and had a high harvest index (0.36). It is rare to have such a high conversion of biomass to grain (HI) at such a high biomass level and is a fundamental driver of achieving hyper yields.
- 45Y95 CL had a high number of seeds per pod as well as a high number of pods/m². This compares to ATR Wahoo which had a high number of seeds/pod but a low number of pods/m²; and Condor TF which had a high number of pods/m², but a relatively low number of seeds/pod.
- The High Input Management was higher yielding than both the Low and Medium Input management. The yield increased compared to Medium Input which suggests that this was driven by disease control; however it was difficult to ascertain which disease was causing yield loss. Fungicide reduced disease levels, but most diseases were at a low level including sclerotinia.
- The RR/Truflex cultivars 45Y28 RR and Condor TF had the highest oil concentration with 48.8 and 48.3% respectively.
- Protein averaged 20.3%, meaning that 32.4kg/ha N was harvested per tonne of grain harvested.
- There was no effect of management on any of the grain quality parameters.

Treatments: Six spring varieties with three different management levels (combination of fungicide and N).

Table 1. Influence of management strategy and variety on grain yield (t/ha).

Cultivar	**Low input**	**Medium input**	**High input**	**Mean**
		Grain yield (t/ha)		
45Y28 RR	4.64	4.81	5.15	*4.87*
Condor TF	5.26	5.27	4.96	*5.16*
45Y93 CL	5.48	5.55	5.78	*5.60*
45Y95 CL	6.44	6.17	6.69	*6.43*
ATR Wahoo	3.73	3.31	3.81	*3.62*

HyTTec Trifecta	4.68	5.27	5.65	*5.20*
Mean	*5.04*	*5.06*	*5.34*	
LSD Management	0.25	**p value**	0.034	
LSD Cultivar	0.36	**p value**	<0.001	
LSD Management * Cultivar	n.s.	**p value**	n.s.	

Table 2. Influence of management strategy and variety on oil concentration (%), test weight (kg/hL) and protein (%).

Cultivar	Oil %	Test Weight (kg/hL)	Protein %
45Y28 RR	48.8	64.6	18.6
Condor TF	48.3	64.6	19.9
45Y93 CL	45.7	65.3	20.5
45Y95 CL	46.2	64.1	20.5
ATR Wahoo	45.8	67.3	21.1
HyTTec Trifecta	46.8	64.9	21.1
Mean	*47.0*	*65.1*	*20.3*
LSD Cultivar*	0.84	0.44	0.56

***Management and the interaction between cultivar and management were not significant, therefore data only shown for cultivar effects.

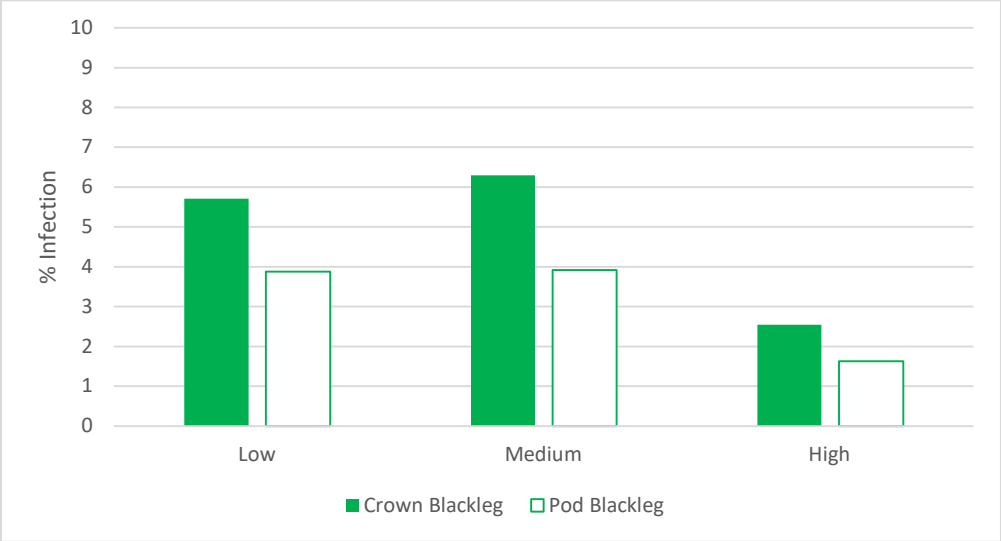

Figure 1: Effect of management strategy on crown canker blackleg infection (cross section of 20 stems at ground level) and pod blackleg infection (% pod area infected).

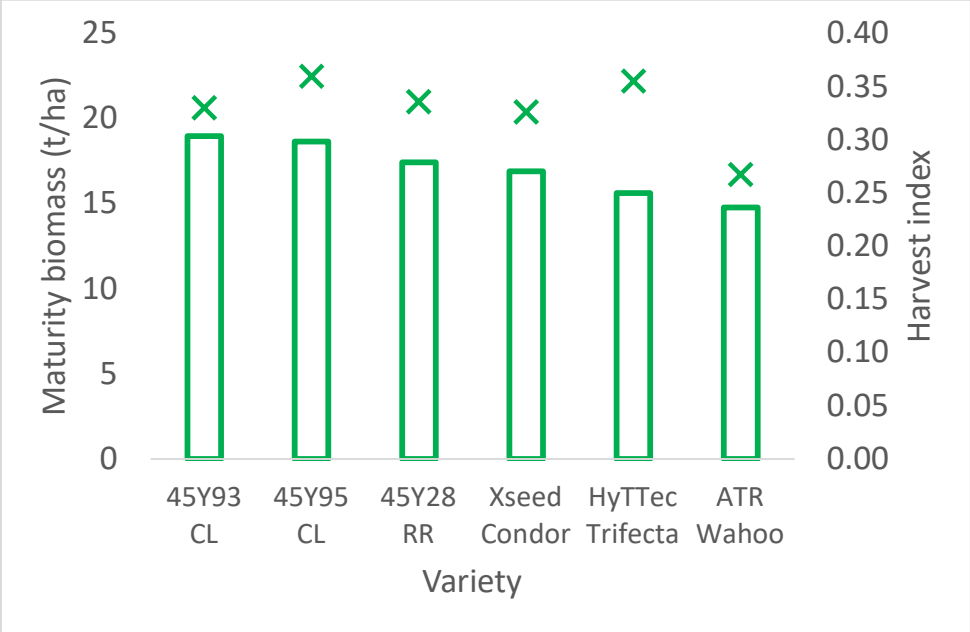

Figure 2: Maturity biomass (bars) and harvest index (X) of six canola cultivars in Wallendbeen GEM trial 2021.

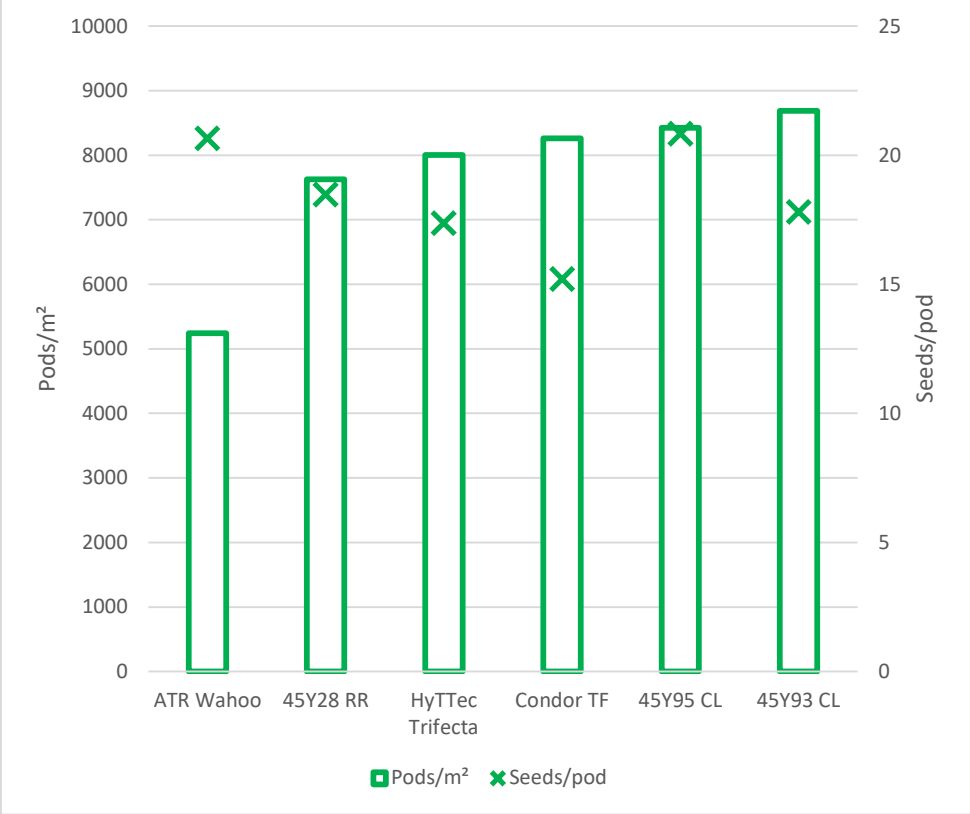

Figure 3: Yield components of six cultivars in Wallendbeen GEM trial 2021 (Measured in high input treatment).

Table 3. Trial management details.

Sowing date:		**30 April**		
Target plant density:		45 plants/m^2		
Basal Fertiliser:		130 kg/ha MAP (in-furrow) & 180 kg/ha Single Super (broadcast pre-sow).		
		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	75kg N/ha	113kg N/ha	113kg N/ha
	Bud visible	75kg N/ha	113kg N/ha	113kg N/ha
Total N Applied:		**150kg N/ha**	**226kg N/ha**	**226kg N/ha**
Fungicide:	GS00	Maxim XL	Maxim XL	Saltro Duo
	6 Leaf	---	---	Prosaro 0.45 L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha
	50% Bloom			Prosaro 0.45 L/ha

Trial 5: Plant density for hyper yielding spring canola

Objectives: To determine optimum plant density for hyper yielding spring canola

Key Messages:

- There was no effect of plant density on grain yield of 45Y28 RR.
- There was no significant lodging in 45Y28 RR even at the highest plant densities.

Treatments: 45Y28 RR canola sown at four seeding rates to target 15, 30, 50 and 75 plants/m².

Table 1: Effect of plant density on grain yield, oil and protein of 45Y28 RR.

Target Plant Density	**Achieved Plant Density**	**Grain Yield (t/ha)**	**Oil (%)**	**Protein (%)**
15 plants/m²	21 plants/m²	4.75	48.5	18.3
30 plants/m²	36 plants/m²	4.78	48.2	18.9
50 plants/m²	58 plants/m²	4.83	48.5	18.8
75 plants/m²	81 plants/m²	4.62	48.7	18.9
LSD (p<0.05)		*n.s.*	*n.s.*	*n.s.*

Table 2. Trial management details.

Sowing date:		**30 April**
Variety:		45Y28 RR
Target plant density:		As per treatments
Sowing Fertiliser:		130 kg/ha MAP (in-furrow) & 180 kg/ha Single Super (broadcast pre-sow).

Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 6: Nitrogen nutrition for hyper yielding winter canola

Objectives: To determine optimum nitrogen nutrient management (including rate and timing) for hyper yielding winter canola.

Key Messages:

- Lodging of Hyola Feast CL increased with increasing nutrition, to the point where at the highest nutrition rates the plots were close to completely flat.
- There was no effect of nutrition on grain yield or grain quality.

Treatments: Five nitrogen rates applied as urea with an equal split at 6-leaf and bud visible stage. A sixth treatment had 5t/ha of chicken manure applied.

Table 1: Effect of nutrient management on grain yield, oil, protein, test weight and lodging of Hyola Feast CL.

Nitrogen Rate	Grain Yield (t/ha)	Oil (%)	Protein (%)	Test Weight (kg/hL)	Lodging (1=standing, 9=flat)
Nil	3.81	45.2	19.5	64.9	4.8
75 kg/ha	3.69	44.9	19.9	64.6	6.8
150 kg/ha	3.58	43.8	21.0	65.3	7.0
225 kg/ha	3.79	44.1	20.9	65.4	8.3
300 kg/ha	3.72	43.8	21.1	65.4	8.5
225 kg/ha + Manure	3.48	44.7	20.2	65.0	7.8
LSD (p<0.05)	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*1.3*

*Chicken manure provided an extra 150 kg/ha N and 45 kg/ha P.

Table 2. Trial management details.

Sowing date:		**30 March**
Variety:		Hyola Feast CL
Target plant density:		45 plants/m^2
Sowing Fertiliser:		130 kg/ha MAP (in-furrow) & 180 kg/ha Single Super (broadcast pre-sow).
Nitrogen:		As per treatment list
Fungicide:	Seed	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

All inputs of insecticides and herbicides were standard across the trial

Trial 7: Nitrogen nutrition for hyper yielding spring canola

Objectives: To determine optimum nitrogen nutrient management (including rate and timing) for hyper yielding spring canola.

Key Messages:

- The application of nitrogen as urea did not increase grain yield in this trial, with only the application of manure increasing yield. Manure applied with 225 kg/ha N yielded 0.55 t/ha more than the same rate of N applied alone.
- The reasons for the manure response are not clear, as the site had high background N and P levels and the response came over and above high application rates of both nutrients.
- There was no effect of nutrition on grain quality or lodging.

Treatments: Five nitrogen rates applied as urea with an equal split at 6-leaf and bud visible stage. A sixth treatment had 5t/ha chicken manure applied.

Table 1. Yield of the Nutrition trial (t/ha) in Canola (45Y28RR).

Nitrogen Rate	Grain Yield (t/ha)	Oil (%)	Protein (%)	Test Weight (kg/hL)	Lodging (1=standing, 9=flat)
Nil	4.52	48.8	18.6	64.2	1.4
75 kg/ha	4.43	49.4	18.2	64.3	1.6
150 kg/ha	4.56	49.3	18.2	64.1	1.5
225 kg/ha	4.47	48.8	18.8	64.5	2.1
300 kg/ha	4.49	48.8	18.9	64.3	1.7
225 kg/ha + Manure*	5.02	48.8	18.7	64.5	1.8
LSD (p<0.05)	*0.32*	*n.s.*	*n.s.*	*n.s.*	*n.s.*

*Chicken manure provided an extra 150 kg/ha N and 45 kg/ha P.

Table 2. Trial management details.

Sowing date:		**30 April**
Target plant density:		45 plants/m²
Canola Variety		Pioneer 45Y28RR
Basal Fertiliser:		130 kg/ha MAP (in-furrow) & 180 kg/ha Single Super (broadcast pre-sow).
Fungicide:	Seed	Saltro Duo
	6 - Leaf	Prosaro 450mL/ha
	20% Bloom	Aviator Xpro 800mL/ha

All inputs of insecticides and herbicides were standard across the trial

Trial 8: Disease management for hyper yielding winter canola

Objectives: To determine optimum fungicide management for hyper yielding winter canola.

Key Messages:

- Hyola Feast CL was badly lodged in this trial; therefore, it is difficult to make any major conclusions from it.
- There was no significant difference in grain yield between fungicide treatments.

- There was disease present in the trial, primarily powdery mildew as the dense, lodged canopy created a humid micro-environment for the disease. Powdery mildew infection was lowest in the treatment that included a Prosaro application at 50% bloom stage. This treatment also had the lowest level of sclerotinia stem rot.
- Sclerotinia stem rot and powdery mildew were present at higher levels than in either of the spring disease management trials.

Treatments: Six Fungicide strategies applied to a Hyola Feast CL winter canola.

Table 1. Influence of fungicide management strategy on winter canola grain yield (t/ha), oil concentration (%), powdery mildew infection (% of stem area infected) and Sclerotinia stem rot (% plants with main stem infection). Data not yet analysed for sclerotinia stem rot and powdery mildew.

Trt.	Seed	6 Leaf	20% Bloom	50% Bloom	Yield (t/ha)	Oil (%)	Powdery Mildew (%)	Sclerotinia (%)
1	**---**	---	---	---	2.49	43.0	36.3	7.6
2	**Maxim XL**	---	Aviator Xpro 800 mL/ha	---	2.83	44.1	19.5	3.5
3	**Saltro Duo**	---	Prosaro 450 mL/ha	---	2.43	44.1	11.2	4.5
4	**---**	---	Aviator Xpro 800 mL/ha	---	2.40	44.0	20.5	4.2
5	**Saltro Duo**	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	---	2.97	43.9	22.7	3.1
6	**Saltro Duo**	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	Prosaro 0.45 L/ha	3.06	43.9	5.5	0.5
				LSD 0.05	n.s.	n.s.	N/A	N/A

Table 2. Trial management details.

Sowing date:		**30 March**
Variety:		Hyola Feast CL
Target plant density:		45 plants/m^2
Sowing Fertiliser:		130 kg/ha MAP (in-furrow) & 180 kg/ha Single Super (broadcast pre-sow).
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:		As per Table 1

Trial 9: Disease management for hyper yielding spring canola

Objectives: Determine the effect of fungicide management strategies on disease control (especially crown canker blackleg, upper canopy blackleg and sclerotinia stem rot) and grain yield in HyTTec Trifecta (Resistant, Blackleg Group ABD) and 45Y28 RR (Moderately Resistant, Blackleg Group BC).

Key Messages:

- Grain yield of 45Y28 RR increased by 0.92t/ha from nil fungicide to where four separate fungicides were used, including seed, 6-leaf, 20% bloom and 50% bloom. However there were treatments that incorporated fewer fungicide applications that yielded similarly to where four applications were used. The highest of these was where Maxim XL was applied to the seed and a single application of Miravis Star was applied at 20% bloom.
- It was difficult to ascertain which disease was responsible for the yield loss. Sclerotinia levels were low with only 1.5% plants infected in the untreated control. Crown canker infection (% of cross section of basal stem) was reduced by fungicide but was not observed in high levels. Upper canopy blackleg infection on the main stem was also reduced by fungicide but was also only present at low levels. Pod Upper canopy blackleg was present at higher levels than 2021, it was reduced best by the treatment that included a 20 and 50% bloom spray.
- There was no statistical benefit of fungicide on HyTTec Trifecta. Upper canopy blackleg infection was generally lower than 45Y28 RR. Sclerotinia levels were also low in HyTTec Trifecta with infection on 2.5% of plants in the untreated control.
- There was no effect of fungicide on any grain quality parameter in either cultivar.

Treatments: Nine Fungicide strategies applied to 45Y28 RR and six to HyTTec Trifecta.

Table 1. Influence of fungicide management strategy on grain yield (t/ha), blackleg at the crown (% of stem cross section infected), Upper Canopy blackleg on main stem (% of main stems cankered from blackleg in upper canopy) and Pod infection from blackleg (% of area infected).

Trt.	Seed	6 Leaf	20% Bloom	50% Bloom	Yield (t/ha)	Crown blackleg %	Upper Canopy Blackleg Main Stem (%)	Upper Canopy Blackleg Pod (%)
1	---	---	---		3.76	4.3	2.8	6.8
2	Maxim XL	---	Aviator Xpro 800 mL/ha	---	4.40	4.6	0.0	5.3
3	Maxim XL	---	Miravis Star 1 L/ha	---	4.61	4.4	0.7	3.5
4	Maxim XL	---	Revystar 1 L/ha	---	4.35	4.6	0.0	4.3
5	Saltro Duo	---	Prosaro 450 mL/ha	---	4.26	1.6	0.23	7.5
6	Maxim XL	Aviator Xpro 650 mL/ha	Prosaro 450 mL/ha	---	4.14	2.5	0.6	5.4
7	---	---	Aviator Xpro 800 mL/ha	---	4.24	3.1	0.25	3.0

8	Saltro Duo	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	---	4.33	1.9	0.26	3.9
9	Saltro Duo	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	Prosaro 450 mL/ha	4.68	1.4	0.52	2.1
			Mean		4.31	3.4	0.6	1.9
			LSD 0.05		0.43	2.3	1.1	<0.001
			P Val		0.012	0.013	<0.001	

Table 2. Influence of fungicide management strategy on grain yield (t/ha), blackleg at the crown (% of stem cross section infected), Upper Canopy blackleg on main stem (% of main stems cankered from blackleg in upper canopy) and Pod infection from blackleg (% of area infected).

Trt.	**Seed**	**6 Leaf**	**20% Bloom**	**50% Bloom**	**Yield (t/ha)**	**Crown blackleg %**	**Upper Canopy Blackleg Main Stem (%)**	**Upper Canopy Blackleg Pod (%)**
1	---	---	---		3.95	4.8	0	1.8
2	Maxim XL	---	Aviator Xpro 800 mL/ha	---	3.88	3.0	0	0
3	Saltro Duo	---	Prosaro 450 mL/ha	---	4.20	1.5	0	1.5
4	---	---	Aviator Xpro 800 mL/ha	---	4.02	2.3	0	1.0
5	Saltro Duo	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	---	4.11	2.3	0	0.5
6	Saltro Duo	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	Prosaro 450 mL/ha	4.33	0.3	0	0.3
			Mean		4.08	2.3	0	0.8
			LSD 0.05		n.s.	1.9	n.s.	<0.001
			P Val		0.381	0.003	n.s.	0.73

Table 3. Trial management details.

Sowing date:		**25 April**
Variety:		45Y28RR & HyTTec Trifecta
Target plant density:		45 plants/m^2
Sowing Fertiliser:		130 kg/ha MAP (in-furrow) & 180 kg/ha Single Super (broadcast pre-sow).
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:		As per treatment list

2021 SA Crop Technology Centre
Millicent, South Australia

Sown: 7 May 2021 (spring-sown trial sown 18 August 2021)
Harvested: Spring cultivar trials: 12-13 December 2021; winter cultivar trials 24 January 2022; spring-sown trial: 25 January 2022
Rotation position: 2020 Wheat
Soil type & management: Neutral-slightly alkaline Organosol (Peat soil)
Colwell P (ppm) 0-10 cm: 56
pH ($CaCl_2$) 0-10 cm: 7.7
Organic Carbon (%) 0-10 cm: 9.7%

Trial 1: SAC C21-21 Winter Screen

Objectives: To examine the suitability of elite commercial and unreleased winter canola cultivars for hyper yielding regions.

Key Messages:

- AGFCA014120, Phoenix CL and CL214103 were the highest yielding cultivars, all significantly higher yielding than Hyola 970CL, RGT Nizza CL and SFR65-056-CL.
- AGFCA014120 and CL214103 also had the highest oil concentration, both either at or close to 49%.
- Despite high N input and a fertile soil, protein levels were low with an average of 17.3%, meaning only 27.7 kg/ha nitrogen was harvested per tonne of grain harvested.

Treatments: 10 winter canola cultivars sown in small plots (half of normal plot length) with three replicates.

Table 1: Grain yield (t/ha), quality (%) and thousand seed weight (TSW, g), harvested 24 January 2022.

		Grain Yield and Quality							
		Yield		Protein		Oil		TSW	
	Variety	t/ha		%		%		g	
1.	Hyola Feast CL	3.48	ab	17.7	ab	47.7	bc	5.18	-
2.	AGFCA014420	3.78	ab	18.0	a	47.1	c	5.01	-
3.	Hyola 970CL	3.13	b	18.3	a	47.3	c	5.38	-
4.	RGT Nizza CL	3.10	b	17.8	ab	48.6	ab	5.29	-
5.	Phoenix CL	4.43	a	16.5	b	48.7	ab	4.96	-
6.	CL214103	4.65	a	17.7	ab	48.9	a	5.27	-
7.	CL214006	3.40	ab	18.0	a	46.8	c	4.93	-
8.	SFR65-056-CL	2.83	b	16.5	b	47.1	c	5.56	-
9.	AGFCA014120	4.67	a	17.2	ab	49.0	a	5.04	-
10.	AGFCA014320	4.07	ab	15.1	c	47.0	c	5.04	-
Mean		3.75		17.3		47.8		5.16	
LSD		1.29		1.4		1.2		0.56	
P Val		0.048		0.002		<0.001		0.385	
CV		23.71		5.5		1.7		7.51	

AOV

Table 2. Trial management details.

Sowing date:		**7 May**
Plant density target:		60 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed treatment	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 2: SAC C21-22 Spring Screen

Objectives: To examine the suitability of elite commercial and unreleased spring cultivars for hyper yielding regions.

Key Messages:
Clearfield trial

- 45Y93 CL and 45Y95 CL were the standouts for grain yield, yielding above 5.6t/ha.
- The European spring cultivar AGFCA014520 was very tall but lower yielding compared to the best Australian bred cultivars.
- Oil was highest in the unreleased PS-21CL211 and PS-21XC318.

Glyphosate tolerant trial (Roundup Ready and Truflex)

- NCH20Q729 was the highest yielding and tallest cultivar.
- There was no difference in oil concentration in the glyphosate tolerant trial.

Triazine tolerant trial

- There was no statistical difference in yield between the four TT cultivars.
- ATR Wahoo and HyTTec Trifecta had the highest oil concentration.

Overall conclusions

- There were larger yield differences observed within trials than between trials. It is best to pick the appropriate herbicide tolerance required for a paddock than select the best cultivar within that herbicide tolerance group.
- Protein was higher than the winter screen, with an average of 21.8% meaning 34.3kg/ha nitrogen was harvested per tonne of grain harvested.

Treatments: 16 cultivars sown in small plots (half of normal plot length) with three replicates. Trial was blocked and analysed by herbicide tolerance.

Table 1: Height (cm), grain yield (t/ha), quality (%) and thousand seed weight (TSW, g) of Clearfield tolerant cultivars, harvested 13 December 2021.

		Grain Yield and Quality			
		Height	Yield	Protein	Oil
	Variety	cm	t/ha	%	%
2.	**45Y93 CL**	148.6 bc	5.64 ab	21.2 -	44.0 c
3.	**45Y95 CL**	146.9 bc	5.66 a	21.6 -	44.2 bc
4.	**AGFCA014520**	178.1 a	4.10 cd	20.4 -	45.5 abc
5.	**AGFCA014820**	184.8 a	3.51 d	16.8 -	46.3 abc
9.	**Hyola Equinox CL**	141.8 c	4.18 cd	20.7 -	44.0 c
12.	**PS-21CL211**	146.8 bc	4.70 abc	20.3 -	47.4 a
13.	**PS-21CT106**	145.0 bc	4.03 cd	23.1 -	47.0 ab
14.	**PS-21XC318**	153.2 b	4.56 bcd	21.5 -	47.7 a
Mean		155.6	4.55	20.7	45.8
LSD		9.7	1.09	3.5	2.8
P Val		<0.001	0.008	0.068	0.046
CV		3.6	13.67	9.6	3.5

AOV CL cultivars

Table 2: Height (cm), grain yield (t/ha), quality (%) and thousand seed weight (TSW, g) of Roundup Ready cultivars, harvested 13 December 2021.

		Grain Yield and Quality			
		Height	Yield	Protein	Oil
	Variety	cm	t/ha	%	%
1.	**45Y28 RR**	139.0 -	4.80 b	22.3 -	43.8 -
6.	**AN20RR002**	136.1 -	3.83 c	20.4 -	45.7 -
11.	**NCH20Q729**	154.1 -	5.21 a	21.9 -	46.7 -
16.	**Condor TF**	145.9 -	4.68 b	22.7 -	45.2 -
Mean		143.8	4.63	21.8	45.3
LSD		17.4	0.39	2.2	2.4
P Val		0.153	<0.001	0.168	0.118
CV		6.1	4.27	5.1	2.6

AOV RR cultivars

Table 3: Height (cm), grain yield (t/ha), quality (%, kg/hL) and thousand seed weight (TSW, g) of Triazine tolerant cultivars, harvested 13 December 2021.

		Grain Yield and Quality				
		Height	Yield	Protein	Test wt.	Oil
	Variety	cm	t/ha	%	kg/hL	%
7.	**ATR Wahoo**	123.9 -	4.39 -	22.1 b		45.8 a
8.	**Hyola Blazer TT**	123.0 -	4.91 -	23.8 a	64.8 -	44.0 b
10.	**HyTTec Trifecta**	134.3 -	4.25 -	20.6 c	64.0 -	45.7 a
15.	**SF Ignite TT**	134.8 -	4.34 -	20.8 c	65.0 -	44.2 b
Mean		129.0	4.47	21.8	64.6	44.9
LSD		13.7	0.92	1.3	7.6	1.2
P Val		0.143	0.372	0.003	0.482	0.015
CV		5.3	10.25	2.9	1.1	1.3

AOV TT cultivars

Table 4. Trial management details and treatments.

Sowing date:		**7 May**
Plant density target:		60 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed treatment	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 3: SAC C21-23 Winter GEM

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) on two winter canola cultivars, Hyola Feast CL and Hyola 970CL.

Key Messages:

- Hyola Feast CL was higher yielding than Hyola 970CL, with an average benefit across treatments of 1.05t/ha.
- There was no effect of management level on grain yield in this trial.

Treatments: Three management levels applied to two cultivars.

Table 1: Grain yield (t/ha), harvested 11 January 2022.

	Management Level			
	150N + Single SDHI Flower	**225N + Intensive**	**225N + Single SDHI Flower**	**Mean**
Cultivar	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**
Hyola 970 CL	3.00 -	2.97 -	3.53 -	**3.17 b**
Hyola Feast CL	4.38 -	3.89 -	4.40 -	**4.22 a**
Mean	**3.69 -**	**3.43 -**	**3.96 -**	
LSD Cultivar p = 0.05	0.36	**P val**	<0.001	
LSD Management p=0.05	0.47	**P val**	0.090	
LSD Cultivar x Man. P=0.05	0.62	**P val**	0.401	

Factorial AOV: management*variety

Table 2: Thousand seed weight (TSW, g), harvested 11 January 2022.

	Management Level			
	150N + Single SDHI Flower	**225N + Intensive**	**225N + Single SDHI Flower**	**Mean**
Cultivar	**TSW g**	**TSW g**	**TSW g**	**TSW g**
Hyola 970 CL	5.19 -	4.99 -	5.08 -	**5.08 a**
Hyola Feast CL	4.71 -	4.9 -	4.95 -	**4.85 b**

Mean	**4.95 -**	**4.94 -**	**5.01 -**	
LSD Cultivar p = 0.05	0.14	**P val**		0.004
LSD Management p=0.05	0.32	**P val**		0.836
LSD Cultivar x Man. P=0.05	0.24	**P val**		0.054

Factorial AOV: management*variety

Table 3. Trial management details and treatments.

Sowing date:		**7 May**		
Varieties:		Hyola 970 CL & Hyola Feast CL		
Target plant density:		60 plants/m^2		
Basal Fertiliser:		150kg MAP & 125kg SOA		
		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	75kg N/ha	113kg N/ha	113kg N/ha
	Bud visible	75kg N/ha	113kg N/ha	113kg N/ha
Total N Applied:		**150kg N/ha**	**226kg N/ha**	**226kg N/ha**
Fungicide:	GS00	Maxim XL	Maxim XL	Saltro Duo
	6 Leaf	---	---	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha

Trial 4: SAC C21-24 Spring GEM

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) of six spring canola cultivars.

Key Messages:

- Blackleg crown canker reduced with higher input, but this did not relate to yield, with no effect of management level on grain yield.
- 45Y95 CL was the standout cultivar for yield, with an average of 6.26t/ha. This was 2.59t/ha higher yielding than the open-pollinated triazine tolerant ATR Wahoo and even 0.52t/ha higher yielding than the second-best cultivar, 45Y93 CL.

Treatments: Three management levels applied to six cultivars.

Table 1: Blackleg canker (% of stem cross-section infected with blackleg) assessed 30 November 2021.

	Management Level			
	150N + Single SDHI Flower	**225N + Single SDHI Flower**	**225N + Intensive**	**Mean**
Cultivar	**Blackleg canker %**	**Blackleg canker %**	**Blackleg canker %**	**Blackleg canker %**
HyTTec Trifecta	0.0 c	0.0 c	0.0 c	**0.0 b**
ATR Wahoo	0.3 c	0.3 c	0.0 c	**0.2 b**
45Y28 RR	1.0 bc	0.0 c	2.3 b	**1.1 b**
Condor TF	1.8 bc	0.0 c	0.3 c	**0.7 b**
45Y95 CL	7.5 a	1.0 bc	0.3 c	**2.9 a**

45Y93 CL	0.5 bc	0.3 c	0.3 c	**0.3 b**
Mean	**1.8 a**	**0.3 b**	**0.5 b**	
LSD Cultivar p = 0.05	1.2	**P val**	<0.001	
LSD Management p=0.05	0.6	**P val**	0.002	
LSD Cultivar x Man. P=0.05	2.0	**P val**	<0.001	

Factorial AOV: management*variety

Table 2: Grain yield (t/ha) harvested 12/13 December 2021.

	Management Level			
	150N + Single SDHI Flower	**225N + Single SDHI Flower**	**225N + Intensive**	**Mean**
Cultivar	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**
HyTTec Trifecta	4.35 -	5.19 -	5.09 -	**4.87 c**
ATR Wahoo	3.33 -	3.78 -	3.91 -	**3.67 d**
45Y28 RR	5.11 -	5.05 -	5.37 -	**5.18 c**
Condor TF	5.12 -	5.31 -	5.17 -	**5.20 c**
45Y95 CL	6.37 -	6.20 -	6.22 -	**6.26 a**
45Y93 CL	5.73 -	5.75 -	5.75 -	**5.74 b**
Mean	**5.00 -**	**5.21 -**	**5.25 -**	
LSD Cultivar p = 0.05	0.33	**P val**	<0.001	
LSD Management p=0.05	0.34	**P val**	0.237	
LSD Cultivar x Man. P=0.05	0.58	**P val**	0.321	

Factorial AOV: management*variety

Table 3: Thousand seed weight (TSW, g), harvested 12/13 December 2021.

	Management Level			
	150N + Single SDHI Flower	**225N + Single SDHI Flower**	**225N + Intensive**	**Mean**
Cultivar	**TSW g**	**TSW g**	**TSW g**	**TSW g**
HyTTec Trifecta	5.21 -	5.30 -	5.21 -	**5.24 abc**
ATR Wahoo	4.82 -	5.49 -	5.22 -	**5.18 bc**
45Y28 RR	5.05 -	4.82 -	5.04 -	**4.97 c**
Condor TF	5.32 -	5.47 -	5.64 -	**5.48 a**
45Y95 CL	5.11 -	5.35 -	5.34 -	**5.26 ab**
45Y93 CL	5.44 -	5.51 -	5.22 -	**5.39 ab**
Mean	**5.16 b**	**5.32 a**	**5.28 ab**	
LSD Cultivar p = 0.05	0.28	**P val**	0.013	
LSD Management p=0.05	0.13	**P val**	0.043	
LSD Cultivar x Man. P=0.05	0.48	**P val**	0.372	

Factorial AOV: management*variety

Table 4. Trial management details and treatments.

Sowing date:		**7 May**		
Plant density target:		60 plants/m^2		
Basal Fertiliser:		150kg MAP & 125kg SOA		
		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	75kg N/ha	113kg N/ha	113kg N/ha
	Bud visible	75kg N/ha	113kg N/ha	113kg N/ha
Total N Applied:		**150kg N/ha**	**226kg N/ha**	**226kg N/ha**
Fungicide:	GS00	Maxim XL	Maxim XL	Saltro Duo
	6 Leaf	---	---	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha

Trial 5: SAC C21-25 Winter Plant Density (Hyola Feast CL)

Objectives: To determine optimum plant density for hyper yielding winter canola

Key Messages:

- Plant populations achieved were generally about 60% of target populations.
- There was some variability in yield across replicates due to lodging at high plant populations resulting in no significant difference in grain yield observed.
- There was no difference in protein or oil due to plant population. Oil concentration was high (average 48.4%) and protein concentration was low (average 15.4%).

Treatments: One cultivar (Hyola Feast CL) at four seeding rates.

Table 1: Establishment counts (no. plants per 2m of row), 3 May 2021.

		Establishment	
	Plant density target (plants/m^2)	**Plants/m^2**	
1.	15	8.9	d
2.	30	17.8	c
3.	50	30.2	b
4.	75	55.1	a
Mean		28	
LSD		8.2	
P Val		<0.001	

AOV

Table 2: Grain yield (t/ha) and quality (%), harvested 24 January 2022.

		Grain Yield and Quality					
		Yield		**Protein**		**Oil**	
	Planting density (plants/m^2)	**t/ha**		**%**		**%**	
1.	**15**	5.55	-	15.5	-	48.7	-
2.	**30**	5.95	-	14.7	-	48.6	-
3.	**50**	6.34	-	15.8	-	48.3	-

4.	**75**	6.32	-	15.8	-	48.2	-
Mean		6.04		15.4		48.4	
LSD		0.98		1.6		1.4	
P Val		0.285		0.344		0.799	
CV		10.19		6.3		1.8	

AOV

Table 3. Trial management details and treatments.

Sowing date:		**7 May**
Variety		Hyola Feast CL
Plant density target:		As per treatment list
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed treatment	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 6: SAC C21-26 Spring Plant Density (45Y28 RR)

Objectives: To determine optimum plant density for hyper yielding spring canola.

Key Messages:

- Yield was lower for the 15 plants/m² target population (15.6 plants/m² actual population) than the higher population targets of 30 to 75 plants/m².
- The penalty of the low population was close to 1t/ha.
- This is the second year with a similar response at the SA site, suggesting that plant population targets should be higher than other hyper yielding crops environments.
- Winter is relatively mild at Millicent (maritime environment with high minimum temperatures) and development is rapid but with short days and low light intensity during winter growth is slow. Increasing plant population from 15 to 30 plants/m² may be a useful tactic to ensure enough vegetative biomass to reach full yield potential.

Treatments: One cultivar (45Y28 RR) at four seeding rates.

Table 1: Establishment counts (no. plants per 2m of row), 3 May 2021.

		Establishment	
	Planting density (plants/m²)	**Plants/m²**	
1.	**15**	15.6	d
2.	**30**	26.2	c
3.	**50**	35.3	b
4.	**75**	57.6	a
Mean		33.6	
LSD		7.6	
P Val		<0.001	

AOV

Table 2: Grain yield (t/ha) and quality (%), harvested 13 December 2021.

		Grain Yield and Quality					
		Yield		Protein		Oil	
	Planting density (plants/m^2)	t/ha		%		%	
1.	**15**	4.86	b	20.9	-	43.6	-
2.	**30**	5.81	a	23.4	-	42.1	-
3.	**50**	5.77	a	22.4	-	42.4	-
4.	**75**	6.04	a	23.3	-	42.3	-
Mean		5.62		22.5		42.6	
LSD		0.47		2.1		1.5	
P Val		0.002		0.085		0.189	
CV		5.23		5.8		2.2	

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Table 3. Trial management details and treatments.

Sowing date:		**7 May**
Variety:		45Y28 RR
Plant density target		As per treatment list
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed treatment	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 7: SAC C21-27 Spring Nutrition (45Y28 RR)

Objectives: To determine optimum nitrogen nutrient management for hyper-yielding canola.

Key Messages:

- Canola responded to N input (as urea) but only to 75 kg/ha N, with no yield response with further urea N input.
- The application of pig manure at 6.7t/ha with 225kg/ha N increased yield compared to where 225kg/ha N (as urea) was applied alone.
- The project team will aim to better understand the response to manure, especially as the response was over and above a very high rate of applied N. Should phosphorus input recommendations be changed for very high yield potential environments or are there other aspects of the manure driving the positive yield response?
- There was no effect of nutrient management on oil or protein concentration, but the manure application increased crop height by 8.7 cm.
-

Treatments: Five nitrogen rates applied as urea with an equal split at 6-leaf and bud visible stage. A sixth treatment had 6.7t/ha of pig manure applied.

Table 1: Height (cm), **g**rain yield (t/ha), quality (%) and thousand seed weight (TSW, g), harvested 13 December 2021.

		Grain Yield and Quality									
		Height		Yield		Protein		Oil		TSW	
	N rate	cm		t/ha		%		%		g	
1.	0	130.6	d	4.93	c	21.5	-	42.1	-	5.34	-
2.	75	140.8	bc	5.65	b	20.2	-	41.6	-	5.27	-
3.	150	140.3	c	6.00	ab	19.2	-	42.1	-	5.10	-
4.	225	143.4	bc	5.82	b	19.6	-	42.3	-	5.00	-
5.	300	145.1	b	6.07	ab	20.0	-	42.0	-	5.26	-
6.	225 + Manure*	152.1	a	6.45	a	20.7	-	41.9	-	5.27	-
Mean		142.0		5.82		20.2		42.0		5.21	
LSD		4.6		0.56		1.9		1.4		0.53	
P Val		<0.001		0.001		0.208		0.917		0.748	
CV				6.33		6.4		2.2		6.70	

***Pig Manure applied at 6.7 t/ha (2.7% Nitrogen, and 1.26% Phosphorus) = additional 169kg N/ha and 85kg P/ha to replicate high fertility soils.

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Table 2. Trial management details and treatments.

Sowing date:		**7 May**
Plant density target:		60 plants/m²
Canola Variety		Pioneer 45Y28RR
Basal Fertiliser:		150 kg/ha MAP (15 kg/ha N)
		125 kg/ha SOA (26.2 kg/ha N)
Fungicide:	Seed trt	Saltro Duo
	6 - Leaf	Prosaro 450mL/ha
	20% Bloom	Aviator Xpro 800mL/ha

All inputs of insecticides and herbicides were standard across the trial

Trial 8: SAC C21-28 Spring TT Disease Management (HyTTec Trifecta)

Objectives: To determine the effect of seed and seedling fungicide management on grain yield of HyTTec Trifecta (Blackleg resistance = R, Blackleg Group = ABD).

Key Messages:

- There were small differences in blackleg leaf lesion infection on seedlings of HyTTec Trifecta, but this did not manifest into a difference in grain yield, with no effect of seed or seedling foliar fungicide on grain yield.
- Average yield of HyTTec Trifecta in this trial was 4.67t/ha.

Treatments: Four fungicide strategies for blackleg crown canker management applied to the cultivar HyTTec Trifecta.

Table 1: Disease assessment (%LAI blackleg lesions) at the 4 to 5 leaf crop stage.

		Disease	
	Treatment	**%LAI**	
1.	**Nil**	6.5	a
2.	**Maxim XL**	3.7	b
3.	**Saltro Duo (seed)**	*	
4.	**Saltro Duo (seed) + Prosaro 0.375 L/ha 6-leaf**	4.0	b
Mean		4.7	
LSD		1.3	
P Val		0.003	

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Table 2: Grain yield (t/ha) and quality (%), harvested 13 December 2021.

		Grain Yield and Quality					
		Yield		**Protein**		**Oil**	
	Treatment	**t/ha**		**%**		**%**	
1.	**Nil**	4.76	-	22.1	-	44.8	-
2.	**Maxim XL**	4.75	-	21.6	-	45.0	-
3.	**Saltro Duo (seed)**	4.62	-	22.3	-	44.6	-
4.	**Saltro Duo (seed) + Prosaro 0.375 L/ha 4-leaf**	4.51	-	21.0	-	44.4	-
Mean		4.67		21.8		44.6	
LSD		0.23		1.0		1.5	
P Val		0.173		0.112		0.858	
CV		3.26		3.1		2.1	

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Table 3. Trial management details and treatments.

Sowing date:		**7 May**
Variety:		HyTTec Trifecta
Target plant density:		60 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:		As per treatment list

Trial 9: SAC C21-29 Spring RR Disease Management (45Y28 RR)

Objectives: To determine the effect of seed and seedling fungicide management on grain yield of HyTTec Trifecta (Blackleg resistance = MR, Blackleg Group = BC).

Key Messages:

- There were small differences in blackleg leaf lesion infection on seedlings of 45Y28 RR, but this did not manifest into a difference in grain yield, with no effect of seed or seedling foliar fungicide on grain yield.
- Average yield of 45Y28 RR in this trial was 5.54t/ha.

Treatments: Five fungicide strategies for blackleg crown canker management applied to the cultivar 45Y28 RR.

Table 1: Disease assessment (%LAI) on 10 plants per rep in trts 1, 3, 8 only, 6 July 2021 (4-5 leaf stage).

		Disease	
	Treatment	**%LAI**	
1.	**Nil**	7.4	a
2.	**Maxim XL (Seed)**	5.6	b
3.	**Saltro Duo (Seed)**	*	*
4.	**Maxim XL (Seed) + Aviator Xpro 0.65 L/ha 4-leaf**	*	*
5.	**Saltro Duo (Seed) + Prosaro 0.375 L/ha 4-leaf**	5.2	b
Mean		6.0	
LSD		1.5	
P Val		0.025	

AOV

Table 2: Grain yield (t/ha) and quality (%), harvested 13 December 2021.

		Grain Yield and Quality					
		Yield		**Protein**		**Oil**	
	Treatment	**t/ha**		**%**		**%**	
1.	**Nil**	5.59	-	22.7	-	42.9	-
2.	**Maxim XL (Seed)**	5.49	-	22.4	-	42.6	-
3.	**Saltro Duo (Seed)**	5.47	-	22.9	-	42.6	-
4.	**Maxim XL (Seed) + Aviator Xpro 0.65 L/ha 4-leaf**	5.56	-	23.9	-	42.9	-
5.	**Saltro Duo (Seed) + Prosaro 0.375 L/ha 4-leaf**	5.59	-	21.7	-	42.9	-
Mean		5.54		22.6		42.8	
LSD		0.28		1.8		0.9	
P Val		0.977		0.398		0.990	
CV		3.43		5.4		1.5	

AOV

Table 3. Trial management details and treatments.

Sowing date:		**7 May**
Variety:		45Y28RR
Target plant density:		45 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:		As per treatment list

Trial 10: SAC C21-30 Spring Sown G.E.M. Trial

Objectives: To determine the potential of spring-sown canola cultivars in a hyper-yielding environment.

Key Messages:

- There were no differences between cultivar choice or fungicide management for a spring (August) sowing of canola.
- Average yield of the cultivars in this spring sown trial were approximately 50% of autumn sown.

Treatments: Two fungicide levels applied to three cultivars.

Table 1: Grain yield (t/ha) harvested 25 January 2022.

	Management Level		
	Nil fungicide	**Saltro Duo (Seed) + Prosaro 0.375 L/ha 4-leaf**	**Mean**
Cultivar	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**
45Y28 RR	2.62 -	2.90 -	**2.76 -**
45Y93 CL	2.76 -	2.64 -	**2.70 -**
HyTTec Trifecta	2.26 -	2.19 -	**2.22 -**
Mean	**2.55 -**	**2.58 -**	
LSD Cultivar p = 0.05	1.21	**P val**	0.529
LSD Management p=0.05	0.50	**P val**	0.897
LSD Cultivar x Man. P=0.05	0.86	**P val**	0.734

Table 2. Trial management details and treatments.

Sowing date:		**18 August**
Variety:		45Y28 RR, 45Y93 CL, HyTTec Trifecta
Target plant density:		45 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	Bud Visible	113kg N/ha
Fungicide:		As per treatment list

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Winter canola sown: April 9
Winter canola harvested: December 29
2020 Crop: Wheat
Soil type & management: Grey Sodosol
Available Nitrogen (kg/ha) 0-60 cm: 69.6
Colwell P 0-10 cm: 34 mg/kg
pH (CaCl2) 0-10 cm: 5.3
Organic Carbon 0-10 cm: 1.4%

Spring canola sown: April 25
Spring canola harvested: December

Trial 1: HYC Winter canola screen

Objectives: To examine the suitability of elite commercial and unreleased winter canola cultivars for hyper yielding regions.

Key Messages:

- There was no statistical difference in grain yield of the 12 cultivars with an average yield of 4.01t/ha.
- Oil concentration was highest from AGFCA014120 with 48.7%. The trial average was 46.9%.
- There was a range of 9 days from the start of flowering of the quickest winter cultivars - Hyola Feast CL and CL214103, and the slowest cultivar, SF65-056-CL.

Treatments: 12 cultivars sown in small plots (half of normal plot length) with 'High input' treatment as per Trial 3.

Table 1. Yield of the variety evaluation trial (t/ha, % site mean) and grain quality results.

	Yield	**Grain Quality**		
Variety	Yield (t/ha)	Oil %	Test wt kg/HL	TSW g
Hyola Feast CL	4.04 -	47.5 abc	62.7 d	4.1 d
Hyola 970 CL	4.12 -	46.0 de	64.7 ab	4.6 ab
SF Nizza CL	3.44 -	47.4 abc	62.7 d	4.7 a
Phoenix CL	3.78 -	46.8 b-e	64.7 ab	4.5 ab
CL214103	4.63 -	47.5 ab	64.5 abc	4.6 ab
CL214006	4.14 -	46.9 bcd	63.1 cd	4.4 bc
SF65-056-CL	3.87 -	46.1 cde	65.7 a	4.6 ab
AGFCA014120	4.07 -	48.7 a	62.9 d	4.0 d
AGFCA014320	3.78 -	45.5 e	65.4 a	4.5 ab
AGFCA014420	4.20 -	47.0 bcd	63.6 bcd	4.2 cd
Mean	4.01	46.9	64.0	4.4
LSD 0.05	ns	1.4	1.4	0.3
P Val	0.120	0.004	<0.001	<0.001

Table 2. Phenology evaluation, growth stage (0-99) recorded at key messages in the season.

Variety	Start of flowering date
Hyola Feast CL	13/09/2021
Hyola 970 CL	19/09/2021
SF Nizza CL	18/09/2021
Phoenix CL	20/09/2021
CL214103	13/09/2021
CL214006	19/09/2021
SF65-056-CL	22/09/2021
AGFCA014120	17/09/2021
AGFCA014320	18/09/2021
AGFCA014420	20/09/2021

Table 3. Trial management details.

Sowing date:		**9 April**
Target plant density:		45 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 2: HYC Spring canola screen

Objectives: To examine the suitability of elite commercial and unreleased spring cultivars for hyper yielding regions

Key Messages:

- There was no statistical difference in the grain yield of the glyphosate tolerant varieties, with a trial mean yield of 4.42t/ha.
- 45Y95 CL was the highest yielding variety in the Clearfield trial with a yield of 5.5t/ha. Average yield of the Clearfield trial was 4.81t/ha.
- Only two cultivars were sown in the conventional trial with the European cultivar AGFCA014720 yielding 0.74t/ha more than Quartz. Mean yield of the Conventional trial was 4.4t/ha.
- There was no statistical difference in yield of the TT trial, with a mean yield of 4.37t/ha.
- Average protein of the four trials was 21%, meaning there was an average of 33.6kg/ha nitrogen removed per tonne of grain.
- Seed size was large overall, with an average of 5.05 grams/1000 seeds.
- There were differences in oil concentration with PS-21XC318 having highest oil in the glyphosate trial; PS-CL21211 highest in the CLF trial and ATR Wahoo and HyTTec Trifecta highest in the TT trial.

Treatments: 24 cultivars sown in small plots (half of normal plot length) with 'High input' management as per Trial 3.

Table 1. Yield of the glyphosate tolerant spring variety evaluation trial (t/ha, % site mean) and grain quality results.

	Yield		Grain Quality			
Variety	**Yield (t/ha)**	**Site Mean (%)**	**Oil (%)**	**Test wt (kg/HL)**	**Protein (%)**	**TSW (g)**
45Y28 RR	4.71 -	104.7	44.7 c	62.5 -	21.6 -	5.3 -
AN20RR002	4.27 -	94.9	46.2 bc	61.7 -	19.2 -	5.0 -
InVigor R4520P	3.94 -	87.5	44.8 c	62.0 -	21.1 -	5.2 -
NCH20Q729	4.62 -	102.6	46.9 b	62.7 -	21.6 -	5.2 -
PS-21XC318	4.51 -	100.2	48.8 a	62.2 -	21.9 -	5.4 -
Condor TF	4.46 -	99.1	46.2 bc	62.3 -	22.0 -	5.2 -
Mean	4.42	98.2	46.3	62.2	21.2	5.2
LSD 0.05	ns	ns	1.6	ns	ns	ns
P Val	0.288	0.286	0.003	0.734	0.192	0.635

Table 2. Yield of the Clearfield spring variety evaluation trial (t/ha, % site mean) and grain quality results.

	Yield		Grain Quality			
Variety	**Yield (t/ha)**	**Site Mean (%)**	**Oil (%)**	**Test wt (kg/HL)**	**Protein (%)**	**TSW (g)**
45Y93 CL	5.09 ab	113.1	45.2 b	62.4 -	19.2 -	5.0 -
45Y95 CL	5.50 a	122.1	43.7 c	61.7 -	23.0 -	5.3 -
AGFCA014520	4.45 bc	98.8	45.1 b	63.2 -	19.8 -	4.6 -
PS-21CL211	4.19 c	93.2	49.5 a	61.6 -	20.1 -	5.0 -
Mean	4.81	106.8	45.9	62.2	20.6	5.0
LSD 0.05	0.77	17.2	0.8	ns	ns	ns
P Val	0.021	0.021	<0.001	0.144	0.086	0.067

Table 3. Yield of the Conventional spring variety evaluation trial (t/ha, % site mean) and grain quality results.

	Yield		Grain Quality			
Variety	**Yield (t/ha)**	**Site Mean (%)**	**Oil (%)**	**Test wt (kg/HL)**	**Protein (%)**	**TSW (g)**
AGFCA014720	4.77 a	106.0	44.3 -	59.8 -	20.1 -	4.9 -
Quartz	4.03 b	89.6	44.8 -	63.3 -	20.8 -	5.4 -
Mean	4.40	97.8	44.6	61.5	20.4	5.1
LSD 0.05	0.41	9.3	ns	ns	ns	ns
P Val	0.016	0.017	0.556	0.051	0.336	0.060

Table 4. Yield of the Triazine Tolerant spring variety evaluation trial (t/ha, % site mean) and grain quality results.

	Yield		Grain Quality			
Variety	**Yield (t/ha)**	**Site Mean (%)**	**Oil (%)**	**Test wt (kg/HL)**	**Protein (%)**	**TSW (g)**
ATR Wahoo	4.05 -	90.0	45.1 a	64.7 -	21.0 b	4.9 -
Hyola Blazer TT	4.67 -	103.8	43.8 b	64.5 -	24.0 a	5.1 -
HyTTec Trifecta	4.30 -	95.6	44.8 a	63.9 -	22.2 b	5.0 -
SF Ignite TT	4.44 -	98.6	42.9 c	64.5 -	19.5 c	4.7 -

Mean	4.37	97.0	44.1	64.4	21.7	4.9
LSD 0.05	ns	ns	0.6	ns	1.3	ns
P Val	0.211	0.210	<0.001	0.399	0.001	0.732

Table 5. Start of flowering date of all cultivars in the spring screen trials.

Variety	Start of flowering date
45Y28 RR	19/07/2021
45Y93 CL	19/07/2021
45Y95 CL	18/07/2021
AGFCA014520	30/07/2021
AGFCA014720	18/07/2021
AN20RR002	1/08/2021
ATR Wahoo	31/07/2021
Hyola Blazer TT	20/07/2021
HyTTec Trifecta	19/07/2021
InVigor R4520P	20/07/2021
NCH20Q729	18/07/2021
PS-21CL211	18/07/2021
PS-21XC318	18/07/2021
Quartz	18/07/2021
SF Ignite TT	18/07/2021
Condor TF	18/07/2022

Table 6. Trial management details

Sowing date:		**25 April**
Target plant density:		45 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 3: HYC Winter G.E.M Trial series

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) of a range of winter canola variety types.

Key Messages:

- There was no difference in the yield of Hyola Feast CL and Hyola 970CL in this trial and no impact of increasing crop inputs.
- Oil of Hyola Feast CL was higher than Hyola 970CL but Hyola Feast CL had smaller seed.
- Average protein was 17.4%, meaning only 27.4kg of nitrogen was removed with every tonne of grain.

Treatments: Three management levels (combination of nitrogen and fungicide) applied to two winter canola varieties (Hyola 970 CL & Hyola Feast CL).

Table 1. Influence of management strategy and variety on grain yield (t/ha).

	Management Level			
	Low input	**Mid Input**	**High input**	**Mean**
Cultivar	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**
Hyola 970 CL	4.03 -	4.14 -	4.26 -	**4.14** -
Hyola Feast CL	4.27 -	4.22 -	4.31 -	**4.27** -
Mean	**4.15** -	**4.18** -	**4.28** -	**4.20**
LSD Variety p = 0.05	ns	**P val**	0.382	
LSD Management p=0.05	ns	**P val**	0.692	
LSD Var.x Man. P=0.05	ns	**P val**	0.833	

Table 2. Influence of management strategy and variety on grain quality (protein (%), test weight (kg/hl) and oil (%)).

		Grain Quality			
Input	**Variety**	**Oil**	**Protein**	**Test wt**	**TSW**
		%	**%**	**kg/HL**	**g**
Low	Hyola 970 CL	45.7 -	17.0 -	63.2 -	4.7 -
Medium	Hyola 970 CL	45.0 -	18.0 -	63.9 -	4.7 -
High	Hyola 970 CL	44.9 -	17.7 -	63.6 -	4.9 -
	Mean	**45.2 b**	**17.6 -**	**63.6 a**	**4.8 a**
Low	Hyola Feast CL	47.6 -	15.8 -	62.3 -	4.3 -
Medium	Hyola Feast CL	46.7 -	19.0 -	62.4 -	4.3 -
High	Hyola Feast CL	46.8 -	17.1 -	62.9 -	4.4 -
e	**Mean**	**47.0 a**	**17.3 -**	**62.6 b**	**4.4 b**
	Grand Mean	**46.1**	**17.4**	**63.1**	**4.6**
LSD Management (p = 0.05)		ns	ns	ns	ns
LSD Variety		1.5	1.6	0.5	0.2
LSD Var x Management		ns	ns	ns	ns
P Val Management		0.454	0.097	0.170	0.119
P Val Variety		0.021	0.720	0.001	0.005
P Val Var x Management		0.983	0.481	0.328	0.966
CV		3.5	10.1	0.8	5.8

Table 3. Trial management details.

Sowing date:		**9 April**		
Varieties:		Hyola 970 CL & Hyola Feast CL		
Target plant density		45 plants/m^2		
Basal Fertiliser:		150kg MAP & 125kg SOA		
		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	75kg N/ha	113kg N/ha	113kg N/ha
	Bud visible	75kg N/ha	113kg N/ha	113kg N/ha
Total N Applied:		**150kg N/ha**	**226kg N/ha**	**226kg N/ha**
Fungicide:	GS00	Maxim XL	Maxim XL	Saltro Duo

	6 Leaf	---	---	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha

Trial 4: HYC Spring G.E.M Trial series

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) of a range of spring canola variety types.

Key Messages:

- 45Y28 RR was the standout variety in this trial, with yield close to 5t/ha with High Input Management. Overall, it was 0.6t/ha higher yielding than the next best cultivar, HyTTec Trifecta.
- There was an overall yield increase of 0.33t/ha with High Input management compared with Low Input management.
- 45Y28 RR had the highest biomass (at maturity) and the highest harvest index.
- Disease levels were low and there was no difference between treatments.
- Condor TF had the highest oil concentration, 2.1% higher than 45Y28 RR.
- There was no effect of management on any of the grain quality parameters.
- Protein averaged 21.8%, 4.4% higher than the Winter GEM trial. On average, an extra 7kg of N was removed in the Spring GEM per tonne of grain, compared with the winter GEM.

Treatments: Four spring varieties (two glyphosate tolerant and two triazine tolerant) under three different management levels.

Table 1. Influence of management strategy and variety on grain yield (t/ha).

	Management Level			
	Low input	**Medium input**	**High Input**	**Mean**
Cultivar	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**
45Y28 RR	4.46 -	4.66 -	4.86 -	**4.66 a**
Condor TF	3.89 -	3.96 -	4.13 -	**3.99 b**
ATR Wahoo TT	3.50 -	3.64 -	3.82 -	**3.65 c**
HyTTec Trifecta	3.89 -	4.06 -	4.23 -	**4.06 b**
Mean	**3.93 b**	**4.08 ab**	**4.26 a**	**4.09**
LSD Cultivar p = 0.05	0.21	**P val**	<0.001	
LSD Management p=0.05	0.21	**P val**	0.025	
LSD Cultivar x Man. P=0.05	ns	**P val**	0.998	

Table 2: Plant Height (cm) assessed 17 November 2021.

	Management Level			
	150N + Single SDHI Flower	**225N + Intensive**	**225N + Single SDHI Flower**	**Mean**
Cultivar	**Height (cm)**	**Height (cm)**	**Height (cm)**	
45Y28 RR	152.9 -	157.6 -	153.0 -	**154.5 a**
Xseed Condor	155.0 -	158.6 -	154.0 -	**155.9 a**
ATR Wahoo	146.4 -	147.3 -	142.4 -	**145.4 b**

HyTTec Trifecta	145.3	-	144.5	-	149.0	-	**146.3**	**b**
Mean	**149.9**	**-**	**152.0**	**-**	**149.6**	**-**		
LSD Cultivar p = 0.05	5.1		**P val**				<0.001	
LSD Management p=0.05	4.2		**P val**				0.495	
LSD Cultivar x Man. P=0.05	7.2		**P val**				0.443	

Table 3: Harvest Biomass (t/ha) assessed 17 November 2021.

	Management Level					
	150N + Single SDHI Flower	**225N + Intensive**	**225N + Single SDHI Flower**	**Mean**		
Cultivar	**Harvest Biomass (t/ha)**	**Harvest Biomass (t/ha)**	**Harvest Biomass (t/ha)**			
45Y28 RR	12.8 -	14.4 -	15.7 -	**14.3**	**a**	
Xseed Condor	12.4 -	13.7 -	12.2 -	**12.8**	**ab**	
ATR Wahoo	11.8 -	9.6 -	12.2 -	**11.2**	**b**	
HyTTec Trifecta	11.1 -	10.6 -	11.9 -	**11.2**	**b**	
Mean	**12.0 -**	**12.1 -**	**13.0 -**			
LSD Cultivar p = 0.05	2.31	**P val**		0.029		
LSD Management p=0.05	3.42	**P val**		0.742		
LSD Cultivar x Man. P=0.05	4.01	**P val**		0.656		

Table 4: Harvest Index (0-1) assessed 17 November 2021.

	Management Level					
	150N + Single SDHI Flower	**225N + Intensive**	**225N + Single SDHI Flower**	**Mean**		
Cultivar	**Harvest Index (0-1)**	**Harvest Index (0-1)**	**Harvest Index (0-1)**			
45Y28 RR	0.36 -	0.34 -	0.33 -	**0.34**	**a**	
Xseed Condor	0.29 -	0.24 -	0.29 -	**0.28**	**b**	
ATR Wahoo	0.26 -	0.27 -	0.28 -	**0.27**	**b**	
HyTTec Trifecta	0.34 -	0.27 -	0.27 -	**0.29**	**b**	
Mean	**0.31 -**	**0.28 -**	**0.29 -**			
LSD Cultivar p = 0.05	0.41	**P val**		0.006		
LSD Management p=0.05	0.49	**P val**		0.389		
LSD Cultivar x Man. P=0.05	0.71	**P val**		0.458		

Table 5. Influence of management strategy and variety on grain quality (protein (%), test weight (kg/hl) and oil (%)).

		Grain Quality			
Input	**Variety**	**Oil**	**Protein**	**Test wt**	**TSW**
		%	**%**	**kg/HL**	**g**
Low	45Y28 RR	44.3 -	22.6 -	63.4 -	5.1 -
Medium	45Y28 RR	44.0 -	22.6 -	62.8 -	5.1 -
High	45Y28 RR	44.5 -	22.3 -	63.2 -	4.8 -
	Mean	**44.3 c**	**22.5 a**	**63.1 b**	**5.0 -**
Low	Condor TF	46.5 -	21.9 -	62.5 -	5.1 -
Medium	Condor TF	46.4 -	21.5 -	62.9 -	4.8 -
High	Condor TF	46.4 -	21.8 -	63.2 -	5.2 -
	Mean	**46.4 a**	**21.7 bc**	**62.9 b**	**5.0 -**
Low	ATR Wahoo	45.1 -	21.4 -	64.3 -	5.1 -
Medium	ATR Wahoo	45.5 -	21.0 -	63.9 -	5.2 -
High	ATR Wahoo	44.9 -	21.3 -	64.7 -	5.2 -
	Mean	**45.1 b**	**21.2 c**	**64.3 a**	**5.2 -**
Low	HyTTec Trifecta	45.0 -	22.1 -	63.2 -	5.0 -
Medium	HyTTec Trifecta	45.7 -	21.6 -	63.6 -	5.1 -
High	HyTTec Trifecta	46.1 -	22.1 -	63.6 -	5.1 -
	Mean	**45.6 b**	**21.9 ab**	**63.5 b**	**5.0 -**
	Grand Mean	**39.7**	**21.8**	**63.5**	**5.0**
LSD Management (p = 0.05)		ns	ns	ns	ns
LSD Variety		0.7	0.6	0.6	ns
LSD Var x Management		ns	ns	ns	ns
P Val Management		0.540	0.173	0.566	0.846
P Val Variety		<0.001	0.005	0.001	0.174
P Val Var x Management		0.578	0.966	0.703	0.136
CV		1.7	3.4	1.2	4.7

Table 6. Trial management details.

Sowing date:		**25 April**		
Target plant density:		45 plants/m^2		
Basal Fertiliser:		150kg MAP & 125kg SOA		
		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	75kg N/ha	113kg N/ha	113kg N/ha
	Bud visible	75kg N/ha	113kg N/ha	113kg N/ha
Total N Applied:		**150kg N/ha**	**226kg N/ha**	**226kg N/ha**
Fungicide:	GS00	Maxim XL	Maxim XL	Saltro Duo
	6 Leaf	---	---	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha

Trial 5: Plant density for hyper yielding winter canola

Objectives: To determine optimum plant density for hyper yielding winter canola.

Key Messages:

- Plant densities achieved were generally within 10% of target plant densities.
- Vegetation assessments (NDVI) showed little differences in vegetative biomass of the two higher plant densities, with the 30 plants/m² density also coming close to the two higher densities by late winter.
- The low density (15 plants/m²) treatment was always lower on vegetative biomass than the three higher treatments.
- Yield of the 15 plants/m² target treatment was 0.73t/ha lower yielding than the 30 plants/m² target treatment.
- There was no impact of plant density on any grain quality parameter.

Treatments: Hyola Feast CL sown at four seeding rates to target 15, 30, 50 and 75 plants/m².

Table 1. Grain yield (t/ha), % site mean, protein (%), test weight (kg/hl) and screenings (%).

		Grain Yield		Grain Quality			
Target Seed Rate	**Plants**	**Yield**	**Site Mean**	**Oil**	**Protein**	**Test wt**	**TSW**
(m²)	(m²)	**(t/ha)**	**(%)**	**%**	**%**	**kg/HL**	**g**
15	16.9 c	3.72 b	89.8	45.9 -	18.3 -	63.3 -	4.7 -
30	33.8 bc	4.45 a	107.4	47.0 -	17.5 -	62.9 -	4.6 -
50	50.6 b	4.20 ab	101.6	46.1 -	17.7 -	63.5 -	4.5 -
75	88.8 a	4.19 ab	101.2	45.8 -	17.3 -	63.7 -	4.6 -
Mean	47.5	4.14	100.0	46.2	17.7	63.3	4.6
LSD 0.05	28.3	0.49	11.9	ns	ns	ns	ns
P Val	0.002	0.046	0.047	0.402	0.701	0.342	0.744
CV		7.4					

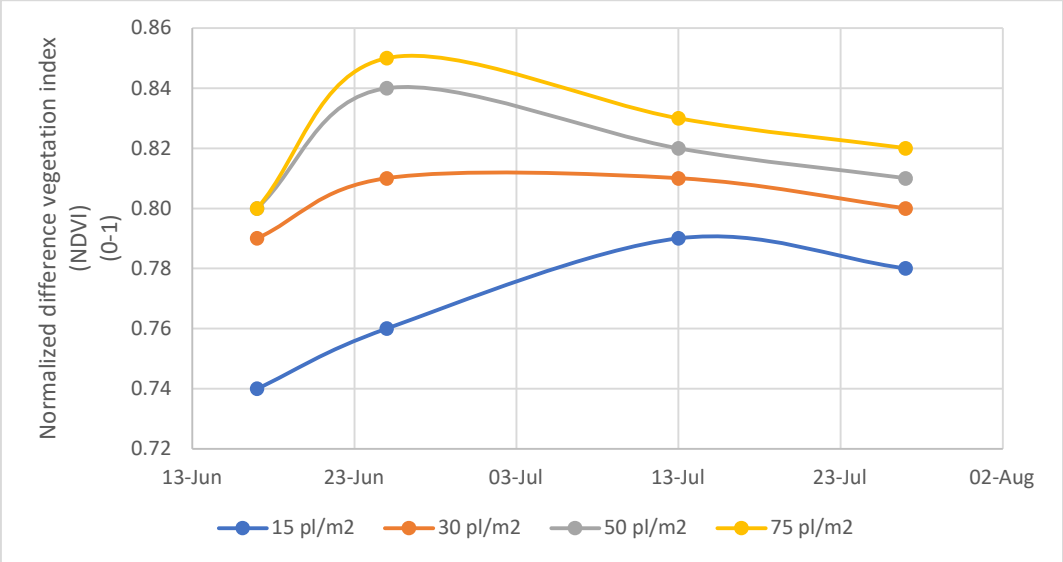


Figure 1. Normalized difference vegetation index (NDVI) (0-1) during the vegetative period of Hyola Feast CL at 4 target plant densities.

Table 2. Trial management details.

Sowing date:		**9 April**
Variety		Hyola Feast CL
Target plant density:		As per treatment list
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	Seed	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 6: Plant density for hyper yielding spring canola

Objectives: To determine optimum plant density for hyper-yielding spring canola.

Key Messages:

- There were large differences in vegetation index (NDVI) through to mid-July but the treatments converged by bud visible stage.
- There was no significant effect of plant density on grain yield, oil concentration or seed size.

Treatments: 45Y28 RR canola sown at four seeding rates to target 15, 30, 50 and 75 plants/m².

Table 1. Grain yield (t/ha), % site mean, protein (%), test weight (kg/hl) and screenings (%).

		Grain Yield		Grain Quality			
Target Seed Rate	**Plants**	**Yield**	**Site Mean**	**Oil**	**Protein**	**Test wt**	**TSW**
(m²)	(m²)	**(t/ha)**	**(%)**	**%**	**%**	**kg/HL**	**g**
15	15.6 c	4.57 -	94.5	45.1 -	20.6 b	63.0 -	4.7 -
30	30.0 bc	4.76 -	98.4	45.0 -	19.9 b	63.2 -	4.8 -
50	46.3 ab	4.64 -	96.0	44.2 -	21.5 a	63.3 -	4.8 -
75	62.5 a	5.31 -	109.8	44.8 -	21.4 a	63.3 -	5.0 -
Mean	38.6	4.82	99.7	44.8	20.8	63.2	4.8
LSD 0.05	19.6	ns	ns	ns	0.9	ns	ns
P Val	0.002	0.168	0.170	0.094	0.006	0.864	0.296
CV		9.41					

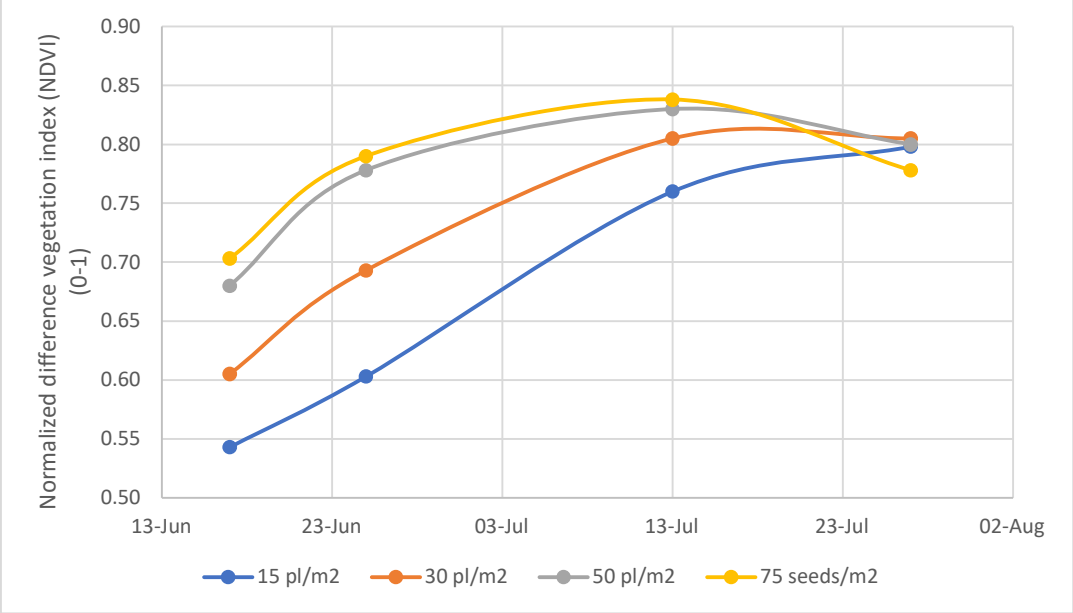


Figure 1. Normalized difference vegetation index (NDVI) (0-1) during the vegetative period of 45Y28 RR at 4 target plant densities.

Table 2. Trial management details.

Sowing date:		**25 April**
Variety:		45Y28 RR
Target plant density:		As per treatments
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 7: Nitrogen nutrition for hyper yielding winter canola

Objectives: To determine optimum nitrogen nutrient management (including rate and timing) for hyper-yielding winter canola.

Key Messages:

- There was no effect of nitrogen applied as granular urea on grain yield of the winter cultivar Hyola Feast CL.
- Where pig manure was applied, grain yield increased by 0.57 t/ha compared to where N alone was applied.
- There was no effect of nutrition on oil, protein or test weight, but seed size increased with higher nutrition.

Treatments: Five nitrogen rates applied as urea with an equal split at 6-leaf and bud visible stage. A sixth treatment had 6.7t/ha of pig manure applied.

Table 1. Yield and grain quality of the Nutrition trial in Canola (Hyola Feast CL).

	Yield	Grain Quality			
Applied Nitrogen in Crop	**Yield (t/ha)**	**Oil (%)**	**Protein (%)**	**Test Weight (kg/hl)**	**TSW (g)**
Nil	3.75 b	47.7 -	17.1 -	62.6 -	4.1 b
75 kg N /ha	3.94 b	47.3 -	17.8 -	62.6 -	4.2 b
150 kg N /ha	4.13 b	48.2 -	17.1 -	62.7 -	4.1 b
225 kg N /ha	4.10 b	48.4 -	16.5 -	63.1 -	4.2 ab
300 kg N /ha	4.02 b	46.4 -	17.2 -	62.5 -	4.4 a
225 kg N /ha + Manure	4.67 a	47.5 -	17.9 -	63.1 -	4.4 a
Mean	4.10	47.6	17.3	62.7	4.2
LSD 0.05	0.51	ns	ns	ns	0.2
P Val	0.032	0.530	0.527	0.834	0.010

*****Pig Manure expressed dry matter basis (2.7% Nitrogen, and 1.26% Phosphorus) = additional 169kg N/ha and 85kg P/ha to replicate high fertility soils.

Table 2. Canopy measurements at flowering and crop maturity (t/ha, %).

	Flowering Biomass	Maturity Biomass	Harvest Index
Applied Nitrogen in Crop	Dry Matter t/ha	Dry Matter t/ha	
Nil	7.5 -	13.3 d	0.31 -
75 kg N /ha	6.8 -	15.9 cd	0.32 -
150 kg N /ha	8.1 -	17.1 bcd	0.34 -
225 kg N /ha	7.9 -	19.6 abc	0.32 -
300 kg N /ha	8.2 -	22.7 a	0.32 -
225 kg N /ha + Manure	9.0 -	20.5 ab	0.34 -
Mean	7.91	18.2	0.33
LSD 0.05	2.9	4.1	ns
P Val	0.712	0.003	0.250

Table 3. Trial management details.

Sowing date:		**9 April**
Variety:		Hyola Feast CL
Target plant density:		45 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:		As per treatment list
Fungicide:	Seed	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

All inputs of insecticides and herbicides were standard across the trial

Trial 8: Nitrogen nutrition for hyper yielding spring canola

Objectives: To determine optimum nitrogen nutrient management (including rate and timing) for hyper yielding spring canola.

Key Messages:

- A grain yield of close to 6t/ha was achieved where a high rate of nitrogen fertiliser was combined with the application of animal manure to replicate high fertility soils.
- The manure alone increased yield by 0.75t/ha and raised the bar on our understanding of achievable yield for canola for this environment.
- Yields responses to granular urea N peaked at 150kg N/ha and similar yields were achieved between 150, 225, and 300kg/ha of applied N.

Treatments: Five nitrogen rates applied as urea with an equal split at 6-leaf and bud visible stage. A sixth treatment had 6.7 t/ha of pig manure applied.

Table 1. Yield of the Nutrition trial (t/ha) in Canola (45Y28RR).

	Yield		Grain Quality					
Applied Nitrogen in Crop	**Yield (t/ha)**		**Oil (%)**		**Protein (%)**		**Test weight (kg/hl)**	**TSW (g)**	
Nil	4.03	d	45.8	a	19.9	c	62.8 -	4.58	a
75 kg N /ha	4.49	c	45.4	ab	20.4	bc	61.8 -	4.54	ab
150 kg N /ha	4.94	b	45.2	ab	20.5	bc	63.2 -	4.52	ab
225 kg N /ha	5.14	b	44.7	bc	21.5	ab	63.4 -	4.47	bc
300 kg N /ha	4.95	b	44.8	bc	20.9	bc	63.4 -	4.48	bc
225 kg N /ha + Manure	5.89	a	43.9	c	22.1	a	64.0 -	4.39	c
Mean	4.91		45.0		20.9		63.1	4.50	
LSD 0.05	0.36		1.0		1.2		ns	0.1	
P Val	<0.001		0.016		0.017		0.071	0.016	

*Pig Manure expressed dry matter basis (2.7% Nitrogen, and 1.26% Phosphorus) = additional 169kg N/ha and 85kg P/ha to replicate high fertility soils

Table 2. Canopy measurements at flowering and crop maturity (t/ha, %).

	Flowering Biomass		**Harvest Crop Height**		**Maturity Biomass**	**Harvest Index**	
Applied Nitrogen in Crop	Dry Matter t/ha		cm		Dry Matter t/ha		
Nil	4.4	c	144.9	c	16.3 -	0.34	-
75 kg N /ha	5.3	ab	153.2	b	17.1 -	0.36	-
150 kg N /ha	4.8	bc	155.6	b	17.7 -	0.35	-
225 kg N /ha	5.1	abc	154.6	b	19.2 -	0.34	-
300 kg N /ha	5.1	abc	153.9	b	18.2 -	0.35	-
225 kg N /ha + Manure	5.8	a	160.6	a	19.8 -	0.34	-
Mean	5.1		153.8		18.0	34.7	
LSD 0.05	0.9		4.7		ns	ns	
P Val	0.049		<0.001		0.572	0.257	

Table 3. Trial management details.

Sowing date:		**25 April**
Target plant density:		45 plants/m²
Canola Variety		Pioneer 45Y28RR
Basal Fertiliser:		150 kg/ha MAP (15 kg/ha N)
		125 kg/ha SOA (26.2 kg/ha N)
Fungicide:	Seed	Saltro Duo
	6 - Leaf	Prosaro 450mL/ha
	20% Bloom	Aviator Xpro 800mL/ha

All inputs of insecticides and herbicides were standard across the trial

Trial 9: Disease management for hyper yielding winter canola

Objectives: To determine optimum fungicide management for hyper-yielding winter canola.

Key Messages:

- There was no effect of fungicide management on grain yield of the winter canola cultivar Hyola Feast CL. Trial average yield was 4.19t/ha.
- Sowing winter canola early combines the best of blackleg resistance (effective Group H) and cultural management, avoiding blackleg spore showers on seedling canola.
- Levels of all diseases were low, including blackleg crown canker, upper canopy blackleg and sclerotinia stem rot.

Treatments: Six Fungicide strategies applied to a Hyola Feast CL winter canola.

Table 1. Influence of fungicide management strategy on winter canola grain yield (t/ha).

Trt.	Seed	6 Leaf	20% Bloom	50% Bloom	Yield (t/ha)	% Site mean
1	**---**	---	---	---	4.05 -	96.5
2	**Maxim XL**	---	Aviator Xpro 800 mL/ha	---	4.12 -	98.2
3	**Saltro Duo**	---	Prosaro 450 mL/ha	---	4.18 -	99.7
4	**---**	---	Aviator Xpro 800 mL/ha	---	4.21 -	100.2
5	**Saltro Duo**	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	---	4.21 -	100.3
6	**Saltro Duo**	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	Veritas 1 L/ha	4.41 -	105.1
				Mean	4.19	100.0
				LSD 0.05	ns	ns
				P Val	0.446	0.449

Table 2. Influence of management strategy on winter canola grain quality (%, kg/hl & g).

Trt.	Oil (%)		Protein (%)		Test Weight (kg/hl)		TSW (g)	
1	45.8	-	16.8	-	63.1	-	4.5	-
2	46.9	-	18.7	-	63.1	-	4.5	-
3	46.3	-	18.1	-	62.8	-	4.2	-
4	46.9	-	17.4	-	62.6	-	4.4	-
5	47.0	-	17.1	-	62.9	-	4.3	-
6	46.2	-	18.4	-	63.2	-	4.5	-
Mean	46.5		17.7		63.0		4.4	
LSD 0.05	ns		ns		ns		ns	
P Val	0.315		0.141		0.774		0.259	

Table 3. Trial management details.

Sowing date:		**9 April**
Variety:		Hyola Feast CL
Target plant density:		45 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:		As per Table 1

Trial 10: Disease management for hyper yielding spring canola

Objectives: To determine optimum foliar fungicide management for hyper-yielding spring canola. Determine the effect of fungicide management strategies on disease control (upper canopy blackleg and sclerotinia), grain yield and profitability.

Key Messages:

- Grain yield increased by 0.78t/ha from nil fungicide to where an intensive fungicide program was applied, including Saltro Duo on seed, Prosaro at 6-leaf, Aviator Xpro at 20% bloom and Veritas at 50% bloom.
- Highest yields were generally achieved with Seed and 6-leaf fungicide (Maxim XL f.b. Aviator Xpro of Saltro Duo f.b. Prosaro) followed by an application of fungicide (either Prosaro or Aviator Xpro) at 20% bloom. This suggests the response was due to the control of multiple diseases.
- All treatments (except for Maxim XL followed by Miravis Star) were higher yielding than the untreated control.
- There was no effect of fungicide treatment on oil concentration.
- It was difficult to ascertain the reasons for the yield response to fungicide as blackleg (upper canopy and crown) and sclerotinia infection levels were low.

Treatments: Nine Fungicide strategies applied to 45Y28 RR (moderately resistant to blackleg, Group BC).

Table 1. Influence of management strategy on 45Y28 RR canola grain yield (t/ha).

Trt.	Seed	6 Leaf	20% Bloom	50% Bloom	Yield (t/ha)		% Site mean
1	---	---	---	---	4.54	e	91.6
2	Maxim XL	---	Aviator Xpro 800 mL/ha	---	4.95	bc	100.0
3	Maxim XL	---	Miravis Star 1 L/ha	---	4.67	de	94.4
4	Maxim XL	---	Revystar 1 L/ha	---	4.97	bc	100.4
5	Saltro Duo	---	Prosaro 450 mL/ha	---	4.87	cd	98.4
6	Maxim XL	Aviator Xpro 650 mL/ha	Prosaro 450 mL/ha	---	5.07	abc	102.5
7	---	---	Aviator Xpro 800 mL/ha	---	5.00	bc	101.1
8	Saltro Duo	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	---	5.15	ab	104.0
9	Saltro Duo	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	Veritas 1 L/ha	5.32	a	107.5
				Mean	4.95		100.0
				LSD 0.05	0.26		5.2
				P Val	<0.001		<0.001

Table 2. Disease severity measured at 7 leaf and crop maturity (%LAI, %).

	Blackleg Leaf infection (7 leaf)		Blackleg Canker infection	
Treatment	%LAI		**%**	
1	4.4	b	1.3	-
2	6.8	a	0.5	-
3	3.1	bcd	2.3	-
4	2.6	cde	1.5	-
5	3.6	bc	2.5	-
6	1.1	e	0.8	-
7	4.4	b	2.8	-
8	1.7	de	2.3	-
9	1.0	e	2.0	-
Mean	3.2		1.8	
LSD 0.05	1.7		ns	
P Val	<0.001		0.495	

Table 3. Influence of management strategy on spring canola grain quality (%, kg/hl & g).

Trt.	Oil (%)		Protein (%)		Test Weight (kg/hl)		TSW (g)	
1	44.5	-	20.6	abc	62.8	-	4.3	b
2	43.6	-	21.0	ab	63.2	-	4.5	ab
3	45.3	-	20.1	bc	63.3	-	4.7	a
4	44.7	-	21.6	a	63.5	-	4.4	b
5	45.4	-	19.6	c	63.2	-	4.3	b
6	44.5	-	20.2	bc	63.9	-	4.3	b

7	44.9	-	21.7	a	63.7	-	4.5	ab
8	44.5	-	20.7	abc	63.9	-	4.4	b
9	44.7	-	20.6	abc	63.6	-	4.4	b
Mean	44.7		20.7		63.5		4.4	
LSD 0.05	ns		1.3		ns		0.2	
P Val	0.146		0.050		0.056		0.049	

Table 4. Trial management details.

Sowing date:		**25 April**
Variety:		45Y28RR
Target plant density:		45 plants/m^2
Sowing Fertiliser:		150kg MAP & 125kg SOA
Nitrogen:	6 Leaf	113kg N/ha
	Bud Visible	113kg N/ha
Fungicide:		As per treatment list

2021 WA Crop Hyper Yielding Canola Trials
Kojonup, WA

Sown: April 20
Harvested: December 3 (spring canola) and 19 December (winter canola)
2020 Crop: Barley
Soil type & management: Sandy loam duplex
Available Nitrogen (kg/ha) 0-40 cm: 55 kg/ha
Colwell P 0-10 cm: 50 mg/kg
pH (CaCl2) 0-10 cm: 5.5
Organic Carbon 0-10 cm: 3.57%

Trial 2. HYC Spring canola screen

Objectives: To examine the suitability of elite commercial and unreleased spring cultivars for hyper yielding regions

Key Messages:

- The screen trials were conducted to identify new commercial cultivars with suitability for high yielding environments.
- 45Y93 CL was the highest yielding cultivar in the CLF trial but there were no statistical differences in yield in the RR/Truflex and TT trials.
- Trial mean yield was 3.82, 3.75 and 3.35t/ha in the CLF, RR/Truflex and TT trials respectively.
- Significant difference in oil content between the varieties in the CLF, RR/Truflex and TT groups.

Table 1. Yield of spring canola screen trial for CLF, RR/Truflex and TT canola. Yield is reported at 42% oil content and 8% moisture.

CLF		RR/Truflex		TT	
45Y93 CL	4.08 a	NCH20Q729	4.23 a	HyTTec Trifecta	4.12 a
45Y95 CL	3.96 ab	PS-21XC318	4.06 a	InVigor T6010	3.54 a
PS-21CL211	3.94 ab	45Y28 RR	3.86 a	Hyola Blazer TT	3.27 a
AGFCA014520	3.30 b	Condor TF	3.56 a	SF Ignite TT	3.20 a
		InVigor R4520P	3.55 a	ATR Wahoo	3.07 a
		AN20RR002	3.24 a	HyTTec Trophy	2.90 a
Mean	3.82		*3.75*		3.35
l.s.d.	0.77		1.13		1.49
p value	0.05		ns		ns

Table 2. Grain oil concentration of spring canola screen trial for CLF, RR/Truflex and TT canola.

CLF		RR/Truflex		TT	
45Y93 CL	47.5 b	NCH20Q729	49.0 b	HyTTec Trifecta	48.5 a
45Y95 CL	47.0 b	PS-21XC318	50.2 a	InVigor T6010	48.2 ab
PS-21CL211	49.8 a	45Y28 RR	49.2 b	Hyola Blazer TT	48.2 ab
AGFCA014520	48.8 a	Xseed Condor	48.6 b	SF Ignite TT	47.5 bc

		InVigor R4520P	46.6 c	ATR Wahoo	47.2 c
		AN20RR002	47.1 c	HyTTec Trophy	46.8 c
Mean	48.5		*48.4*		47.7
l.s.d.	1.07		0.61		0.95
p value	0.05		0.05		0.05

Table 3. Trial management details.

Sowing date:		**20 April**
Target plant density:		45 plants/m^2
Sowing Fertiliser:		200 kg/ha Agras (32 kg N/ha, 18 kg P/ha, 28 kg S/ha)
Nitrogen:	6 Leaf	50kg N/ha
	Bud Visible	118kg N/ha
Fungicide:	Seed	Saltro Duo
	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 3. HYC Winter G.E.M Trial series

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) of a range of winter canola variety types.

Key Messages:

- Hyola Feast CL yielded more than Hyola 970 CL and had higher oil content, likely because it flowered 10 days earlier than Hyola 970 CL.
- No yield difference between the fungicide management schemes.
- No interaction between variety and fungicide management and nitrogen rate.
- Neither blackleg nor sclerotinia disease infection was observed in this trial.

Treatments: Three management levels (combination of nitrogen and fungicide) applied to 2 winter canola varieties (Hyola 970 CL & Hyola Feast CL).

Table 1: Yield, harvest index (HI) and oil concentration (%) of winter GEM trial.

Treatment	Yield (t/ha)	HI	Oil (%)
Management			
225N + Intensive	3.59 a	0.296	45.8 a
225N + Single SDHI Flower	3.50 a	0.298	46.8 a
150N + Single SDHI Flower	3.39 a	0.300	46.3 a
Mean	3.50	0.298	46.2
LSD 0.05	0.39	0.017	1.01
P Val	ns	ns	ns
Variety			
Hyola 970 CL	3.27 a	0.295	45.8 b

Hyola Feast CL	3.72 b	0.301	46.6 a
Mean	3.50	0.298	46.2
LSD 0.05	0.234	0.008	0.73
P Val	0.05	ns	0.05

Table 2. Trial management details.

Sowing date:		**20 April**		
Varieties:		Hyola 970 CL & Hyola Feast CL		
Target plant density		45 plants/m^2		
Basal Fertiliser:		200 kg/ha Agras (32 kg N/ha, 18 kg P/ha, 28 kg S/ha)		
		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	50kg N/ha	63kg N/ha	63kg N/ha
	Bud visible	67kg N/ha	130kg N/ha	130kg N/ha
Total N Applied:		**150kg N/ha**	**225kg N/ha**	**225kg N/ha**
Fungicide:	Seed	Maxim XL	Maxim XL	Saltro Duo
	6 Leaf	---	---	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha

Trial 4: HYC Spring G.E.M Trial series

Objectives: To determine the response to increased crop inputs (fungicide and nitrogen) of a range of spring canola variety types.

Key Messages:

- Hybrid RR/Truflex canola (45Y28 RR and Condor TF) produced a higher yield than TT canola (HyTTec Trifecta and ATR Wahoo) but there was no difference in oil between groups with an average of 48%.
- Condor TF was the highest yielding in the RR/Truflex group and HyTTec Trifecta was higher yielding than ATR Wahoo in the TT group.
- Harvest index was high (average 0.36) but there was no difference between cultivars.
- Blackleg crown canker infection was reduced with increasing fungicide input, being the lowest in the high input treatment where Saltro Duo was applied to seed and Prosaro was applied at the 6-leaf stage. Despite this, there was no effect of input level on grain yield.
- There was minimal presence of upper canopy blackleg and sclerotinia stem rot.

Treatments: Four spring varieties (two glyphosate tolerant and two triazine tolerant) with three different management levels.

Table 1. Yield, harvest index (HI), blackleg infection (% stem cross-section infected with blackleg at maturity) and oil concentration in Spring GEM trial.

Treatment	Yield (t/ha)	Oil (%)	**Stem cross-section of blackleg infection (%)**	**HI**
Herbicide groups				
RR	3.15 a	48.6 a	19 a	0.347
TT	2.28 b	47.3 a	18 a	0.370

LSD 0.05	0.86	2.36	18	0.036
P Val	0.05	ns	ns	ns
Management				
225N + Intensive	2.87 a	48.0 a	9 a	0.355
225N + Single SDHI Flower	2.70 ab	47.8 a	19 b	0.357
150N + Single SDHI Flower	2.59 b	48.0 a	26 c	0.363
Mean	2.72	47.9	18	0.358
LSD 0.05	0.24	0.46	4.4	0.021
P Val	0.05	ns	0.05	ns
Variety				
Condor TF	3.40 a	48.5 a	24 a	0.350
45Y28 RR	2.90 b	48.7 a	13 b	0.344
HyTTec Trifecta	2.73 c	48.1 a	26 a	0.370
ATR Wahoo	1.84 d	46.5 b	8 b	0.370
Mean	2.72	47.9	18	0.358
LSD 0.05	0.13	0.97	9.7	ns
P Val	0.05	0.05	0.05	

Table 2. Trial management details.

Sowing date:		**20 April**		
Varieties:		RR/Truflex - Condor TF & 45Y28 RR TT – HyTTec Trifecta and ATR Wahoo		
Target plant density		45 plants/m^2		
Basal Fertiliser:		200 kg/ha Agras (32 kg N/ha, 18 kg P/ha, 28 kg S/ha)		
		Low Input	**Mid Input**	**High Input**
Nitrogen:	6-leaf	50kg N/ha	63kg N/ha	63kg N/ha
	Bud visible	67kg N/ha	130kg N/ha	130kg N/ha
Total N Applied:		**150kg N/ha**	**225kg N/ha**	**225kg N/ha**
Fungicide:	Seed	Maxim XL	Maxim XL	Saltro Duo
	6 Leaf	---	---	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha	Aviator Xpro 0.80L/ha

Trial 5: Plant density for hyper yielding spring canola

Objectives: To determine optimum plant density for hyper yielding spring canola

Key Messages:

- There was no significant effect of plant density on grain yield, oil concentration or seed size.
- 20 plants/m^2 is enough to achieve similar yield to high seeding rates.

Treatments: 45Y28 RR canola sown at four seeding rates to target 15, 30, 50 and 75 plants/m^2.

Table 1. Grain yield (t/ha), % site mean, protein (%), test weight (kg/hl) and screenings (%).

		Yield and quality		
Target Seed Rate (m^2)	**Plants** (m^2)	**Yield (t/ha)**	**Oil %**	**Protein %**
15	19 a	2.98 a	48.9 a	17.4 a
30	19 a	3.30 a	48.6 a	17.9 a
50	36 b	3.28 a	48.7 a	17.8 a
75	46 b	3.32 a	48.9 a	18.0 a
2.98Mean	30	3.22	48.8	17.8
LSD 0.05	10.8	0.38	0.42	0.67
P Val	0.05	n.s.	n.s.	n.s.
CV		7.6		

Table 2. Trial management details

Sowing date:		**25 April**
Variety:		45Y28 RR
Target plant density:		As per treatments
Sowing Fertiliser:		200 kg/ha Agras (32 kg N/ha, 18 kg P/ha, 28 kg S/ha)
Nitrogen:	6 Leaf	50kg N/ha
	Bud Visible	118kg N/ha
Fungicide:	6 Leaf	Prosaro 0.45L/ha
	20% Bloom	Aviator Xpro 0.80L/ha

Trial 6: Nitrogen nutrition for hyper-yielding spring canola

Objectives: To determine optimum nitrogen nutrient management for hyper yielding spring canola.

Key Messages:

- A grain yield of close to 5t/ha was achieved where a high rate of nitrogen fertiliser combined with the application of animal manure to replicate high soil fertility.
- The manure alone increased yield by 0.77t/ha. The high rate of manure applied may not always be profitable but shows that yield is being limited by nutrition beyond just fertiliser nitrogen application.
- Yield responses to applied nitrogen fertiliser plateaued at 75kg N/ha and similar yields were achieved between 75, 150, 225, and 300kg/ha of applied N (urea).

Treatments: Five nitrogen rates applied as urea with an equal split at 6-leaf and bud visible stage. A sixth treatment had 10t/ha of chicken manure applied.

Table 1. Yield, harvest index (HI) and Oil (%) of the Nutrition trial (t/ha) in Canola (45Y28RR).

Applied Nitrogen in Crop	Yield (t/ha)	HI	Oil (%)
Nil	**3.30 c**	**0.384**	**48.8 a**
75 kg N/ha	**3.76 b**	**0.353**	**48.6 a**
150 kg N/ha	**3.78 b**	**0.352**	**48.7 a**
225 kg N/ha	**3.90 b**	**0.361**	**48.5 a**
300 kg N/ha	**3.67 b**	**0.352**	**48.7 a**
225 kg N/ha + 10 t/ha Chicken manure	**4.67 a**	**0.370**	**48.6 a**
Mean	**3.85**	**0.362**	**48.7**
LSD 0.05	**0.31**	**0.0144**	**0.60**
P Val	**0.05**	**0.05**	**ns**

***Chicken Manure was 25% moisture and 3.0% Nitrogen and 0.9% Phosphorus (on a dry matter basis).

Table 2. Trial management details.

Sowing date:		**10 April**
Target plant density:		45 plants/m²
Canola Variety		Pioneer 45Y28RR
Basal Fertiliser:		200 kg/ha Agras (32 kg N/ha, 18 kg P/ha, 28 kg S/ha)
Nitrogen:	6 Leaf	50kg N/ha
	Bud Visible	118kg N/ha
Fungicide	6 - Leaf	Prosaro 450mL/ha
	20% Bloom	Aviator Xpro 800mL/ha

All inputs of insecticides and herbicides were standard across the trial

Trial 7: Disease management for hyper yielding spring canola

Objectives: Determine the effect of fungicide management strategies on disease control (primarily blackleg and sclerotinia), grain yield and profitability in 45Y28 RR (moderately resistant, blackleg group BC) and HyTTec Trifecta (Resistant, blackleg group ABD).

Key Messages:

- Blackleg crown canker (measured as stem cross-section blackleg) was generally highest (in both trials) where no seed or 6-leaf (seedling) fungicide was used, however there was no effect of fungicide management on grain yield.
- There was minimum upper canopy blackleg and sclerotinia disease in both trials.
- Oil content difference was minimum between the fungicide treatments.

Treatments: Eight Fungicide strategies applied to 45Y28 RR (Table 1) and HyTTec Trifecta (Table 2).

Table 1. Influence of management strategy on 45Y28 RR canola grain yield (t/ha).

Trt.	Seed	6 Leaf	20% Bloom	Yield (t/ha)	Oil%	Stem cross-section blackleg (%)
1	---	---	---	3.94 a	48.40	62 a
2	Maxim XL	---	Aviator Xpro	4.24 a		41 ab

			800 mL/ha		48.68	
3	Maxim XL	---	Miravis Star 1 L/ha	4.09 a	48.65	20 b
4	Maxim XL	---	Revystar 1 L/ha	4.09 a	48.85	32 b
5	Saltro Duo	---	Prosaro 450 mL/ha	3.99 a	48.72	24 b
6	Maxim XL	Aviator Xpro 650 mL/ha	Prosaro 450 mL/ha	4.03 a	48.72	14 b
7	---	---	Aviator Xpro 800 mL/ha	3.93 a	48.72	38 ab
8	Saltro Duo	Prosaro 450ml/ha	Aviator Xpro 800 mL/ha	3.85 a	48.65	22 b
			Mean	4.03	48.67	31
			LSD 0.05	1.20	0.40	27
			P Val	n.s.	0.05	0.05

Table 2. Influence of management strategy on HyTTec Trifecta canola grain yield (t/ha).

Trt.	Seed	6 Leaf	20% Bloom	Yield (t/ha)	Oil%	Stem cross section blackleg (%)
1	---	---	---	3.67 a	47.4	33 a
2	Maxim XL	---	Aviator Xpro 800 mL/ha	3.85 a	47.2	28 a
3	Saltro Duo	---	Prosaro 450 mL/ha	3.83 a	47.4	9 b
4	Saltro Duo	Prosaro 450 mL/ha	Aviator Xpro 800 mL/ha	3.78 a	47.35	17 ab
5	---	---	Aviator Xpro 800 mL/ha	3.73 a	47.7	23 a
			Mean	3.76	47.4	22
			LSD 0.05	1.36	2.23	18
			P Val	n.s.	n.s.	0.05

Table 3. Trial management details.

Sowing date:		**20 April**
Variety:		45Y28RR & HyTTec Trifecta
Target plant density:		45 plants/m^2
Sowing Fertiliser:		200 kg/ha Agras (32 kg N/ha, 18 kg P/ha, 28 kg S/ha)
Nitrogen:	6 Leaf	50kg N/ha
	Bud Visible	118kg N/ha
Fungicide:		As per treatment list

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

HYPER YIELDING CROPS

2021 growing season

Wheat Results

Prepared by:

FAR AUSTRALIA

Department of Primary Industries and Regional Development · MFMG · CSIRO · RiverinePlains · FAR AUSTRALIA · CeRDI | Federation University Australia · BRILLAG Agronomy & Research · TechCrop · Stirlings to Coast Farmers · SFS

2021 NSW Crop Technology Centre - Wallendbeen, New South Wales

Time of Sowing – 20 April 2021

Unless otherwise stated the following details apply to the results presented in this section. For other details please go to the appendix.

Sown: 20 April 2021
Harvested: 5 January 2021
Rotation position: 1st Cereal after canola 2020
Soil type and management: Red clay loam – Kelly chained over summer

Trial 1: HYC 1st Stage Screen

Objectives:
To examine the phenology, disease resistance and standing power of new wheat germplasm sown on 20 April versus control varieties.

Treatments: 30 lines were sown in small plots (4m in length) with standard nitrogen management but **NO FUNGICIDE or PGR input** to this trial. Plots were not taken to yield.

Key Messages:

- Stripe rust (Puccinia striiformis f. sp. tritici) was the most destructive disease in the untreated screen, severely affecting Catapult, Rockstar, and Trojan (93%, 65%, and 35% plot infection respectively).
- From sampling carried out the 239 pathotype was the dominant pathotype on site with lower levels of the 198 pathotype (the dominant pathotype in 2020).
- Septoria tritici blotch (STB) caused by the pathogen Zymoseptoria tritici was more significant in 2021 in terms of green leaf area lost, with up to 75% plot infection in Scepter. Other notable infections include V12167-048, Coota, and L13070-027 (70%-39% plot infection).
- The following varieties AGFWH004418, AGFWH004618, Big Red (AGFWH004718) and AGFWH004818 had similar phenology, and as good as or better disease resistance and standing power (straw strength) than the highest yielding feed wheats on the research site RGT Accroc, Anapurna and RGT Cesario (see trials 2 – 4).

Table 1. Growth stage assessments from 30 June, 22 July, 19 August, 16 September, 6 October, 18 October and 1 November – recorded on the Zadoks scale 0 – 99. RGT Accroc considered as control cultivar.

Variety	30-Jun	22-Jul	19-Aug	16-Sep	6-Oct	18-Oct	1-Nov
Scepter	23	30	32	51	65	71	77
Trojan	23	31	32	45	59	71	73
Annapurna	24	28	29	33	49	59	69
RGT Accroc	25	29	31	33	49	65	71
Nighthawk	27	30	31	39	53	67	71
Reflection	24	28	30	32	33	39	55
Graham	26	28	29	31	33	39	55
Savello	26	27	28	32	37	41	58
Shabras	25	28	30	32	33	41	53
Coota	23	31	32	45	61	71	75
Manning	24	27	30	32	37	51	65
Rockstar	25	28	31	41	59	71	75
Catapult	24	31	32	45	61	71	75
Tabasco	25	28	29	32	33	41	55
Beckom	23	31	32	51	61	67	75
RGT Cesario (SFR86-090)	26	29	30	33	41	53	67
LPB17-5691	23	31	32	41	61	69	73
LRPB16-0582	24	29	31	37	55	63	73
LPB16-0598	24	31	31	37	52	63	71
SUN1087I	24	30	32	45	59	69	75
V12167-048	25	28	32	41	59	61	73
V11068-085-047	24	27	31	39	58	65	75
AGFWH004418	24	28	31	33	41	55	69
AGFWH004618	24	29	30	37	49	59	71
AGFWH004718 (Big Red)	25	28	29	32	45	56	71
AGFWH004818	25	28	28	32	41	52	69
L13070-027	24	26	31	33	58	61	73
Aurora (Durum)	24	31	32	41	59	62	71
Bitalli (Durum)	24	31	32	45	58	61	73
Westcourt (Durum)	23	29	31	37	52	59	71

There was a range of approximately 40 days between the earliest spring milling wheats reaching flowering and the later developing feed winter wheat from a 20th April sowing date (Table 1 & Figure 1).

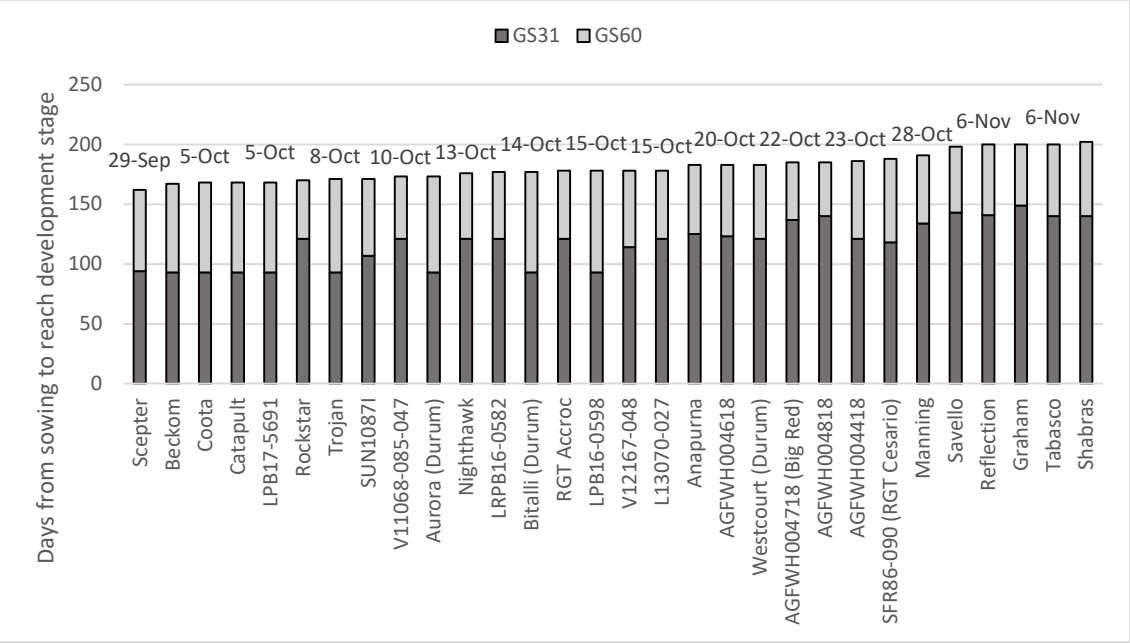


Figure 1. Approximate number of days taken to reach critical growth stage (from sowing) periods of 1st node (GS 31) and start of flowering (GS 60). Data label shows approximate date of GS60.

Table 2. Diseases present in each variety throughout the growing season. (STB= Septoria tritici blotch, YLS= Yellow leaf spot, Sr= Stripe rust, Lr= Leaf rust). A tick indicates diseases present at any point in the season.

Variety	SR	STB	YLS	LR
Scepter	✓	✓		
Trojan	✓	✓		
Anapurna		✓		✓
RGT Accroc	✓	✓		✓
Nighthawk		✓	✓	✓
Reflection		✓		
Graham		✓		✓
Savello		✓		✓
Shabras		✓		✓
Coota	✓	✓		
Manning		✓		✓
Beckom		✓	✓	
Rockstar	✓	✓		
Catapult	✓			
Tabasco	✓	✓		
SFR86-090 (RGT Cesario)		✓		✓
LPB17-5691	✓	✓		
LRPB16-0582		✓	✓	
LPB16-0598	✓	✓		
AGFWH004418	✓	✓		
AGFWH004618	✓	✓		✓
AGFWH004718 (Big Red)	✓	✓		

AGFWH004818	✓	✓	✓		
SUN1087I	✓	✓			
V12167-048		✓			
V11068-085-047	✓	✓	✓	✓	
L13070-027		✓			
Aurora (Durum)	✓	✓			
Bitalli (Durum)	✓		✓		
Westcourt (Durum)	✓				

The most diseased 1st stage screen cultivars tested in the trial were Catapult, Rockstar, Trojan, V12167-048, Coota and L13070-027 (Figure 2) with the most damaging diseases being stripe rust and Septoria tritici blotch. The more disease resistant wheats tended to be the later developing winter feed wheats from Europe. The exception to this was RGT Accroc which had intermediate resistance and gave large responses to fungicides in the Tasmania, southern Victoria and lower SE region of SA environments. Note this response to fungicide is in contrast to responses observed at high altitude at Wallendbeen in southern NSW.

In terms of standing power, the stiffest strawed cultivars at maturity were the European winter wheats, the exception to this being that Big Red (AGFWH004718) which at high yields has been weaker than the other high yielding winter feed wheats. Also note that RGT Accroc is weaker strawed under high yielding scenarios (Figure 3). The durum wheats Bitalli and Westcourt were some of the most affected varieties in terms of lodging.

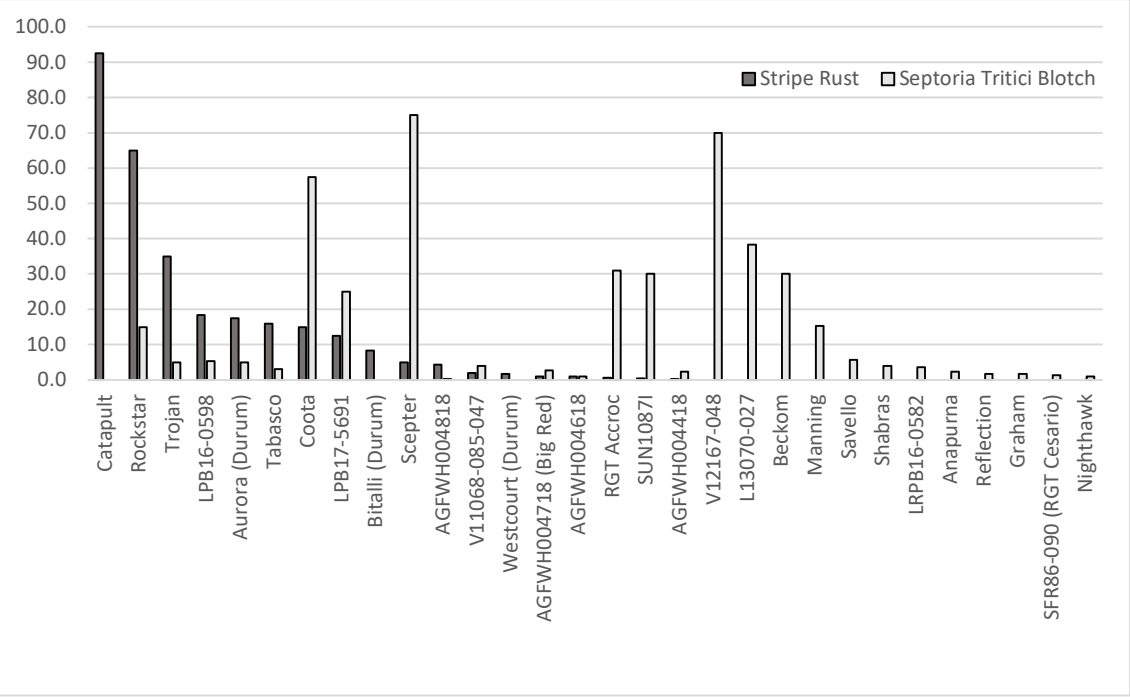


Figure 2. Disease severity of Stripe rust and Septoria tritici blotch (whole plot % score), assessed 16 November (GS69-85).

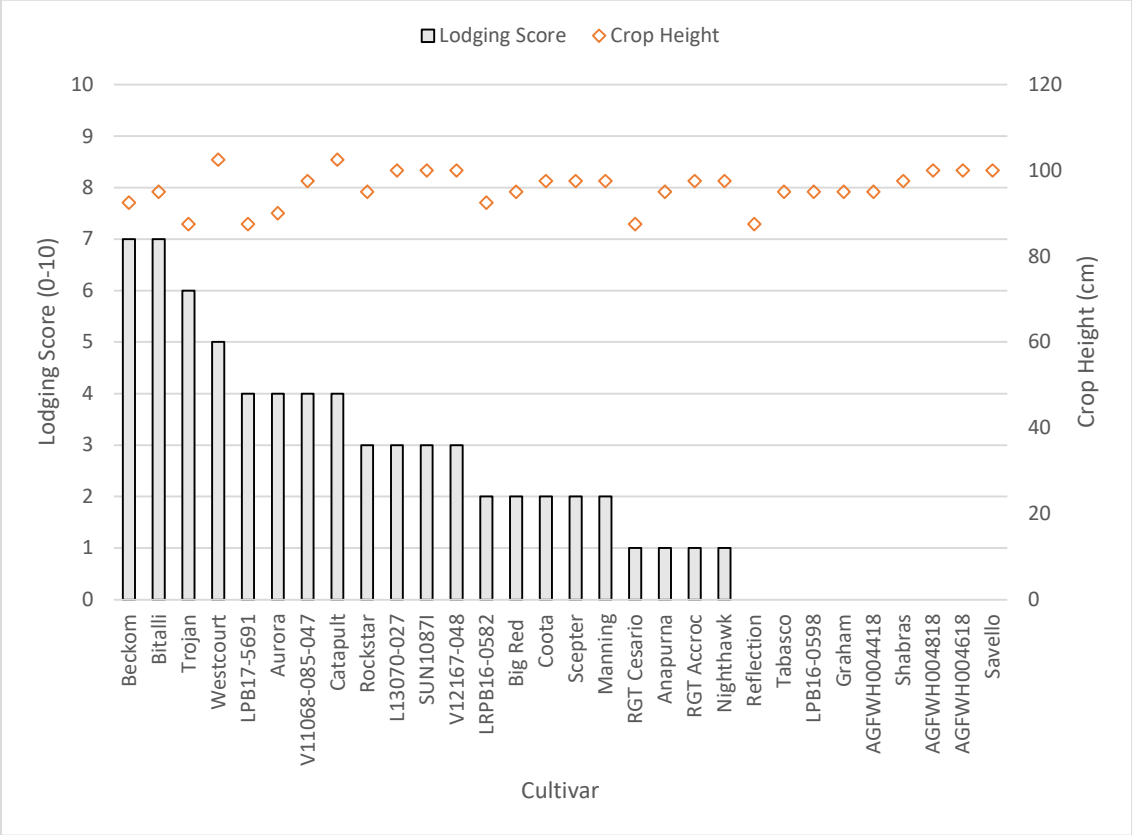


Figure 3. Crop lodging at physiological maturity assessed as Lodging index and crop height (cm) assessed on 22 December.

Table 3. Details of the management levels (kg, g, ml/ha).

Plant pop'n:		180 seeds/m^2 (150 plants/m^2 target)
	Timing	**Untreated**
Seed treatment:		Vibrance + Goucho
Basal Fertiliser:	20 April	120kg MAP (12 Kg N)
Nitrogen:	17 June	18.5kg N/ha
	11 Sep	115kg N/ha
Total N Applied:		**133.5kg N/ha**
PGR:		---
Fungicide:	GS31	---
	GS39	---
	GS59-61	---

All other inputs of insecticides and herbicides were standard across the trial.

Trial 2. HYC Elite Screen (Yielded)

Objective: To assess the performance of winter and spring wheat germplasm that has shown potential in either HYC 1st stage screening or breeder's trials with characteristics that may be suitable for regions with high yield potential. The yielded trial was grown under Hyper Yielding Crop management system with full fungicide protection (20th April sown).

Key Messages:

- The following yields should be considered in the context of maximum and minimum temperature during flowering and grain fill that were 4-5 degrees cooler than the long-term average.
- This resulted in longer season wheats originating from the UK (e.g. Reflection) producing yields of 10t/ha when normally the season would be too short for them to finish grain fill.
- In the NSW HYC Elite screen the recently commercialised red feed wheat from Europe Big Red (AGFWH004718) was significantly higher yielding than all other wheats in the Elite screen.
- Several winter feed wheat cultivars of European decent were in a group that yielded 10t/ha. Of these RGT Accroc was the fastest developing whilst Reflection, Shabras and Tabasco are likely to be too slow for a season with a harder finish.
- Beaufort spring feed wheat stood out amongst the spring germplasm being significantly superior to all other spring germplasm except BX7932-039, however its test weight was significantly poorer than all other cultivars tested.
- LPB16-0598 has been consistently higher yielding than LPB16-0582 and is a white wheat that is a longer season spring with intermediate resistance to stripe rust and STB noted at Wallendbeen. We await the grade classification.

The yields in the Elite screen as a result of position in the paddock were slightly lower yielding than others on the Crop Technology Centre, however the range was 6.92 – 10.95t/ha (Figure 1, Table 1).

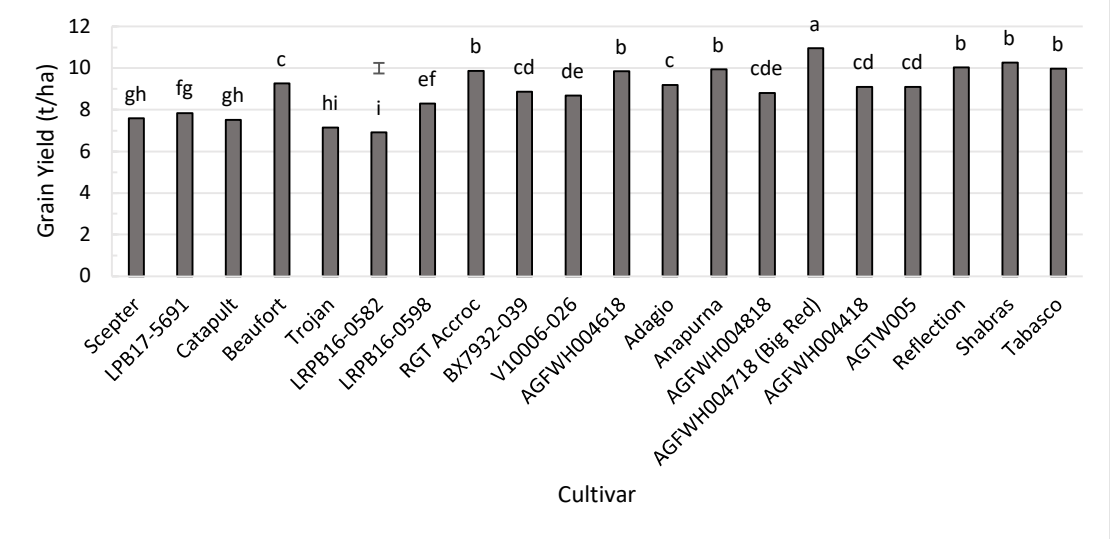


Figure 1. Influence of cultivar on grain yield (t/ha) under HYC management. Error bar represents LSD at P=0.05. P<0.001. Cultivars sorted from fastest (left) to slowest developers (right) days to flowering GS60.

Table 1. Influence of cultivar on grain yield (t/ha) and quality.

	Grain Yield (t/ha)		Protein (%)		Test Weight (kg/hL)		Screenings (%)	
Scepter	7.58	gh	14.6	a	79.6	ef	0.8	fg
Trojan	7.15	hi	14.5	ab	76.5	h	1.4	cd
Annapurna	9.95	b	11.8	def	81.6	b	1.3	cde
RGT Accroc	9.87	b	11.1	fgh	78.5	g	1.3	cde
Catapult	7.51	gh	13.8	b	78.9	efg	1.1	def
Reflection	10.04	b	10.4	hij	76.5	h	1.7	bc
LPB17-5691	7.85	fg	12.9	c	79.6	de	0.5	g
Shabras	10.27	b	10	j	77.1	h	0.9	efg
Tabasco	9.97	b	10.2	ij	76.6	h	1	def
SF Adagio	9.19	c	11.7	def	79.2	efg	1.4	cd
LRPB16-0582	6.92	i	13.9	ab	74.4	i	1.9	b
LPB16-0598	8.3	ef	12	de	76.7	h	2.4	a
V10006-026	8.68	de	11.3	efg	78.7	fg	2	ab
AGFWH004418	9.1	cd	11.7	def	80.7	c	1.4	cd
AGFWH004618	9.85	b	11.2	fg	79.6	ef	1.4	cde
AGFWH004718 (Big Red)	10.95	a	10	j	82.6	a	0.8	fg
AGFWH004818	8.8	cde	10.7	ghi	80.5	cd	1.7	bc
BX7932-039	8.88	cd	12.2	cd	80.6	c	1.4	cd
AGTW005	9.11	cd	11.8	def	80.5	cd	0.7	fg
Beaufort	9.27	c	12.7	c	72.6	j	1.9	b
Mean	8.96		11.9		78.6		1.4	
LSD (P=0.05)	0.50		0.7		0.9		0.4	
P val	<0.001		<0.001		<0.001		<0.001	

Table 2. Details of the management levels (kg, g, ml/ha).

Plant pop'n:		180 seeds/m^2 (150 plants/m2 target)
	Timing	**Untreated**
Seed treatment:		Vibrance/Gaucho
Basal Fertiliser:	21 April	120kg MAP (12 Kg N/ha)
Nitrogen*:	17 June	18.5kg N/ha
	11 Sep	138kg N/ha
Total N Applied:	(Including basal fert)	**168kg N/ha**
PGR:	GS30-31	Moddus Evo 0.1L/ha + Errex 0.65L/ha
	GS32-33	Moddus Evo 0.1L/ha + Errex 0.65L/ha
Fungicide*:	GS00	Systiva
	GS31	Prosaro 300ml/ha
	GS39	FAR F1 -19 750ml/ha
	GS59-61	Opus 500ml/ha

**Timings of fungicides were adjusted to take account of the differences in spring) and winter wheat phenology.*

Trial 3. HYC Genotype x Environment x Environment (G.E.M) Trial Series

Objectives: To assess the performance of winter and spring wheat germplasm managed under three different levels of management (20th April sown).

Key Messages:

- Winter feed wheats RGT Cesario, RGT Accroc and Anapurna were significantly higher yielding than all other cultivars tested giving yields over 11t/ha and a 3t/ha plus advantage over Scepter.
- The ASW wheat DS Bennett was significantly higher yielding than all other white wheat milling varieties exceeding 10t/ha but required higher input to achieve these yields.
- There was a significant (p=<0.001) interaction between management level and cultivar, indicating that influence of management was different when applied to the germplasm tested in this environment.
- Of the spring wheats Catapult and Scepter were the highest yielding when the mean of the three managements were considered.
- There was a significant reduction in yield as a result of defoliation (simulated grazing) at GS30 when the results from all cultivars were averaged, however the reduction was not apparent in DS Bennett, Scepter and Trojan. The reduction was greatest with latest developing cultivar RGT Cesario (1.2t/ha).
- Although yield was unaffected by defoliation, Trojan and Scepter suffered a down grade in bin grade due to lowered grain protein, indicating that higher N input was required to replace N removed in the defoliation.
- All cultivars gave a yield response to high input management with a range 0.42 - 1.78t/ha, DS Bennett being the most responsive to higher input and RGT Cesario being the least responsive.
- Dry matter (DM) contents at harvest ranged from 16 – 24t/ha with significantly higher DM accumulation in the longer season winter wheats such as RGT Accroc, Anapurna and RGT Cesario compared to Scepter.
- Greater dry matter accumulation with the winter wheat up to GS30 was the result of a longer vegetative period that correlated to higher tiller number per unit area and tillers/plant.
- In general, disease (principally Septoria and stripe rust) has been controlled by the two-spray program set out in standard management approach, however those varieties that tended to give higher yields at higher input were in general the more susceptible cultivars.
- In those cultivars that lodged (Catapult, DS Bennett, Scepter and Trojan), both PGR and grazing reduced plot lodging compared to standard management without PGR.
- DS Bennett was most profitable across all management input levels. Spring wheats were most profitable under the high input management.
- The application of PGR's significantly reduced crop height in all cultivars. DS Bennett was the only cultivar where grazing had a bigger effect on crop height than PGR's.
- Protein levels averaged just 12% and indicated that yields were optimised at the level of N application. Grazing significantly reduced grain protein by 0.8% on average.
- Harvest indices for the higher yielding winter wheats were in general around 41% compared to spring wheats that averaged around 35%.

Treatments and assessments

Three management levels (see Table 6) differing in defoliation, nutrition, fungicide and PGR input were applied to seven varieties of winter and spring wheat. The yields and quality are presented in Tables 1, 2 & 3. The effect of management on crop dry matter and harvest index are presented in

Tables 4, 5 and Figures 1, 3 & 4. Crop structure is illustrated in Table 6 with lodging and crop height (Table 7 and Figure 2). Disease levels noted in the different management levels during flowering and grain fill are recorded in Figures 5 & 6.

Table 1. Influence of management strategy and variety on grain yield (t/ha).

	Management Level (Yield t/ha)						
	Standard		Grazed		High Input		**Mean**
Catapult	7.46	g	7.00	h	8.11	f	**7.52**
Anapurna	10.71	c	10.07	d	11.38	ab	**10.72**
RGT Accroc	10.78	c	10.30	d	11.66	a	**10.91**
DS Bennett	8.47	ef	8.48	e	10.25	d	**9.07**
RGT86-090 (RGT Cesario)	11.24	b	10.04	d	11.66	a	**10.98**
Scepter	7.34	gh	7.09	h	8.25	ef	**7.56**
Trojan	6.16	i	6.06	i	7.32	gh	**6.51**
Mean	**8.88**		**8.43**		**9.80**		
Management	LSD P=0.05		0.20		P val		<0.001
Cultivar	LSD P=0.05		0.21		P val		<0.001
Management x Cultivar	LSD P=0.05		0.36		P val		<0.001

** "Grazed" – Mechanically defoliated at GS30*

Table 2. Influence of management strategy and variety on grain protein (%).

	Management Level (Protein %)							
	Standard		Grazed		High Input		**Mean**	
Catapult	13.7	-	13.4	-	13.6	-	**13.6**	**b**
Anapurna	11.6	-	10.6	-	11.5	-	**11.2**	**c**
RGT Accroc	10.6	-	10.2	-	11.0	-	**10.6**	**d**
DS Bennett	10.7	-	9.8	-	9.9	-	**10.1**	**e**
RGT86-090 (RGT Cesario)	10.7	-	9.6	-	10.4	-	**10.2**	**e**
Scepter	14.7	-	13.5	-	14.0	-	**14.1**	**a**
Trojan	14.8	-	13.9	-	14.3	-	**14.3**	**a**
Mean	**12.4**	**a**	**11.6**	**b**	**12.1**	**a**		
Management	LSD P=0.05		0.4		P val		0.008	
Cultivar	LSD P=0.05		0.3		P val		<0.001	
Management x Cultivar	LSD P=0.05		ns		P val		0.066	

Table 3. Influence of management strategy and cultivar on bin grade and price received ($/t).

	Management Level (Bin Grade and Price Received ($/t))					
	Standard		Grazed		High Input	
Catapult	H2	355.75	H2	355.75	H2	355.75
Anapurna	SFW1	235.75	SFW1	235.75	SFW1	235.75
RGT Accroc	SFW1	235.75	SFW1	235.75	SFW1	235.75
DS Bennett	ASW1	320.75	ASW1	320.75	ASW1	320.75
RGT86-090 (RGT Cesario)	SFW1	235.75	SFW1	235.75	SFW1	235.75
Scepter	H2	355.75	AGP1	240.75	H2	355.75
Trojan	APW1	345.75	AGP1	240.75	APW1	345.75

Table 4. Effects of management strategy on final dry matter and grain yield.

	Losses due to Grazing (t/ha)		Gains due to High Input (t/ha)	
	Yield Loss	Dry Matter Loss	Yield Gain	Dry Matter Gain
Catapult	0.46	1.8	0.65	-0.4
Scepter	0.25	3.4	0.91	-0.1
Trojan	0.10	0.3	1.16	2
Anapurna	0.64	1.3	0.67	1.7
RGT Accroc	0.48	2.9	0.88	-0.8
DS Bennett	+0.01	3.3	1.78	2.5
RGT Cesario	1.20	4.4	0.42	1.2

+ = varieties where defoliation at GS30 increased grain yield. All other figures indicate grain loss

Table 5. The effects of management strategy and cultivar on gross margin ($/ha).

	Standard	**Grazed**	**High Input**	**Mean**
	Gross Margin ($/ha)	Gross Margin ($/ha)	Gross Margin ($/ha)	
Catapult	1939.58	1957.89	1963.99	**1953.82**
Anapurna	1810.57	1908.27	1761.69	**1826.84**
RGT Accroc	1827.07	1918.11	1827.70	**1857.63**
DS Bennet	2002.44	2268.15	2366.54	**2212.38**
RGT Cesario	1935.52	1912.37	1827.70	**1891.86**
Scepter	1896.89	1178.73	2013.79	**1696.47**
Trojan	768.71	851.58	1609.74	**1076.68**
Mean	**1740.11**	**1713.59**	**1910.16**	

Table 6. Dry matter produced (t/ha) at GS30, GS75, and GS90 of standard management cultivars. *Calendar dates vary due to differences in phenology.*

Variety	Stem Elongation Dry matter (GS31)	Grain development Dry Matter (GS69-71)	Harvest Dry Matter (GS90)
	(t/ha)	(t/ha)	(t/ha)
Catapult	1.37 def	15.0 a	19.9 de
Anapurna	1.91 abc	15.4 a	23.1 abc
RGT Accroc	1.98 ab	16.8 a	24.9 a
DS Bennett	2.27 a	15.8 a	21.5 cd
RGT86-090 (RGT Cesario)	2.24 a	16.0 a	24.4 ab
Scepter	1.30 efg	15.5 a	19.7 de
Trojan	0.99 fgh	11.7 b	15.8 f
Mean	**1.72**	**15.2**	**20.8**
LSD (p=0.05)	0.41	2.5	2.6
P value	<0.001	0.013	<0.001

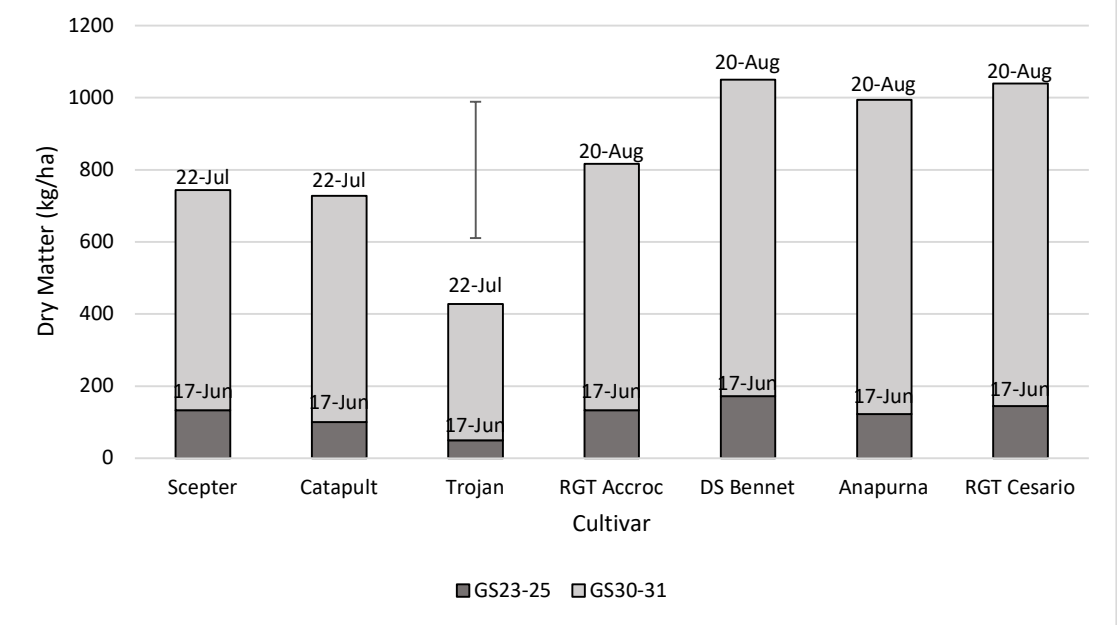


Figure 1. Dry Matter removed (kg/ha) and date of grazing at tillering and GS30, Error bar represents LSD p=0.05 of total DM removed. P=0.030.

Table 7. Plants/m2 assessed at GS12, tillers/m2 assessed GS31, heads/m2 assessed at GS90.

Variety	Plants/m2	Tillers/m2	Heads/m2
Trojan	121 b	374 e	198 d
Catapult	137 ab	532 d	218 d
Scepter	138 ab	451 de	212 d
DS Bennett	148 a	719 c	476 c
Anapurna	145 a	857 b	526 b
RGT Accroc	148 a	949 a	582 a
RGT Cesario	144 a	879 ab	612 a
Mean	140	680	403
LSD	17	86	43
P value	0.034	**<0.001**	**<0.001**

Table 8. Crop lodging index (0-500) at crop maturity (GS90) on 22 December.

Variety	Management level (Lodging GS90 (0-500 scale)			
	Standard	"Grazed"	High input	Mean
Catapult	83 b	5 e	6 e	**31**
Anapurna	3 e	0 e	0 e	**1**
RGT Accroc	4 e	0 e	0 e	**1**
DS Bennett	128 a	3 e	20 de	**50**
RGT86-090 (RGT Cesario)	0 e	0 e	0 e	**0**
Scepter	58 bc	1 e	0 e	**20**
Trojan	129 a	23 de	35 cd	**62**
Mean	**58**	**4**	**9**	
Management	LSD P=0.05	13	P val	**<0.001**
Cultivar	LSD P=0.05	15	P val	**<0.001**
Management x Cultivar	LSD P=0.05	25	P val	**<0.001**

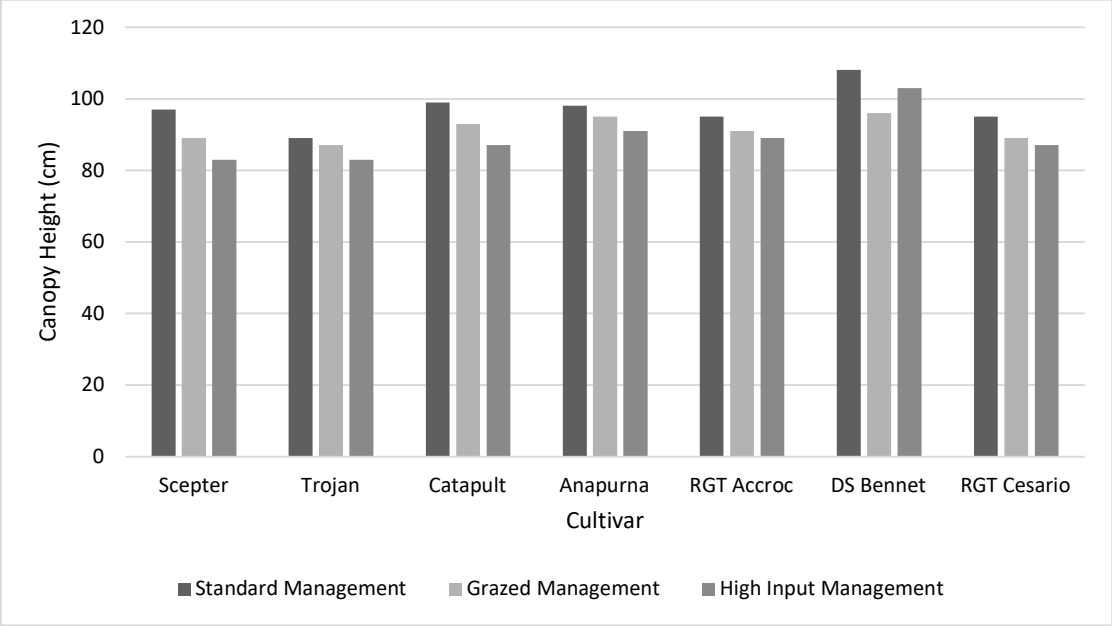


Figure 2. Influence of variety and management on crop canopy height at crop maturity (GS90) on 22 December. P<0.001, LSD=3cm.

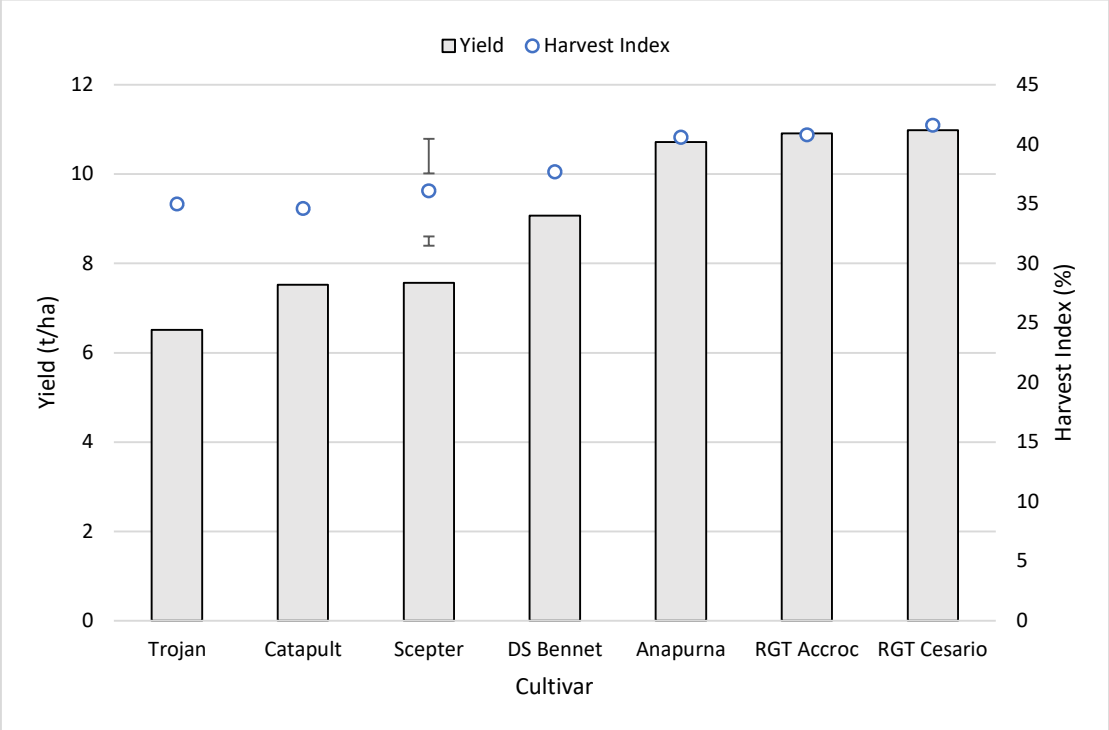
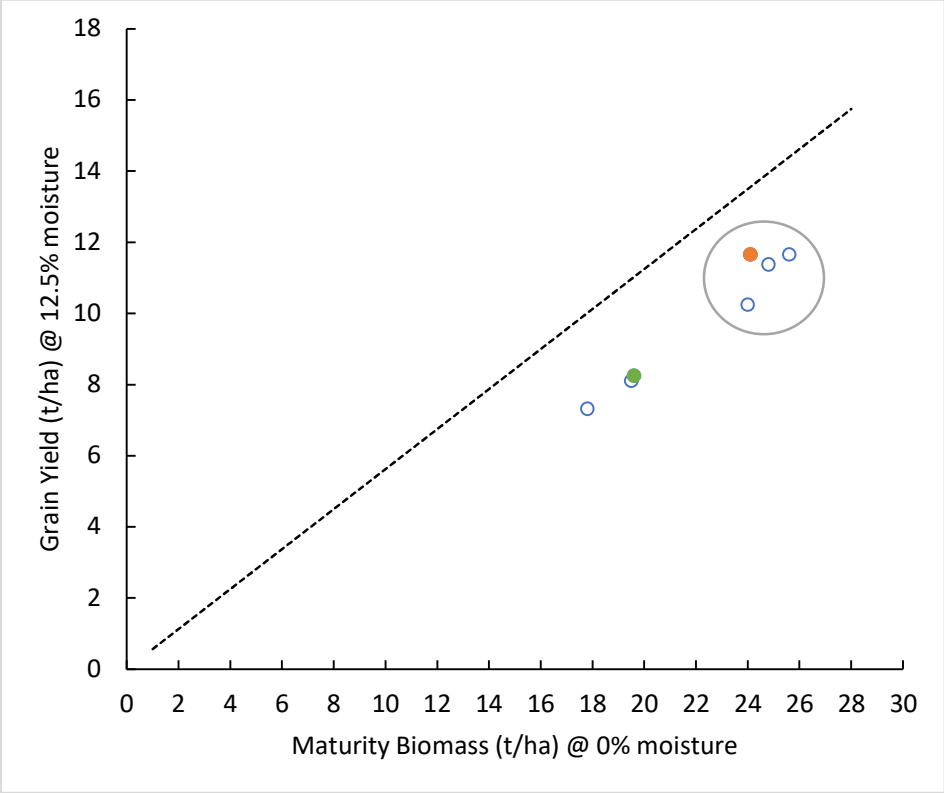


Figure 3. Influence of cultivar on grain yield (t/ha) and harvest index (%) – mean of management levels. Error bars represent LSD ap p=0.05. Yield p<0.001, Harvest index p<0.001.



Sow Date	Variety (Type)	Maturity Biomass (t/ha)	Grain Yield (t/ha)*	Harvest Index (%)
20-Apr	**RGT Accroc (Winter)**	**24.1**	**11.66**	**42.9**
	RGT Cesario (Winter)	25.6	11.66	40.3
	Anapurna (Winter)	24.8	11.38	40.4
	DS Bennet (Winter)	24	10.25	37.7
	Scepter (Spring)	**19.6**	**8.25**	**37.1**
	Catapult (Spring)	19.5	8.11	36.9
	Trojan (Spring)	17.8	7.32	36

Figure 4. Influence of cultivar on biomass, grain yield (t/ha) and harvest index (%) – High input management level. *Dotted line represents an adjusted 50% harvest index line (grain at 12.5% and biomass maturity 0%).*

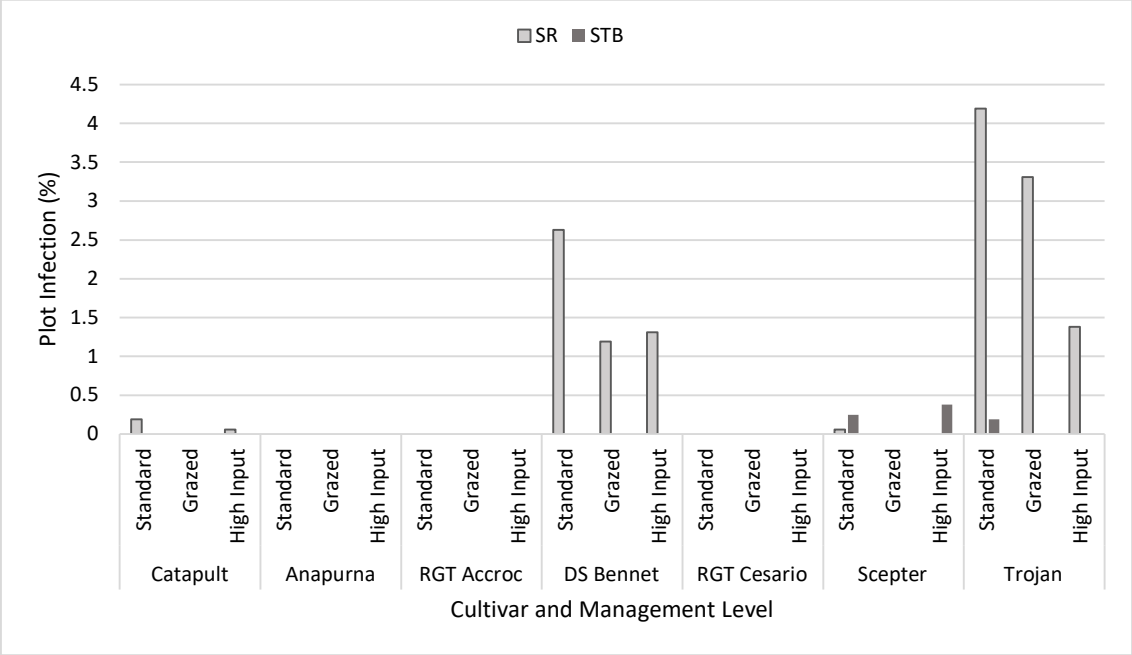


Figure 5. Influence of management level and cultivar on disease infection, assessed 6-Oct.

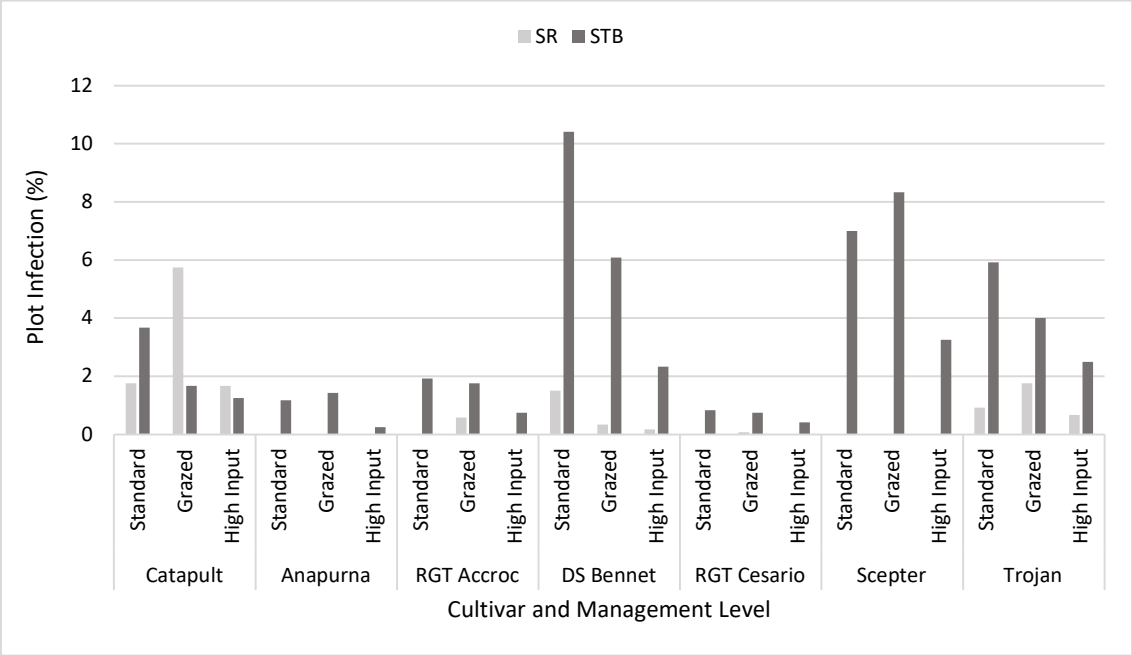


Figure 6. Influence of management level and cultivar on disease infection, assessed 16-Nov.

Table 9. Details of the management levels.

Plant pop'n: 180 seeds/m^2 (150 plants/m2 target) - all three managements

	Timing	Standard	Grazed Standard	High Input
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As 1 F unit + Systiva
Basal Fertiliser:	20 April	120kg MAP (12 Kg N)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)
Nutrition:	18 June	18.5kg N/ha	18.5kg N/ha	18.5kg N/ha
	30 June			29kg P + 23kg K/ha
	11 Sep	138kg N/ha	138kg N/ha	138kg N/ha
Total N Applied:		**168kg N/ha**	**168kg N/ha**	**168kg N/ha**
PGR:	GS23		Mechanical Defoliation	
	GS30-31	---	Mechanical Defoliation	Moddus Evo 100ml/ha Errex 0.65L/ha
	GS32-33			Moddus Evo 100ml/ha Errex 0.65L/ha
Fungicide*:	GS 31	Prosaro 300ml/ha	Prosaro 300ml/ha	Prosaro 300ml/ha
	GS39	FAR F1-19 750ml	FAR F1-19 750ml	FAR F1-19 750ml
	GS59			Opus 500ml/ha

All other inputs of insecticides and herbicides were standard across the trial.

Trial 4. HYC Disease Management Germplasm Interaction

Objectives: To develop profitable and sustainable approaches to disease management in high yielding and HRZ regions.

Individual objectives specific to the trial were:

- To evaluate whether newer germplasm or new fungicide chemistry allows a reduction in the number of fungicide applications whilst increasing profitability (note: reducing the number of fungicides is seen as a key measure for slowing down resistance development in cropping systems).
- Examine whether there is germplasm (varieties tested) that has sufficient early season disease resistance to replace the need for the "at sowing fungicide" and Timing 1 (T1) spray applied at GS31-32.
- To determine the cost benefit ratio of fungicide application in HRZ regions of different season lengths.

Key Messages:

- The feed winter wheats RGT Accroc, Anapurna and RGT Cesario significantly out yielded all other cultivars at all three levels of fungicide input and achieved over 10t/ha with fungicide input.
- There was a significant interaction between cultivar and fungicide management with the stripe rust susceptible cultivars Trojan and Catapult giving yield responses of 1.09 and 3.58t/ha to a single flag leaf fungicide compared to less than a 1t/ha with the majority of cultivars.
- Septoria tritici blotch (STB) was the principal disease in untreated crops of Scepter and Beckom, whilst stripe rust (pathotype 239 dominant with 198 pathotype also present) was the main disease in Trojan, RGT Accroc and Catapult. Other cultivars were subject to low levels of both stripe rust and STB disease pressure.
- Only Trojan and Catapult gave significant yield increases to the application of more than one fungicide unit while only Trojan gave a significant yield increase to four units of fungicide (seed treatment and three foliar fungicides).
- The significant interaction observed in grain yields was also apparent in the grain quality (protein, test weights and screenings) and the resulting wheat grade.
- Highest return on investment with fungicide was seen in the spring wheat cultivars Trojan, Beckom and Catapult due to both higher grain yield and better grain quality.

Increasing fungicide input across seven cultivars of wheat produced significant interactions in both grain yield and quality (protein, test weight and screenings) (Tables 1 – 5). The influence of treatment on net margin, cost benefit ratios ($ earnt for $ spent) and gross margins are presented in Tables 6-8. The disease recorded in the trials was principally Septoria tritici blotch (STB), stripe rust and leaf rust, levels of which are presented.

Table 1. Influence of disease management strategy and variety on grain yield (t/ha).

	Management Level (Yield t/ha)								
Cultivar	**Untreated**		**1 Fungicide Unit**		**2 Fungicide Units**		**4 Fungicide Units**		**Mean**
Trojan (spring)	3.51	l	4.60	k	5.24	j	6.56	i	**4.98**
Scepter (Spring)	7.14	gh	7.67	efg	7.92	e	8.05	e	**7.70**
RGT Cesario (Winter)	10.50	bcd	11.14	a	10.89	abc	10.87	abc	**10.85**
Anapurna (Winter)	10.46	cd	10.84	abc	10.83	abc	10.79	abc	**10.73**
RGT Accroc (Winter)	9.99	d	11.05	a	11.01	ab	10.94	abc	**10.75**
Beckom (Spring)	6.94	hi	7.71	ef	7.84	e	8.10	e	**7.65**
Catapult (Spring)	3.18	l	6.76	hi	7.28	fgh	7.59	efg	**6.20**
Mean	**7.39**		**8.54**		**8.71**		**8.99**		
Cultivar	**LSD**	0.36t/ha		P val	<0.001				
Management	**LSD**	0.20t/ha		P val	<0.001				
Cultivar x Management	**LSD**	0.54t/ha		P val	<0.001				

Table 2. Influence of disease management strategy and variety on grain protein %.

	Management Level (Protein %)								
Cultivar	**Untreated**		**1 Fungicide Unit**		**2 Fungicide Units**		**4 Fungicide Units**		**Mean**
Trojan (spring)	14.9	ab	15.1	a	15.0	a	14.8	abc	14.9
Scepter (Spring)	15.1	a	14.9	ab	14.8	abc	14.4	bcd	14.8
RGT Cesario (Winter)	10.6	lm	10.5	m	11.0	kl	11.5	ijk	10.9
Anapurna (Winter)	12.2	g	12.1	gh	11.9	ghi	12.0	gh	12.0
RGT Accroc (Winter)	11.9	ghi	11.2	jk	11.6	hij	11.6	hij	11.6
Beckom (Spring)	14.0	def	13.6	f	13.6	f	13.8	ef	13.7
Catapult (Spring)	14.1	de	13.9	def	14.3	cd	14.0	def	14.1
Mean	**13.3**		**13.0**		**13.2**		**13.1**		
Cultivar	**LSD**	0.4		P val	<0.001				
Management	**LSD**	ns		P val	0.212				
Cultivar x Management	**LSD**	0.5		P val	0.036				

Table 3. Influence of disease management strategy and variety on grain test weight (kg/hl).

	Management Level (Test Weight kg/hL)								
Cultivar	**Untreated**		**1 Fungicide Unit**		**2 Fungicide Units**		**4 Fungicide Units**		**Mean**
Trojan (spring)	66.1	l	70.5	k	74.0	j	75.6	i	71.5
Scepter (Spring)	76.8	f-i	77.8	c-h	78.4	b-e	78.5	bcd	77.9
RGT Cesario (Winter)	77.9	c-g	78.0	c-g	78.4	b-f	78.8	bc	78.2
Anapurna (Winter)	79.9	ab	80.4	a	80.9	a	80.8	a	80.5
RGT Accroc (Winter)	75.5	ij	76.9	d-i	76.8	e-i	78.0	c-g	76.8
Beckom (Spring)	75.8	i	76.0	i	76.6	ghi	76.7	ghi	76.3
Catapult (Spring)	57.6	m	71.1	k	76.0	i	76.2	hi	70.2
Mean	**72.8**		**75.8**		**77.3**		**77.8**		
Cultivar	**LSD**		1.7		P val		<0.001		
Management	**LSD**		0.6		P val		<0.001		
Cultivar x Management	**LSD**		1.6		P val		<0.001		

Table 4. Influence of disease management strategy and variety on grain screenings (%).

	Management Level (Screenings %)								
Cultivar	**Untreated**		**1 Fungicide Unit**		**2 Fungicide Units**		**4 Fungicide Units**		**Mean**
Trojan (spring)	2.9	b	2.1	c	1.7	cd	1.2	d-h	2
Scepter (Spring)	1.0	fgh	0.8	h	0.9	gh	1.0	fgh	0.93
RGT Cesario (Winter)	1.4	d-g	1.1	e-h	1.1	e-h	1.2	d-h	1.21
Anapurna (Winter)	1.6	cde	1.5	d-g	1.4	d-h	1.4	d-h	1.45
RGT Accroc (Winter)	1.3	d-h	1.3	d-h	1.3	d-h	1.1	e-h	1.26
Beckom (Spring)	1.5	d-g	1.1	e-h	1.1	e-h	1.0	e-h	1.17
Catapult (Spring)	4.7	a	1.5	def	1.1	e-h	1.0	e-h	2.07
Mean	**2.0**		**1.4**		**1.2**		**1.1**		
Cultivar	**LSD**		0.4		P val		<0.001		
Management	**LSD**		0.2		P val		<0.001		
Cultivar x Management	**LSD**		0.6		P val		<0.001		

Table 5. Influence of disease management strategy and variety on receival wheat grade and price ($/t).

	Management Level (Wheat Grade and Price $/t)							
Cultivar	**Untreated**		**1 Fungicide**		**2 Fungicide**		**4 Fungicide**	
Trojan (spring)	FED1	$200*	AGP1	$241	AGP1	$241	AGP1	$241
Scepter (Spring)	H2	$356	H2	$356	H2	$356	H2	$356
RGT Cesario (Winter)	SFW1	$236	SFW1	$236	SFW1	$236	SFW1	$236
Anapurna (Winter)	SFW1	$236	SFW1	$236	SFW1	$236	SFW1	$236
RGT Accroc (Winter)	SFW1	$236	SFW1	$236	SFW1	$236	SFW1	$236
Beckom (Spring)	AUH2	$286	H2	$356	H2	$356	H2	$356
Catapult (Spring)	Undeliverable #	$150*	AUH2	$286	H2	$356	H2	$356

Prices as of 11/1/21 trading at Cootamundra GrainCorp.

**Price unavailable, nominal value used*

 # Low test weight did not meet grain specifications

Table 6. Influence of disease management strategy and variety on return on investment ($ earned for every $ spent) compared to unsprayed crop.

	Management Level (Return on Investment)			
Cultivar	**1 Fungicide**	**2 Fungicide**	**4 Fungicide**	**Mean**
Trojan (spring)	$ 9.14	$ 7.35	$ 6.30	**$ 7.60**
Scepter (Spring)	$ 3.71	$ 3.14	$ 1.69	**$ 2.85**
RGT Cesario (Winter)	$ 2.77	$ 0.37	-$ 0.27	**$ 0.96**
Anapurna (Winter)	$ 1.24	$ 0.30	-$ 0.35	**$ 0.40**
RGT Accroc (Winter)	$ 5.25	$ 2.59	$ 0.86	**$ 2.90**
Beckom (Spring)	$ 22.68	$ 13.83	$ 8.04	**$ 14.85**
Catapult (Spring)	$ 30.80	$ 30.54	$ 17.50	**$ 26.28**
Mean	**$ 10.80**	**$ 8.30**	**$ 4.82**	

Table 7. Influence of disease management strategy and variety on net margin increase ($/ha) (extra income minus fungicide cost).

	Management Level (Increase in net margin $/ha)			
Cultivar	**1 Fungicide**	**2 Fungicide**	**4 Fungicide**	**Mean**
Trojan (spring)	365	493	757	**538**
Scepter (Spring)	149	210	204	**188**
RGT Cesario (Winter)	111	25	-33	**34**
Anapurna (Winter)	50	20	-42	**9**
RGT Accroc (Winter)	210	173	104	**162**
Beckom (Spring)	907	926	966	**933**
Catapult (Spring)	1232	2046	2103	**1794**
Mean	**432**	**556**	**580**	

Table 8. Influence of disease management strategy and variety on net margin ($/ha) (income minus Fungicide costs only).

	Management Level (Net Margin $/ha)				
Cultivar	**Untreated**	**1 Fungicide**	**2 Fungicide**	**4 Fungicide**	**Mean**
Trojan (spring)	702	1067	1195	**1459**	**1106**
Scepter (Spring)	2540	2689	**2751**	**2744**	**2681**
RGT Cesario (Winter)	2475	**2586**	2500	2442	**2501**
Anapurna (Winter)	2466	**2516**	2486	2424	**2473**
RGT Accroc (Winter)	2355	**2565**	2529	2459	**2477**
Beckom (Spring)	1796	2703	2722	**2761**	**2496**
Catapult (Spring)	477	1709	2523	**2580**	**1822**
Mean	**1830**	**2262**	**2386**	**2410**	

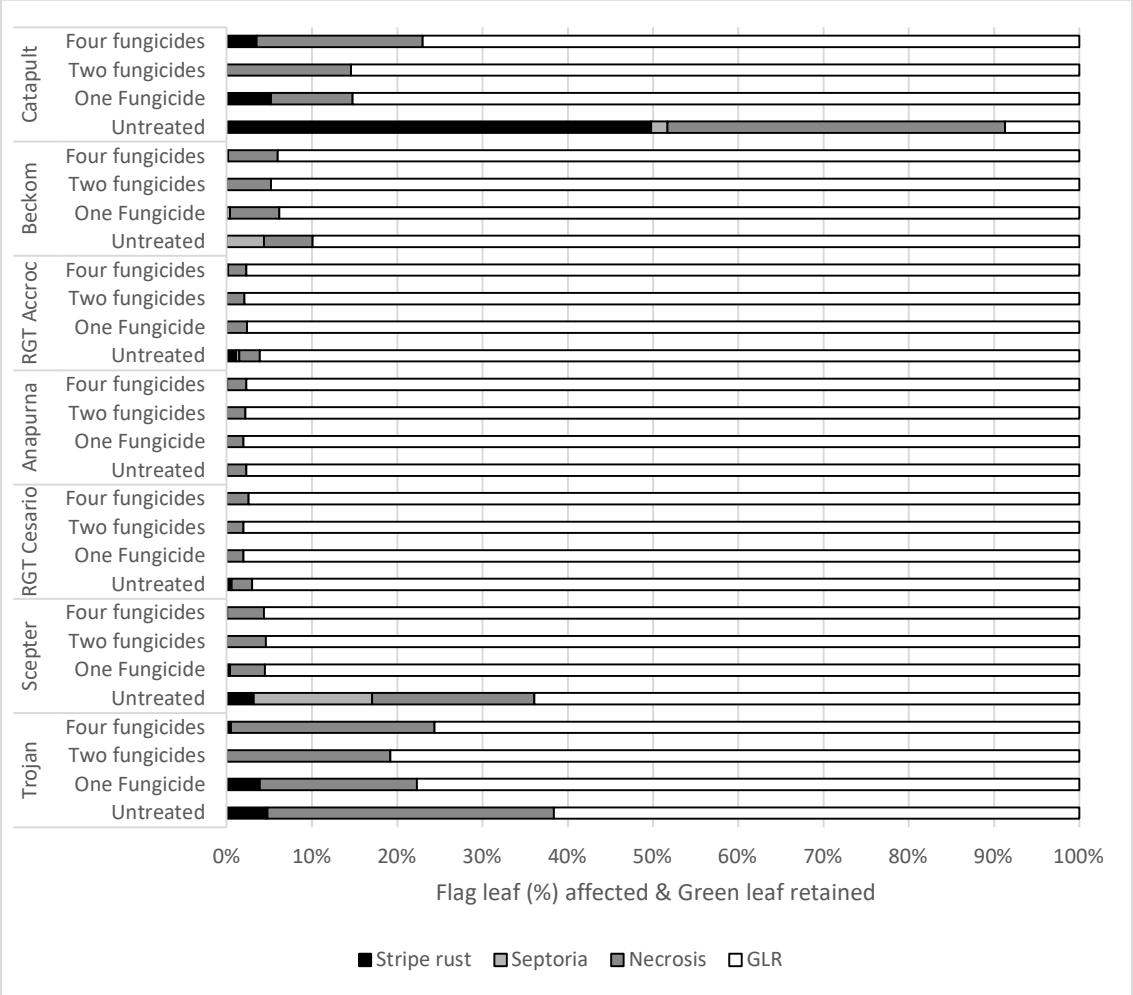


Figure 1. Influence of variety and fungicide programme on % disease leaf area infection of the **flag leaf**, % necrosis of the leaf and % green leaf retention.

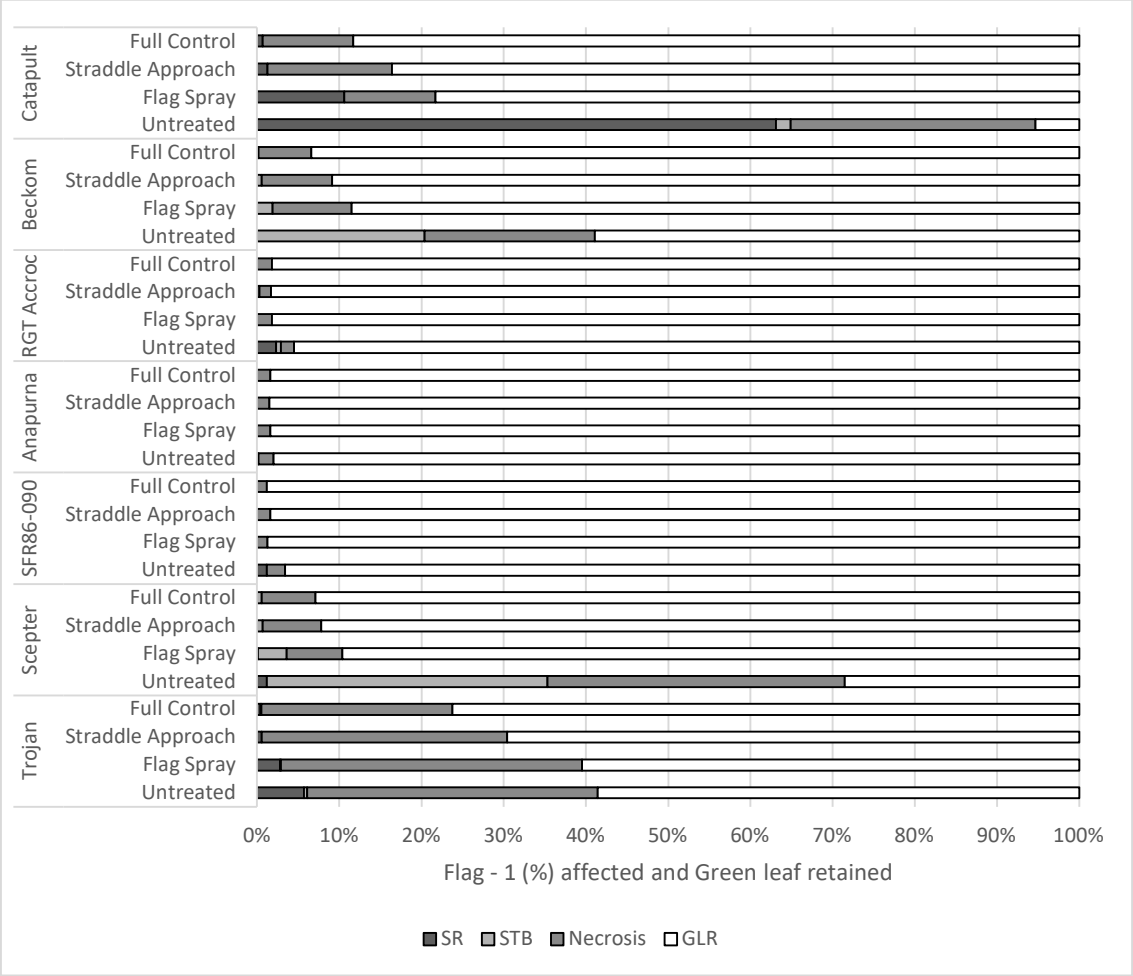


Figure 2. Influence of variety and fungicide programme on % disease leaf area infection of the **flag-1,** % necrosis of the leaf and % green leaf retention. *Note: 4 units of fungicide is referred to as full control, 2 units of fungicide is referred to as the "straddle approach" as fungicides are timed either side of the flag leaf and the flaf spray is one unit of fungicide applied at flag leaf emergence*

Table 9. Details of the management levels (kg, g, ml/ha).

Plant pop'n:		180 seeds/m^2 (150 plants/m^2 target)			
	Timing	**Untreated**	**Flag Spray**	**2 Fungicides**	**Full Control**
Seed treatment:		Vibrance + Goucho	Vibrance + Goucho	Vibrance + Goucho	Vibrance + Goucho
Fert Treatment:		---	---	---	Flutriafol
Basal Fertiliser:	20 April	120kg MAP (12 Kg N)	120kg MAP (12 Kg N)	120kg MAP (12 Kg N)	120kg MAP (12 Kg N)
Nitrogen:	17 June	18.5kg N/ha	18.5kg N/ha	18.5kg N/ha	18.5kg N/ha
	11 Sep	138kg N/ha	138kg N/ha	138kg N/ha	138kg N/ha
Total N Applied:		**168kg N/ha**	**168kg N/ha**	**168kg N/ha**	**168kg N/ha**
PGR:		---	---	---	---
Fungicide:	GS31	---	---	FAR F1-19 750ml (GS33)	Prosaro 300ml

	GS39	---	FAR F1-19 750ml	---	FAR F1-19 750ml
	GS59-61	---	---	Opus 500ml	Radial 600ml

All other inputs of insecticides and herbicides were standard across the trial.

Trial 5. Nutrition for Hyper Yielding Wheat

Objectives: To assess the value of higher nutrition input (N, P, K & S) for wheat in the growing season.

Individual objectives specific to the trials were:

- To assess the value of additional nutrients in the growing crop (set up as small plots at the HYC Research sites).
- To assess the value of adding increased P and K when targeting higher yield potential rather than N alone.

Key Messages:

- There was no yield response in winter feed wheat cv RGT Accroc to additional nutrient input above the standard N input of 168kg N/ha, which included a standard of 120kg/ha MAP at sowing (12N, 24P) despite yields of 9.5-10t/ha.
- The average yield of the trial in RGT Accroc was 9.47t/ha compared to 7.83t/ha in the milling wheat Rockstar trial (in surrounding commercial crop).
- Protein levels in the zero N plots (control) were significantly increased from 9.5% to 11.7 – 12.0% with the additional nutrients, but the increases were not associated with higher grain yields above standard nutrition (168N, 24P) in the feed wheat RGT Accroc.
- With the farm crop milling wheat trial in Rockstar additional nutrition increased both yield and protein, even though protein was over %12.6.
- On average, protein levels were higher in the milling wheat Rockstar (13.6%) compared to the feed wheat RGT Accroc (11.3%).
- At harvest there were increased head numbers and dry matter production associated with greater nutrition input (cv RGT Accroc – feed wheat) but this did not lead to increased grain yield.
- There was no effect of additional nutrition on harvest index (data not presented), however the milling wheat Rockstar had higher harvest index (40.5%) compared to the feed wheat RGT Accroc (34.2%).
- The unfertilised crop of RGT Accroc had a N offtake in the grain of 129kg N/ha based on 7.74t/ha and 1.66% N in the grain (9.5% protein). If it is assumed that 25% of the N at harvest is in the straw and chaff then the unfertilised crop would have removed approximately 172kg N//ha of which 59.3 kg N/ha was recorded in the soil core on 29th July (0-60cm) with 12kg N/ha provided by the MAP.
- This residual fertility in the farming system would explain why the standard nutrition control removed 242kg N/ha in the canopy (based on the same calculations) when only 168kg N/ha was applied as fertiliser.

Treatments: Seven different nutrition strategies (Tables 5 & 6) were put in place in RGT Accroc that differed in the level of nutrition (N, P & K). The same trial was set up in the surrounding farm crop. The starting nitrogen (N) in the soil was 59.3kg N/ha (0-60cm) and a soil carbon of 1.9 % (0-10cm). Taken on 29 July 2021.

Winter Feed Wheat (RGT Accroc)

Table 1. Influence of crop nutrition on wheat yields (t/ha) – cv RGT Accroc.

Treatment	Yield (t/ha)	
Standard nutrition (168kg N/ha)	9.58	a
Standard + 25% (N) (204 kg N/ha)	9.38	a
Standard + 25% (N) (204kg N/ha) + (P, K)	9.81	a
Standard + 50% (N) (241kg N/ha)	9.9	a
Standard + 50% (N) (241kg N/ha) + (P, K)	9.93	a
Nil N	7.74	b
Standard + 100% (N) (316kg N/ha)	9.95	a
Grand Mean	9.47	
LSD p=0.05	0.61	
P val	**<0.001**	
CV	4.34	

Table 2. Influence of crop nutrition on grain quality (Protein %, Test weight kg/hL, and Screenings %).

Treatment	Protein (%)		Test Weight (kg/hl)		Screening (%)	
Standard nutrition	10.8	c	75.5	ab	1.7	-
Standard + 25% (N)	11.5	b	75.2	b	1.1	-
Standard + 25% (N+ P, K)	11.5	b	76.1	a	1.5	-
Standard + 50% (N)	11.7	ab	75.6	ab	1.6	-
Standard + 50% (N+ P, K)	11.8	ab	75.7	ab	1.6	-
Nil N	9.5	d	72.5	c	2	-
Standard + 100% (N)	12.0	a	75.6	ab	1.3	-
Grand Mean	11.3		75.2		1.5	
LSD P=.05	0.4		0.9		ns	
Treatment Prob(F)	**<0.001**		**<0.001**		**0.116**	

Table 3. Influence of crop nutrition on harvest parameter (Heads/m^2, Dry matter production t/ha, and nitrogen removal kg/ha).

Treatment	Head Count (m^2)		Dry Matter (t/ha)		Nitrogen Removal (kg/ha)	
Standard nutrition	523	bc	23.3	b	78.4	-
Standard + 25% (N)	586	ab	25.2	ab		
Standard + 25% (N+ P, K)	569	ab	25.3	ab	168.5	-
Standard + 50% (N)	550	abc	25.0	ab		
Standard + 50% (N+ P, K)	582	ab	25.5	ab	171.7	-
Nil N	499	c	19.8	c	74.9	-
Standard + 100% (N)	614	a	26.3	a		
Grand Mean	560		24.3		123.3	
LSD P=.05	65		2.5		ns	
Treatment Prob(F)	**0.023**		**<0.001**		**0.126**	

Spring Milling Wheat (Rockstar) in commercial crop surrounding the paddock (Sown 10th May)

Table 4. Influence of crop nutrition on wheat yields (t/ha).

Treatment	Yield (t/ha)	
HYC Standard nutrition (282kg N/ha)	7.33	bc
Standard + 25% (N) (320 kg N/ha)	8.16	a
Standard + 25% (N) (320kg N/ha) + (P, K)	7.85	ab
Standard + 50% (N) (357kg N/ha)	8.22	a
Standard + 50% (N) (357kg N/ha) + (P, K)	8.26	a
Farm Standard (167kg N/ha)	6.97	c
Standard + 100% (N) (432kg N/ha)	7.98	a
Grand Mean	**7.83**	
LSD P=.05	0.56	
Treatment Prob(F)	**<0.001**	
CV	4.79	

Table 5. Influence of crop nutrition on grain quality (Protein %, Test weight kg/hL, and Screenings %).

Treatment	Protein (%)		Test Weight (kg/hl)		Screening (%)	
Standard nutrition	13.4	b	74.8	-	1.3	-
Standard + 25% (N)	13.7	b	75.3	-	1.4	-
Standard + 25% (N+ P,K)	13.8	b	74.4	-	1.4	-
Standard + 50% (N)	13.7	b	74.7	-	1.4	-
Standard + 50% (N+ P, K)	13.9	ab	74.4	-	1.5	-
Farm Standard	12.6	c	75.2	-	1.4	-
Standard + 100% (N)	14.4	a	74	-	1.4	-
Grand Mean	13.6		74.7		1.4	
LSD P=.05	0.6		ns		ns	
Treatment Prob(F)	**<0.001**		0.294		0.959	

Table 6. Influence of crop nutrition on harvest parameter (Heads/m^2, Dry matter production t/ha, and nitrogen removal kg/ha).

Treatment	Head Count (m^2)	Dry Matter (t/ha)	Nitrogen Removal (kg/ha)
Standard nutrition	425 -	16.2 -	162.9 -
Standard + 25% (N)	462 -	18.1 -	
Standard + 25% (N+ P,K)	442 -	17.3 -	222.1 -
Standard + 50% (N)	423 -	17.5 -	
Standard + 50% (N+ P, K)	421 -	16.6 -	208.7 -
Farm Standard	417 -	15.3 -	154.6 -
Standard + 100% (N)	441 -	17.4 -	
Grand Mean	433	16.9	187.1
LSD P=.05	ns	1.7	ns
Treatment Prob(F)	0.830	0.017	0.255

Table 7. Details of the management levels (kg, ml/ha). Spring milling wheat Rockstar.

Plant pop'n: 180 seeds/m^2 (150 plants/m2 target) - all three managements

	Timing	HYC Standard Nutrition	+ 25% Yield Potential N	+50% Yield Potential N	+25% Yield Potential (N P K)	+50% Yield Potential (N P K)	Farm Standard	+ 100% Yield Potential N
Seed treatment:		Vibrance + Gaucho	As Standard	As Standard	As Standard	As Standard		
Basal Fertiliser:	10 May	120kg MAP (12 Kg N)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)
	10 May	40N (NH_3)	40N (NH_3)	40N (NH_3)	40N (NH_3)	40N (NH_3)	40N (NH_3)	40N (NH_3)
Nutrition:	30 June				29kg P + 23kg K	29kg P + 23kg K		
	17 Aug	115N	115N	115N	115N	115N	115N	115N
	11 Sep	115N	153N	190N	153N	190N	0	265N
Total Applied:		**282kg N**	**320kg N**	**357kg N**	**320N +22P +22K**	**357N +22P +22K**	**167N**	**432N**
PGR:	GS33	Moddus Evo 200ml + Errex 1300ml	As Standard	As Standard	As Standard	As Standard	As Standard	As Standard
Fungicide:	GS31	Propiconazole 130ml	As Standard	As Standard	As Standard	As Standard	As Standard	As Standard
	GS39	Accolade 450ml + Epoxiconazole 375ml	As Standard	As Standard	As Standard	As Standard	As Standard	As Standard
	GS61	Propiconazole 250ml	As Standard	As Standard	As Standard	As Standard	As Standard	As Standard

All other inputs of insecticides and herbicides were standard across the trial.

Table 8. Details of the management levels (kg, ml/ha). Winter feed Wheat RGT Accroc.

Plant pop'n: 180 seeds/m^2 (150 plants/m2 target) - all three managements

	Timing	Standard Nutrition	+ 25% Yield Potential N	+50% Yield Potential N	+25% Yield Potential (N P K)	+50% Yield Potential (N P K)	0N	+ 100% Yield Potential N
Seed treatment:		Vibrance + Gaucho	As Standard	As Standard	As Standard	As Standard		
Basal Fertiliser:	21 April	120kg MAP (12 Kg N)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)
Nutrition:	18 June	18N	18N	18N	18N	18N	0	18N
	30 June				29kg P + 23kg K	29kg P + 23kg K		
	11 Sep	138N	211N	100N	211N	100N	0	286N
Total Applied:		**168kg N**	**204kg N**	**241kg N**	**204N +22P +22K**	**241N +22P +22K**	**12N**	**316N**
PGR:	GS33	Moddus Evo 200ml + Errex 1300ml	As Standard	As Standard	As Standard	As Standard	As Standard	As Standard
Fungicide:	GS31	Prosaro 300ml	As Standard	As Standard	As Standard	As Standard	As Standard	As Standard
	GS49	FAR F1-19 750ml	As Standard	As Standard	As Standard	As Standard	As Standard	As Standard

All other inputs of insecticides and herbicides were standard across the trial.

Appendix

Climate Data

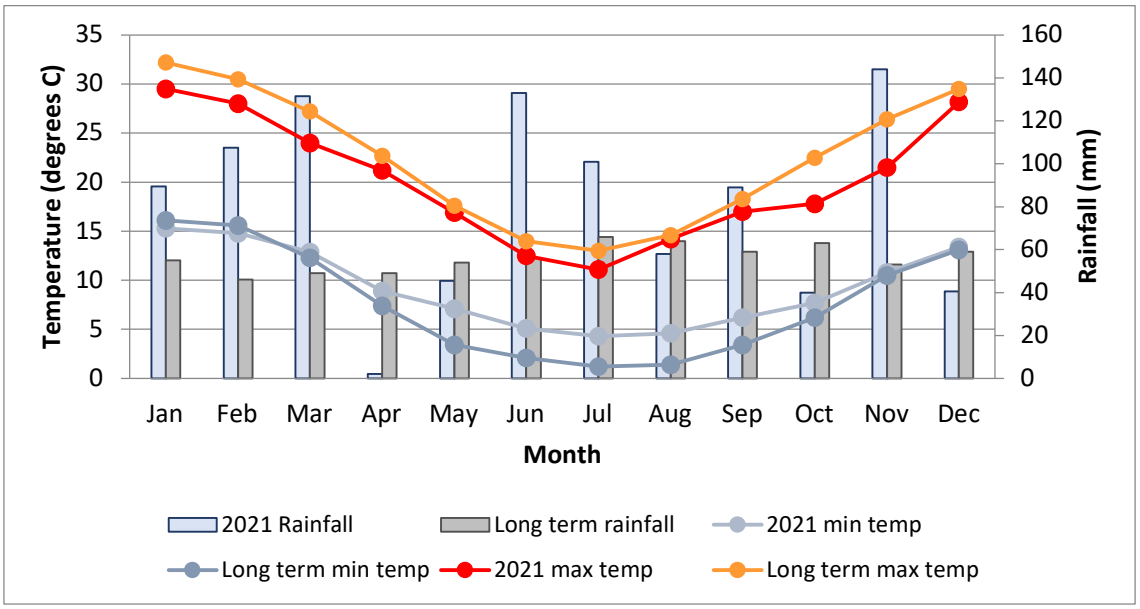


Figure 1. Monthly climate data from NSW Crop Technology Centre.

Soil Test

Table 1. Soil test result from NSW Crop Technology Centre. Sampled 29 July 2021.

Analyte	Unit	0-10m	10-30cm	30-60cm
pH ($CaCl_2$)		5.3		
Electrical Conductivity (Sat. Ext.)	dS/m	0.5		
Organic Carbon (W&B)	%	1.9		
Nitrate	mg/kg	2.2	4.0	10.0
Ammonium	mg/kg	1.5	0.9	0.7
Phosphorus (Colwell)	mg/kg	62		
Phosphorus Buffer Index		77		
Potassium	mg/kg	690		
Cation Exchange Capacity	cmol(+)/kg	9.3		
Aluminium	%	<0.1		
Calcium	%	72.0		
Magnesium	%	9.0		
Sodium	%	0.42		
Potassium	%	19.00		
Calcium: Magnesium	%	8		
Zinc (DTPA)	mg/kg	0.89		
Copper (DTPA)	mg/kg	2.30		
Iron (DTPA)	mg/kg	52.0		
Manganese (DTPA)	mg/kg	170.0		
Boron (Hot $CaCl_2$)	mg/kg	1.1		

2021 Tasmania Crop Technology Centre
Hagley, Tasmania

Time of Sowing – 29th April 2021

Unless otherwise stated the following details apply to the results presented in this section. For other details please go to the appendix.

Sown: 29 April 2021
Harvested: 20 January 2022 – 4 February 2022
Rotation position: 1st cereal following Poppies
Soil Type: Chromosol

Trial 1: HYC 1st Stage Screen

Objectives: To examine the phenology, disease resistance and standing power of new wheat germplasm established in the traditional late April sowing window.

Key Messages:

- Using RGT Accroc and Trojan (not coloured) as controls and comparisons to Trial 2 cultivars of interest were LPB16-0598 (which has potential quality) but was stiff strawed and moderately affected by Septoria tritici blotch (STB).
- Big Red and its sister AGF lines also looked interesting, particularly AGFWH004618 (see trial 2), however Big Red was probably still the pick of the four.
- AGTW005 has looked interesting for the second year with intermediate maturity, good standing power and good resistance to STB.
- The more northern European wheat cultivars Reflection, Graham, Savello, Shabras displayed much later maturity than the cultivars of greater interest Big Red, RGT Cesario and RGT Accroc.
- Rockstar was slower through stem elongation and slightly later to develop than Scepter, stiff strawed with intermediate disease resistance.
- Looking at lodging and straw stiffness Manning was the weakest strawed variety tested.

Treatments: 38 varieties and lines were sown in small plots (5m in length) with standard nitrogen management but **NO FUNGICIDE or PGR input** to this trial. **Plots were not taken to yield.**

Table 1. Phenology evaluation, Zadoks growth stage recorded at key points in the season (Zadoks GS00-99) – lighter background denotes slower development relative to calendar date.

Variety	18 Aug	30 Sep	21 Oct	22 Dec
	Z GS	Z GS	Z GS	Maturity
Scepter	31.0	49.0	61.0	9.0
Trojan	31.0	50.0	59.0	9.0
Anapurna	30.0	38.0	59.0	5.5
RGT Accroc	25.0	37.0	58.0	7.0

Nighthawk	30.5	39.0	57.0	6.5
Reflection	25.0	31.0	55.0	1.5
Graham	25.0	31.0	55.0	3.0
Savello	25.0	31.5	55.0	2.5
Shabras	25.0	32.0	55.0	2.5
LPB17-5691	31.0	40.0	59.0	4.0
LRPB16-0582	27.5	35.0	59.0	4.5
L13070-027	25.0	37.0	59.0	6.5
SFR 86-090 (RGT Cesario)	25.0	37.0	59.0	4.5
V12167-048	31.0	41.0	59.0	10.0
SUN10871	31.0	43.0	59.0	6.5
SF Adagio	25.0	33.0	63.0	3.5
V10006-026	30.0	37.0	65.0	3.5
BX7932-039	30.0	33.0	65.0	3.5
AGTW005	25.0	33.0	57.0	5.5
Coota	30.5	47.0	61.0	9.5
V11068-085-047	30.0	41.0	63.0	6.5
Manning	25.0	32.0	59.0	3.0
AGFWH004418	25.0	33.0	59.0	4.5
AGFWH004618	25.0	39.0	59.0	3.5
AGFWH004718 (Big Red)	25.0	33.0	60.0	5.5
AGFWH004818	25.0	39.0	59.0	3.5
Rockstar	30.5	46.0	63.0	9.0
Catapult	31.0	41.0	63.0	7.5
Genius	25.0	32.0	61.0	2.5
BA26.35	25.0	31.0	61.0	2.0
Oakley	25.0	39.0	62.0	2.5
Xi19	25.0	31.0	55.0	3.0
Apache	25.0	32.5	58.0	2.5
CS170	25.0	32.0	55.0	2.5
Hereford	25.0	39.0	59.0	2.5
JB Asano	25.0	32.0	61.0	2.5
Tabasco	25.0	31.0	59.0	2.5
LPB16-0598	25.0	33.0	61.0	6.5

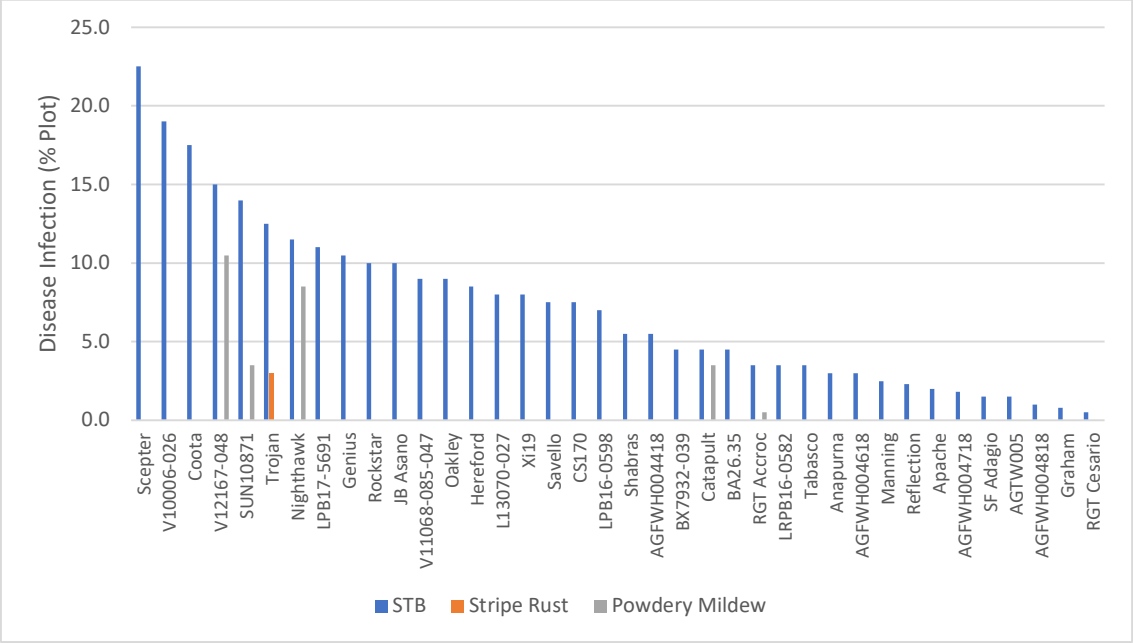


Figure 1. Plot disease scores (% Plot infected) for Septoria tritici blotch (STB), stripe rust and powdery mildew (GS31-51).

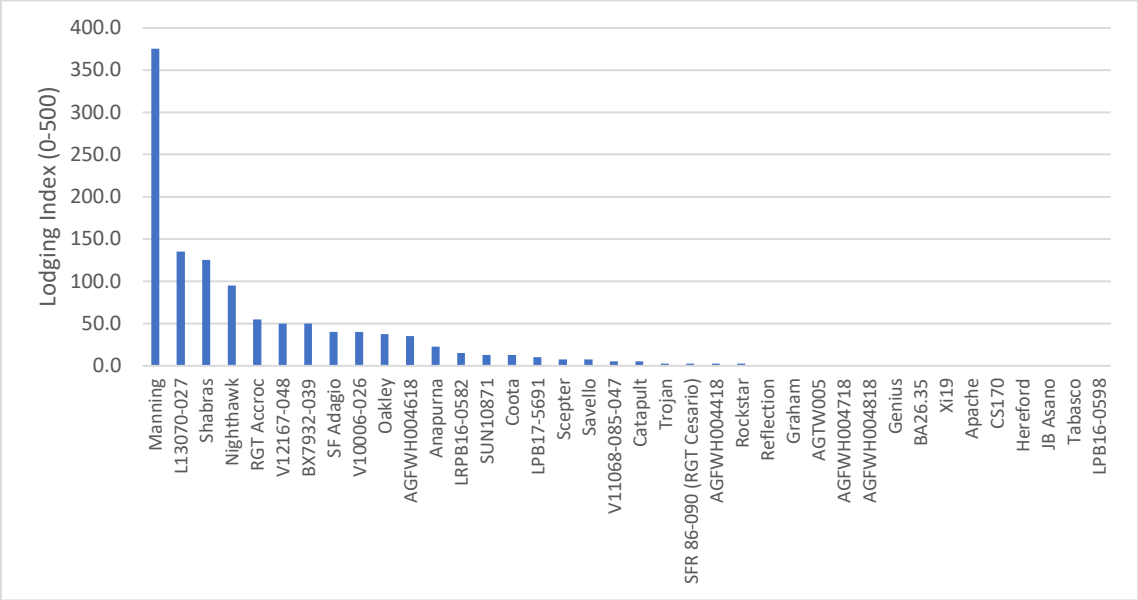


Figure 2. Lodging index (0-500) of screening varieties at crop maturity (GS90).

Table 2. Details of the management levels (kg, g, ml/ha).

Sowing date:		**29 April**
Seed Rate:		180 seeds/m2
Sowing Fertiliser:		100kg MAP
Seed Treatment:		Vibrance & Goucho
Grazing:		Nil

Nitrogen:	10 Aug	46kg N/ha
	1 Oct	160kg N/ha
PGR:		Nil
Fungicide:		Nil

Trial 2: HYC Elite Screen

Objectives: To examine the yield potential of winter and spring germplasm (cultivars/lines) grown under a HYC high input management package against spring and winter controls in the traditional late April (ANZAC day) sowing window.

Key Messages:

- RGT Accroc (13.4t/ha) continues to be the high yielding feed wheat to beat being statistically higher yielding than all other wheats except Beaufort (spring feed), GS-18-105-W, AGFWH004618 and Big Red.
- Amongst white wheats with potential quality LPB16-0598 is the standout cultivar going forward. Rockstar did not feature at this HYC location but was in Trial 1 for the first year and will feature in HYC Elite trials in 2022.
- SFR86-085 is the other variety worthy of note as a high yielding winter white wheat which progressed from HYC 1st stage screening last season to the Elite Screen in 2022. It has good disease resistance and standing power (see 2020 HYC wheat).

Treatments: (20 elite lines tested under HYC High input management (full foliar fungicide program (3 foliar fungicides – GS31, GS39 & GS61 following Systiva seed treatment) and PGR management – split application Moddus 0.1 + Cycocel 0.65 – (GS30 & GS32).

Table 1. Yield (t/ha), % Site Mean and grain quality, protein (%), test weight (kg/HL) & screenings (%).

	Yield			Quality							
	Yield (t/ha)		% of Mean	Protein (%)		Test Weight (kg/hl)		Screenings (%)	
Scepter	6.87	g	59.1	14.9	a	79.7	bcd	0.6	de
Trojan	7.27	g	62.5	14.8	a	77.0	efg	0.6	cde
Anapurna	12.62	b-e	108.5	12.7	bc	80.1	abc	0.8	cde
RGT Accroc	13.40	a	115.2	11.3	ef	77.4	ef	0.5	e
Catapult	7.48	g	64.3	14.7	a	79.1	d	0.7	cde
Reflection	12.37	de	106.4	10.6	f	76.1	gh	2.0	a
Beaufort	12.92	a-d	111.1	12.8	bc	74.6	i	1.6	b
Shabras	12.61	b-e	108.4	10.6	f	75.4	hi	1.3	b
Tabasco	12.50	cde	107.5	10.9	f	74.5	i	1.5	b
SF Adagio	12.42	de	106.8	12.1	b-e	77.4	ef	0.8	cd
Nighthawk	10.35	f	89.0	13.1	b	79.3	cd	0.6	cde
LPB16-0598	12.28	de	105.6	10.9	f	80.7	a	0.9	c
LRPB16-0582	10.90	f	93.7	12.5	bcd	77.8	e	0.7	cde
SFR86-092	11.99	e	103.1	12.7	bc	80.0	a-d	0.8	cde
SFR86-085	12.54	b-e	107.8	11.5	def	79.1	cd	0.8	cde
GS-18-105-W	12.74	a-d	109.5	10.5	f	80.6	ab	0.8	cde

AGFWH004418	12.47	cde	107.2	12.0	cde	79.1	d	0.9	cd
AGFWH004618	13.09	abc	112.6	12.2	b-e	76.7	fg	0.9	cd
AGFWH004718 (Big Red)	13.20	ab	113.5	11.4	ef	79.6	bcd	0.7	cde
AGFWH004818	12.61	b-e	108.4	11.5	def	78.0	e	0.7	cde
Mean	11.63		100.0	12.2		78.1		0.9	
LSD 0.05	0.67		5.8	1.1		1.0		0.4	
P Val	<0.001		<0.001	<0.001		<0.001		<0.001	
CV	3.5								

Table 2. Details of the management levels.

Sowing date:		**29 April**
Plant population:		180 seeds/m²
Basal Fertiliser:		100 kg/ha MAP
Nitrogen:	**10 Aug**	46kg N/ha
	1 Oct	160kg N/ha
PGR:	**GS30**	Moddus Evo 100ml/ha + Errex 650ml/ha
	GS32	Moddus Evo 100ml/ha + Errex 650ml/ha
Fungicide:	**GS00**	Systiva
	GS31	Opus 500ml/ha
	GS39	Radial 840ml/ha
	GS61	Prosaro 300ml/ha

All inputs of insecticides and herbicides were standard across the trial

Trial 3: HYC Genotype x Environment x Management (G.E.M) Trial Series

Objectives: To assess the performance of winter and spring wheat germplasm managed under three different levels of management (ANZAC 25 April sown).

Key Messages:

- The trial produced the highest yields since 2016 when HYC yields exceeded 16t/ha at the research centre.
- Four varieties yielded in excess of 14.5t/ha with Cesario under high input (five fungicide units, 260 kg N/ha and split PGR) topping the yields with 15.2t/ha. RGT Accroc and Big Red under the same input were slightly lower yielding than 15t/ha.
- The superior disease resistance (primarily STB and leaf rust) exhibited by Big Red and RGT Cesario resulted in superior yields under standard input compared to the more disease susceptible RGT Accroc and Anapurna.
- There was significant interaction between cultivar and management (p=0.039) meaning that cultivars responded differently to the three management levels applied.
- Although it was not always statistically significant mechanical defoliation “grazing” reduced the yield of the winter wheats relative to the standard management input. However with the earlier developing spring wheats there was no difference in performance.
- It should be noted that in part the reduction in yield with the winter wheats might have been partially offset by adding more nitrogen post grazing.
- Both Scepter and Trojan gave significant yield increases in response to higher input, principally associated with additional fungicide.

- Grain protein levels indicated that levels of N fertiliser applied did not need to be increased from 200 to 260kg N/ha as only Tabasco had a protein level below 10.3%.
- Influence of fungicide input was most evident in Trojan, particularly with regard to test weight.

Treatments: Three management levels (see Table 2) differing in defoliation, nitrogen, fungicide and PGR input were applied to 10 varieties of winter and spring wheat.

Table 1. Influence of management strategy/input on cultivar grain yield (t/ha).

	Management Level						
	Standard Input Management		**Grazed Standard Management**		**High Input Management**		**Mean**
Cultivar	**Yield t/ha**		**Yield t/ha**		**Yield t/ha**		**Yield t/ha**
Big Red (Winter)	14.00	bcd	13.20	def	14.80	ab	**14.00**
Anapurna (Winter)	13.00	ef	12.00	g	14.50	ab	**13.20**
RGT Accroc (Winter)	13.30	c-f	12.50	fg	14.90	ab	**13.60**
Tabasco (Winter)	12.70	efg	12.00	g	12.50	fg	**12.40**
RGT Cesario (Winter)	14.30	abc	13.50	cde	15.20	a	**14.30**
Scepter (Spring)	5.40	k	5.30	k	8.80	i	**6.50**
Trojan (Spring)	6.70	j	7.00	j	10.60	h	**8.10**
Mean	**11.30**	**b**	**10.80**	**b**	**13.00**	**a**	**11.72**
LSD Cultivar p = 0.05			0.30t/ha		P val		<0.001
LSD Management p=0.05			0.20t/ha		P val		<0.001
LSD Cultivar x Man. P=0.05			0.60t/ha		P val		0.039

Table 2. Influence of treatment on grain quality - protein (%), test weight (kg/hL) and screenings (%).

Variety	**Mgmt. Level**	**Protein**		**Test Weight**		**Screenings**	
		%		**Kg/hl**		**%**	
Big Red	**Standard**	11.3	hij	77.9	abc	1.7	e-h
Anapurna	**Standard**	12.3	g	76.5	bcd	2.6	cd
RGT Accroc	**Standard**	10.8	jk	74.1	d-g	1.9	d-g
Tabasco	**Standard**	10.3	kl	72.6	gh	4.0	a
RGT Cesario	**Standard**	11.9	gh	76.5	bcd	1.3	gh
Scepter	**Standard**	15.4	ab	70.5	hi	1.9	d-g
Trojan	**Standard**	14.4	cd	69.6	i	2.4	cde
Mean		**12.3**	**a**	**74.0**	**b**	**2.2**	**-**
Big Red	**Grazed**	10.8	jk	78.3	ab	1.4	fgh
Anapurna	**Grazed**	11.4	hi	77.4	abc	2.8	bc
RGT Accroc	**Grazed**	10.8	jk	75.6	b-f	1.4	fgh
Tabasco	**Grazed**	10.2	l	72.8	e-h	3.1	bc
RGT Cesario	**Grazed**	10.9	ij	76.9	bcd	1.1	h

Scepter	**Grazed**	15.7	a	71.2	hi	1.3	fgh
Trojan	**Grazed**	13.9	de	72.7	fgh	1.7	e-h
Mean		**12.0**	**b**	**75.0**	**ab**	**1.8**	**-**
Big Red	**High**	11.5	hi	79.9	a	2.0	d-g
Anapurna	**High**	12.9	f	77.7	abc	2.1	def
RGT Accroc	**High**	11.7	gh	75.7	b-e	1.4	fgh
Tabasco	**High**	11.4	hi	73.4	e-h	3.5	ab
RGT Cesario	**High**	11.9	gh	78.0	abc	1.1	h
Scepter	**High**	14.8	bc	75.4	c-g	1.5	fgh
Trojan	**High**	13.5	ef	76.7	bcd	1.3	gh
Mean		**12.5**	**a**	**76.7**	**a**	**1.8**	**-**
Grand Mean		**12.3**		**75.2**		**2.0**	
LSD Cultivar p = 0.05		0.3		1.7		0.4	
LSD Management p=0.05		0.3		1.7		ns	
LSD Cultivar x Man. P=0.05		0.6		2.9		0.8	
P val Cultivar		<0.001		<0.001		<0.001	
P val Management		0.017		0.023		0.561	
P val Cultivar x Man.		<0.001		0.151		0.364	

Table 3. Details of the management levels (kg, g, ml/ha).

Sowing Date:		**29-April**		
Plant pop'n:		180 seeds/m^2		
Seed Treatment:		100kg/ha MAP (10 kg N/ha included in total N below)		
Basal Fertiliser:		Vibrance & Gaucho		
		Standard	**"Grazed" GS30**	**High**
Grazing	GS30	---	✓	---
Nitrogen (N):	GS26	40 N kg/ha	40 N kg/ha	50 N kg/ha + 12 S kg/ha
	GS30-31	80 N kg/ha	80 N kg/ha	100 N kg/ha
	GS33	80 N kg/ha	80 N kg/ha	100 N kg/ha
Total N:		**210 N kg/ha**	**210 N kg/ha**	**260 N kg/ha**
PGR:	GS30	---	---	Moddus Evo 100mL/ha & Errex 650ml/ha
	GS32	---	---	Moddus Evo 100mL/ha & Errex 650ml/ha
Fungicide:	GS00	---	---	Systiva & Flutriafol
	GS31	Opus 500ml/ha	Opus 500ml/ha	Prosaro 300ml/ha
	GS39	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha
	GS59-61	---	---	Opus 500ml/ha

All other inputs of insecticides and herbicides were standard across the trial.

**Timings of fungicides and PGRs were adjusted to take account of the differences in spring and winter wheat phenology (development). Mechanical defoliation representing grazing was conducted at GS30.*

Trial 4: HYC Disease Management Germplasm Interaction

Objectives: To develop profitable and sustainable approaches to disease management in HRZ wheat.

Individual objectives specific to the trial were:

- Monitor the effectiveness of flutriafol in furrow for early disease control in wheat.
- To evaluate whether newer germplasm or new fungicide chemistry allows a reduction in the number of fungicide applications whilst increasing profitability (note: reducing the number of fungicides is seen as a key measure for slowing down resistance development in cropping systems).
- Examine whether there is germplasm (varieties tested) that has sufficient early season disease resistance to replace the need for the Timing 1 (T1) spray applied at GS31-32.
- To determine the cost benefit ratio of fungicide application in HRZ regions of different season lengths.

Key Messages:

- Yields of 14t/ha and above were achieved with three varieties of wheat - Big Red, RGT Cesario and RGT Accroc with untreated plots of RGT Cesario and Big Red yielding 13.52 and 13.68t/ha.
- Although the untreated crops of RGT Cesario and Big Red were lower yielding than treated plots there was no statistically significant yield response to fungicides in these varieties with a maximum 0.5t/ha response in Cesario and 0.7t/ha response in Big Red.
- These responses to fungicides compared to the more susceptible RGT Accroc giving a maximum of 3t/ha to fungicide, intermediate susceptibility of Anapurna giving a maximum of 2.57t/ha.
- These larger responses to fungicides were the result of higher infection levels of Septoria tritici blotch (STB) and late leaf rust infection which were far less significant in Cesario and Big Red.
- The response to four units of fungicide in Revenue, the most susceptible cultivar for both STB and leaf rust was almost 4t/ha and the yield penalty for dropping to 2 units of fungicide was a minimum of 0.7t/ha.
- With RGT Cesario the yield increase associated with moving from a single flag spray to 4 units of fungicide was only 0.22t/ha (not significant) valued at $66/ha at $300/t, which was approximately the cost of the extra fungicide units (seed treatment and two foliars) and their application.
- With Big Red two units of fungicides (IDM 2-unit approach – GS31 and GS39) gave a 0.28t/ha advantage (not significant) over one spray at flag leaf (GS39).
- Where leaf rust was more severe than early STB the 2-spray straddle approach of a later first and second spray (GS33 & GS55-59) were more successful than the 2 spray IDM approach which had earlier spray timings GS31 and GS39.

i) Standard plots

Treatments: Five levels of fungicide management applied across 8 varieties
Five levels of fungicide input were applied to eight cultivars based on five timings: at sowing (seed treatment SDHI Systiva based on fluxapyroxad, GS31, GS33, GS39, GS59.
1 unit of fungicide was applied at GS39 – flag leaf fully emerged on the main stem.
2 units IDM (Integrated Disease Management) was applied at GS31 and GS39 – 1st node and flag leaf.
4 units were applied at sowing (Systiva s.t.) and GS31, GS39 and GS59 – head emergence.
2 units Straddle applied at GS33 (third node) and GS55-59 (head 50-100% emerged).

Products applied are presented in Table 3. Disease levels were primarily Septoria tritici blotch (STB), leaf rust, stripe rust was also present in Trojan and Tabasco. Stripe rust in Tabasco has never been observed in Tasmania since it was first tested in 2016 at the Hyper Yielding Crops research centre.

Table 1. Influence of management strategy and variety on grain yield (t/ha) – SAGI Predicted yield analysis with Standard Error (SE).

	Management Level					
	Untreated	**1 Fungicide Unit**	**4 Fungicide Units**	**2 units IDM approach**	**2 units Straddle approach**	**Mean**
Cultivar	Yield t/ha	Yield t/ha	Yield t/ha	Yield t/ha	Yield t/ha	**Yield t/ha**
Trojan (s)	**3.86**	**4.94**	**6.20**	**4.90**	**6.51**	**5.28**
Scepter (s)	**6.14**	**5.78**	**6.10**	**5.77**	**5.85**	**5.93**
Big Red (w)	**13.68**	**14.10**	**13.96**	**14.38**	**14.30**	**14.08**
RGT Cesario (w)	**13.52**	**13.80**	**14.02**	**13.76**	**13.52**	**13.72**
Anapurna (w)	**11.02**	**12.24**	**13.59**	**12.79**	**12.86**	**12.50**
RGT Accroc (w)	**11.41**	**13.07**	**14.41**	**12.94**	**13.81**	**13.13**
Revenue (w)	**8.52**	**10.18**	**12.44**	**11.20**	**11.71**	**10.81**
Tabasco (w)	**11.13**	**13.41**	**12.96**	**12.98**	**13.03**	**12.70**
Mean	**9.91**	**10.94**	**11.71**	**11.09**	**11.45**	
LSD Cultivar x Fung. P=0.05		0.98t/ha (all wheats)			P val 0.	

ii) Integrated Disease Management (IDM)/inoculated plots

Part of the same trial series described above was expanded to look at four cultivars and four fungicide management treatments and three starting "Disease Pressures". The starting point "Disease Pressures" for the treatments were as follows:

1. Flutriafol applied to the MAP fertiliser – 100g/ha ai 400ml/ha
2. Standard – untreated (cultivated poppy stubble)
3. Inoculated with infected wheat stubble – 1.5 kg/plot

Treatments: On top of these three starting points were four levels of fungicide management applied across four varieties with varying resistance to STB. These cultivars were:

1. RGT Cesario – winter wheat (STB R-MR rating)
2. Anapurna – winter wheat (MR-MS)
3. RGT Accroc – winter wheat (MS)
4. Revenue – winter wheat (S)

Four levels of fungicide input were applied to these four cultivars based on four timings: at sowing (seed treatment SDHI Systiva based on fluxapyroxad, GS31, GS39 and GS59 as described.
1 unit of fungicide was applied at GS39 – flag leaf fully emerged on the main stem.
2 units IDM (Integrated Disease Management) were applied at GS31 and GS39 – 1st node and flag leaf.
4 units were applied at sowing (Systiva s.t.) and GS31, GS39 and GS59 – head emergence.

Key Messages:

- Increasing disease pressure (principally STB) using infected wheat straw reduced the yield of the most susceptible cultivars and invariably increased the yield response to full fungicide protection, although this increase was not statistically significant.
- Applying flutriafol in furrow before other treatments were applied significantly reduced disease pressure in more susceptible cultivars and had the greatest impact on yield with Revenue and RGT Cesario.
- However, with Anapurna and RGT Accroc, provided that at least one foliar fungicide was applied, there was little value in flutriafol in furrow upfront.
- The value of genetic resistance to STB and leaf rust was evident in the maximum responses to fungicide which when infected stubble was present was 4.11t/ha with Revenue (S), 3.42t/ha RGT Accroc (MS), 2.89t/ha Anapurna (MR/MS) and 0.57t/ha with RGT Cesario (R-MR) which was the most resistant of the cultivars.
- Flutriafol application in furrow reduces the overall response to subsequent fungicide programmes, but not sufficiently to affect the overall level of foliar fungicide input required.

Table 2. Influence of management strategy and variety on grain yield (t/ha).

		Management Level								
		Untreated		**1 Fungicide Unit**		**4 Fungicide Units**		**IDM approach**		**Mean**
Disease pressure	**Cultivar**	Yield t/ha		Yield	t/ha	Yield t/ha		Yield t/ha		**Yield**
Flutriafol	RGT Cesario	**13.93**	0.36	**14.25**	0.36	**14.50**	0.36	**14.41**	0.36	**14.27**
	Anapurna	**11.20**	0.36	**12.12**	0.36	**13.31**	0.36	**12.58**	0.36	**12.27**
	RGT Accroc	**11.44**	0.36	**12.76**	0.36	**14.30**	0.37	**12.85**	0.36	**12.82**
	Revenue	**9.37**	0.36	**10.64**	0.36	**12.76**	0.36	**11.55**	0.36	**10.99**
	Mean	**11.49**		**12.44**		**13.72**		**12.85**		
Standard	RGT Cesario	**13.52**	0.38	**13.80**	0.37	**14.02**	0.37	**13.76**	0.37	**13.78**
	Anapurna	**11.02**	0.37	**12.24**	0.37	**13.59**	0.37	**12.79**	0.38	**12.41**
	RGT Accroc	**11.41**	0.37	**13.07**	0.38	**14.41**	0.39	**12.94**	0.37	**12.96**
	Revenue	**8.52**	0.37	**10.18**	0.37	**12.44**	0.37	**11.20**	0.37	**10.59**
	Mean	**11.12**		**12.32**		**13.62**		**12.67**		
Stubble	RGT Cesario	**13.17**	0.37	**13.35**	0.38	**13.74**	0.37	**13.82**	0.37	**13.52**
	Anapurna	**9.96**	0.38	**11.36**	0.38	**12.85**	0.37	**12.42**	0.37	**11.65**
	RGT Accroc	**10.46**	0.36	**12.54**	0.37	**13.88**	0.37	**12.71**	0.37	**12.40**
	Revenue	**7.67**	0.37	**9.59**	0.36	**11.78**	0.37	**10.46**	0.37	**9.88**
	Mean	**10.32**		**11.71**		**13.06**		**12.35**		

LSD Disease pressure p=0.05	0.5t/ha	**P val**	<0.001
LSD Dis. press. x cultivar p=0.05	0.88t/ha	**P val**	<0.001
LSD Dis. press.x fung. p=0.05	0.52t/ha	**P val**	<0.001
LSD Cultivar x fung. P=0.05	0.60t/ha	**P val**	<0.001

LSD Dis. press.x cultivar x fung. p=0.05	ns	**P val**	0.995

Table 3. Details of the management levels (kg, g, ml/ha).

Sowing date:		**29 April**				
Seed Rate:		180 Seeds/m2				
Sowing Fertiliser:		100kg MAP				
Seed Treatment:		Vibrance & Goucho				
Grazing:		Nil				
Nitrogen:	10 Aug	46kg N/ha				
	1 Oct	160kg N/ha				
PGR:	GS30	Moddus Evo 100ml/ha + Errex 650ml/ha				
	GS32	Moddus Evo 100ml/ha + Errex 650ml/ha				
		Untreated	**1 Fungicide Unit**	**4 Fungicide Units**	**IDM approach**	**Straddle approach**
Fungicide:	GS00	---	---	Systiva	---	---
	GS31	---	---	Prosaro 300ml/ha	Prosaro 300ml/ha	---
	GS33	---	---	---	---	FAR F1-19 750ml/ha
	GS39	---	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha	---
	GS55	---	---	---	---	Opus 500ml/ha
	GS59-61	---	---	Opus 500ml/ha	---	---

Trial 5: Nutrition for Hyper Yielding Wheat

Objectives: To assess the value of higher nutrition input (N, P, K & S) for wheat in the growing season and as an "N bank" for the following season.

Individual objectives specific to the trials were:

- To assess the value of additional nutrients in the growing crop (set up as small plots at the HYC Research sites) and for the following crop (mirror image trial set up in the host farmer's surrounding paddock).
- To assess the value of adding increased P, K, and S when targeting higher yield potential rather than N alone.

Key Messages:

- There was a significant response to N application in the trial with a 2.41t/ha yield increase associated with a 200kg N/ha application applied in three splits.
- 200kg N/ha produced a crop canopy of 23t/ha dry matter
- There was no significant increase in yield over and above 200N or from the application of additional P and S, although grain protein continued to increase up to 291N the highest rate of nitrogen fertiliser applied.

- The unfertilised crop (100 MAP only at sowing) resulted in a 9.37t/ha crop and 8.9% grain protein.
- Based on the N concentration in the grain the N offtake in the grain alone was approximately 146kg N/ha. If 25% of the N typically resides in the straw and chaff at harvest, then crop uptake in the unfertilised plot was approximately 195kg N/ha.
- On this basis of soil N available in May (103N) and 10N from the MAP it would indicate 82kg N/ha from mineralisation.
- Increasing grain protein did not increase crop canopy size beyond 23.8t/ha dry matter at harvest. Application of 291N produced significantly lower yields than 204N and 252N applied.
- Although grain protein increased with higher N fertiliser input screenings gradually increased with test weight and thousand seed weight showing a decreasing trend.

Treatments: Five different nutrition strategies were put in place in RGT Accroc that differed in the level of nutrition (N, P & S). The same trial was set up in the surrounding farm crop. The starting mineral nitrogen (N) available in the soil was 130.9kg N/ha (0-60cm) taken on 21 May.

Table 1. Detailed treatment list, grain yield (t/ha) & % site Mean.

Trt.		Nitrogen rate	Potassium rate	Sulphur rate	Yield		Mean
		kg N/ha	kg K/ha	kg S/ha	(t/ha)		(%)
1	Untreated	10.0 (MAP)	---	---	9.37	c	85.3
2	Current Practice	204.0	---	---	11.78	a	107.3
3	Current Practice +25%N	252.5	---	---	11.45	a	104.2
4	Current Practice +50% NPKS	252.5	41.6	17.2	11.52	a	104.9
5	Current Practice +50%N	291.0	---	---	10.80	b	98.3
				Mean	10.98		100.0
				LSD (p=0.05)	0.63		5.8
				P Val	<0.001		<0.001

Note: All treatments received 100kg/ha MAP (10N: 22P) which is included in the treatment details

Table 2. Influence of nitrogen rate on grain quality, protein (%), test weight (kg/HL) and screenings (%).

	Nitrogen rate	Phosphorus rate	Sulphur rate	Protein		Test weight		Screenings	
Trt.	**kg N/ha**	**kg P/ha**	**kg S/ha**	**(%)**		**(kg/HL)**		**(%)**	
1	10.0	---	---	8.9	d	75.7	-	3.1	b
2	204.0	---	---	11.4	c	74.4	-	4.1	ab
3	252.5	---	---	11.8	bc	75.0	-	4.2	ab
4	252.5	41.6	17.2	12.6	ab	72.2	-	4.3	ab
5	291.0	---	---	12.7	a	70.4	-	5.2	a
			Mean	11.5		73.5		4.2	
			LSD (p=0.05)	0.9		ns		1.2	
			P Val	<0.001		0.172		0.041	

Table 3. Influence of nitrogen rate on harvest dry matter (t/ha), head (m^2).

	Nitrogen rate	Phosphorus rate	Sulphur rate	Harvest Dry Matter	Harvest Index	TSW
Trt.	**kg N/ha**	**kg P/ha**	**kg S/ha**	**(t/ha)**	**%**	**g**
1	10.0	---	---	18.2 b	45.6 -	50.6 a
2	204.0	---	---	23.8 a	44.2 -	42.2 b
3	252.5	---	---	23.6 a	42.9 -	40.9 b
4	252.5	41.6	17.2	23.2 a	43.6 -	40.8 b
5	291.0	---	---	23.6 a	40.8 -	38.7 b
			Mean	22.5	43.4	42.6
			LSD (p=0.05)	2.4	ns	5.2
			P Val	0.001	0.443	0.003

Table 4. Site soil test details.

	Level Found
ECEC	0.12 dS/m
Organic Carbon W&B	2.24%
pH 1:5 water	6.57pH
Total Mineral N*	130.9kg soil mineral N/ha
Colwell Phosphorus	210.2 ppm
Colwell Potassium	281.3 ppm
KCl Sulfur	11.9 ppm

*Mineral N 0-60cm, all other results 0-10cm depth sampled 11/6/2020

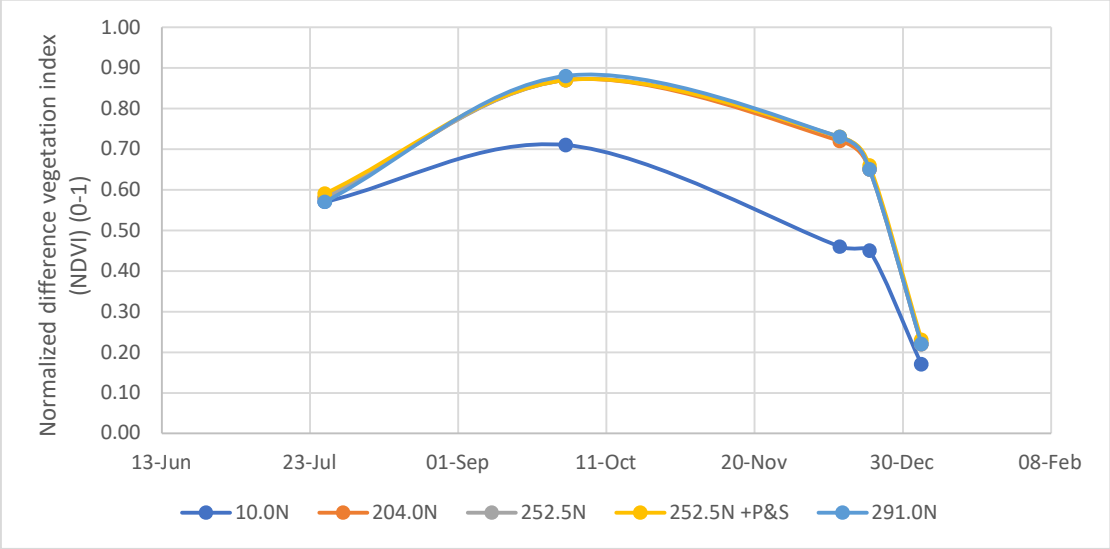


Figure 1. Normalised difference vegetation index (NDVI) (0-1) of RGT Relay nitrogen rates showing the strong visual differences observed in season between treated and untreated plots.

Table 5. Details of the management levels (kg, g, ml/ha).

Sowing date:		**29 April**
Seed Rate:		180 seeds/m2
Sowing Fertiliser:		100kg MAP
Seed Treatment:		Vibrance & Goucho

Grazing:		Nil
Nitrogen:		As per treatment list
PGR:	GS30	Moddus Evo 100ml/ha + Errex 650ml/ha
	GS32	Moddus Evo 100ml/ha + Errex 650ml/ha
Fungicide:	GS31	Opus 500ml/ha
	GS39	Radial 840ml/ha
	GS61	Prosaro 300ml/ha

Trial 6: Erect Head Control in April Sown Wheat

Objectives:
To assess the principal causes of erect heads in April sown wheat crops
Individual objectives specific to the trial were:

- To determine the value of Barley Yellow Dwarf Virus (BYDV) tolerance in HRZ wheat crops using a tolerant (cv Manning) and a non-tolerant (cv Revenue) cultivar.
- To assess the connection between erect heads and stem base disease complex e.g. crown rot, eyespot, sharp eyespot in the presence of different stem base fungicide applications.

Key Messages:

- *No BYDV was observed in the trial and as a result there were no significant yield differences due to BYDV control recorded in either Manning (tolerant) or Revenue (non BYDV tolerant) cultivars.*
- *Omitting the GS31 fungicide however (treatment 7 & 8) had a significant impact on grain yield with both Manning (minus 2.13t/ha) and Revenue (minus 2.34t/ha).*
- *Adding azoxystrobin to the first fungicide application at GS31 over and above the experimental fungicide increased yield with Manning but not with Revenue.*
- *The additional application of Dominex Duo along with the experimental fungicide (as opposed to Opus 250mL/ha) at GS31 significantly increased the yield of the non BYDV tolerant cultivar Revenue but the yield of Manning was unaffected.*
- *The "Revenue BYDV tolerant bred line" with no insecticide input was the highest yielding treatment of Revenue and not significantly different from the best Manning treatment that received azoxystrobin at GS31.*

Treatments:
Six different treatments applying four different levels of insecticide input for aphid (BYDV) control were applied to a tolerant (cv Manning) and a non-tolerant variety (cv Revenue). Two additional experimental treatments were applied that examined the value of an experimental fungicide applied at GS31, applied with and without the strobilurin azoxystrobin. Please note these treatments were applied to examine stem base disease control in this trial and are not commercially available treatments.

Table 1. Detailed treatment list of products (ml/ha, L/ha) and timings.

Trt	Cultivar	GS00	GS21	GS31
1	Revenue	---	---	---
2	Manning	---	---	---
3	Revenue	Pontiac	---	---
4	Manning	Pontiac	---	---
5	Revenue	Pontiac	Karate Zeon	---
6	Manning	Pontiac	Karate Zeon	---
7	Revenue	Pontiac	Karate Zeon	Dominex Duo (No GS31 fungicide)
8	Manning	Pontiac	Karate Zeon	Dominex Duo (No GS31 fungicide)
9	Revenue	Pontiac	Karate Zeon	Dominex Duo with Exp. Fungicide
10	Manning	Pontiac	Karate Zeon	Dominex Duo with Exp. Fungicide
11	Revenue	Pontiac	Karate Zeon	Dominex Duo, Exp. Fungicide + Azoxystrobin
12	Manning	Pontiac	Karate Zeon	Dominex Duo, Exp. Fungicide + Azoxystrobin
13	*BYDV Tolerant Revenue*	---	---	---
14	Revenue	Pontiac	---	---

Applications of Karate Zeon at 18ml/ha and Dominex Due at 125ml/ha were applied experimentally to exclude aphids and prevent BYDV in this trial, experimental fungicide applied at 2L/ha and Azoxystrobin applied at 62.5g ai/ha.
Treatment 1-6 had a GS31 fungicide based on 250mL/ha epoxiconazole

Table 2. Grain yield (t/ha), % site mean, protein (%), test weight (kg/hl) and screenings (%).

		Grain Yield		Grain Quality		
Trt	**Variety**	**Yield**	**Site Mean**	**Protein**	**Test wt**	**Screenings**
		(t/ha)	**(%)**	**(%)**	**(kg/HL)**	**(%)**
1	Revenue	9.60 ef	90.5	11.1 -	74.8 bc	3.6 -
2	Manning	11.48 abc	108.2	10.3 -	76.4 ab	2.7 -
3	Revenue	9.87 e	93.1	11.1 -	75.3 abc	3.6 -
4	Manning	10.80 cd	101.9	10.0 -	76.3 ab	3.4 -
5	Revenue	10.10 de	95.2	11.2 -	74.6 bc	3.6 -
6	Manning	10.98 c	103.5	10.5 -	76.3 ab	2.8 -
7	Revenue	8.88 f	83.8	11.0 -	74.0 c	4.2 -
8	Manning	10.03 e	94.6	10.2 -	75.7 abc	3.3 -
9	Revenue	11.19 bc	105.6	11.3 -	75.5 abc	3.3 -
10	Manning	10.90 c	102.8	9.8 -	76.4 ab	3.1 -
11	Revenue	11.22 bc	105.8	11.0 -	75.9 abc	3.0 -
12	Manning	12.16 a	114.7	9.9 -	77.1 a	2.8 -
13	*BYDV tolerant Revenue*	11.74 ab	110.7	11.5 -	76.5 ab	3.1 -
14	Revenue	9.51 ef	89.7	11.0 -	71.9 d	4.1 -
Grand mean		**10.60**	**100.0**	**10.7**	**75.5**	**3.3**
LSD Mgmt (p = 0.05)		0.40	3.8	0.4	1.8	0.5
LSD Var (p = 0.05)		0.28	2.6	0.2	ns	ns
LSD Var x Mgmt (p = 0.05)		0.73	6.9	ns	2.0	ns
P Val Mgmt		<0.001	<0.001	0.006	0.180	0.024
P Val Var		0.002	0.002	<0.001	0.166	0.095

P Val Var x Mgmt	<0.001	<0.001	0.320	0.001	0.147
CV	4.7				

Table 3. Details of the management levels (kg, g, ml/ha).

Sowing date:		**25-April**
Seed Rate:		180 seeds/m^2
Sowing Fertiliser:		100kg/ha MAP
Seed Treatment:		As per treatment list
Grazing:		Nil
Nitrogen:	10 Aug	46kg N/ha
	1 Oct	160kg N/ha
PGR:	GS30	Moddus Evo 100ml/ha + Errex 650ml/ha
	GS32	Moddus Evo 100ml/ha + Errex 650ml/ha
Fungicide:	GS31	Trt 1-4 Epoxiconazole 62.5g/ha ai
	GS39	Radial 840ml/ha
	GS61	Prosaro 300ml/ha

Meteorological Data

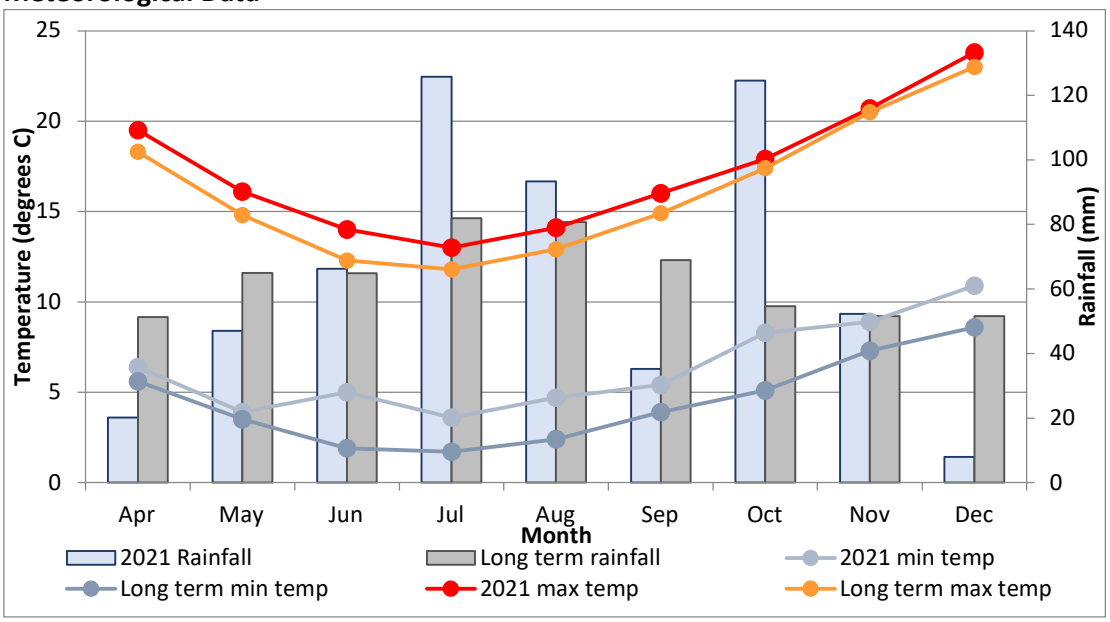


Figure 1. 2021 growing season rainfall and long-term rainfall (1978-2021) (recorded at Westbury (Birralee Road)), 2021 min and max temperatures and long-term min and max temperatures (1980-2021) (recorded at Launceston (Ti Tree Bend)). *Rainfall April to December= 572.6.0mm. Rainfall April*

to December (with supplementary irrigation) = 612.6mm.

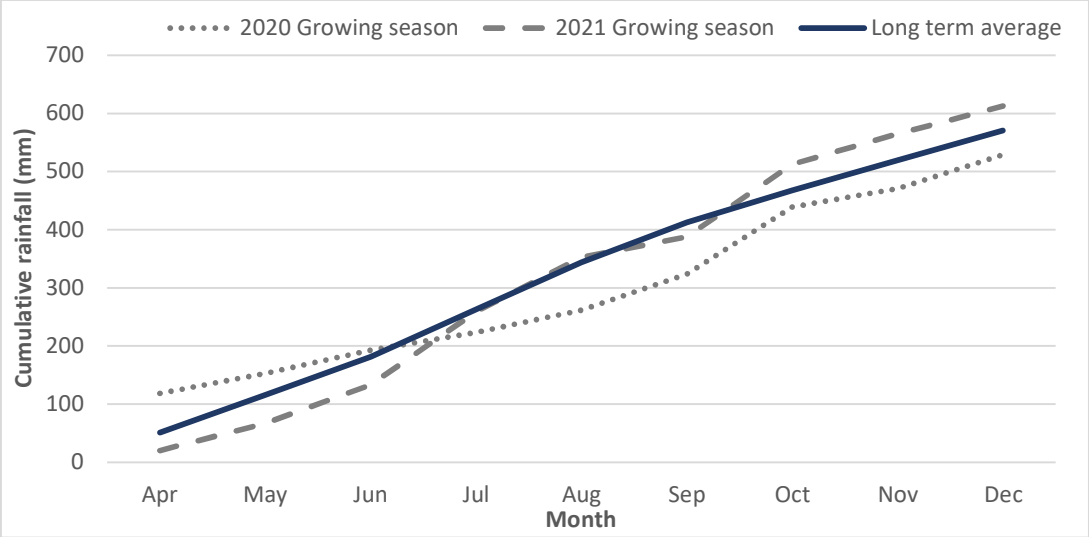


Figure 2. Cumulative growing season rainfall for 2020, 2021 and the long-term average for the growing season.

2021 South Australia Crop Technology Centre
Millicent, SA

Unless otherwise stated the following details apply to the results presented in this section. For other details please go to the appendix.

Sown: 20 - 22 April 2021
Harvested: 11 - 13 January 2022
Rotation position: 1st cereal after faba bean, 2019 canola.
Soil type & management: Neutral-slightly alkaline Organosol (Peat soil) – high organic matter (0-30cm).

Trial 1: HYC 1st Stage Screen (sown 22 April)

Key Messages:

- The following 1st HYC stage screen was amalgamated with the SARDI untreated nursery to evaluate phenology for HYC and disease for NVT in the absence of fungicide protection.
- To give a guide to suitable phenology for this site sown in April, the high yielding feed wheats Anapurna and RGT Accroc give good indications of flowering windows, however it should be noted that RGT Accroc was earlier than normal for the research site this season.
- The European lines Reflection and Tabasco that gave the highest yields on the research site in 2021 (12.74 & 12.5t/ha) are typically too long season for the lower SE environment, however in 2021 the mild conditions during November and December allowed these lines to finish.
- The AGF lines including 4618, 4818 and Big Red were also high yielding and again had phenology similar to Anapurna which has performed strongly over the last four years at SA Crop Technology Centre.

The following HYC screening trial (first 27 cultivars) was established to look for crop phenology similar to those cultivars that have performed well in the mid-April sowing window. Table 1 illustrates the development stage reached on 4 August and 17 October. The trial was left untreated with fungicides and PGRs to allow disease resistance to be assessed as part of the NVT system. The short plots were not taken to yield.

Table 1. Zadoks development stage score on 17 October.

Cultivar/line	4-Aug	17-Oct
Tabasco	24	37
Reflection	24	41
Shabras	24	37
Graham	24	37
Savello	30	41
SUN10871	32	69
V11068-085-047	31	69
L13070-027	31	69

AGFWH004418	30	60
AGFWH004618	30	61
AGFWH004718 (Big Red)	24	61
AGFWH004818	24	60
Anapurna (winter control)	24	61
Catapult	31	69
Coota	32	69
LPB16-0582	31	57
LPB16-0598	31	55
LRPB Nighthawk (facultative control)	31	69
LRPB Trojan (spring control)	33	69
Manning	30	53
RGT Accroc (winter control)	30	67
RockStar	32	77
Scepter (spring control)	33	69
SFR86-071	24	51
SFR86-085	24	49
V12167-048	32	69
SFR86-090	24	60
16Q2H0055		71
16Q2H0125		71
16Q2H0196		69
ADV14.1393		69
Ascot		69
Ballista		69
Beckom		71
Brennan		63
BSWDH04-062		71
BH120020S-11		71
BH130196S-B1		71
BX7932-039		69
Chief CL Plus		69
Cutlass		67
Denison		69
DS Bennett		63
DS Pascal		69
EDGE12W-011-04		69
EDGE16-RWA-07-01		69
EDGE19SA-0178		69
EDGE19WB-4112		71
EDGE-SARWB416		69
EG Jet		69
EG Titanium		69
Elmore CL Plus		69
Grenade CL Plus		69
Hammer CL Plus		71
IGW6483		69
IGW6683		71
IGW6709		69
IGW6752		49
IGW6755		60

IGW6767	69
IGW6783	69
IGW6787	69
IGW6805	71
IGW8139	69
Illabo	69
Longsword	69
LPB14-0012	73
LPB17-6157	73
LPB18-7946	57
LPB18-7982	69
LRPB Beaufort	69
LRPB Kittyhawk	69
Mace	71
RAC2721	71
RGT Calabro	60
RGT Zanzibar	69
SANW70.105	69
SANW70.607	49
Severn	69
Sheriff CL Plus	71
SQP Revenue	59
SUN944O	69
SUN945A	69
Sunflex	69
Sunmaster	69
V12152-023	69
V12152-054	69
Valiant CL Plus	69
LRPB Arrow	71
LRPB Cobra	73
Sunblade CL Plus	69
V09063-47-16	69

Trial 2: HYC Elite Screen (Comparison of 21 April and 12 May sown)

Sown: 21 April & 12 May 2021
Harvested: 11 & 12 January 2022
Rotation position: 2020 Faba Beans
Soil type & Management: Neutral-slightly alkaline Organosol (Peat soil) – high organic matter (0-30cm).

Key Messages:

- For the first time in HYC trials on the mainland, wheat yields exceeded 12t/ha at the SA Crop Technology Centre.
- With a softer finish than 2020, later developing northern European winter wheats fulfilled their yield potential for the first time at the SA research site at the April sowing date, with Reflection and Tabasco yielding over 12.5t/ha along with a coded line AGTW005.

- Despite the HYC higher fungicide input, these two cultivars (Reflection and Tabasco) were noticeably more resistant to leaf rust in the lower Southeast SA environment.
- Of those cultivars that are commercially available in Australia, the winter feed wheat Big Red (AGFWH004718) was the highest cultivar in both 2020 (10.94t/ha) and 2021 (11.45t/ha) in April sown HYC trials.
- Although set up as spatially separate trials on the same research site, the winter feed wheat Anapurna gave higher yields sown on 12 May than on 21 April (11.87t/ha vs 11.30t/ha).
- With second sowing date on 12 May, Rockstar significantly outyielded all other spring milling cultivars, however its overall yield was approximately 2t/ha or 19% lower yielding than the feed wheat Anapurna sown at the same time.
- If Anapurna feed wheat was priced at $275/t then Rockstar would have required a $57/t premium to achieve the same margin using the yield differentials in the trial.
- With the earlier sowing where Big Red achieved 11.45t/ha, the premium necessary to match the output would have dropped to $45/t (assuming quality could have been achieved with the milling wheat).
- Protein levels (11% plus in most varieties) and test weights would indicate that optimum yields were generated with the level of nitrogen applied (120kg N/ha).

Background

With less emphasis on breeding for the long season HRZ environments, the Hyper Yielding Crops (HYC) project has been looking at Australian and overseas candidate cultivars and coded lines to assess their suitability for growing in the lower Southeast of SA. Although yields in the two trials presented are not statistically comparable, they give a comparison of wheat yields achieved at the FAR Australia SA Crop Technology Centre in 2021 from April and May sowing.

i) Early sown wheat trial – 21 April

Treatments

20 elite lines (as suggested by breeders or overseas breeder's agents) were tested under HYC full fungicide management (Foliar fungicide program based on three foliar fungicides – GS31, GS39 & GS59). All cultivars were sown on an Organosol soil with high organic matter content following faba beans.

Results

Table 1. Influence of cultivar (habit type in parentheses) and coded lines on grain yield and quality (protein (%), test weight (kg/hL) and screenings (%)) – **sown 21 April**, Millicent, SA.

Variety		**Grain Yield and Quality**							
		Yield		Protein		Test wt.		Screenings	
		t/ha		%		Kg/hL		%	
1.	Scepter (spring)	5.38	k	14.3	ab	79.3	def	3.3	gh
2.	Trojan (spring)	6.79	jk	13.1	cde	80.7	bcd	1.8	i
3.	Anapurna (winter)	11.30	abc	13.0	cde	82.1	b	4.8	de
4.	RGT Accroc (winter)	10.89	cde	11.8	hi	82.1	b	3.0	h
5.	BX7932-039	9.70	d-g	13.1	cde	82.3	b	3.2	gh
6.	Reflection (winter)	12.74	a	11.6	hi	76.5	g	8.7	a
7.	Beaufort (spring)	8.49	ghi	13.4	cd	77.6	fg	6.9	b
8.	Shabras (winter)	10.89	cde	12.9	c-f	77.5	fg	6.0	c
9.	Tabasco (winter)	12.56	ab	12.2	fgh	76.5	g	5.7	c

10.	V10006-026	9.29	fgh	12.8	d-g	79.6	cde	4.6	ef
11.	Nighthawk (facultative)	7.78	ij	13.2	cde	82.2	b	3.0	h
12.	LPB16-0598	9.49	e-h	12.9	c-f	80.7	bcd	5.5	cd
13.	LRPB16-0582	8.07	hij	14.4	a	77.5	fg	3.9	fg
14.	SFR86-092	10.96	cd	11.4	i	78.8	ef	7.7	b
15.	SFR86-085	11.53	abc	12.6	efg	80.7	bcd	5.5	cd
16.	AGTW005	12.54	ab	13.5	cd	81.2	bc	1.9	i
17.	AGFWH004418	10.34	c-f	12.2	fgh	80.9	bcd	6.9	b
18.	AGFWH004618	10.64	c-f	13.6	bc	80.0	cde	3.8	g
19.	Big Red (AGFWH004718) (winter)	11.45	abc	11.6	hi	84.2	a	4.7	e
20.	AGFWH004818	11.13	bcd	12.1	ghi	81.2	bcd	5.9	c
	Mean	10.10		12.8		80.1		4.8	
	LSD	1.46		0.7		1.8		0.8	
	P Val	<0.001		<0.001		<0.001		<0.001	
	CV	8.74		3.5		1.4		10.1	

For the first time in HYC trials on the mainland, yields exceeded 12t/ha (Table 1). With a softer finish than 2020, later developing winter wheats fulfilled their yield potential, with the northern European wheats Reflection and Tabasco yielding over 12.5t/ha along with a coded line AGTW005 which also yielded over 12t/ha. These cultivars and lines did well in 2020 but yielded closer to 10t/ha. Reflection and Tabasco produced notable cleaner crop canopies that were free from leaf rust infection that was prevalent in other later developing cultivars. Several of the cultivars and lines that did well in 2020 performed well in 2021 (approximately 11t/ha or over) and were not considered statistically different to those wheats yielding over 12t/ha. These were Big Red (AGFWH004718), Anapurna, SFR86-085, all of which performed well in 2020. There is evidence that the high yield of Reflection and later maturity resulted in smaller grains as screenings were significantly higher than any other cultivar tested. Of the named commercially available cultivars in the trial, the winter feed wheat Big Red (AGFWH004718) was the highest yielding (11.45t/ha) cultivar in the trial as it was in 2020 when the then coded line achieved 10.94t/ha.

i) Later sown wheat trial – 12 May

Treatments

12 elite named cultivars and coded lines were tested under HYC full fungicide management on the same HYC research site sown later in May. The comparison of cultivars sown in May placed greater emphasis on milling cultivars rather than feed cultivars.

Results

Table 2. Influence of cultivar (habit type in parentheses) and coded lines on grain yield and quality (protein (%), test weight (kg/hL) and screenings (%)) – harvested 12 January and **sown 12 May**, Millicent, SA.

Variety		**Grain Yield and Quality**							
		Yield		Protein		Test wt.		Screenings	
		t/ha		%		Kg/hL		%	
1.	Scepter (spring)	8.04	c	13.8	ab	82.1	a	2.1	c
2.	Trojan (spring)	7.86	cd	13.3	abc	81.6	abc	2.0	c
3.	Anapurna (winter)	11.87	a	13.2	abc	81.2	bcd	3.9	a
4.	RGT Accroc (winter)	10.48	b	12.5	c	79.3	fg	2.2	c
5.	Catapult (spring)	7.30	d	13.7	ab	81.5	abc	2.3	c
6.	Rockstar (spring)	9.83	b	13.9	ab	81.1	cd	2.4	c
7.	Vixen (spring)	7.67	cd	14.0	a	80.4	de	2.1	c

8.	Beaufort (spring)	10.30	b	13.0	bc	79.2	g	4.0	a
9.	Devil (spring)	7.91	cd	13.1	abc	80.0	efg	2.4	c
10.	AGFWH004618	11.82	a	13.8	ab	80.1	ef	3.2	b
11.	AGFWH004818	11.96	a	11.3	d	80.1	ef	3.7	ab
12.	LPB17-5691	9.84	b	13.8	ab	81.9	ab	1.3	d
	Mean	9.57		13.3		80.7		2.6	
	LSD	0.65		1.0		0.8		0.6	
	P Val	<0.001		0.001		<0.001		<0.001	
	CV	4.03		4.5		0.6		13.8	

The later developing winter feed wheats Anapurna, AGFWH004618 and AGFWH004818 gave the highest yields in the trial despite the mid May sowing date. These feed wheats were approximately 2t/ha higher yielding than the best of the quality milling spring wheats Rockstar. Rockstar significantly outyielded all other spring milling wheats except LPB17-5691 and the spring feed wheat Beaufort. All protein levels in the trial indicated that optimum yield had been satisfied (Table 2) since protein levels were in excess of 12.5%. If feed wheat was costed at $275/t then Rockstar would have needed to attract a $57/t premium to out gross margin feed wheat sown at the same time ($332/t).

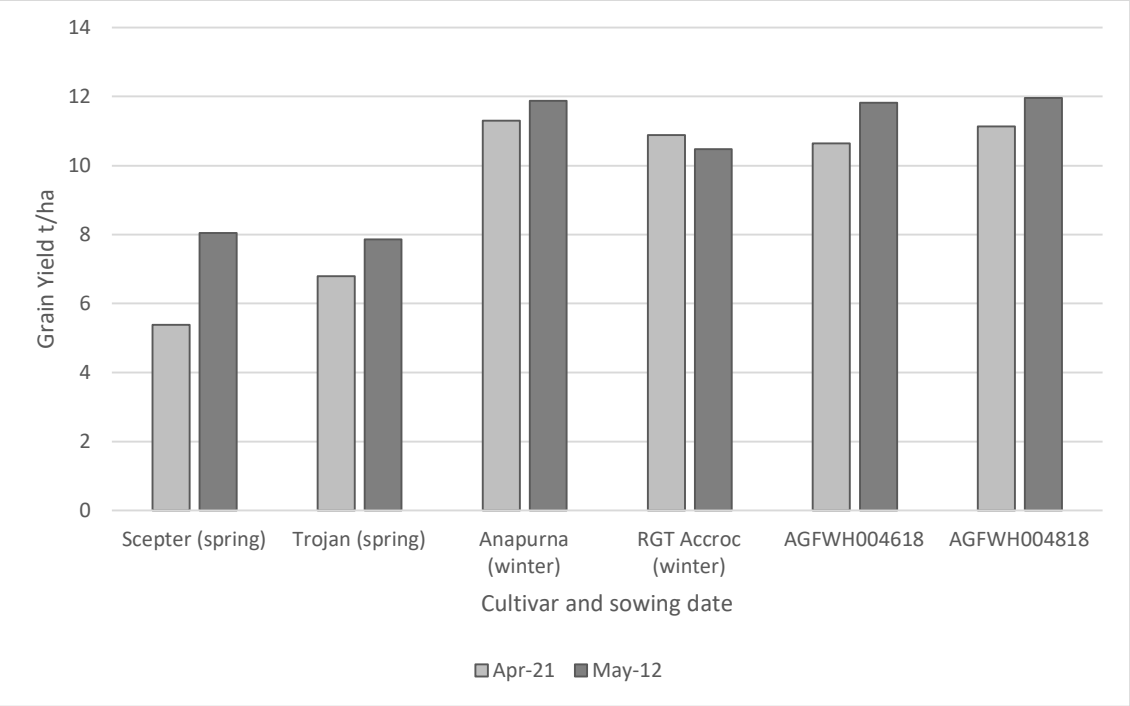


Figure 1. Observations of grain yield of spring (Scepter & Trojan) and winter wheats (other wheats shown) grown in two separate trials on the same site approximately one month apart (t/ha) – sown 21 April and 12 May. *(These yields are from separate trials and cannot be statistically compared).*

Observations indicated that it was the spring wheats that had improved yield when sowing date was moved into May. Interestingly for the region there was little difference between the winter wheat yields of 21 April and 12 May sowing. This illustrated that growing winter wheats for grain only production could be achieved successfully even with early-mid May sowing.

Appendix

The following nutrition and disease management packages were adopted for these two trials

Supplementary Table 1. Crop nutrition applied through the growing season on trials sown 21 April and 12 May Millicent, SA.

No.	Date	Product	Rate	Placement
1.	21/4/21	MAP	100 kg/ha	At sowing
2.	2/6/21	Rapisol 3-2-1	750 g/ha	Foliar
3.	4/8/21	Urea	87 kg/ha	Spreader
4.	8/8/21	Rapisol 3-2-1	700 g/ha	Foliar
5.	5/10/21	Urea	175 kg/ha	Spreader

Supplementary Table 2. Fungicides applied through the growing season on both trials sown 21 April and 12 May, Millicent, SA.

No.	Date	Product	Rate	Placement
1.	5/8/21	Prosaro	300 mL/ha	Foliar
2.	26/9/21	Radial	840 mL/ha	Foliar
3.	21/10/21	Opus	500 mL/ha	Foliar

Herbicides and insecticides applied as standard farm practice

Trial 3: HYC Genotype x Environment x Management (G.E.M) Trial Series (April sown)

Objectives: To assess the performance of winter and spring wheat varieties managed under three different levels of management sown in mid-April (20th April).

Key Messages:

- Winter type cultivars outyielded the spring cultivars by 3.3 to 4.9t/ha across all levels of input management. Winter red feed wheat Anapurna significantly outyielded all other cultivars except RGT Cesario.
- The response to higher input (PGR, 4 units of fungicide, additional N) was greatest with RGT Accroc (4.38t/ha) which was greater than Anapurna (2.17t/ha) > Calabro (2.03t/ha) > Big Red (1.94t/ha) > RGT Cesario (1.17t/ha).
- The rank order of these responses to higher input primarily aligns with susceptibility to Septoria tritici blotch (STB) and leaf rust susceptibility so it would appear that fungicide input was an important aspect of the higher input (4 units vs 2 units).
- There was no significant interaction of cultivar and management observed in this trial, meaning that all varieties responded roughly the same to the different management levers, with all varieties responding to the high input strategy.
- Cesario was the only cultivar to achieve >10 t/ha in all three management strategies (grazed, standard and high input) and was the most resistant to disease.
- In addition, Cesario was the only cultivar to accumulate statistically similar levels of total dry matter at harvest in the grazed compared to the high input strategy, which likely led to it being the only cultivar to achieve 10t/ha grain yield in the grazed strategy.
- Anapurna maintained % grain protein (>13%) across all management strategies. This was also achieved in the spring milling cultivar Trojan, whilst the other spring milling cultivar, Scepter, achieved significantly higher protein (≥14.4%) in the Standard and High Input strategies than all other cultivars and strategies.
- 11t/ha grain yields were observed in varieties that achieved over 20t/ha dry matters at harvest.

Table 1. Influence of management strategy and cultivar on grain yield (t/ha).

	Management Level			
	"Grazed" Input	**Standard Input**	**High Input**	**Mean**
Cultivar	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**	
Trojan (Spring)	4.92	6.15	6.38	5.82
Scepter (Spring)	5.98	5.38	6.00	5.79
Cesario (Winter)	9.83	10.09	10.96	10.30
Anapurna (Winter)	9.53	10.55	11.54	10.54
RGT Accroc (Winter)	7.66	8.81	10.18	8.89
Calabro (Winter)	8.18	7.12	10.35	8.55
Big Red (AGFH004718) (Winter)	8.99	8.76	10.86	9.54
Mean	7.87	8.12	9.47	
LSD Cultivar p = 0.05	0.72	**P val**	<0.001	
LSD Management p = 0.05	0.65	**P val**	<0.001	
LSD Cultivar x Man. P = 0.05	1.30	**P val**	0.006	

Table 2. Influence of management strategy and cultivar on protein (%).

	Management Level			
	"Grazed" Input	**Standard Input**	**High Input**	**Mean**
Cultivar	**Protein %**	**Protein %**	**Protein %**	
Trojan (Spring)	13.3	13.3	13.5	13.3
Scepter (Spring)	13.0	14.7	14.2	14.0
Cesario (Winter)	12.9	12.4	12.2	12.5
Anapurna (Winter)	13.5	13.1	13.2	13.2
RGT Accroc (Winter)	12.0	12.1	11.9	12.0
Calabro (Winter)	12.6	13.2	12.6	12.8
Big Red (AGFH004718) (Winter)	12.0	11.9	11.7	11.9
Mean	12.8	12.9	12.7	
LSD Cultivar p = 0.05	0.3	**P val**	<0.001	
LSD Management p = 0.05	0.2	**P val**	0.155	
LSD Cultivar x Man. p = 0.05	0.6	**P val**	<0.001	

Table 3. Influence of management strategy and cultivar on screenings (%).

	Management Level			
	"Grazed" Input	**Standard Input**	**High Input**	**Mean**
Cultivar	**Screenings %**	**Screenings %**	**Screenings %**	
Trojan (Spring)	2.7	1.6	1.8	2.0
Scepter (Spring)	2.9	2.2	2.2	2.5

Cesario (Winter)	2.5	2.6	2.4	2.5
Anapurna (Winter)	4.0	3.9	3.9	4.0
RGT Accroc (Winter)	3.1	2.2	2.3	2.5
Calabro (Winter)	4.1	4.0	3.7	3.9
Big Red (AGFH004718) (Winter)	3.4	3.3	3.6	3.4
Mean	3.2	2.8	2.9	
LSD Cultivar p = 0.05		0.4	**P val**	<0.001
LSD Management p = 0.05		0.7	**P val**	0.519
LSD Cultivar x Man. p = 0.05		0.8	**P val**	0.121

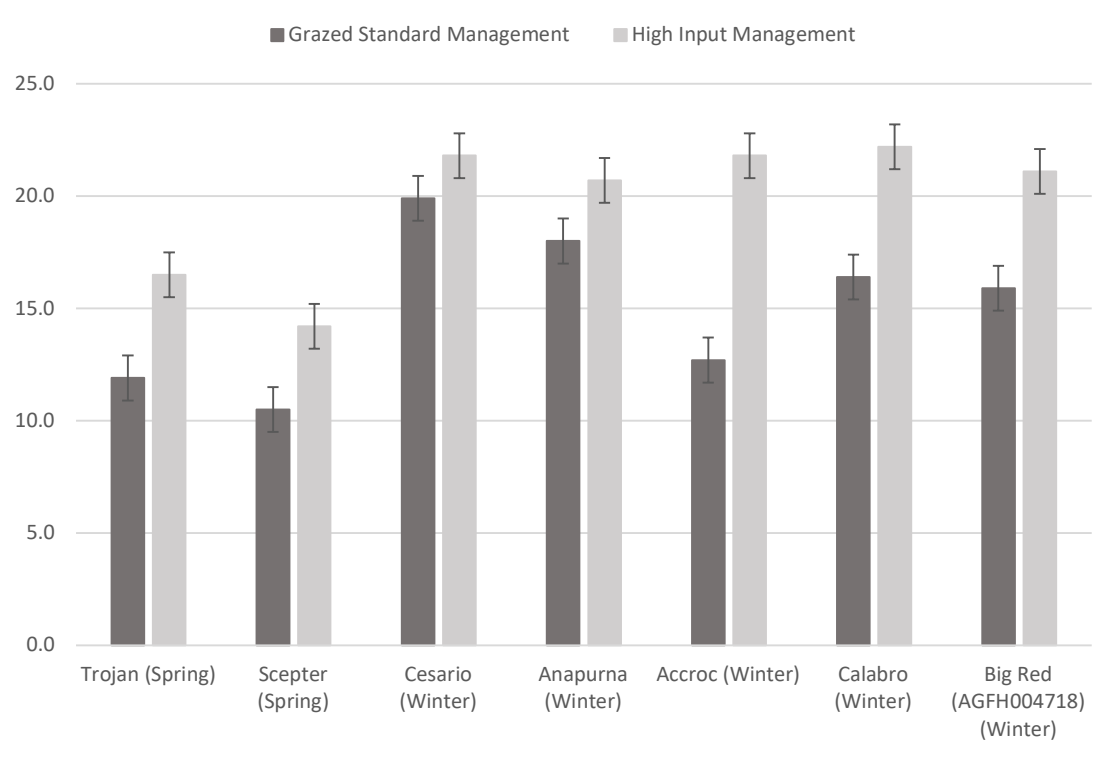


Figure 1. Dry matter at physiological maturity GS89, 4 January 2022. LSD (p=0.05) = 2.0. Error bars = LSD ÷ 2.

Table 4. Details of the management levels (kg, g, ml/ha).

Plant pop'n:		**180 seeds/m² (150 plants/m2 target) - all three managements**		
		Standard Input (grazed*)	**Standard Input**	**High Input**
Grazing:		✓	----	----
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As standard + Systiva
Basal Fertiliser:	20 April	100kg MAP	100kg MAP	100kg MAP + Flutriafol
Nitrogen:**				
	4 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)

	21 September	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	5 October	87 kg Urea (40 N)	87 kg Urea (40 N)	175 kg Urea (80 N)
Total N Applied:		120 N	120 N	160 N
PGR:**	GS30	---	---	Mod. 200ml + Errex 1300ml
	GS32	---	---	---
Fungicide:**	GS31-32	Opus 500ml	Opus 500ml	Prosaro 300ml
	GS39	Radial 840ml	Radial 840ml	Radial 840ml
	GS59-61	---	---	Opus 500ml

All other inputs of insecticides and herbicides were standard across the trial. Mod. - Moddus
** Mechanically defoliated, **Timings of PGRs, fertiliser and fungicides were adjusted to take account of the differences in spring (s) and winter wheat (w) phenology (development).*

Trial 4: HYC Disease Management Germplasm Interaction

Objectives: To develop profitable and sustainable approaches to disease management in HRZ wheat – winter and spring wheat sown 21 April.

Individual objectives specific to the trial were:

- To monitor the effectiveness of flutriafol in furrow for early disease control in wheat.
- To evaluate whether newer germplasm or new fungicide chemistry allows a reduction in the number of fungicide applications whilst increasing profitability *(note: reducing the number of fungicides is seen as a key measure for slowing down resistance development in cropping systems).*
- Examine whether there is germplasm (varieties tested) that has sufficient early season disease resistance to replace the need for the Timing 1 (T1) spray applied at GS31-32.
- To determine the cost benefit ratio of fungicide application in HRZ regions of different season lengths.

Key Messages:

- Fungicide management significantly increased yield in all varieties except RGT Cesario.
- The maximum yield response to fungicides was as follows: RGT Accroc (3.81t/ha) > Revenue 3.39t/ha) > RGT Calabro (2.42t/ha), Anapurna (2.2t/ha), Trojan (1.25t/ha) > Big Red (0.97t/ha) > Scepter (0.91t/ha) and RGT Cesario (0.71t/ha).
- At $300/t the value of even the lowest response to fungicide was $213/ha.
- Anapurna and RGT Cesario both generated 11t/ha but in both cases only two fungicide units was required to achieve these yields, whereas with RGT Accroc it was necessary to use 4 units of fungicide to maximise yield.
- Maximum yield response was achieved with 4 units of fungicide in RGT Calabro, Revenue, Trojan and Big Red.
- With Scepter there was little yield difference (0.14t/ha) between 2 and 4 units of fungicide.
- The impact of fungicide application was noted in grain quality with all fungicide strategies showing lower screenings, although the impact on screenings was clearly related to the size of yield increase, such that with Revenue there was a large difference in screenings (4%) between management approaches and only 1% with RGT Cesario.

i) Standard plots

Treatments: Five levels of fungicide management applied across 8 varieties
Five levels of fungicide input were applied to eight cultivars based on five timings: at sowing (seed treatment SDHI Systiva based on fluxapyroxad, GS31, GS33, GS39, GS59.
1 unit of fungicide was applied at GS39 – flag leaf fully emerged on the main stem.
2 units IDM (Integrated Disease Management) was applied at GS31 and GS39 – 1st node and flag leaf.
4 units were applied at sowing (Systiva s.t.) and GS31, GS39 and GS59 – head emergence.
2 units Straddle applied at GS33 (third node) and GS55-59 (head 50-100% emerged).
Products applied are presented in Table 3. Disease levels were primarily Septoria tritici blotch (STB) and leaf rust.

Table 1. Influence of fungicide management strategy and cultivar on grain yield (t/ha).

	Management Level											
	Untreated		**1 Fungicide Unit**		**4 Fungicide Units**		**IDM approach**		**Straddle approach**		**Mean**	
Cultivar	**Yield t/ha**		**Yield t/ha**		**Yield t/ha**		**Yield t/ha**		**Yield t/ha**			
Trojan	5.82	no	6.49	lmn	7.07	kl	6.60	klm	6.62	kl	**6.52**	**d**
Scepter	4.93	p	4.80	p	5.84	mno	5.70	o	5.69	o	**5.39**	**e**
Big Red (AGFWH004718)	9.78	d-h	10.58	abc	10.75	ab	10.52	a-d	9.99	cde	**10.32**	**a**
RGT Calabro	7.35	k	9.06	hij	9.77	d-h	9.34	e-i	8.88	ij	**8.88**	**bc**
RGT Cesario	10.46	a-d	10.77	ab	11.02	ab	10.80	ab	11.17	a	**10.84**	**a**
Anapurna	8.83	ij	10.32	bcd	9.85	c-g	11.03	ab	11.02	ab	**10.21**	**a**
RGT Accroc	6.73	kl	9.10	g-j	10.54	abc	9.91	c-f	9.40	e-i	**9.13**	**b**
Revenue	5.76	no	8.55	j	9.15	f-j	8.45	j	8.76	ij	**8.14**	**c**
Mean	**7.46**	**d**	**8.71**	**c**	**9.25**	**a**	**9.04**	**ab**	**8.94**	**bc**		

LSD Cultivar p = 0.05	0.91	**P val**	<0.001
LSD Fungicide p = 0.05	0.27	**P val**	<0.001
LSD Cultivar x Fung. p = 0.05	0.76	**P val**	<0.001

Table 2. Influence of management strategy and cultivar on screenings (%).

	Management Level											
	Untreated		**1 Fungicide Unit**		**4 Fungicide Units**		**IDM approach**		**Straddle approach**		**Mean**	
Cultivar	**Screenings %**		**Screenings %**		**Screenings %**		**Screenings %**		**Screenings %**			
Trojan	2.8	e-l	1.6	mn	2.0	k-n	1.5	n	2.0	k-n	**2.0**	**d**
Scepter	2.8	e-l	1.9	k-n	1.9	k-n	2.0	k-n	2.6	g-m	**2.2**	**cd**
Big Red (AGFWH004718)	2.9	c-k	2.6	g-n	2.4	h-n	2.9	c-k	2.3	i-n	**2.6**	**c**
Calabro	3.8	b-f	2.8	d-l	2.8	d-k	3.4	b-h	3.2	b-j	**3.2**	**b**
Cesario	2.7	f-l	2.1	j-n	1.9	k-n	2.4	h-n	1.7	lmn	**2.2**	**cd**
Anapurna	4.2	b	3.8	b-e	3.6	b-g	3.8	b-f	3.3	b-i	**3.7**	**b**
RGT Accroc	3.2	b-i	2.3	i-n	1.9	k-n	2.4	h-n	1.8	k-n	**2.3**	**cd**

Revenue	8.7	a	3.9	bc	3.9	bcd	3.7	b-f	3.8	b-e	**4.8**	**a**
Mean	**3.9**	**a**	**2.6**	**b**	**2.5**	**b**	**2.8**	**b**	**2.6**	**b**		

LSD Cultivar p = 0.05	0.6	**P val**	<0.001
LSD Fungicide p = 0.05	0.4	**P val**	<0.001
LSD Cultivar x Fung. p = 0.05	1.1	**P val**	<0.001

ii) Integrated Disease Management (IDM)/inoculated plots

Part of the same trial series described above was expanded to look at four cultivars and four fungicide management treatments and three starting "Disease Pressures". The starting point "Disease Pressures" for the treatments were as follows:

1. Flutriafol applied to the MAP fertiliser – 100g/ha ai 400ml/ha
2. Standard – untreated (cultivated faba bean stubble)
3. Inoculated with infected wheat stubble – 1.5 kg/plot

Treatments: On top of these three starting points were four levels of fungicide management applied across 4 varieties with varying resistance to STB. These cultivars were:

1. RGT Cesario – winter wheat (STB R-MR rating)
2. Anapurna – winter wheat (MR-MS)
3. RGT Accroc – winter wheat (MS)
4. Revenue – winter wheat (S)

Four levels of fungicide input were applied to these four cultivars based on four timings: at sowing (seed treatment SDHI Systiva based on fluxapyroxad, GS31, GS39 and GS59 foliar fungicides as described in section i).

1 unit of fungicide was applied at GS39 – flag leaf fully emerged on the main stem.

2 units IDM (Integrated Disease Management) were applied at GS31 and GS39 – 1st node and flag leaf.

4 units were applied at sowing (Systiva s.t.) and GS31, GS39 and GS59 – head emergence.

Key Messages:

- Increasing disease pressure (principally STB and leaf rust) associated with growing more susceptible cultivars was the only situation that gave benefit to the addition of flutriafol.
- With Revenue the impact of flutriafol in terms of yield showed irrespective of the input of later applied foliar fungicides.
- RGT Cesario resistance to STB resulted in no significant difference in yield irrespective of starting point (flutriafol, stubble or cultivation) or level of subsequent fungicide input (0, 1, 2 or 4 fungicides).
- Only 0.27t/ha covered the difference between 1 and 4 units of fungicide when growing RGT Cesario.
- Differences in yield were also related to grain screenings with only 0.4% difference due to fungicide in RGT Cesario compared to 4.1% difference in screening levels in Revenue due to fungicide input.

Table 3. Influence of disease pressure, management strategy and cultivar on grain yield (t/ha).

		Cesario		Anapurna		RGT Accroc		Revenue		*Mean*	
Cultivar		10.75	a	10.27	b	9.11	c	8.33	d	**9.62**	
	LSD	0.28						***P-Value***		<0.001	
Disease Pressure											
Flutriafol		10.62	a	10.65	a	8.74	d	8.89	d	9.72	-
Standard		10.86	a	10.06	b	9.14	cd	8.05	e	9.53	-
Stubble		10.78	a	10.09	b	9.46	c	8.05	e	9.60	-
Disease Pressure	***LSD***	***0.24***						***P-Value***		***0.330***	
Disease Pressure x Cultivar	***LSD***	***0.49***						***P-Value***		***0.049***	
Fungicide Management Regime											
Untreated		10.50	a	9.13	cd	6.93	e	6.10	f	8.16	c
1 Fungicide Unit		10.66	a	10.44	a	9.16	cd	8.78	d	9.76	b
4 Fungicide Units		10.92	a	10.54	a	10.50	a	9.66	bc	10.40	a
IDM approach (2 Spray approach)		10.93	a	10.97	a	9.87	b	8.79	d	10.14	a
Fungicide Management Regime	***LSD***	***0.28***						***P-Value***		***<0.001***	
Cultivar x Fung Mgmt Regime	***LSD***	***0.56***						***P-Value***		***<0.001***	
Disease Pressure x Fung Mgmt. Regime											
Flutriafol											
Untreated		10.46	-	9.58	-	6.73	-	7.13	-	8.48	-
1 Fungicide Unit		10.29	-	10.71	-	9.02	-	9.50	-	9.88	-
4 Fungicide Units		10.96	-	10.97	-	10.00	-	10.07	-	10.50	-
IDM approach		10.77	-	11.35	-	9.21	-	8.85	-	10.04	-
Standard											
Untreated		10.57	-	8.89	-	6.79	-	5.81	-	8.01	-
1 Fungicide Unit		10.88	-	10.39	-	9.17	-	8.63	-	9.77	-
4 Fungicide Units		11.11	-	9.88	-	10.62	-	9.25	-	10.21	-
IDM approach		10.89	-	11.08	-	9.98	-	8.53	-	10.12	-
Stubble											
Untreated		10.47	-	8.91	-	7.27	-	5.34	-	8.00	-
1 Fungicide Unit		10.82	-	10.22	-	9.29	-	8.22	-	9.64	-
4 Fungicide Units		10.70	-	10.76	-	10.87	-	9.65	-	10.50	-
IDM approach		11.13	-	10.48	-	10.43	-	8.99	-	10.26	-
Disease Pressure x Fung Mgmt	***LSD***	***0.49***						***P-Value***		***0.339***	
Disease Pressure x Fung Mgmt x Cultivar	***LSD***	***0.97***						***P Value***		***0.641***	

Table 4. Influence of disease pressure, management strategy and cultivar on screenings (%).

		Cesario		Anapurna		RGT Accroc		Revenue		*Mean*	
Cultivar		2.4	c	3.6	b	2.6	c	5.0	a	**3.4**	
	LSD	***0.3***						***P-Value***		***<0.001***	
Disease Pressure											
Flutriafol		2.5	-	3.6	-	2.6	-	4.9	-	3.4	-
Standard		2.3	-	3.9	-	2.5	-	5.1	-	3.4	-
Stubble		2.5	-	3.3	-	2.6	-	5.0	-	3.3	-
Disease Pressure	***LSD***	***0.3***						***P-Value***		***0.721***	
Disease Pressure x Cultivar	***LSD***	***0.6***						***P-Value***		***0.726***	

Fungicide Management Regime											
Untreated		2.6	d	3.9	bc	3.5	c	7.8	a	4.4	a
1 Fungicide Unit		2.2	d	3.4	c	2.4	d	4.3	b	3.1	bc
4 Fungicide Units		2.2	d	3.3	c	2.0	d	3.7	bc	2.8	c
IDM approach		2.5	d	3.7	bc	2.4	d	4.1	b	3.2	b
Fungicide Management Regime	***LSD***		***0.3***					***P-Value***		***<0.001***	
Cultivar x Fung Mgmt Regime	***LSD***		***0.7***					***P-Value***		***<0.001***	
Disease Pressure x Fung Mgmt. Regime											
Flutriafol											
Untreated		2.7	-	3.7	-	3.8	-	7.2	-	4.3	-
1 Fungicide Unit		2.2	-	3.2	-	2.7	-	4.3	-	3.1	-
4 Fungicide Units		2.5	-	3.2	-	1.9	-	3.8	-	2.8	-
IDM approach		2.6	-	4.2	-	2.2	-	4.3	-	3.3	-
Standard											
Untreated		2.7	-	4.2	-	3.3	-	8.8	-	4.7	-
1 Fungicide Unit		2.2	-	3.9	-	2.3	-	4.0	-	3.1	-
4 Fungicide Units		1.9	-	3.6	-	1.9	-	3.9	-	2.8	-
IDM approach		2.4	-	3.8	-	2.4	-	3.7	-	3.1	-
Stubble											
Untreated		2.5	-	3.7	-	3.3	-	7.5	-	4.2	-
1 Fungicide Unit		2.4	-	3.1	-	2.2	-	4.6	-	3.1	-
4 Fungicide Units		2.3	-	3.2	-	2.2	-	3.3	-	2.8	-
IDM approach		2.7	-	3.1	-	2.5	-	4.5	-	3.2	-
Disease Pressure x Fung Mgmt	***LSD***		***0.6***					***P-Value***		***0.792***	
Disease Pressure x Fung Mgmt x Cultivar	***LSD***		***1.2***					***P Value***		***0.642***	

Table 5. Details of the management levels (kg, g, ml/ha).

Sowing date:		**20 April**				
Seed Rate:		180 Seeds/m2				
Sowing Fertiliser:		100kg MAP				
Seed Treatment:		Vibrance & Goucho				
Grazing:		Nil				
Nitrogen:	10 Aug	46kg N/ha				
	1 Oct	160kg N/ha				
PGR:	GS30	Moddus Evo 100ml/ha + Errex 650ml/ha				
	GS32	Moddus Evo 100ml/ha + Errex 650ml/ha				
		Untreated	**1 Fungicide Unit**	**4 Fungicide Units**	**IDM approach**	**Straddle approach**
Fungicide:	GS00	---	---	Systiva	---	---
	GS31	---	---	Prosaro 300ml/ha	Prosaro 300ml/ha	---
	GS33	---	---	---	---	FAR F1-19 750ml/ha
	GS39	---	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha	---

	GS55	---	---	---	---	Opus 500ml/ha
	GS59-61	---	---	Opus 500ml/ha	---	---

Trial 5: HYC Spring Wheat "Reset" Trial

Objectives: To assess the value of pre and post GS30 defoliation in spring germplasm grown in HRZ regions of different season lengths using 21st April sowing date.
Caution: Please note aspects of carrying out defoliation post GS30 is purely experimental since it may reduce grain yield.

Key Messages:

- There were no significant differences in grain yield as result of grazing Trojan at GS30 but yield was reduced when grazing was delayed to GS32 (second node).
- There was evidence of frost in the ungrazed plots indicating that the slightly earlier flowering period in the ungrazed was not disadvantaged which can often be the case when spring wheat is sown in mid-late April.
- The delayed grazing strategy (GS32) resulted in lower grain yield and higher screenings, however there was an increase in grain protein content.
- Grazing late at GS32 resulted in an increase in grain protein and correlates to the lower yield in this treatment.

The trial was sown 21 April with standard inputs for the site. Mechanical defoliation with a mower was used to simulate the defoliation effect of grazing but no additional inputs were applied to replace the plant material removed in this experiment. The concept was to see if earlier flowering in the ungrazed plots resulted in a greater frost risk. However no differential frost effects were observed in the trial. Yields in this case illustrating no effect of defoliation at GS30 but lower yields when defoliation was delayed until GS32.

Table 1. Influence of grazing strategy and cultivar on grain yield (t/ha).

		"Grazing" timing		
	Ungrazed	**Grazed GS30 6 July**	**Grazed GS32 17 August**	**Mean**
Cultivar	**Yield t/ha**	**Yield t/ha**	**Yield t/ha**	
Trojan (Spring)	7.28 a	7.13 a	6.20 b	**6.87**
LSD p = 0.05	0.79	**P val**	0.03	

Table 2. Influence of grazing strategy and cultivar on protein (%).

		Grazing timing		
	Ungrazed	**Grazed GS30 6 July**	**Grazed GS32 17 August**	**Mean**
Cultivar	**Protein %**	**Protein %**	**Protein %**	
Trojan (Spring)	13.7 b	13.4 b	14.5 a	**13.9**
LSD p = 0.05	0.7	**P val**	0.026	

Table 3. Influence of grazing strategy and cultivar on screenings (%).

	Grazing timing			
	Ungrazed	**Grazed GS30 6 July**	**Grazed GS32 17 August**	**Mean**
Cultivar	**Screenings %**	**Screenings %**	**Screenings %**	
Trojan (Spring)	1.5 b	1.8 b	**3 a**	**2.1**
LSD p = 0.05	0.5	**P val**	<0.001	

Trial 6: HYC Nutrition for Hyper Yielding Wheat

Objectives: To assess the value of higher nutrition input (N, P, K & S) for wheat in the growing season (cv RGT Accroc).

Individual objectives specific to the trials were:
- To assess the value of additional nutrients in the growing crop (set up as small plots at the Research Centre) .
- To assess the value of adding increased P, K, and S when targeting higher yield potential rather than N alone.

Key Messages:

- Nutrition treatments had no effect on harvest dry matter, grain yield, test weight or screenings.
- Based on the grain protein and yield of the unfertilised plots which received 100kg/ha MAP (10N), the unfertilised plots removed 225kg N/ha from the soil for the N present in the grain.
- If it is assumed that 75% of the N in the canopy resides in the grain with 25% in the straw and chaff, then it is assumed the crop removed 299kg N/ha from the soil to grow the crop.
- The trial indicated that additional N, P and K applied in this trial did not increase yield with a trend (not significant) for N application to reduce grain yield and harvest dry matter.
- With grain protein at 12.5% in the unfertilised plots there was a significant increase in protein when 150 – 240N was applied.
- Although not significant, the 0N and 120N treatments were the only treatments to achieve grain yield >10 t/ha.

Table 1. The effect of crop nutrition on harvest dry matter (t/ha), yield (t/ha), and grain quality.

Nutrition treatment (kg)	Harvest Dry Matter (t/ha)	Yield (t/ha)	Protein (%)	Test Weight (kg/hL)	Screenings (%)
0N	17.8 -	10.26 -	12.5 d	79.2 -	1.7 -
120N	16.9 -	10.01 -	12.5 cd	78.8 -	1.8 -
150N	16.8 -	9.97 -	13.0 ab	78.9 -	1.6 -
150N + 20.8P + 37.35K + 41.59S	18.0 -	9.51 -	12.7 bcd	78.5 -	2.1 -
180N	17.7 -	9.91 -	13.2 a	79.4 -	1.5 -
180N + 31.76P + 52.71K + 61.73S	15.7 -	9.13 -	12.7 bcd	77.4 -	2.3 -
240N	15.7 -	8.95 -	12.9 abc	77.4 -	2.8 -
Mean	16.9	9.68	12.8	78.5	2.0
LSD p = 0.05	3.4	1.01	0.4	2.0	1.4
P val	ns	ns	0.017	ns	ns
CV	13.4	7.00	2.2	1.8	47.6

Table 2. Details of the management levels (kg, g, ml/ha).

Seed Rate:		**180 seeds/m^2**
Sowing Fertiliser:	12 May	100kg/ha MAP
Seed Treatment:		Vibrance & Gaucho
Nitrogen:	29 July	40 N kg/ha
	11 August	40 N kg/ha
	2 September	40 N kg/ha
Fungicide:	GS31	Prosaro 300ml/ha
	GS39	Radial 840ml/ha
	GS61	Opus 500ml/ha

Trial 7: HYC Genotype x Environment x Management (GEM) Trial Series (Mid-May sown)

Objectives: To assess the performance of winter and spring wheat germplasm managed under three different levels of management (mid-May sown).

Key Messages:

- Winter red feed wheat Anapurna yielded significantly higher (2.0t/ha plus) than the spring milling cultivars planted in mid-May, but showed no significant yield difference in response to the three management levels applied.
- Rockstar (>9 t/ha) yielded significantly more than the other spring milling cultivars tested, all of which yielded less than 8t/ha when averaged over the three management levels.
- Although no significant differences were observed, protein content of all cultivars across the three management strategies were >13% except Anapurna under the standard management.
- There were no significant differences in harvest dry matter between the low input high seeding rate and high input management strategies.
- Higher grain yields with Anapurna correlated to significantly higher dry matter (approximately 20t/ha)
- Rockstar milling wheat was significantly higher yielding than other spring wheats with a trend for higher harvest dry matter compared to other milling wheats.

Table 1. Influence of management strategy and cultivar on grain yield (t/ha).

	Management Level							
	Low Input High Seed Rate		**Standard Input**		**High Input**		**Mean**	
Cultivar	**Yield t/ha**		**Yield t/ha**		**Yield t/ha**			
Anapurna	11.10	-	11.76	-	11.70	-	**11.52**	**a**
Coota	7.40	-	7.41	-	8.12	-	**7.64**	**c**
Rockstar	8.78	-	8.74	-	9.75	-	**9.09**	**b**
Scepter	6.72	-	7.28	-	8.31	-	**7.43**	**c**
Trojan	7.49	-	7.38	-	8.24	-	**7.70**	**c**
Mean	**8.30**	**-**	**8.51**	**-**	**9.22**	**-**		

LSD Cultivar p = 0.05	0.34	**P val**	<0.001
LSD Management p = 0.05	0.90	**P val**	ns
LSD Cultivar x Man. p = 0.05	0.60	**P val**	ns

Table 2. Influence of management strategy and cultivar on protein (%).

	Management Level							
	Low Input High Seed Rate		**Standard Input**		**High Input**		**Mean**	
Cultivar	**Protein %**		**Protein %**		**Protein %**			
Anapurna	13.1	de	12.6	e	14.0	ab	**13.2**	**c**
Coota	13.5	bcd	14.0	ab	14.3	a	**13.9**	**a**
Rockstar	13.3	cd	14.0	ab	13.4	cd	**13.5**	**bc**
Scepter	13.8	abc	13.5	bcd	13.8	abc	**13.7**	**ab**
Trojan	13.1	de	13.5	bcd	13.7	abc	**13.4**	**bc**
Mean	**13.4**	**-**	**13.5**	**-**	**13.8**	**-**		

LSD Cultivar p = 0.05	0.3	**P val**	0.002
LSD Management p = 0.05	0.5	**P val**	ns
LSD Cultivar x Man. p = 0.05	0.6	**P val**	0.001

Table 3. Influence of management strategy and cultivar on thousand seed weight (g).

	Management Level							
	Low Input High Seed Rate		**Standard Input**		**High Input**		**Mean**	
Cultivar	**Test Wt. (kg/hL)**		**Test Wt. (kg/hL)**		**Test Wt. (kg/hL)**			
Anapurna	81.2	-	81.5	-	81.5	-	81.4	-
Coota	80.9	-	81.1	-	81.4	-	81.1	-
Rockstar	81.0	-	80.5	-	81.0	-	80.8	-
Scepter	81.2	-	81.0	-	81.0	-	81.1	-
Trojan	81.1	-	81.2	-	79.9	-	80.7	-
Mean	81.1	-	81.1	-	80.9	-		

LSD Cultivar p = 0.05	0.5	**P val**	0.085
LSD Management p = 0.05	0.7	**P val**	0.883
LSD Cultivar x Man. p = 0.05	0.9	**P val**	0.098

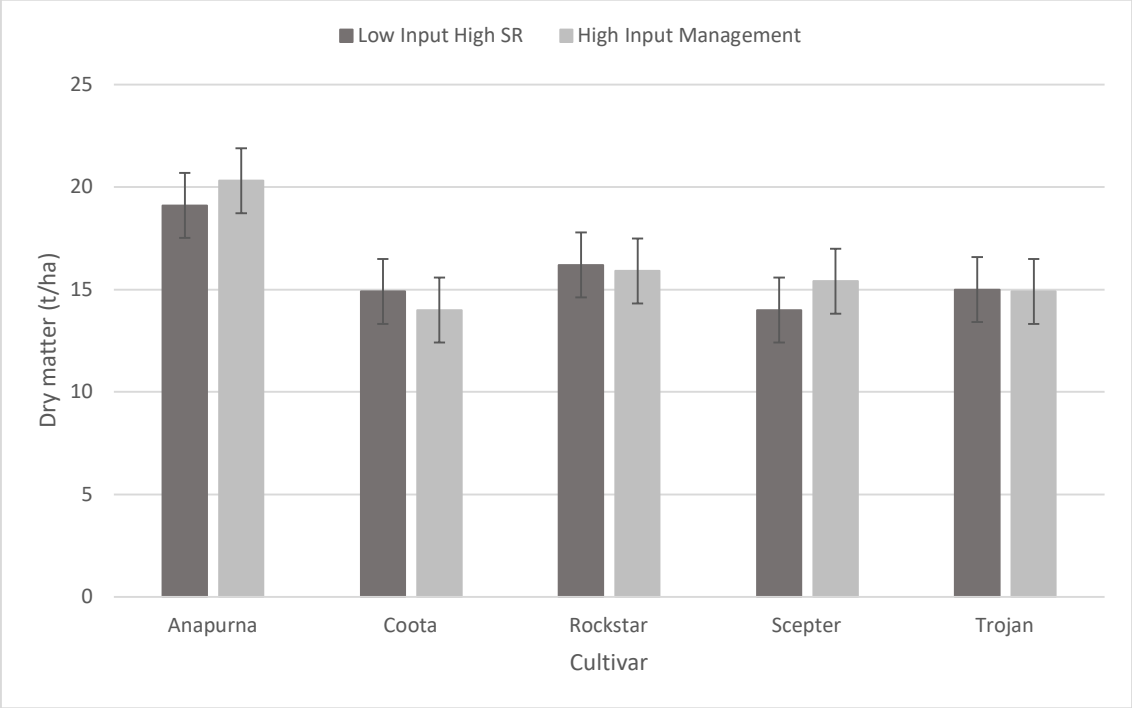


Figure 1. Influence of management strategy and cultivar on harvest dry matter (t/ha).

Table 4. Details of the management levels (kg, g, ml/ha).

		Low Input High Seed Rate	**Standard Input**	**High Input**
Seed rate:		**300 seeds/m2**	180 seeds/m2	180 seeds/m2
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As standard + Systiva
Basal Fertiliser:	12 May	100kg MAP	100kg MAP	100kg MAP
Nitrogen:				
	4 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	21 Sept	175 kg Urea (80 N)	175 kg Urea (80 N)	175 kg Urea (80 N)
	7 October	175 kg Urea (80 N)	175 kg Urea (80 N)	87 kg Urea (40 N)
Total N Applied:		120 N	120 N	160 N
PGR:**	GS30	---	---	Mod. 100ml + Errex 650ml
	GS32	---	---	Mod. 100ml + Errex 650ml
Fungicide:**	GS31-32	Opus 500ml	Opus 500ml	Prosaro 300ml
	GS39	Radial 840ml	Radial 840ml	Radial 840ml
	GS59-61	---	---	Opus 500ml

All other inputs of insecticides and herbicides were standard across the trial.

2021 Victoria Crop Technology Centre
Gnarwarre, Victoria

Time of Sowing – 29 April 2021

Trials at the Victoria Crop Technology Centre were badly affected by waterlogging through the winter of 2021 making yield results variable and interpretation more difficult. The following trial is one of the largest on the centre in wheat and was sent to SAGI to see if spatial analysis and predicted yields could salvage a trial result in which the primary diseases were Septoria tritici blotch (STB) and leaf rust. Some varieties such as Trojan were also affected by stripe rust.

Trial 1: HYC Disease Management Germplasm Interaction

Objectives: To develop profitable and sustainable approaches to disease management in HRZ wheat.

Individual objectives specific to the trial were:

- Monitor the effectiveness of flutriafol in furrow for early disease control in wheat.
- To evaluate whether newer germplasm or new fungicide chemistry allows a reduction in the number of fungicide applications whilst increasing profitability *(note: reducing the number of fungicides is seen as a key measure for slowing down resistance development in cropping systems).*
- Examine whether there is germplasm (varieties tested) that has sufficient early season disease resistance to replace the need for the Timing 1 (T1) spray applied at GS31-32.
- To determine the cost benefit ratio of fungicide application in HRZ regions of different season lengths.

Key Messages:

- *Yields were severely curtailed by waterlogging in this trial but results mirror what was observed in disease levels at other HYC research sites.*
- *Waterlogging compressed the yield impact of fungicide application, but the influence of genetic resistance was still apparent in the results.*
- *As observed at other centres Revenue gave a significantly greater response (maximum 2.61t/ha) to a disease management package than the higher yielding cultivars such as RGT Cesario and Anapurna where the maximum response to fungicide was 0.51t/ha and 0.55t/ha respectively.*
- *These larger responses to fungicides were the result of higher infection levels of Septoria tritici blotch (STB) and late leaf rust infection which were far less significant in Cesario and Big Red.*
- *The other aspect of the yield results that is more noticeable is that with the more disease resistant lines there is much less difference in whether it was 1, 2 or 4 units of fungicide.*

i) Standard plots

Treatments: Five levels of fungicide management applied across eight varieties
Five levels of fungicide input were applied to eight cultivars based on five timings: at sowing (seed treatment SDHI Systiva based on fluxapyroxad, GS31, GS33, GS39 and GS59.
1 unit of fungicide was applied at GS39 – flag leaf fully emerged on the main stem.

2 units IDM (Integrated Disease Management) were applied at GS31 and GS39 – 1st node and flag leaf.
4 units were applied at sowing (Systiva s.t.) and GS31, GS39 and GS59 – head emergence.
2 units Straddle applied at GS33 (third node) and GS55-59 (head 50-100% emerged).
Products applied are presented in Table 3. Disease levels were primarily Septoria tritici blotch (STB) and leaf rust. Stripe rust was also present in Trojan.

Table 1. Influence of management strategy and variety on grain yield (t/ha) – SAGI Predicted yield values following spatial analysis.

	Management Level					
	Untreated	**1 Fungicide Unit**	**4 Fungicide Units**	**2 units IDM approach**	**2 units Straddle approach**	**Mean**
Cultivar	Yield t/ha	Yield t/ha	Yield t/ha	Yield t/ha	Yield t/ha	**Yield t/ha**
Trojan (s)	3.24	4.11	4.66	4.18	4.13	**4.06**
Scepter (s)	3.57	4.55	4.39	4.95	3.84	**4.26**
Big Red (w)	5.43	6.22	6.25	6.08	6.41	**6.08**
RGT Cesario (w)	6.57	6.66	7.08	7.02	6.85	**6.84**
Anapurna (w)	6.29	6.64	6.16	6.34	6.84	**6.45**
RGT Accroc (w)	6.07	6.83	6.70	6.64	7.08	**6.66**
Revenue (w)	3.75	5.93	6.36	5.59	5.33	**5.39**
Calabro (w)	6.55	7.38	7.97	7.57	6.83	**7.26**
Mean	**5.19**	**6.04**	**6.20**	**6.05**	**5.91**	
LSD Cultivar x Fung. P=0.05		0.62			P val <0.001	

ii) Integrated Disease Management (IDM)/inoculated plots

Part of the same trial series described above was expanded to look at four cultivars and four fungicide management treatments and three starting "Disease Pressures". The starting point "Disease Pressures" for the treatments were as follows:

1. Flutriafol applied to the MAP fertiliser – 100g/ha ai 400ml/ha
2. Standard – untreated (cultivated poppy stubble)
3. Inoculated with infected wheat stubble – 1.5 kg/plot

Treatments: On top of these three starting points were four levels of fungicide management applied across four varieties with varying resistance to STB. These cultivars were:

1. RGT Cesario – winter wheat (STB R-MR rating)
2. Anapurna – winter wheat (MR-MS)
3. RGT Accroc – winter wheat (MS
4. Revenue – winter wheat (S)

Four levels of fungicide input were applied to these four cultivars based on four timings: at sowing (seed treatment SDHI Systiva based on fluxapyroxad, GS31, GS39 and GS59 as described.
1 unit of fungicide was applied at GS39 – flag leaf fully emerged on the main stem.
2 units IDM (Integrated Disease Management) were applied at GS31 and GS39 – 1st node and flag leaf.
4 units were applied at sowing (Systiva s.t.) and GS31, GS39 and GS59 – head emergence.

Key Messages:

- Increasing disease pressure (principally STB) using infected wheat straw reduced the yield of the most susceptible cultivars and invariably increased the yield response to full fungicide protection, although this increase was not statistically significant.
- The lack of a GS31 fungicide with the susceptible cultivar Revenue cost 0.68t/ha of yield where the crop was grown in infected stubble. This was to no yield difference where flutriafol was used upfront or where faba bean stubble was the principal residue.
- Applying flutriafol in furrow before other treatments were applied significantly reduced disease pressure in the more susceptible cultivars and had the greatest impact on yield with Revenue but gave no benefit with the most resistant cultivar RGT Cesario.

Table 2. Influence of management strategy and variety on grain yield (t/ha).

		Management Level				
		Untreated	**1 Fungicide Unit**	**4 Fungicide Units**	**IDM approach**	**Mean**
Disease pressure	**Cultivar**	Yield t/ha	Yield t/ha	Yield t/ha	Yield t/ha	**Yield**
Flutriafol	RGT Cesario	6.64	6.83	6.91	7.12	**6.87**
	Anapurna	5.79	6.27	5.79	6.30	**6.04**
	RGT Accroc	6.57	6.81	6.98	6.89	**6.81**
	Revenue	5.12	6.22	6.26	6.22	**5.95**
	Mean	**6.03**	**6.53**	**6.48**	**6.63**	
Standard	RGT Cesario	6.57	6.66	7.08	7.02	**6.83**
	Anapurna	6.29	6.64	6.16	6.34	**6.36**
	RGT Accroc	6.07	6.83	6.70	6.64	**6.56**
	Revenue	3.75	5.93	6.36	5.59	**5.41**
	Mean	**5.67**	**6.52**	**6.58**	**6.40**	
Stubble	RGT Cesario	6.66	6.49	7.28	7.70	**7.03**
	Anapurna	5.19	6.55	6.03	6.27	**6.01**
	RGT Accroc	5.42	6.05	6.81	6.71	**6.25**
	Revenue	3.75	5.56	6.55	6.24	**5.53**
	Mean	**5.25**	**6.16**	**6.67**	**6.73**	

LSD Disease pressure p=0.05	0.50	**P val**	<0.001
LSD Dis. press. x cultivar p=0.05	0.72	**P val**	0.34
LSD Dis. press.x fung. p=0.05	0.52	**P val**	<0.002
LSD Cultivar x fung. P=0.05	0.62	**P val**	<0.001
LSD Dis. press.x cultivar x fung. p=0.05	0.88	**P val**	0.74

Table 3. Details of the management levels (kg, g, ml/ha).

Sowing date:		**29 April**
Seed Rate:		180 Seeds/m2

Sowing Fertiliser:		100kg MAP				
Seed Treatment:		Vibrance & Goucho				
Grazing:		Nil				
Nitrogen:	10 Aug	46kg N/ha				
	1 Oct	160kg N/ha				
PGR:	GS30	Moddus Evo 100ml/ha + Errex 650ml/ha				
	GS32	Moddus Evo 100ml/ha + Errex 650ml/ha				
		Untreated	**1 Fungicide Unit**	**4 Fungicide Units**	**IDM approach**	**Straddle approach**
Fungicide:	GS00	---	---	Systiva	---	---
	GS31	---	---	Prosaro 300ml/ha	Prosaro 300ml/ha	---
	GS33	---	---	---	---	FAR F1-19 750ml/ha
	GS39	---	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha	FAR F1-19 750ml/ha	---
	GS55	---	---	---	---	Opus 500ml/ha
	GS59-61	---	---	Opus 500ml/ha	---	---

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