Hyper Yielding Crops Project

Provisional 2020 Wheat Results

Hyper Yielding Crop project research site 2020, Gnarwarre, Vic – Photo: Darcy Warren, FAR Australia

Field Applied Research (FAR) Australia
Phone 03 5265 1290
Post Shed 2/ 63 Holder Road, Bannockburn, 3331, Victoria, Australia
Website: http://www.faraustralia.com.au **ABN:** 33159209480

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INTERPRETATION NOTES

Winter – winter wheat.
Spring – spring wheat.

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). All provisional results have been analysed through ARM software with further spatial analysis from SAGI when the final results are released.

Section 2.0 – 2020 Hyper Yielding Crops Wheat Research Programme

Overall Objective and Research Question

What are the germplasm types and management inputs that will enable us to routinely achieve final harvest dry matters of 25t/ha and a harvest index of 0.5 in wheat crops grown in the Australian High Rainfall Zone (HRZ) of Australia?

How does this benchmark objective compare to the highest yield potential for these regions determined by current physiological metrics such as water use efficiency (WUE) and photothermal quotient (PTQ)?

2020 SA Crop Technology Centre – Millicent, South Australia
First Time of Sowing (16th – 18th April 2020)

Sown: 16 - 18 April 2020
Harvested: 4 - 6 January 2021
Rotation position: 1st Cereal after canola, 2018 wheat.
Soil type & management: Neutral-slightly alkaline Organosol (Peat soil) – high organic matter (0-30cm).

Trial 1. HYC 1st Stage Screen

Objectives:

To examine the phenology, disease resistance and standing power of new wheat germplasm established in an early mid-April sowing window.

Key Points:

- *For mid-April sowing dates at the SA Crop Technology Centre (CTC) Anapurna has been one of the most consistent varieties grown over the last three years.*
- *In the following tables varieties with similar phenology (Table 1) and better disease resistance and standing power compared to Anapurna (Table 2) have been referenced.*
- *The other controls were based on Scepter (spring), Trojan (spring), RGT Accroc (winter) and Nighthawk (facultative).*
- *Of those lines which had similar phenology to Anapurna and equivalent or better than disease resistance and standing power it was AGF codes, SFR codes, GS-18-105-W, BA26.35 and AGT004 that looked most promising.*
- *Some of these lines were also assessed for yield at the same sowing date in the HYC Elite Screen trial (Trial 2 – next write up).*

Treatments: All varieties and lines were sown in small plots (6m in length) with standard nitrogen management but ***NO FUNGICIDE or PGR input***. ***Plots are not taken to yield.***

Table 1. Zadoks score on 26 August, 29 September and 27 October.

Variety	26-Aug	29-Sep	27-Oct
Scepter (Spring control)	47	65	83
Trojan (Spring control)	39	65	72
Anapurna (Winter control)	31	43	72
RGT Accroc (Winter control)	32	49	75
Nighthawk (Facultative control)	33	51	71
Reflection	31	33	48
Graham	30	33	47
Manning	31	37	59
Savello	32	37	47
Shabras	31	33	49
BX7932-039	37	65	78
V12069-076	33	55	76
SFR86-092	32	39	68
SFR86-071	32	41	69
SFR86-085	30	33	65
GSUQ-19-48-W	41	65	78
GS-18-107-W	41	65	79
GS-18-105-W	32	39	65
GSUQ-19-04-W	37	61	78
AGFWH004418	32	45	68
AGFWH004518	31	45	68
AGFWH004618	31	49	69
AGFWH004718	31	39	71
AGFWH004818	32	41	69
V13079-049	33	59	68
SUN862I	32	55	79
SUN944O	39	65	81
SUN945A	39	65	83
AGTW003	32	51	74
AGTW004	31	37	69
AGTW005	32	45	69
AGTW006	32	55	75
V10006-026	33	39	68
WAGT734	33	61	79
V12167-048	37	59	81
V10100-064	37	61	83
Genius	32	37	61
Mercedes	32	33	52
BA26.35	31	37	49

Oakley	30	33	42
Xi19	31	45	51
Apache	31	45	69
CS170	31	45	55
Hereford	31	44	55
JB Asano	31	45	59

Note: Shaded varieties had similar phenology to the winter wheat control Anapurna that has performed consistently at the SA CTC over the last three years.

Table 2. Disease Severity (% plot infection - Septoria tritici blotch (STB), stripe rust, leaf rust **and lodging on 26 October.**

Variety	Septoria	Leaf Rust	Stripe Rust	Lodging Severity	Lodging Index
	% Plot	% Plot	% Plot	0-5	0-500
Scepter	98	0	0	1.7	131.0
Trojan	85	0	1	0.5	20.0
Anapurna	15	2	0	0.5	15.0
RGT Accroc	70	20	0	0.0	0.0
Nighthawk	65	0	0	0.5	25.0
Reflection	6	1	0	0.0	0.0
Graham	25	50	0	0.0	0.0
Manning	45	30	0	3.5	310.0
Savello	40	30	0	0.8	63.8
Shabras	25	4	0	0.0	0.0
BX7932-039	70	1	0	1.3	20.0
V12069-076	30	3	0	1.5	105.0
SFR86-092	10	5	0	0.5	40.0
SFR86-071	30	20	0	0.5	10.0
SFR86-085	5	1	0	0.5	35.0
GSUQ-19-48-W	65	0	0	2.8	220.0
GS-18-107-W	90	2	0	1.0	70.0
GS-18-105-W	12	0	0	0.0	0.0
GSUQ-19-04-W	85	0	0	1.5	47.5
AGFWH004418	20	5	0	0.5	5.0
AGFWH004518	10	2	0	0.8	26.3
AGFWH004618	20	8	0	0.0	0.0
AGFWH004718	9	1	0	0.0	0.0
AGFWH004818	3	0	0	0.0	0.0
V13079-049	20	1	0	1.3	96.3
SUN862I	75	0	0	2.0	125.0
SUN944O	65	0	0	2.0	80.0
SUN945A	45	0	0	1.8	97.5
AGTW003	10	4	0	2.0	75.0
AGTW004	6	0	0	0.5	7.5
AGTW005	4	2	0	0.0	0.0

AGTW006	9	1	0	2.3	165.0
V10006-026	60	15	0	1.3	112.5
WAGT734	70	5	0	2.5	155.0
V12167-048	80	0	0	1.5	45.0
V10100-064	90	0	0	1.0	75.0
Genius	60	4	0	0.5	10.0
Mercedes	30	30	0	0.0	0.0
BA26.35	15	4	0	0.0	0.0
Oakley	25	30	0	1.5	80.0
Xi19	40	0	0	0.0	0.0
Apache	30	8	0	0.0	0.0
CS170	65	3	0	0.5	15.0
Hereford	35	15	0	0.0	0.0
JB Asano	50	3	0	0.5	5.0

Note: Shaded varieties had similar phenology to the winter wheat control Anapurna that has performed consistently at the SA CTC over the last three years.

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

Seed Rate:		**180 seeds/m^2**
Sowing Fertiliser:	18 April	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

Trial 2. HYC Elite Screen

Objectives: To examine the yield potential of elite winter and spring germplasm (cultivars/lines) grown under a *HYC High input Management Package* (full disease management) against spring and winter controls in the traditional late April sowing window.

Key Points:

- *For mid-April sowing dates at the SA Crop Technology Centre (CTC) it was the AGFWH004718, AGFWH004818 and AGFWH004618 that stood out with good agronomic characteristics and yields of 10t/ha or greater.*
- *The longer season UK wheats Reflection and Shabras also gave 10t/ha yields despite a phenology that meant that they were at the end of booting (GS49) in the period considered to be the optimum for flowering (GS61) based on the last two years sowing in mid-April.*
- *Reflection was the most interesting of the two with excellent disease resistance and standing power, however Shabras was similar but with more pronounced susceptibility to Septoria.*

- *Of those varieties that were just under 10t/ha that had good agronomic characteristics it was GS-18-105-W and SFR86-092 that exhibited good disease resistance.*
- *SFR86-071 was equally good under full fungicide protection but susceptible to both STB and leaf rust in the HYC 1st stage screen.*

Treatments: (24 elite lines tested under HYC high input management (full foliar fungicide program (3 foliar fungicides – GS31, GS39 & GS61). Plots were full length 15m long plots.

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

Variety		**Grain yield and quality**									
		Yield		Protein		Test weight		Screenings		TSW	
		t/ha		%		%		%		gram	
1.	Trojan	5.66	j	14.0	bc	76.3	ghi	0.6	c-f	47.5	b-e
2.	Anapurna	9.73	ab	11.6	ij	80.3	abc	0.6	cd	49.7	bc
3.	RGT Accroc	8.71	cd	11.8	hi	75.5	hij	0.6	c-f	43.6	g-j
4.	Reflection	10.13	ab	10.0	n	74.5	ijk	0.7	c	39.3	k
5.	Graham	8.54	de	10.8	klm	73.5	k	0.6	cd	41.9	ijk
6.	Shabras	10.08	ab	10.3	mn	74.4	jk	0.5	c-f	44.0	ghi
7.	BX7932-039	7.88	ef	12.5	fg	79.2	bcd	0.7	c	44.9	e-i
8.	V12069-076	6.70	gh	12.8	ef	76.8	fgh	1.3	b	39.2	k
9.	AGFWH004718	10.45	a	10.7	klm	81.7	a	0.2	def	54.6	a
10.	AGFWH004818	10.04	ab	11.1	jkl	80.2	abc	0.4	c-f	50.2	b
11.	Scepter	5.97	hij	13.4	cd	76.5	gh	0.5	c-f	46.7	c-g
12.	SFR86-092	9.45	bc	10.7	klm	78.7	b-f	0.6	cde	45.2	e-h
13.	SFR86-071	9.80	ab	10.6	lm	79.5	bcd	0.6	cd	47.7	b-e
14.	Nighthawk	8.13	de	12.1	ghi	78.8	b-e	0.8	c	43.4	hij
15.	Scepter	5.84	ij	13.4	cd	75.6	hij	0.5	c-f	44.3	f-i
16.	GS-18-107-W	6.44	ghi	14.8	a	77.9	d-g	0.2	ef	46.0	d-h
17.	GS-18-105-W	9.79	ab	11.2	jk	75.7	hij	0.5	c-f	43.0	hij
18.	SUN8621	5.66	j	14.6	a	77.1	e-h	0.3	def	49.7	bc
19.	WAGT734	6.19	hij	13.3	de	78.4	c-f	0.4	c-f	47.6	b-e
20.	AGFWH004418	9.38	bc	10.9	kl	80.1	abc	0.4	c-f	48.9	bcd
21.	AGFWH004518	7.12	fg	13.5	cd	79.8	bc	0.2	f	47.3	b-f
22.	AGFWH004618	10.00	ab	12.0	ghi	80.4	ab	0.2	def	55.3	a
23.	V10006-026	8.78	cd	12.4	fgh	77.1	e-h	1.8	a	40.5	jk
24.	V10100-064	5.78	ij	14.2	ab	77.0	e-h	0.5	c-f	47.9	b-e
	Mean	8.18		12.19		77.71		0.57		46.19	
	LSD	0.77		0.57		1.91		0.38		3.11	
	P Val	<0.001		<0.001		<0.001		<0.001		<0.001	
	CV	5.70		2.86		1.50		40.74		4.09	

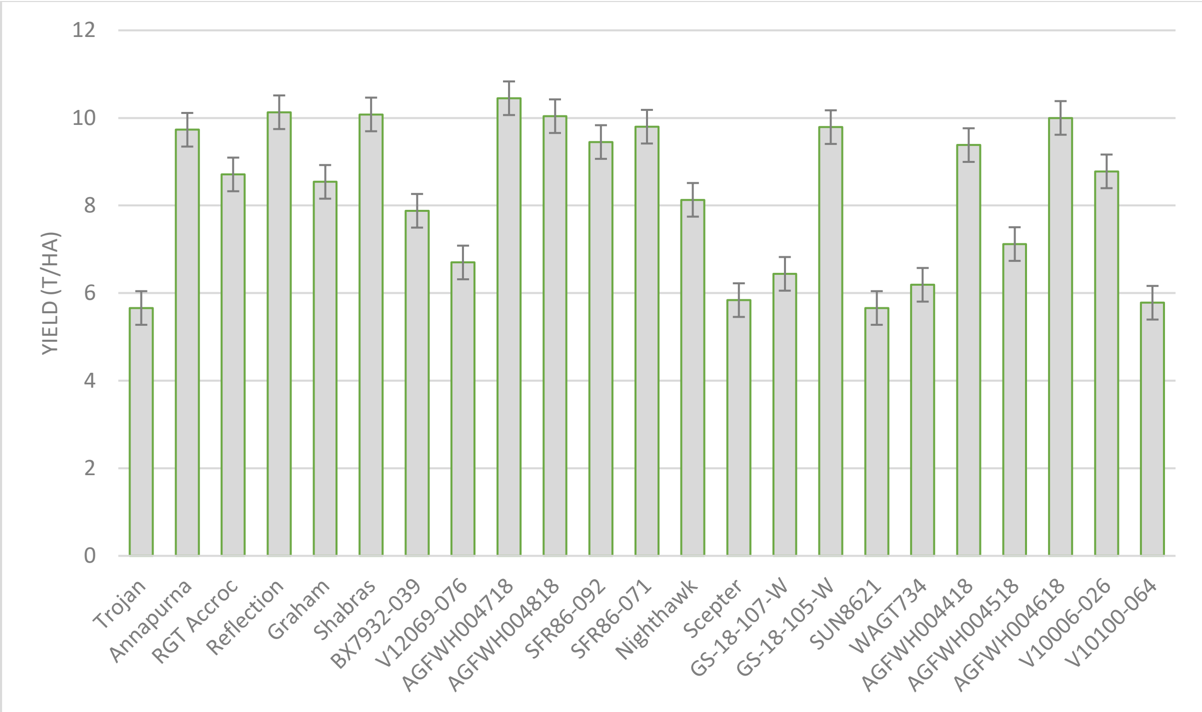

Figure 1. Grain yield (t/ha) of 23 different wheat cultivars.

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

Seed Rate:		**180 seeds/m^2**
Sowing Fertiliser:		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 3. HYC Genotype x Environment x Management (G.E.M) Trial Series

Objectives: To assess the performance of winter and spring wheat varieties managed under three different levels of management sown in mid-April (17th April).

Key Points:

- *The awnless feed wheat SFR86-090 (RGT Cesario) was the top yielding variety under high input management at 9.88t/ha, however its yield was not significantly different to the winter varieties Anapurna and Tabasco.*
- *Unlike SFR86-090, Anapurna and Tabasco gave no significant reduction in yield when input level was reduced to standard input (120N, 2 Fungicide units, no PGR) from high (160N, 4 Fungicide units and 2 PGRs).*
- *Protein levels of 11 – 11.6% for most feed wheats indicated that yields were maximised at 120N with no need to go to 160N in the high N input.*
- *The sowing date was too early for the spring wheat germplasm (Trojan and Scepter) which developed too quickly (flowering 22-25 September) even when defoliated (simulated grazing).*
- *Defoliation at GS30 resulted in greater dry matter offtake with later developing cultivars, Tabasco giving over 2100kg/ha with defoliation on 25 August, compared to RGT Accroc which produced 1340kg/ha from 7 August defoliation.*
- *In contrast to previous seasons, there was little yield penalty for defoliation observed in the high yielding winter wheats compared to standard and high input, a possible indication that yield potential at standard and higher input was restricted.*
- *There were a number of factors that were the possible causes but warmer than average temperatures in November, leaf rust pressure, later army worm and low-level crown rot could have been factors.*
- *The dominant foliar diseases in the trial were Septoria tritici blotch (STB) with leaf rust also a significant disease. Late stripe rust was also observed in the trial, particularly in Trojan.*
- *In terms of yield potential, elevated temperatures in early November may have limited yield potential, but local commercial yields were higher and Tabasco with its late flowering (1st December) was still one of the highest yielding cultivars.*
- *With the exception of Tabasco the highest yielding cultivars flowered in the last 10 days of October, the period traditionally associated with the highest yields from this mid-April sowing date over the last three years at the SA CTC.*

Treatments: Three management levels (see Table 5) differing in defoliation, nitrogen, fungicide and PGR input were applied to 10 varieties of winter and spring wheat.

Table 1. Influence of management strategy and variety 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)	5.65	p	5.71	p	6.67	no	**6.01**
Scepter (spring)	5.47	p	5.59	p	6.46	o	**5.84**
Nighthawk (facultative)	7.23	mn	7.50	lm	7.87	kl	**7.53**
Anapurna (winter)	9.43	a-d	9.56	abc	9.82	ab	**9.60**
RGT Acrocc (winter)	8.35	h-k	7.95	jkl	8.62	e-i	**8.31**
Manning (winter)	8.22	h-k	7.17	mn	7.10	mno	**7.49**
SF Adagio (winter)	8.82	d-h	8.53	g-j	9.24	b-e	**8.86**
RGT Calabro (winter)	8.62	e-i	8.14	ijk	8.59	f-i	**8.45**
SFR86-090 (winter)	9.20	b-f	9.10	c-g	9.88	a	**9.39**
Tabasco (winter)	8.02	i-l	9.71	abc	9.68	abc	**9.13**

LSD Cultivar p = 0.05	0.37 t/ha	P val	<0.001
LSD Management p=0.05	0.42 t/ha	P val	0.042
LSD Cultivar x Man. P=0.05	0.64 t/ha	P val	<0.001

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

	Management Level							
	High Input		Standard Input		"Grazed" Input		Mean	
Cultivar	**Protein %**		**Protein %**		**Protein %**			
Trojan (spring)	14.0	-	13.4	-	12.6	-	**13.3**	**a**
Scepter (spring)	13.6	-	13.5	-	12.2	-	**13.1**	**ab**
Nighthawk (facultative)	12.5	-	12.2	-	12.1	-	**12.3**	**bc**
Anapurna (winter)	12.2	-	11.6	-	11.3	-	**11.7**	**cd**
RGT Acrocc (winter)	12.2	-	11.6	-	8.4	-	**10.7**	**ef**
Manning (winter)	12.5	-	11.6	-	10.4	-	**11.5**	**cde**
SF Adagio (winter)	12.1	-	11.6	-	11.1	-	**11.6**	**cd**
RGT Calabro (winter)	11.9	-	11.2	-	10.9	-	**11.3**	**def**
SFR86-090 (winter)	11.8	-	11.3	-	10.7	-	**11.3**	**def**
Tabasco (winter)	11.2	-	10.5	-	9.7	-	**10.4**	**f**
Mean	**12.4**	**a**	**11.8**	**a**	**10.9**	**b**		

LSD Cultivar p = 0.05	0.87 %	P val	<0.001
LSD Management p=0.05	0.68 %	P val	0.005
LSD Cultivar x Man. p = 0.05	ns	P val	0.453

There were significant interactions between variety and management in the effect on grain size and screenings. Spring varieties that were defoliated later than planned (GS31-32) showed a significant decrease in grain size and increase in screenings compared to winter wheat such as Anapurna (largest grained variety) that showed stable grain size across the three managements (Tables 3 & 4).

Table 3. Influence of management strategy and variety thousand Seed Weight (grams).

	Management Level						
	High Input		Standard Input		"Grazed" Input		Mean
Cultivar	**TSW (gram)**		**TSW (gram)**		**TSW (gram)**		
Trojan (spring)	46.6	a-d	44.4	efg	39.1	lmn	**43.3**
Scepter (spring)	44.6	d-g	44.4	efg	39.7	klm	**42.9**
Nighthawk (facultative)	42.2	hij	41.1	i-l	40.7	jkl	**41.3**
Anapurna (winter)	46.1	b-e	46.4	a-e	45.3	b-f	**45.9**
RGT Acrocc (winter)	41.8	h-k	41.0	i-l	39.2	lmn	**40.6**
Manning (winter)	34.6	p	35.2	p	38.3	mn	**36.0**
SF Adagio (winter)	45.6	b-e	44.7	c-g	46.4	a-e	**45.6**
RGT Calabro (winter)	46.7	abc	47.2	ab	48.4	a	**47.4**
SFR86-090 (winter)	43.4	fgh	42.9	ghi	41.9	hij	**42.7**
Tabasco (winter)	38.4	mn	37.5	no	35.9	op	**37.3**
Mean	**43.0**	**-**	**42.5**	**-**	**41.5**	**-**	

LSD Cultivar p = 0.05	1.2 g	P val	<0.001
LSD Management p=0.05	1.3 g	P val	0.073
LSD Cultivar x Man. p = 0.05	2.1 g	P val	<0.001

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

	Management Level							
	High Input		Standard Input		"Grazed" Input		Mean	
Cultivar	**Screenings (%)**		**Screenings (%)**		**Screenings (%)**			
Trojan (spring)	0.5	g-j	0.7	e-j	1.8	a	**1.0**	**b**
Scepter (spring)	0.5	g-j	0.6	f-j	1.4	abc	**0.9**	**bc**
Nighthawk (facultative)	1.1	cde	1.4	bc	1.5	ab	**1.3**	**a**
Anapurna (winter)	0.5	g-j	0.8	e-i	0.7	e-j	**0.7**	**cd**
RGT Acrocc (winter)	1.0	def	1.3	bcd	0.9	efg	**1.0**	**b**
Manning (winter)	1.4	abc	1.7	ab	1.3	bcd	**1.5**	**a**
SF Adagio (winter)	0.4	ij	0.3	j	0.5	hij	**0.4**	**e**
RGT Calabro (winter)	0.8	e-i	0.7	e-j	0.6	f-j	**0.7**	**cd**
SFR86-090 (winter)	0.6	f-j	0.7	e-j	0.4	ij	**0.6**	**de**
Tabasco (winter)	0.7	e-j	0.7	e-j	0.8	e-h	**0.7**	**cd**
Mean	**0.7**	**b**	**0.9**	**ab**	**1.0**	**a**		

LSD Cultivar p = 0.05	0.23 %	P val	<0.001

LSD Management p=0.05	0.15 %	P val	0.015
LSD Cultivar x Man. p = 0.05	0.40 %	P val	<0.001

Table 4. Approximate date of pseudo stem erect (GS30), mid flowering (GS65) under grazed management, dry matter (DM) removed in simulated grazing (mechanical defoliation) management at GS30 and grain yield reduction associated with grazing.

Phenology (GS30 and GS65), Dry matter removal (GS30) and yield decrease with grazing				
	Date	**Date**	**DM**	**Yield reduction**
Cultivar	**GS30**	**GS65**	**Kg/ha GS30**	**(t/ha)**
Trojan (spring)	8-Jul	25-Sep	680	0.06
Scepter (spring)	8-Jul	22-Sep	690	0.13
Nighthawk (facultative)	8-Jul	15-Oct	450	0.27
Anapurna (winter)	7-Aug	21-Oct	1490	0.13
RGT Acrocc (winter)	7-Aug	15-Oct	1340	+0.40
Manning (winter)	7-Aug	3-Nov	1840	+1.06
SF Adagio (winter)	7-Aug	21-Oct	1480	+0.28
RGT Calabro (winter)	7-Aug	27-Oct	1440	+0.48
SFR86-090 (winter)	13-Aug	21-Oct	1510	+0.10
Tabasco (winter)	25-Aug	1-Dec	2210	1.68

Compared to 2019 dry matter at harvest was significantly lower with none of the wheat varieties under any management giving 20t/ha dry matter at harvest. As would be expected with later than planned defoliation the spring wheats had reduced harvest dry matter compared to the standard (Figure 1). Although not statistically part of the same trial the second sowing date of GEM (11 May sown) tended to produce higher dry matter at maturity (Figure 2). This resulted in a trend for higher yields from the May sowing date (Figure 3).

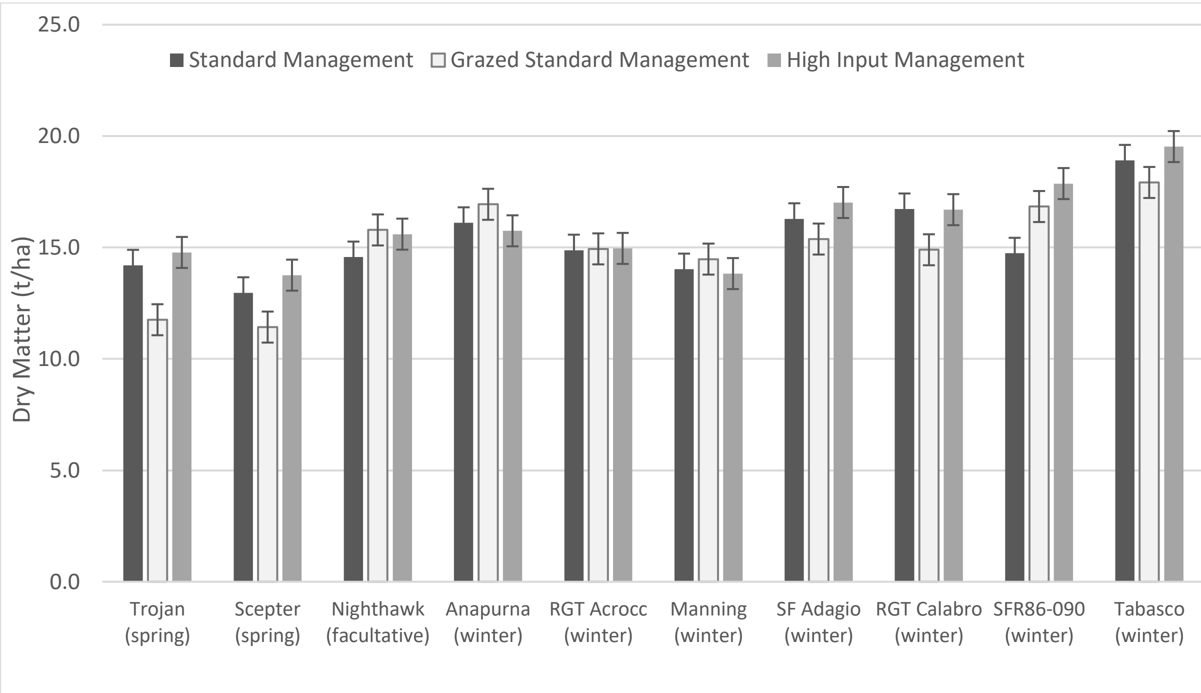

Figure 1. Dry matter at physiological maturity GS89 (except Tabasco), 8 December.

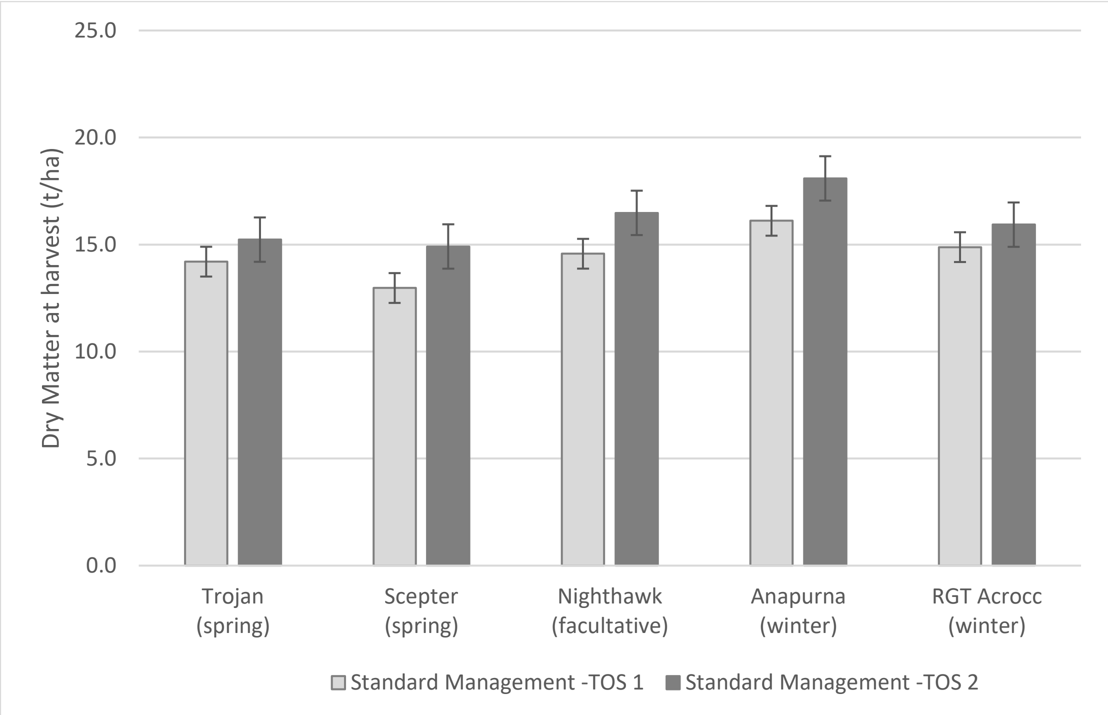

Figure 2. Dry matter accumulation at physiological maturity (t/ha) from five cultivars under the standard management sown on 17 April and 11 May.

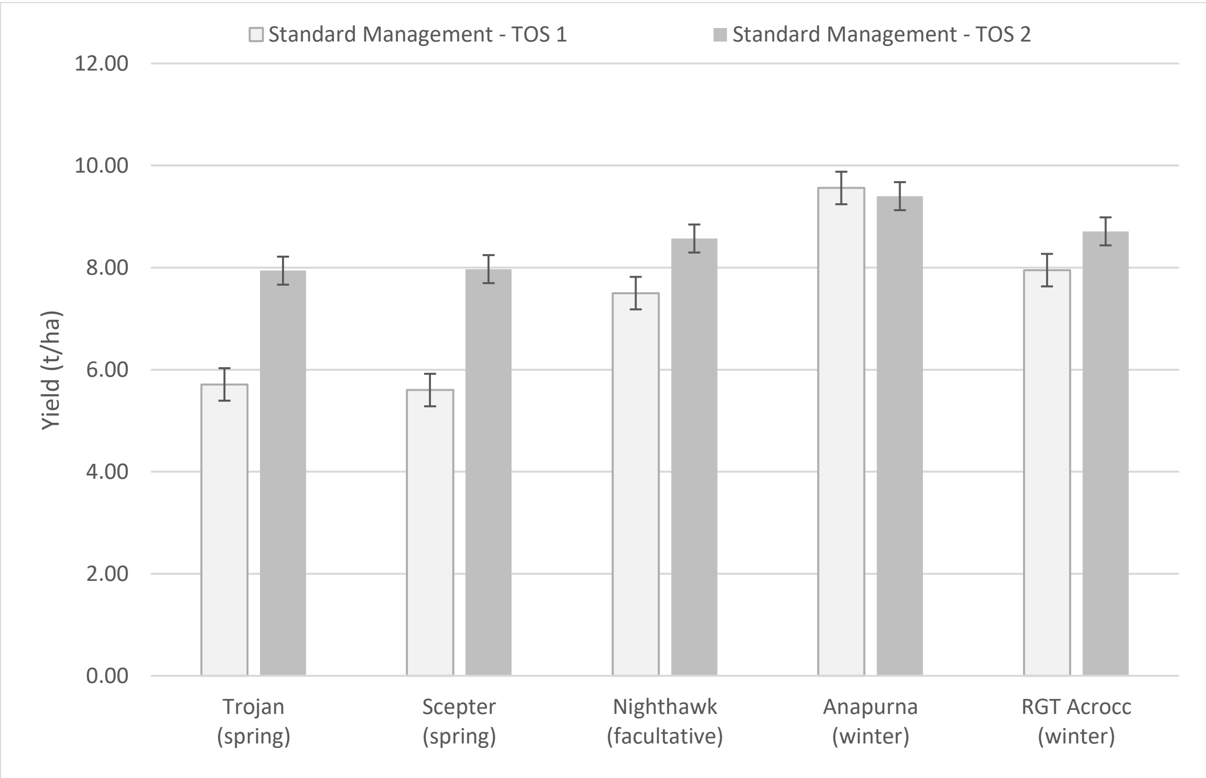

Figure 3. Grain yield (t/ha) observations from five cultivars grown under the standard management sown at TOS 1 (17 April) and TOS 2 (12 May).

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

Plant pop'n:		180 seeds/m^2 (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:	17 April	100kg MAP	100kg MAP	100kg MAP
Nitrogen:**	29 July	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	11 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (80 N)
	2 September	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (80 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. 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). High management spring plots received 40N extra at 29 July, winters received 40N extra 2 September as listed in table.*

Trial 4. HYC Disease Management Germplasm Interaction

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

Key Points:

- *There was a significant interaction between variety and fungicide management on grain yield indicating that varieties responded differently to the application of fungicide.*
- *The more disease resistant winter feed wheats Tabasco, Anapurna and SFR86-090 were significantly higher yielding than other cultivars when left untreated with fungicide or when treated with only one unit of fungicide at flag leaf.*
- *In addition, the margin return with each of these varieties were maximised with one unit of fungicide applied at GS39 as opposed to four units of fungicide applied at seeding, GS31, GS39 and GS61.*
- *The dominant disease in the trial was Septoria tritici blotch (STB) with leaf rust also present through much of the season as a result of the earlier mid-April sowing.*
- *RGT Accroc suffered the greatest yield reduction when left untreated with fungicide with a 3.81t/ha yield reduction, in large part due to the leaf rust pressure.*
- *Much of the effect of fungicide application is observed in green leaf retention at flowering and grain fill (Figure 1 – 4) whether measured subjectively or using crop reflectance (NDVI).*
- *There is evidence that leaf rust susceptible cultivars such as RGT Accroc may have lost yield to leaf rust post flowering as at flowering (GS65) the flag leaf already showed 5% infection in the treatment that had four units of fungicide applied.*
- *The significance of late leaf rust development in a warmer November cannot be understated and may have taken yield from the more susceptible varieties in the GEM trial (Trial 3).*

Treatments: Three levels of fungicide management (untreated, 1 Fungicide unit applied GS39 & 4 Fungicide units (seed treatment, GS31, GS39 and GS61) were applied across 10 wheat varieties (Tables 1 & 2).

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

	Management Level						
	Untreated		1 Fungicide Unit		4 Fungicide Units		Mean
Cultivar	Yield t/ha		Yield t/ha		Yield t/ha		Yield t/ha
Trojan (spring)	4.89	mn	5.50	lm	6.07	jkl	**5.49**
Scepter (spring)	4.34	n	5.88	kl	6.23	ijk	**5.48**
Nighthawk (facultative)	6.89	hi	7.40	gh	7.39	gh	**7.22**
Anapurna (winter)	8.22	def	9.65	a	9.65	a	**9.18**
RGT Acrocc (winter)	5.12	m	7.98	efg	8.93	bc	**7.35**
SF Adagio (winter)	6.72	ij	8.49	c-f	8.88	bcd	**8.03**
Calabro (winter)	5.92	kl	7.97	fg	8.49	c-f	**7.46**
SFR86-090 (winter)	8.64	cde	9.45	ab	8.96	bc	**9.01**
Tabasco (winter)	8.00	efg	9.49	ab	9.95	a	**9.15**
Einstein (winter)	6.59	ij	7.96	fg	8.94	bc	**7.83**

LSD Cultivar p = 0.05	0.38 t/ha	P val	<0.001
LSD Fungicide p=0.05	0.33 t/ha	P val	<0.001
LSD Cultivar x Fung. P=0.05	0.66 t/ha	P val	<0.001

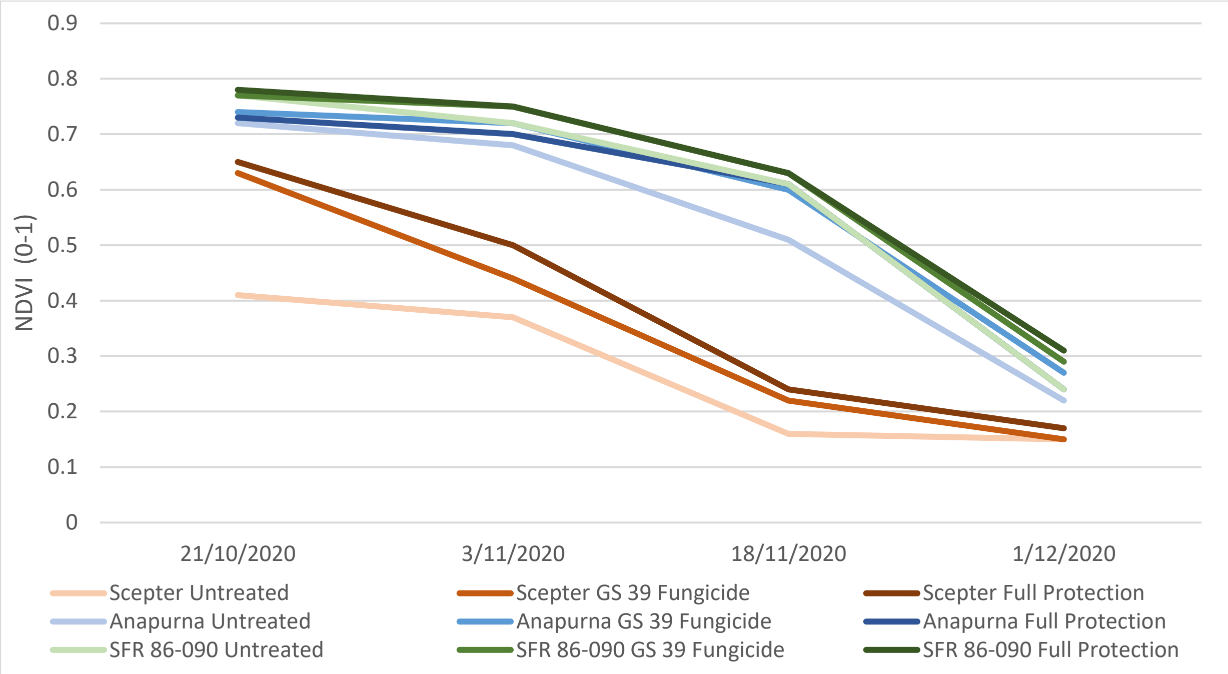

Figure 1. NDVI at four dates in spring of Scepter, Anapurna and SFR 86-090.

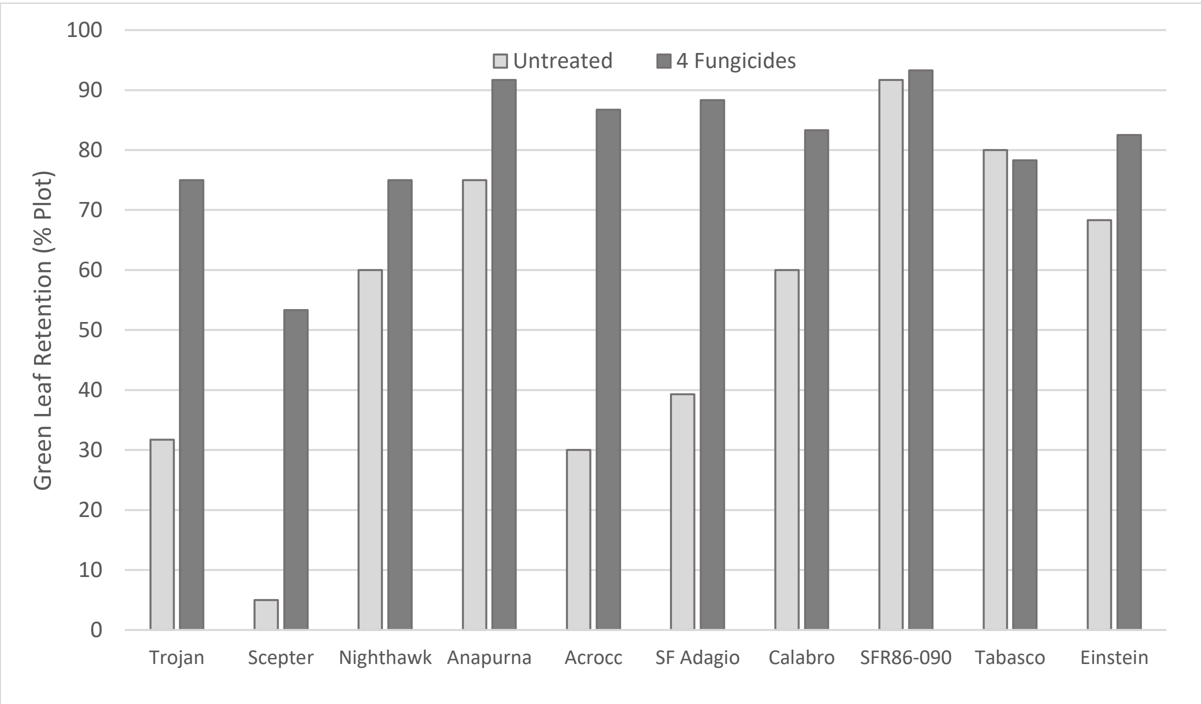

Figure 2. Green Leaf Retention (% plot green) in the untreated and four fungicide units assessed on 27 October.

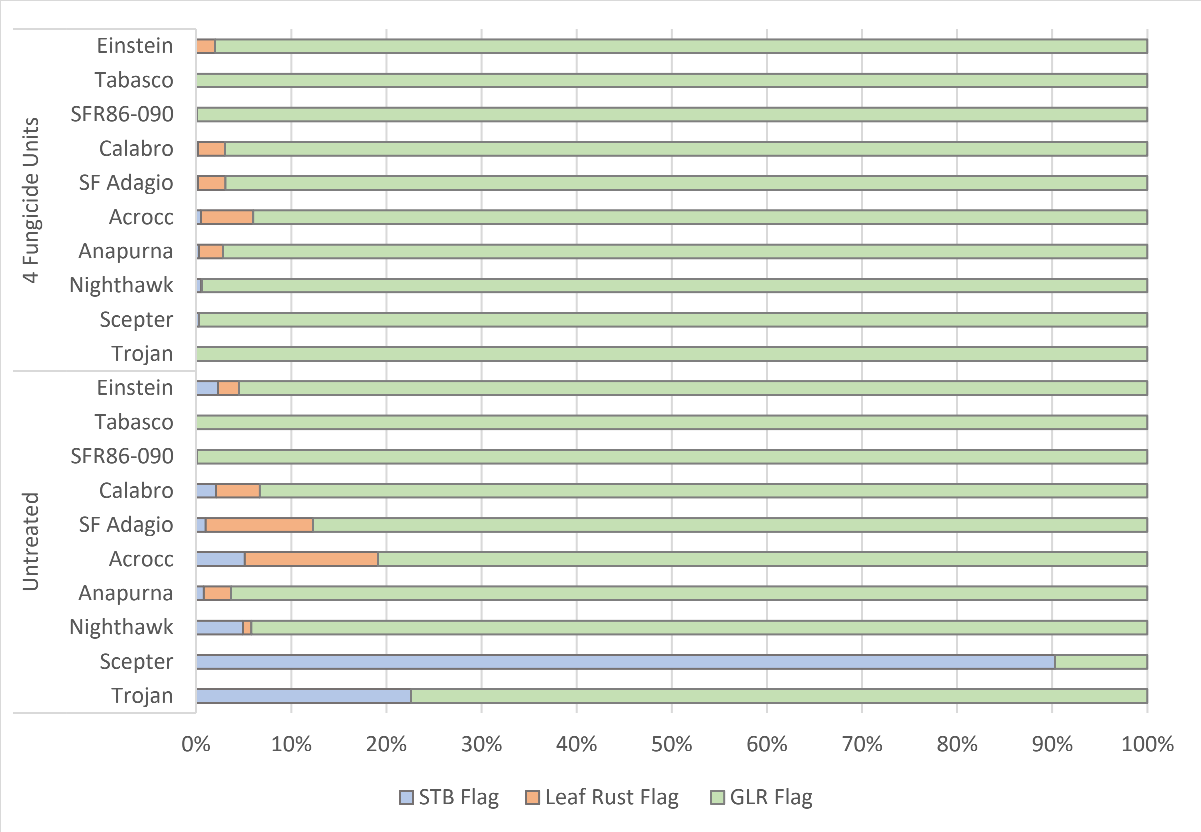

Figure 3. Influence of fungicide strategy and cultivar on STB and leaf rust Flag, assessed 27 October.

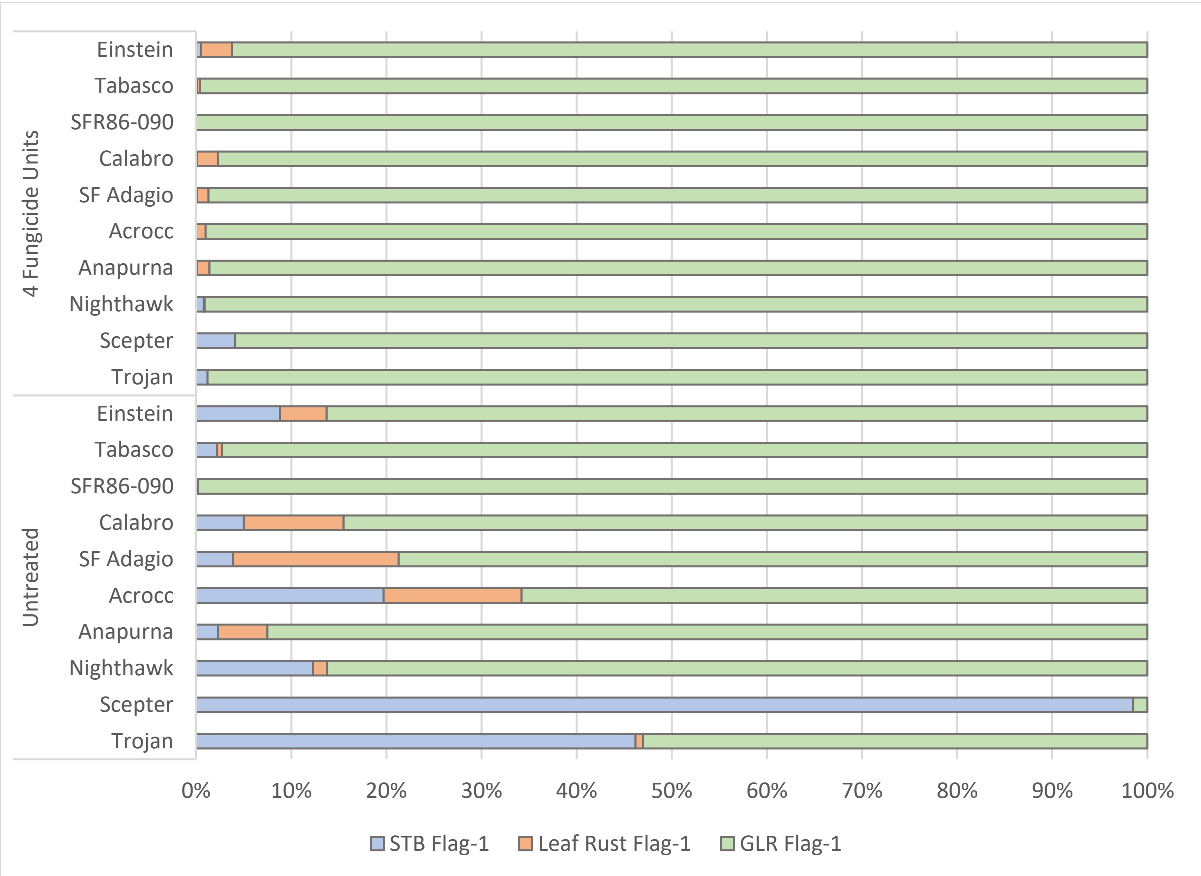

Figure 4. Influence of fungicide strategy and cultivar on STB and leaf rust Flag-1, assessed 27 October

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

Plant pop'n:		180 seeds/m^2 (150 plants/m2 target) - all three managements		
		Untreated	**1 Fungicide Unit**	**4 Fungicide Units**
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As standard + Systiva
Basal Fertiliser:	17 April	100kg MAP	100kg MAP	100kg MAP
Nitrogen*:	29 July	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	11 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	2 September	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
Total N Applied:		120 N	120 N	120 N
Fungicide*:	GS31-32	---	---	Prosaro 300ml
	GS39	---	FAR F1-19 750ml	Radial 840ml
	GS59-61	---	---	Opus 500ml

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

**Timings of fertiliser and fungicides were adjusted to take account of the differences in spring (s) and winter wheat (w) phenology (development).*

Trial 5. HYC Spring Wheat "Reset" Trial

Objectives: To assess the value of pre and post GS30 defoliation in winter and spring germplasm grown in HRZ regions of different season lengths using 17th April sowing date.

Caution: Please note aspects of defoliation post GS30 are purely experimental.

Key Points:

- *All defoliation treatments reduced grain yield relative to the "ungrazed" crop except the light graze treatment in Trojan.*
- *Those defoliation treatments that removed larger amounts of dry matter at stem elongation (GS30-32) invariably reduced grain yield more.*
- *The concept of "resetting" Trojan at GS32 was unsuccessful in maintaining or increasing yield.*
- *In Trojan "light grazing" (as opposed to hard grazing) did not reduce grain yield and was the only treatment that showed canopy compensation by flowering (GS61) when assessed by canopy reflectance (NDVI).*
- *With Trojan "light grazing" at GS30 which removed only 240kg/ha on July 7 increased margins by the value of the grazing $60/ha plus a small increase in grain output (not significant) of $53/ha.*

Treatments:

A winter and spring wheat (RGT Accroc and Trojan) were hard grazed and light grazed at the start of stem elongation at GS30, grazed post stem elongation at second node (GS32) and left ungrazed. Defoliation was carried out with a lawn mower set at different heights at the two development stages.

The concept of "resetting" is specifically designed for early sowing spring wheat that develops too quickly from earlier sowing than would be recommended, in this case mid-April. The idea is that defoliation later than GS31 specifically removes advanced main stems that would have been frosted due to their very early development. Please note this is an experimental approach and should not yet be applied to commercial acreage.

Table 1. Grazing dates and the influence of grazing management of grain yield (t/ha).

	Trojan		**Accroc**		**Mean**	
	Yield (t/ha)		Yield (t/ha)		Yield (t/ha)	
Ungrazed	7.15	b	7.93	a	**7.54**	**a**
"Hard Graze" (GS30) (8 July & 7 August)	6.87	bc	6.17	d	**6.52**	**c**
"Light Graze" (GS30) (8 July & 7 August)	7.34	b	6.59	cd	**6.97**	**b**
Late (GS32) graze* 20 July	6.21	d	7.27	b	**6.74**	**bc**
Mean	**6.89**	**-**	**6.99**	**-**		
LSD Variety p=0.05		ns		P val	**0.769**	
LSD Defoliation p=0.05		0.37		P val	**<0.001**	
LSD Var x Defoliation p=0.05		0.52		P val	**<0.001**	

All simulated grazing treatments were carried out by mechanical defoliation (lawnmower).

Trojan mechanically defoliated on 7 July and RGT Accroc on 8 August.

** The late GS32 graze was only conducted on Trojan and RGT Accroc was defoliated at the same calendar date.*

The later defoliation of RGT Accroc produced higher dry matters than Trojan with over 1t/ha dry matter when hard grazed at GS30, however if Trojan and RGT Accroc were grazed on the same day (Trojan reset date 20 July) Trojan produced twice the dry matter.

Table 2. Grazing dates and the influence of grazing management of dry matter (t/ha) removed (and total above ground biomass prior to DM removal) at each grazing timing and harvest.

	Date	**Dry Matter (t/ha)**					
		DM removed		Total		Harvest	
Trojan; untreated	---	---	---	---	---	13.3	-
Trojan; Hard graze	8-Jul	0.49	d	0.65	e	12.5	-
Trojan; Light graze	8-Jul	0.24	e	0.54	e	12.3	-
Trojan GS32 graze	20-Jul	0.85	b	1.11	c	12.2	-
RGT Accroc; Untreated	---	---	---	---	---	14.4	-
RGT Accroc; Hard graze	7-Aug	1.12	a	1.79	a	12.3	-
RGT Accroc; Light graze	7-Aug	0.67	c	1.45	b	13.3	-
RGT Accroc; GS32 graze	20-Jul	0.44	d	0.85	d	13.5	-
LSD p=0.05		0.15		0.14		ns	
P val		**<0.001**		**<0.001**		**0.323**	

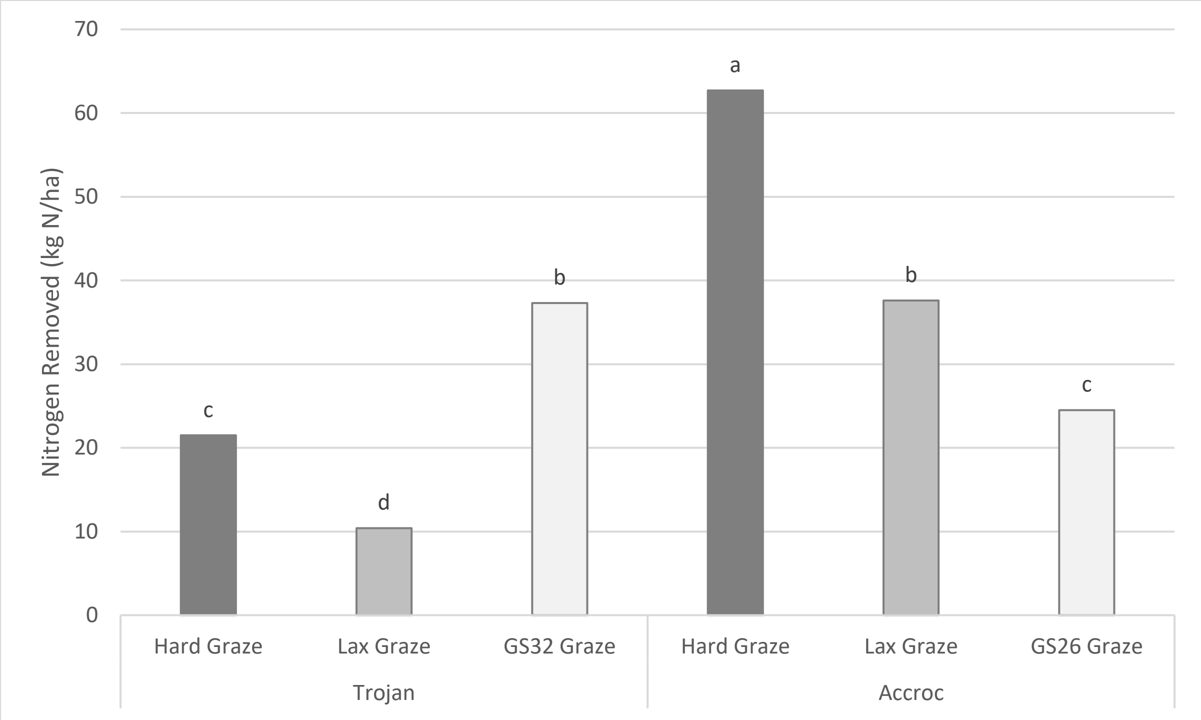

Figure 1. Nitrogen removed by grazing, LSD: 7.48, P Value: <0.001

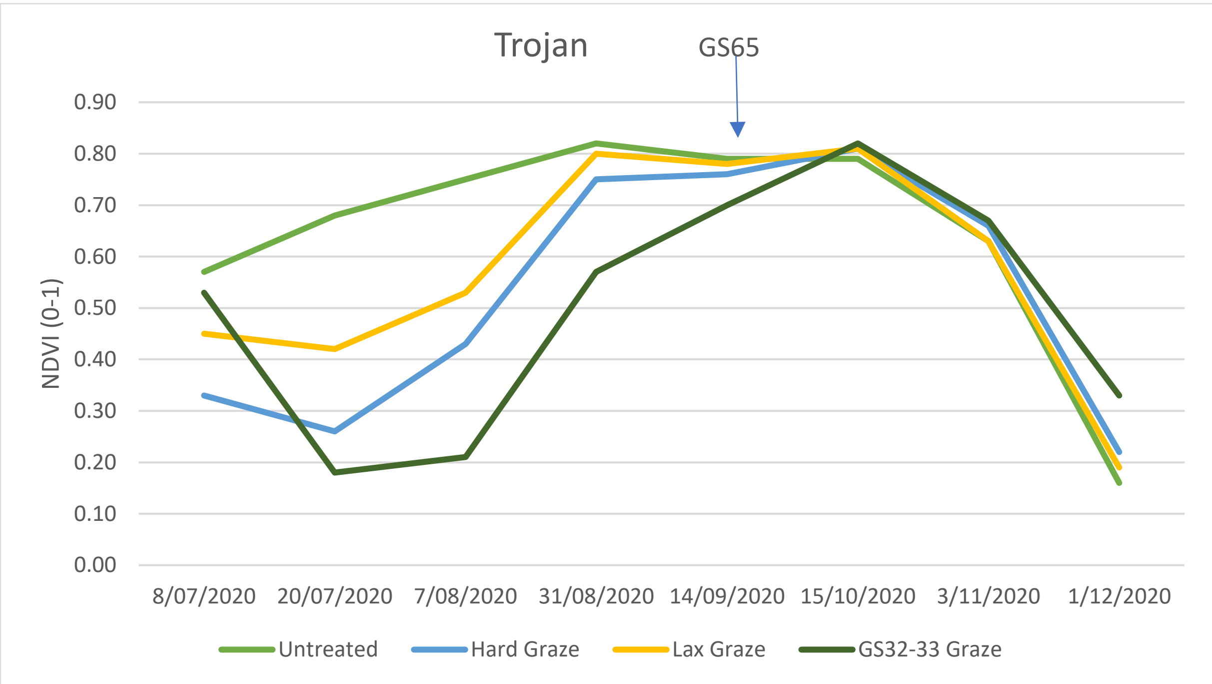

Figure 1. Trojan Crop reflectance measured by the Greenseeker as NDVI (0 - 1 scale) July – December 2020.

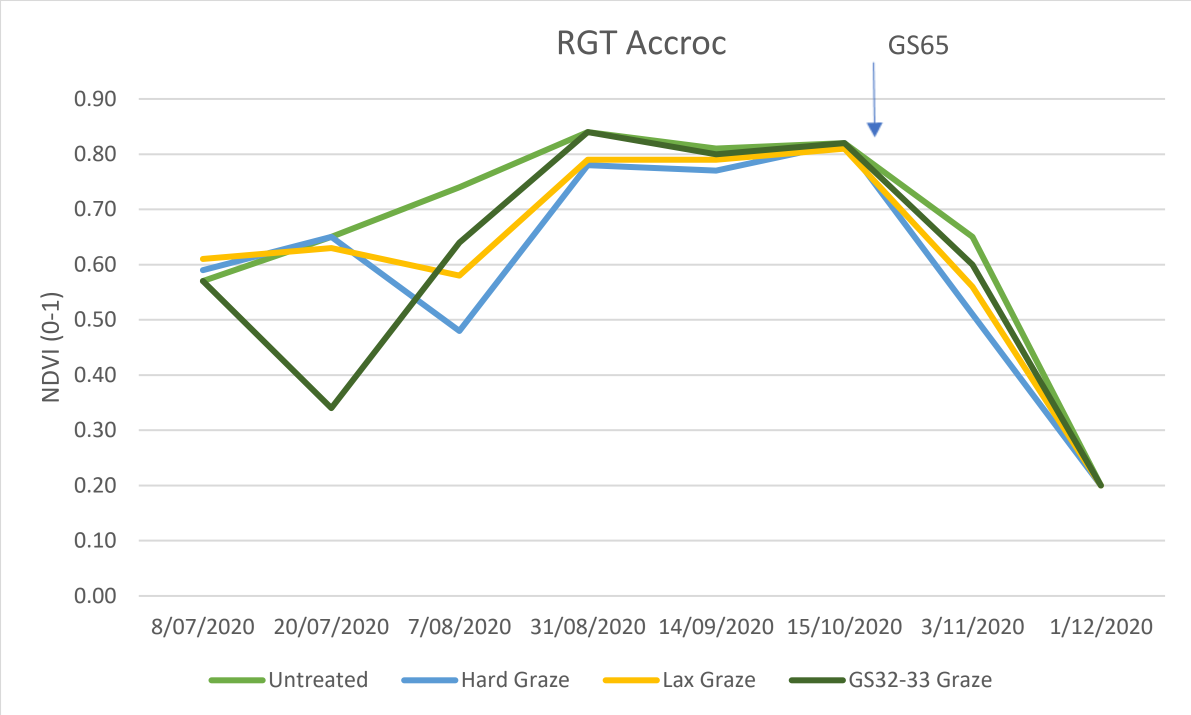

Figure 2. RGT Accroc Crop reflectance measured by the Greenseeker as NDVI (0 - 1 scale) July – December 2020.

Table 3. Details of the management levels applied (ml/ha)

Plant pop'n:	180 seeds/m^2 (150 plants/m2 target) - all management levels							
	Timing	**Ungrazed**	**Light Graze**		**Hard Graze**		**Late (GS32) Graze**	
Seed trt:		Vibrance/Gaucho						
Basal Fertiliser:	17 April	100kg MAP (10 Kg N)						
Nitrogen:	29 July	40kg N/ha						
	11 August	40kg N/ha						
	28 August	40kg N/ha						
	2 September	40kg N/ha						
Total N Applied:		**170kg N/ha**						
PGR:		---	---		---		---	
Grazing**	Trojan	---	GS31	8 Jul	GS31	8 Jul	GS33	20 Jul
	Accroc	---	GS30	7 Aug	GS30	7 Aug	GS26	20 Jul
Fungicide*:	GS31	Prosaro 300ml	Prosaro 300ml		Prosaro 300ml		Prosaro 300ml	
	GS39	Radial 840ml	Radial 840ml		Radial 840ml		Radial 840ml	
	GS59-61	Opus 500ml	Opus 500ml		Opus 500ml		Opus 500ml	

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

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

*** Grazing height varied to suit treatment.*

Trial 6. 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 (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) and for the following crop (mirror image trial set up in host farmer paddock to be monitored in 2021).
- To assess the value of adding increased P, K, and S when targeting higher yield potential rather than N alone.

Key Points:

- *There was no response above the standard N input of 130kg N/ha, which also received a standard of 100kg/ha MAP at sowing (10N, 21.9P).*
- *Protein levels (12.1% in the standard) and dry matter at harvest indicated that yield was maximised at this level of nutritional input.*
- *Protein was increased by more N applied but yield was unaffected.*
- *Test weight was significantly reduced but differences were small (1kg/hL)*

Treatments: Five different nutrition strategies were put in place in RGT Accroc that differed in the level of nutrition (N, P, K & S). The same trial was set up in the surrounding farm crop. The starting nitrogen (N) in the soil was 228.13kg N/ha (0- 90cm).

Table 1. The effect of crop nutrition on harvest dry matter (t/ha), yield (t/ha), and grain quality

Name	Harvest Dry Matter (t/ha)		Yield (t/ha)		Protein (%)		Test Weight (kg/hl)		Screening (%)	
130N (standard)	14.9	-	7.25	-	12.1	c	73.5	-	1.4	-
160N	15.2	-	7.67	-	12.1	c	73.0	-	1.5	-
190N	13.7	-	7.39	-	12.2	bc	73.6	-	1.4	-
160N + 40P + 37K + 38S	15.0	-	7.53	-	12.4	a	73.2	-	1.5	-
190N + 40P + 37K + 38S	16.3	-	7.50	-	12.3	ab	72.7	-	1.8	-
Grand Mean	15.0		7.47		12.2		73.2		1.50	
LSD P=.05	ns		ns		0.20		ns		ns	
Treatment Prob(F)	0.130		0.619		0.010		0.416		0.227	

The effect of nutrition on dry matter at harvest gave variable results, particularly where 190kg N/ha was applied alone. It is these apparently aberrant results that would appear to indicate that harvest index is improved at 190kg N/ha (Figure 1).

Table 2. Site soil test details

	Level Found
ECEC	50.5 cmol/kg
Organic Carbon 9W&B)	9.83 %
pH 1:5 water	7.64

Total Mineral N*	228.13 kg N/ha
Colwell Phosphorus	42 mg/kg
Colwell Potassium	320 mg/kg
KCl Sulfur	86 mg/kg

*Mineral N 0-90cm sampled 29/6/2020, all other results 0-10cm depth sampled 8/4/2020

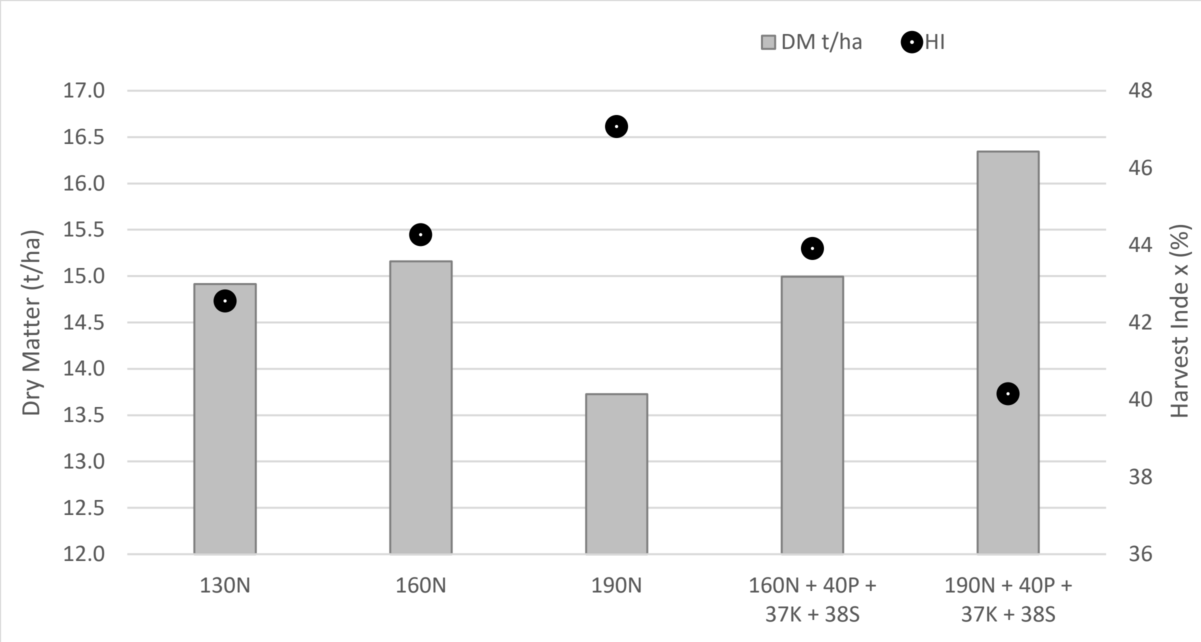

Figure 1. Effect of Nutrition strategy on harvest Dry Matter and harvest Index 13 December.

Table 3. Trial input and management details (kg, g, ml/ha).

Plant pop'n:		180 seeds/m^2
Seed treatment:		Vibrance/Gaucho
Basal Fertiliser:	16 April	100kg MAP
Nitrogen:	29 July	87 kg Urea (40 N) ± treatment list
	11 August	87 kg Urea (40 N) ± treatment list
	2 September	87 kg Urea (40 N)
Fungicide*:	25 August	Prosaro 300mL/ha
	14 September	Radial 840mL/ha
	28 October	Opus 500mL/ha

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

Trial 7. 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 are:

- 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 RGT Relay) 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 Points:

- *The long season UK wheat RGT Relay out yielded Manning but none of the treatments of insecticide or fungicide produced any significant difference in grain yield.*
- *There were clear indications that symptoms of BYDV were present in the RGT Relay that were not present in the BYDV tolerant variety Manning, but these differences did not result in a yield effect.*
- *BYDV like symptoms became more apparent in the canopy as the crop began to grain fill with less BYDV observed in the insecticide treated plots in RGT Relay (non-tolerant).*
- *Little or no BYDV like symptoms were observed in the Manning.*
- *There was no significant expression of erect heads in this trial or significant differences in erect head numbers.*
- *ELISA testing confirmed Cereal yellow dwarf virus (CYDV-prv) presence but not Barley yellow dwarf virus (BYDV-pav).*

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. 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. The effect of variety and crop protection treatment on Yield (t/ha).

	Manning		**Relay**		**Mean**	
	Yield (t/ha)		Yield (t/ha)		Yield (t/ha)	
Untreated	8.55	-	9.50	-	**9.03**	**-**
Gaucho	8.48	-	9.57	-	**9.02**	**-**
Gaucho + GS21 Insecticide	8.93	-	9.71	-	**9.32**	**-**
Gaucho + GS21 & GS31 Insecticide	8.81	-	9.53	-	**9.17**	**-**
Gaucho + GS21 & GS31 Insecticide + Experimental Fungicide 1	9.04	-	10.27	-	**9.65**	**-**
Gaucho + GS21 & GS31 Insecticide + Experimental Fung 1 + Azoxystrobin	9.16	-	9.95	-	**9.55**	**-**
Mean	**8.83**	**b**	**9.75**	**a**		
LSD Variety p=0.05		0.46		P val	**0.008**	
LSD Treatment p=0.05		0.53		P val	**0.095**	
LSD Var x Treatment p=0.05		ns		P val	**0.908**	

Treatments 1 – 4 were treated with Opus at full rate at GS31 after which all treatments were treated the same.

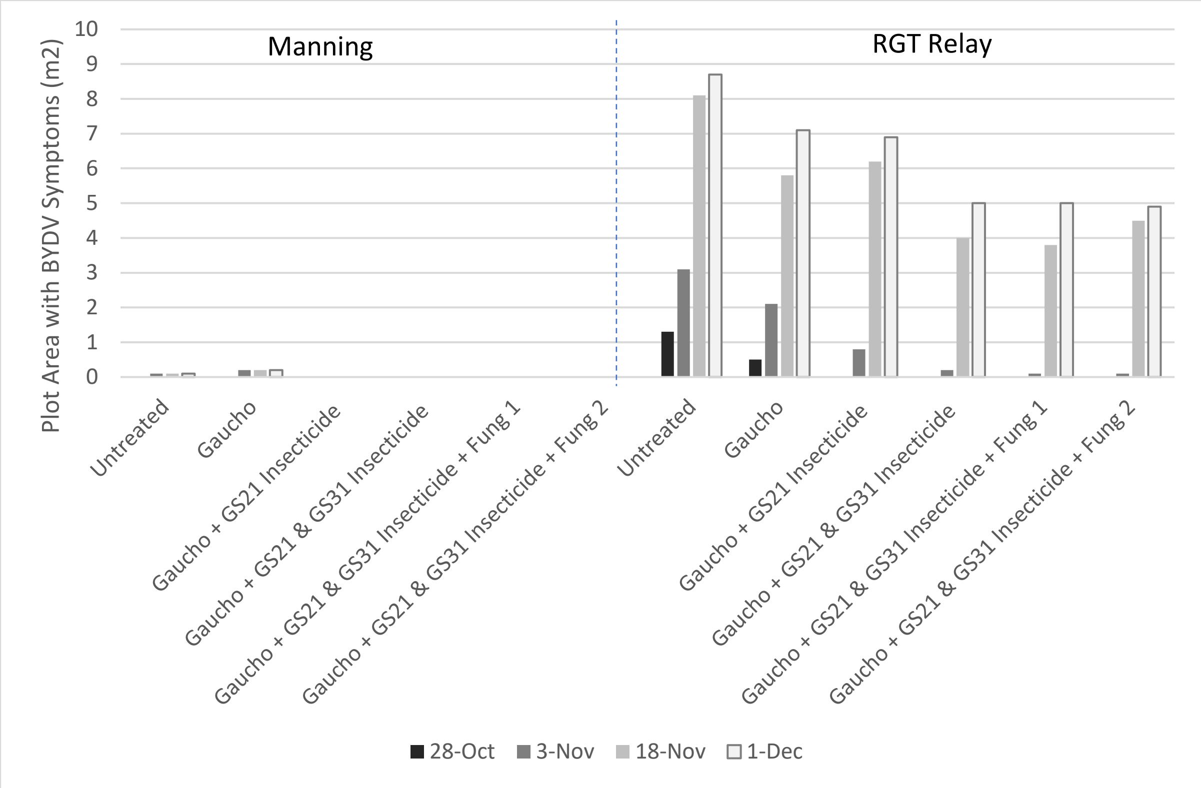

Figure 1. Area of the plot (m^2) displaying visual symptoms of BYDV (later ELISA testing confirmed as Cereal Yellow Dwarf Virus). Total plot area = approximately 24/$m^{2.}$

Table 2. Trial input and management details (kg, g, ml/ha).

Plant pop'n:		180 seeds/m^2
Seed treatment:		Vibrance ± Gaucho
Basal Fertiliser:	16 April	100kg MAP
Nitrogen:	29 July	87 kg Urea (40 N) ± treatment list
	11 August	87 kg Urea (40 N) ± treatment list
	2 September	87 kg Urea (40 N)
Fungicide:	GS31*	Opus 800mL/ha
	14 September	Aviator Xpro 400mL/ha
	28 October	Radial 840mL/ha

*All inputs of insecticides and herbicides were standard across the trial. *Trt 1-4 & 7-10 when each cultivar reached GS31.*

2020 SA Crop Technology Centre - Millicent, South Australia
Second Time of Sowing (11th – 12th May 2020)

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

Sown: 11 - 12 May 2020
Harvested: 4 - 6 January 2020
Rotation position: 1st Cereal after canola, 2018 wheat.
Soil type & Management: Neutral-slightly alkaline Organosol (Peat soil) – high organic matter (0-30cm).

Trial 8. HYC 1st Stage Screen

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

Key Points:

- *Cultivars performed similarly at the second sowing date but lower disease pressure resulted in more screened cultivars looking to be potential candidates (those with less than 10% plot infection and no or little lodging issues (less than lodging index score of 50).*
- *GSUQ-19-48-W, LPB16-0582 and V13079-049 showed STB infection below 10% in addition to those cultivars outlined as more disease resistant in the April sowing screen (Trial 1).*

Treatments: 33 lines and varieties were sown in small plots (6m in length) with standard nitrogen management but ***NO FUNGICIDE or PGR input***. ***Plots are not taken to yield.***

Also refer to the Elite screen sown at the same time that was taken to yield (Trial 9).

Table 1. Zadoks score on 26 August and 29 September.

Variety	26-Aug	29-Sep
Scepter	32	59
Trojan	32	55
Anapurna	31	37
RGT Accroc	31	39
Nighthawk	31	39
Reflection	29	33
Graham	29	32
Savello	30	33
Shabras	29	33
LPB16-0582	31	37

LPB16-0598	31	37
LPB17-4713	32	49
SFR86-092	30	33
SFR86-071	31	37
SFR86-085	31	39
GSUQ-19-48-W	31	39
GS-18-107-W	32	55
GS-18-105-W	31	37
GSUQ-19-04-W	32	45
IGW6563	32	45
IGW6496	32	42
AGFWH004418	31	37
AGFWH004518	31	37
AGFWH004618	31	39
AGFWH004718	30	33
AGFWH004818	30	39
V13079-049	31	45
SUN944O	32	51
SUN945A	32	51
V12167-048	32	48
V10100-064	32	55
SUN862I	32	39
WAGT734	32	48

Table 2. Disease Severity (% plot area infected with Septoria tritici blotch (STB), leaf rust and stripe rust) on 26 October, **Lodging Severity (0-5) and Index (0-500) 5 January.**

Variety	Septoria	Leaf Rust	Stripe Rust	Lodging Severity	Lodging Index
	% Plot	**% Plot**	**% Plot**	**0-5**	**0-500**
Scepter	65	2	0	1.5	101.3
Trojan	10	0	30	1.0	20.0
Anapurna	3	4	0	0.0	0.0
RGT Accroc	20	30	0	0.5	25.0
Nighthawk	8	0	0	0.0	0.0
Reflection	5	0	0	0.0	0.0
Graham	15	10	0	0.0	0.0
Savello	5	25	0	0.0	0.0
Shabras	4	2	0	0.0	0.0
LPB16-0582	9	2	0	0.0	0.0
LPB16-0598	15	0	0	0.0	0.0
LPB17-4713	18	0	8	0.5	35.0
SFR86-092	3	0	0	0.0	0.0
SFR86-071	7	3	0	0.0	0.0
SFR86-085	6	0	0	1.5	50.0

GSUQ-19-48-W	4	0	0	0.8	15.0
GS-18-107-W	25	40	0	0.5	30.0
GS-18-105-W	2	0	0	0.0	0.0
GSUQ-19-04-W	10	2	0	1.0	27.5
IGW6563	25	3	0	2.3	170.0
IGW6496	12	0	0	1.8	70.0
AGFWH004418	7	0	0	0.0	0.0
AGFWH004518	8	0	0	1.3	45.0
AGFWH004618	18	3	0	0.0	0.0
AGFWH004718	3	0	0	0.0	0.0
AGFWH004818	2	0	0	0.0	0.0
V13079-049	4	1	0	1.0	22.5
SUN944O	15	0	0	2.0	120.0
SUN945A	22	0	0	3.0	112.5
V12167-048	30	0	0	1.5	30.0
V10100-064	25	0	0	1.0	30.0
SUN862I	18	0	0	1.0	55.0
WAGT734	18	9	0	2.8	190.0

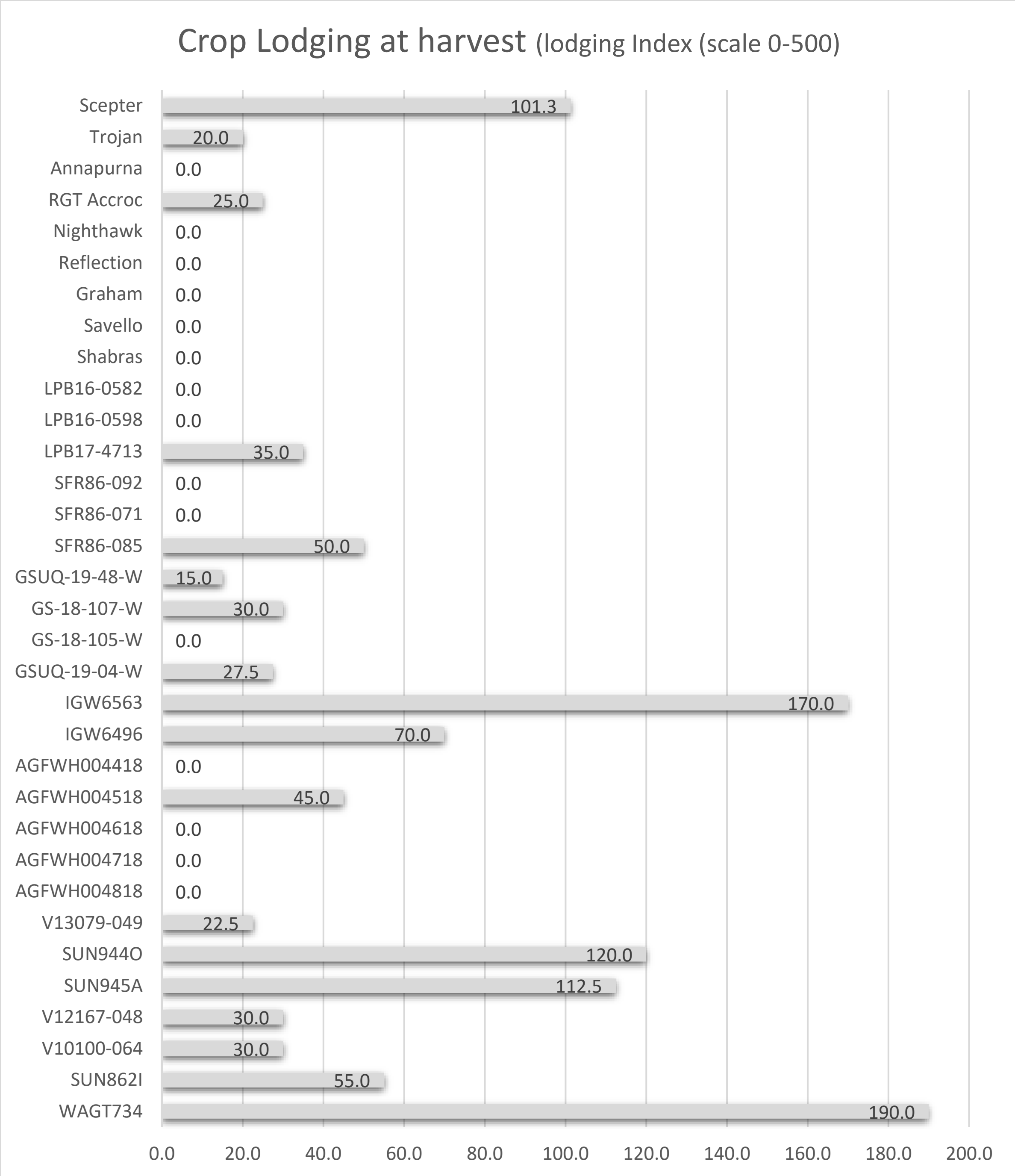

Figure 1. Lodging at harvest presented as lodging index (combination of severity (0 – 5 scale) and % plot area affected) Lodging Index (0-500 scale), 5 January.

Table 3. 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

Trial 9. 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 sown in mid-May.

Key Points:

- *Although set up as spatially separate trials (with some differences in varieties tested) the mean yield of the second time of sowing (12 May) was over 1t/ha higher yielding than the first time of sowing (17 April).*
- *At the second sowing nine varieties exceeded 10t/ha compared to only five varieties at the first time of sowing.*
- *A number of the winter wheat varieties exceeded 10t/ha at the mid May sowing with AGFWH004718 almost hitting 11t/ha.*
- *RGT Accroc which was subject to considerably less STB pressure than the first sowing date yielded 10.62t/ha compared to only 8.71t/ha when sown in mid-April.*
- *Although harvest dry matters were lower in 2020, the harvest index for RGT Accroc was 58% using a typical harvest dry matter (9.29/16t/ha at 0% moisture).*
- *At this sowing date the gap between the best feed wheat and milling wheat (Scepter) was approximately 2t/ha.*
- *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).*

Treatments: 24 elite lines (as suggested by breeders and from previous studies) were tested under HYC full fungicide management (Foliar fungicide program based on 3 foliar fungicides – GS31, GS39 & GS61).

Table 1. Grain yield and quality (protein (%), test weight (kg/hL), Thousand Seed Weight (TSW) (gram) and screenings (%)).

Variety		Grain yield and quality									
		Yield		Protein		Test weight		Screenings		TSW	
		t/ha		%		%		%		gram	
1.	Scepter	8.25	ijk	12.6	d	80.5	de	0.3	ijk	50.3	bcd
2.	Trojan	8.52	i	12.5	d	78.4	fg	0.9	b-g	44.1	j
3.	Anapurna	10.36	bcd	11.8	fgh	81.9	abc	0.6	e-i	49.2	cde
4.	RGT Accroc	10.62	abc	11.3	ijk	79.4	ef	0.3	ijk	51.4	b
5.	Shabras	9.96	de	10.1	n	75.8	i	1.0	bcd	44.0	j
6.	Nighthawk	9.00	gh	11.7	ghi	82.7	ab	0.7	d-h	45.4	hij
7.	Catapult	7.73	l	12.1	ef	80.1	de	0.5	hij	47.5	efg
8.	Reflection	9.83	ef	10.4	mn	76.2	hi	1.6	a	38.7	m
9.	Graham	9.43	fg	10.7	lm	75.5	i	0.8	c-h	41.5	l
10.	LPB16-0582	8.32	ij	13.1	c	76.4	hi	1.1	bc	45.4	hij
11.	LPB16-0598	10.37	bcd	11.5	hij	82.2	abc	0.9	b-f	47.0	fgh
12.	LPB17-4713	8.57	hi	13.4	bc	80.2	de	0.1	k	52.1	ab
13.	SFR86-092	10.22	b-e	10.5	m	78.2	g	1.1	bc	44.8	ij
14.	GS-18-107-W	7.93	jkl	14.2	a	79.6	e	0.3	ijk	46.1	ghi
15.	GS-18-105-W	10.36	bcd	11.2	jk	77.0	h	1.0	bcd	42.0	kl

16.	IGW6563	8.36	ij	13.3	bc	80.2	de	1.2	b	43.8	jk
17.	IGW6496	8.37	ij	12.6	d	82.2	abc	0.2	jk	50.9	bc
18.	AGFWH004418	10.17	cde	11.1	kl	80.2	de	0.8	c-h	46.8	fgh
19.	AGFWH004518	8.27	ijk	13.6	b	82.3	abc	0.3	ijk	48.6	def
20.	AGFWH004618	10.68	ab	11.9	fg	81.7	bc	0.5	g-j	53.6	a
21.	AGFWH004718	10.94	a	10.5	m	82.8	a	0.5	f-i	53.7	a
22.	AGFWH004818	10.44	bc	10.8	lm	81.2	cd	0.8	c-h	48.6	def
23.	BX7932-039	9.07	g	11.9	fg	81.2	cd	0.9	b-e	44.5	ij
24.	V12069-076	7.82	kl	12.3	de	79.7	e	1.0	bcd	41.1	l
	Mean	9.32		11.89		79.82		0.72		46.72	
	LSD	0.47		0.39		1.11		0.34		1.97	
	P Val	<0.001		<0.001		<0.001		<0.001		<0.001	
	CV	3.06		1.99		0.84		28.91		2.57	

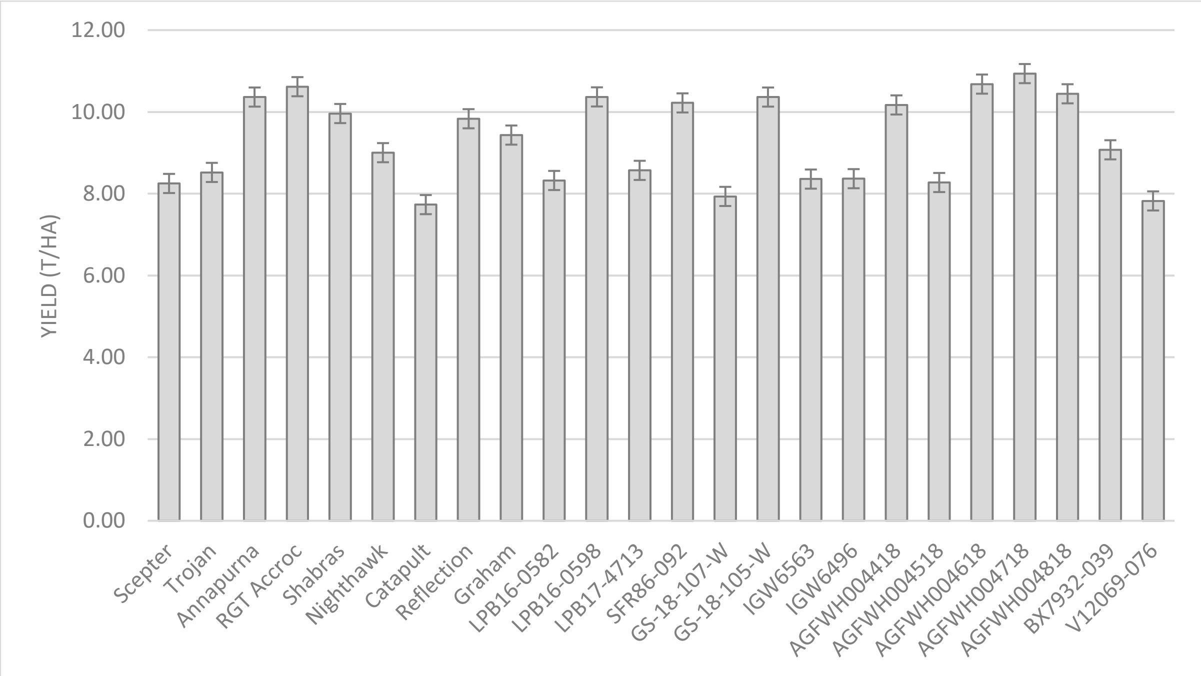

Figure 1. Influence of variety on Grain yield (t/ha) – sown 12 May.

The spring wheat varieties such as Scepter and Trojan showed the biggest improvement in grain yield when the two times of sowing were compared. These are observations as the two trials were spatially separate (Figure 2).

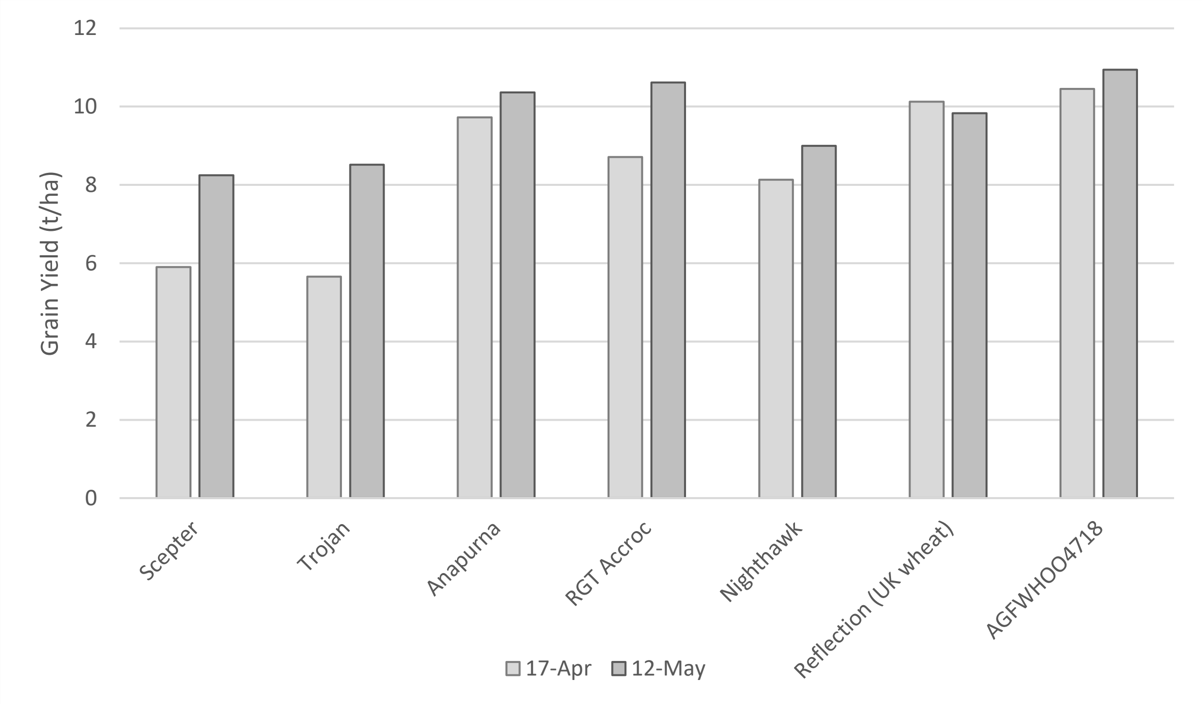

Figure 2. Observations of grain yield of spring (Scepter & Trojan) and winter wheats (other wheats shown) grown in two separate trials on the same site approximately one month apart (t/ha) – sown 12 May.

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 10. 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 (mid-May sown).

Key Points:

- *There was a significant interaction between variety and management on grain yield with Anapurna, Nighthawk, Beaufort and Cobra giving statistically similar yields under the three management regimes (low, standard, high).*

- *In contrast, cultivars such as Zanzibar (spring feed wheat), gave almost 2.5t/ha yield increase as input moved from lower input to higher input.*
- *The winter wheat Anapurna and spring wheat Zanzibar grown under a high input regime (three fungicides, 160kg N and PGR) were the only varieties to yield over 10t/ha, with Anapurna topping the yields at 10.6t/ha.*
- *Unlike Zanzibar, Anapurna maintained yields over 9t/ha when grown under reduced management strategies primarily as a result of significantly better disease resistance.*
- *The dominant disease was Septoria tritici blotch (STB) with leaf rust present throughout the season and a late stripe rust infection evident in susceptible varieties.*
- *Varieties giving over a 1.4t/ha increase in yield when grown under higher input compared to low input were Zanzibar, RGT Accroc and Catapult.*
- *All protein levels were 11% or above therefore it was concluded that grain yield was not compromised by lack of nitrogen supply (soil & fertiliser).*
- *Of the newer milling wheat options Rockstar outperformed Catapult and the controls of Scepter and Trojan, a difference that was significant when inputs were reduced under the low input management approach.*
- *Harvest dry matters varied from approximately 14 – 18t/ha compared to 13 – 19.5t/ha at the first sowing date (excluding defoliation treatments at the first sowing date).*

Treatments: Three management levels (see Table 3) differing in seed rate, nitrogen, fungicide and PGR input were applied to 10 varieties of winter and spring wheat.

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

	Management Level (Yield t/ha)						
Cultivar	**Low Input High Seed Rate**		**Standard Input**		**High Input**		**Mean**
Trojan (spring)	7.51	mno	7.94	k-n	8.37	f-k	**7.94**
Scepter (spring)	6.93	pq	7.97	j-n	8.04	i-m	**7.65**
Nighthawk (facultative)	8.17	g-k	8.57	e-i	8.71	efg	**8.48**
Anapurna (winter)	9.50	cd	9.40	d	10.60	a	**9.83**
RGT Acrocc (winter)	8.39	f-k	8.71	efg	9.96	bc	**9.02**
Catapult (spring)	6.68	q	7.45	nop	8.14	h-l	**7.42**
Beaufort (spring)	8.66	e-h	8.97	de	9.02	de	**8.88**
Rockstar (spring)	8.13	h-l	8.51	e-j	8.79	ef	**8.48**
Zanzibar (spring)	7.61	l-o	8.74	ef	10.05	ab	**8.80**
Cobra (spring)	7.34	op	7.89	k-o	7.93	k-n	**7.72**

LSD Cultivar p = 0.05	0.32 t/ha	P val	<0.001
LSD Management p=0.05	0.52 t/ha	P val	0.007
LSD Cultivar x Man. P=0.05	0.55 t/ha	P val	<0.001

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

	Management Level (Protein %)						
Cultivar	**Low Input High Seed Rate**		**Standard Input**		**High Input**		**Mean**
Trojan (spring)	12.8	cd	12.7	de	13.0	c	**12.8**
Scepter (spring)	12.8	cd	12.8	cd	13.1	c	**12.9**
Nighthawk (facultative)	12.2	f-i	12.3	fgh	12.3	fg	**12.3**
Anapurna (winter)	11.1	o	11.7	klm	12.0	i-l	**11.6**
Acrocc (winter)	11.3	no	11.6	mn	11.7	lm	**11.5**
Catapult (spring)	12.2	f-i	12.2	f-i	12.4	ef	**12.3**
Beaufort (spring)	11.9	j-m	12.0	i-l	12.0	h-k	**11.9**
Rockstar (spring)	12.0	g-j	12.0	i-l	12.1	g-j	**12.0**
Zanzibar (spring)	12.1	g-j	12.0	h-k	12.0	h-k	**12.0**
Cobra (spring)	14.7	a	14.4	b	14.7	ab	**14.6**

LSD Cultivar p = 0.05	0.18 %	P val	<0.001
LSD Management p=0.05	0.19 %	P val	0.065
LSD Cultivar x Man. P=0.05	0.32 %	P val	0.028

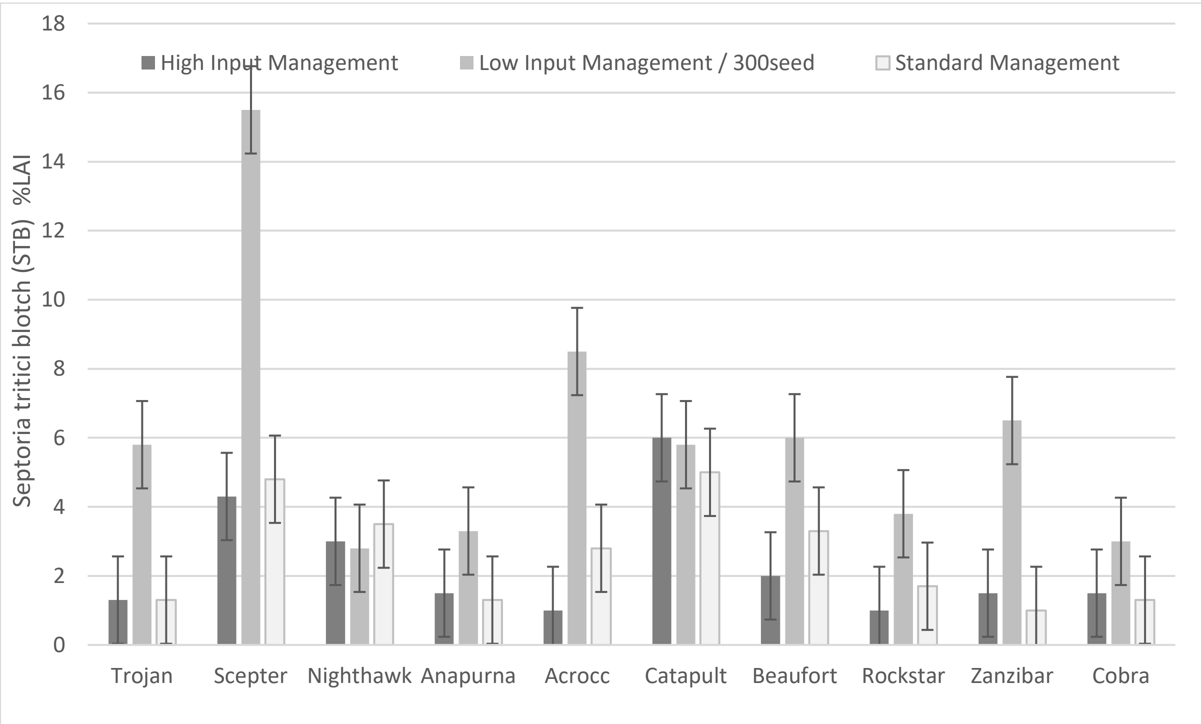

Figure 1. Disease Severity of Septoria tritici blotch (STB) on a whole plot basis of the top three leaves, 17 October (GS range head emergence – grain fill).

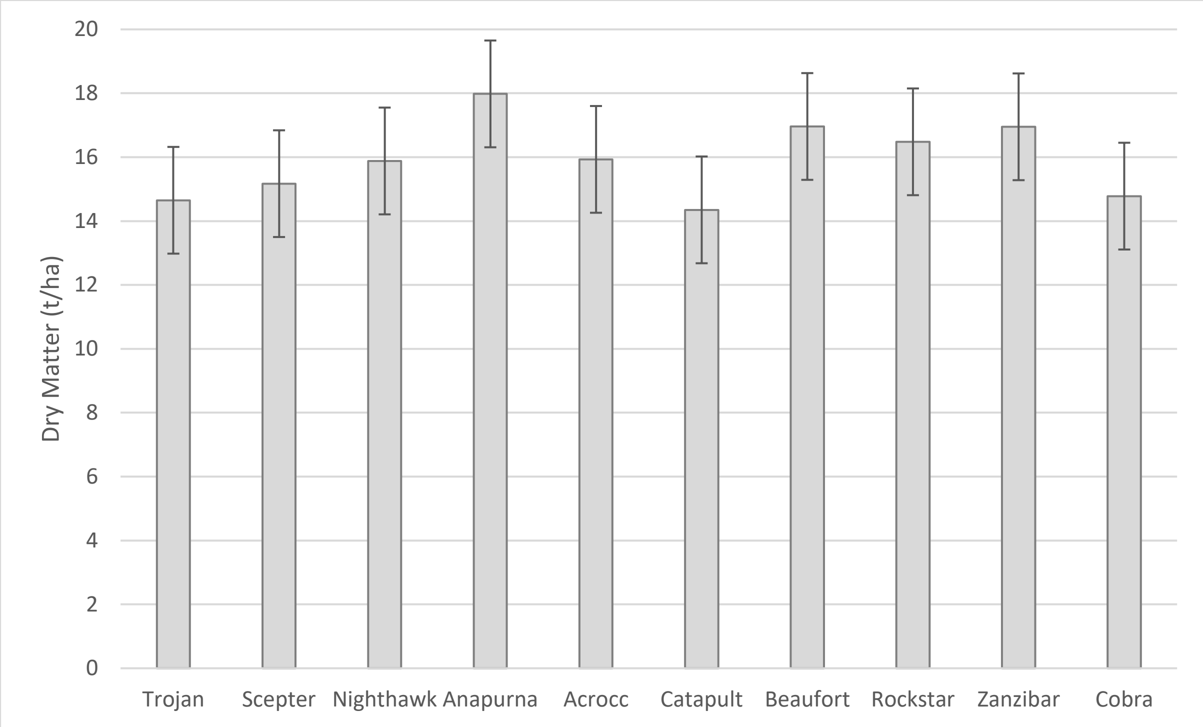

Figure 2. Dry Matter (t/ha) accumulation at Harvest – mean of three management levels.

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

		Low Input, High Seed Rate	Standard Input	High Input
Plant pop'n:		300 seeds/m^2	180 seeds/m^2	180 seeds/m^2
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As standard + Systiva
Basal Fertiliser:	12 May	100kg MAP	100kg MAP	100kg MAP
Nitrogen*:	29 July	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	11 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (80 N)
	2 September	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (80 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	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
**Timings of PGRs, fertiliser and fungicides were adjusted to take account of the differences in spring (s) and winter wheat (w) phenology (development).*

2020 VIC Crop Technology Centre - Gnarwarre, Victoria
Time of Sowing – 26th April 2020

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

Sown: 25 April, 2020
Harvested: 31 December 2020 – 8 January 2021
Rotation position: 1st cereal following canola
Soil Type: Grey clay loam

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/early May sowing window.

Key Points:

- *On 4 September wheat development varied from first node (GS31) to the end of booting (GS49) with Trojan being the most advanced of those wheats tested.*
- *A number of varieties looked promising in terms of straw strength/standing power and disease resistance to Septoria tritici blotch (STB) and rust.*
- *Unfortunately, many of the northern European lines were too long for the southern Victorian HRZ environment. These included Graham, Reflection, Shabras and Savello, although the disease resistant cultivar Reflection performed well in the yielded trial (Trial 2).*
- *Promising lines were represented by SFR86-092, LPB16-0598, AGFWH004618, AGFWH004718 and some of AGT codes 003 & 005. (See trial 2 – Yielded screen entries).*

Treatments: Proposed maximum 50 lines sown in small plots (4-6m in length depending on site) with standard nitrogen management but ***NO FUNGICIDE or PGR input*** to this trial. **Plots are 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	14-Jul	24-Aug	04-Sep	23-Sep	26-Oct	04-Nov
Trojan	31.0	37.0	49.0	55.0	72.0	81.0
Scepter	32.0	39.0	45.0	55.0	72.0	81.0
GS-18-107-W	31.0	32.0	39.0	55.0	74.0	81.0
Catapult	30.0	32.0	39.0	55.0	72.0	78.0
V10100-064	30.0	32.0	39.0	61.0	71.0	81.0
GSUQ-19-04-W	28.0	30.0	39.0	61.0	71.0	75.0
IGW6563	31.0	32.0	39.0	65.0	69.8	72.0
AGTW003	31.0	32.0	39.0	55.0	69.4	71.0

IGW6496	31.0	32.0	39.0	65.0	69.0	75.0
WAGT734	30.0	31.0	37.0	61.0	72.0	72.0
BX7932-039	30.0	32.0	37.0	65.0	71.0	79.0
V13079-049	30.0	31.0	37.0	61.0	71.0	72.0
SUN862I	30.0	31.0	37.0	61.0	71.0	72.0
LPB16-0582	30.0	31.0	37.0	59.0	69.6	75.0
Nighthawk	30.0	33.0	37.0	59.0	69.5	79.0
LPB17-4713	30.0	32.0	33.0	65.0	72.0	75.0
V12069-076	30.0	31.0	33.0	59.0	69.6	75.0
AGTW006	25.0	27.0	33.0	48.0	69.3	71.0
AGFWH004618	30.0	31.0	33.0	55.0	69.2	75.0
RGT Accroc	29.0	32.0	33.0	55.0	69.0	72.0
AGFWH004518	30.0	32.0	33.0	48.0	69.0	71.0
SFR86-071	25.0	28.0	33.0	48.0	67.0	69.0
LPB16-0598	29.0	30.0	32.0	59.0	69.5	71.0
Anapurna	28.0	31.0	32.0	39.0	69.1	71.0
AGFWH004418	29.0	29.0	32.0	48.0	69.0	71.0
AGFWH004718	29.0	30.0	32.0	48.0	69.0	71.0
AGFWH004818	29.0	29.0	32.0	55.0	69.0	71.0
RGT Calabro	29.0	31.0	32.0	55.0	65.0	69.0
Reflection	25.0	27.0	32.0	37.0	52.0	61.0
Savello	25.0	27.0	32.0	37.0	45.0	59.0
SFR86-092	29.0	29.0	31.0	41.0	67.0	71.0
AGTW005	29.0	29.0	31.0	45.0	63.0	69.0
GS-18-105-W	29.0	29.0	31.0	45.0	59.0	69.0
AGTW004	29.0	29.0	31.0	45.0	59.0	69.0
Graham	25.0	27.0	31.0	37.0	49.0	59.0
Shabras	28.0	31.0	31.0	39.0	45.0	55.0

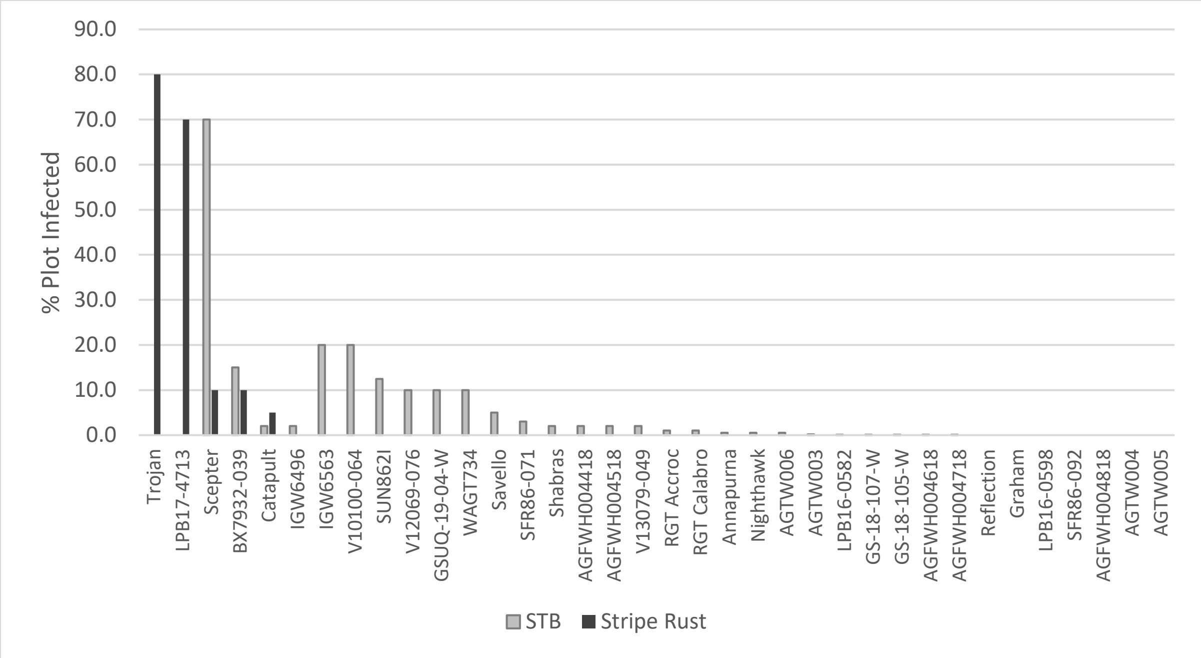

Figure 1. % Plot infection of Septoria tritici blotch and stripe rust assessed on 26 October (GS59 – GS74).

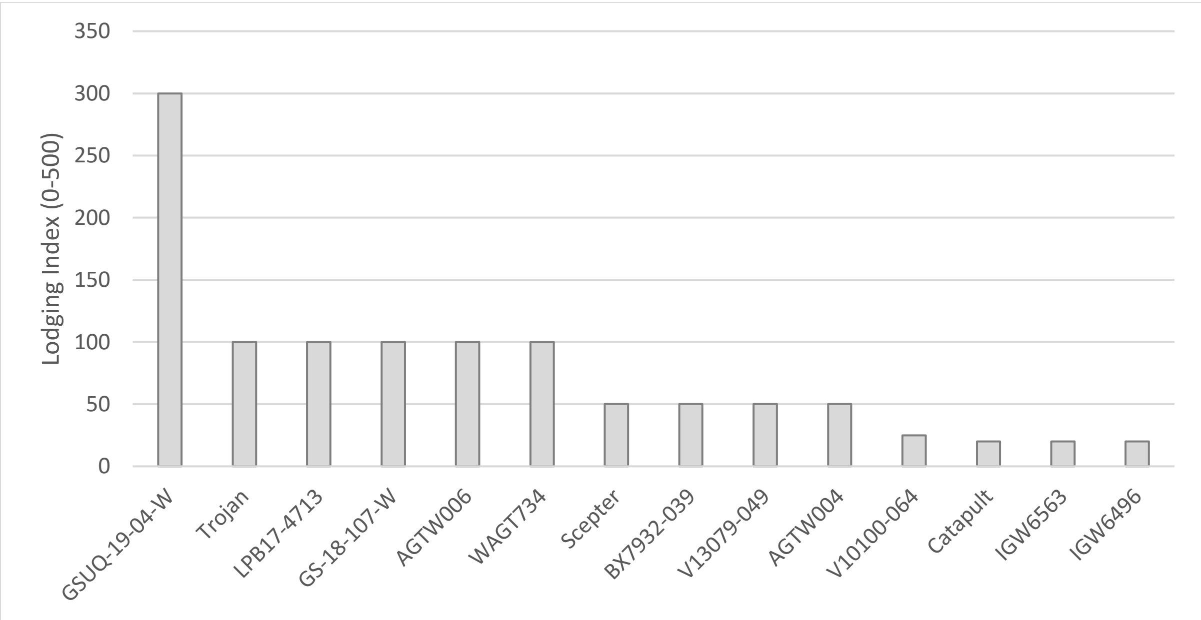

Figure 2. Lodging index (0-500) for small plot screening varieties (no PGR), assessed on 26 October (cultivars not shown did not have any lodging recorded).

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

Sowing date:		**26-April**
Seed Rate:		180 seeds/m^2
Sowing Fertiliser:		100kg/ha MAP
Seed Treatment:		Vibrance & Gaucho
Grazing:		Nil

Nitrogen:	23 June	69 N kg/ha
	7 August	69 N kg/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 points:

- *Other than the control Anapurna, five cultivars yielded in excess of 10t/ha these were LPB16-0598, SFR86-092, SFR86-071, AGFWH004418 and AGFWH004618.*
- *SFR86-092 exceeded 11t/ha.*
- *Many of these cultivars (where tested) have performed well in 1st stage screens.*
- *Despite stripe rust susceptibility and yellowing flecks over the canopy Catapult (mid – late spring AH in south eastern region) gave promising yields, and although they were not significantly better than Scepter its phenology is more suited to late April sowing.*
- *138 kg N/ha plus 10N at sowing with a soil N reserve of 103.5kg N/ha (0-60cm) was sufficient to optimize yield at this site with an average protein content of 11.7% (range 10.4 – 13.9%).*

Treatments: (24 elite lines tested under HYC High input management (full foliar fungicide program (3 foliar fungicides – GS31, GS39 & GS61) and PGR management – split application Moddus 0.1 + Cycocel 0.65 – GS30 & GS32)

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

	Grain Yield				Grain Quality					
Variety (type)	Yield		Site Mean		Protein		Test wt		Screenings	
	(t/ha)		(%)		%		kg/HL		%	
Scepter (s)	9.20	fgh	98.4	f-i	12.5	abc	75.8	a-e	1.7	c-h
Anapurna (w)	10.12	b-e	108.3	b-e	11.6	bc	75.7	a-e	2.0	a-g
Catapult (s)	9.62	c-g	102.9	c-g	12.5	abc	75.9	a-d	1.4	e-h
Reflection (w)	9.14	fgh	97.7	f-i	11.3	bc	74.4	d-h	2.8	ab
Graham (w)	9.17	fgh	98.0	f-i	11.5	bc	75.1	b-g	1.3	fgh
Savello (w)	8.43	hij	90.2	ijk	12.2	abc	73.6	gh	1.9	c-h
Shabras (w)	9.51	c-g	101.8	c-g	10.8	c	74.2	e-h	1.9	a-h
BX7932-039	9.31	efg	99.5	e-h	11.4	bc	75.6	a-e	2.3	a-d
V12069-076	8.89	ghi	95.1	g-j	12.0	abc	76.7	abc	1.6	d-h
LPB16-0582	9.42	d-g	100.7	d-g	11.1	c	75.0	c-g	2.2	a-e
LPB16-0598	10.10	b-e	108.0	b-e	11.2	bc	76.8	ab	1.9	c-h
LPB17-4713	8.21	ij	87.9	jk	10.4	c	73.7	fgh	2.0	a-h
SFR86-092 (w)	11.34	a	121.3	a	11.1	c	75.6	a-e	2.5	abc
SFR86-071 (w)	10.46	b	111.9	b	11.2	c	75.3	a-f	2.1	a-f
SFR86-085 (w)	9.83	b-f	105.2	b-f	11.6	bc	75.9	a-d	1.4	e-h
GSUQ-19-48-W	9.19	fgh	98.4	f-i	10.8	c	74.2	e-h	2.0	a-g

GS-18-107-W	8.14	ij	87.1	jk	13.4	ab	75.8	a-e	1.3	fgh
GS-18-105-W	9.70	b-g	103.8	b-g	10.9	c	72.8	h	1.9	b-h
IGW6563	8.42	hij	90.1	ijk	11.9	abc	75.3	a-g	1.2	h
IGW6496	7.68	j	82.2	k	12.1	abc	76.1	abc	1.8	c-h
AGFWH004418 (w)	10.14	bcd	108.5	bcd	11.7	abc	76.2	abc	2.1	a-f
AGFWH004518 (w)	8.47	hij	90.7	h-k	13.9	a	77.0	a	1.3	gh
AGFWH004618 (w)	10.34	bc	110.6	bc	12.0	abc	75.6	a-e	2.8	a
V13079-049	9.52	c-g	101.8	c-g	11.8	abc	75.1	b-g	2.1	a-f
Mean	9.35		100.0		11.7		75.3		1.9	
LSD 0.05	0.83		8.9		2.2		1.7		0.8	
P Val	<0.001		<0.001		0.378		<0.001		0.009	

W= winter wheat, S= spring wheat, assumed spring where uncategorised

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

Sowing date:		**25-April**
Seed Rate:		180 seeds/m^2
Sowing Fertiliser:		100kg/ha MAP (10N, 21.9P)
Seed Treatment:		Vibrance & Gaucho
Grazing:		Nil
Nitrogen:	23 June	69 N kg/ha
	7 August	69 N kg/ha
PGR:	GS30	Moddus Evo 100mL/ha + 0.65L/ha Errex
	GS32	Moddus Evo 100mL/ha + 0.65L/ha Errex
Fungicide:	GS31	Opus 500ml/ha
	GS39	Radial 840ml/ha
	GS61	Prosaro 300ml/ha

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 Points:

- *The winter feed wheat RGT Accroc (awned) was significantly higher yielding under all managements compared to other varieties tested and exceeded 10t/ha under high input management.*
- *In general, grazing (mechanical defoliation at GS30) had less impact on yield with faster developing cultivars which reached GS30 earlier in the season (e.g. Scepter, Nighthawk, RGT Accroc and DS Bennett) compared to the slower developing wheats (e.g. RGT Calabro, Tabasco and Manning).*
- *Septoria tritici blotch (STB) was the principal disease in the majority of varieties, however the varieties subject to stripe rust infection, Trojan and Scepter, saw the*

biggest improvement in yield (2.95t/ha and 1.63t/ha respectively) associated with greater fungicide input under the high management approach.

- *Tabasco, a slow developing winter wheat from northern Europe with good disease resistance and standing power was significantly higher yielding under the standard input management compared to the high input management regime giving no yield response to additional fungicide, N or PGR input.*
- *Scepter under high input management was the highest yielding (9.03t/ha) quality milling wheat and was 13.4% lower yielding than the highest yielding feed wheat (10.42t/ha).*
- *Above ground dry matter available for grazing varied from 150kg/ha with the spring wheats to over 2000 kg/ha with the long season winter wheats.*

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 variety grain yield performance (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**
Trojan (spring)	4.76	l	3.94	m	7.71	ijk	5.47
Scepter (spring)	7.40	k	7.97	h-k	9.03	cde	8.14
Nighthawk (facultative)	7.85	ijk	7.58	jk	8.55	e-h	7.99
Anapurna (winter)	9.05	cde	7.60	jk	9.25	cd	8.63
RGT Accroc (winter)	9.49	bc	9.20	cde	10.42	a	**9.70**
RGT Calabro (winter)	9.36	cd	7.50	k	9.41	c	8.75
Tabasco (winter)	8.75	d-g	7.59	jk	7.88	ijk	8.07
DS Bennett (winter)	8.30	f-i	8.16	g-j	8.96	cde	8.47
Manning (winter)	9.03	cde	7.46	k	9.25	cd	8.58
Mean	**8.30**		**7.59**		**9.06**		
LSD Cultivar p = 0.05			0.38t/ha		P val		0.003
LSD Management p=0.05			0.58t/ha		P val		<0.001
LSD Cultivar x Man. P=0.05			0.66t/ha		P val		<0.001

Winter – winter wheat, Spring – spring wheat.
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).
Grazing was accomplished by mechanical defoliation at GS30.

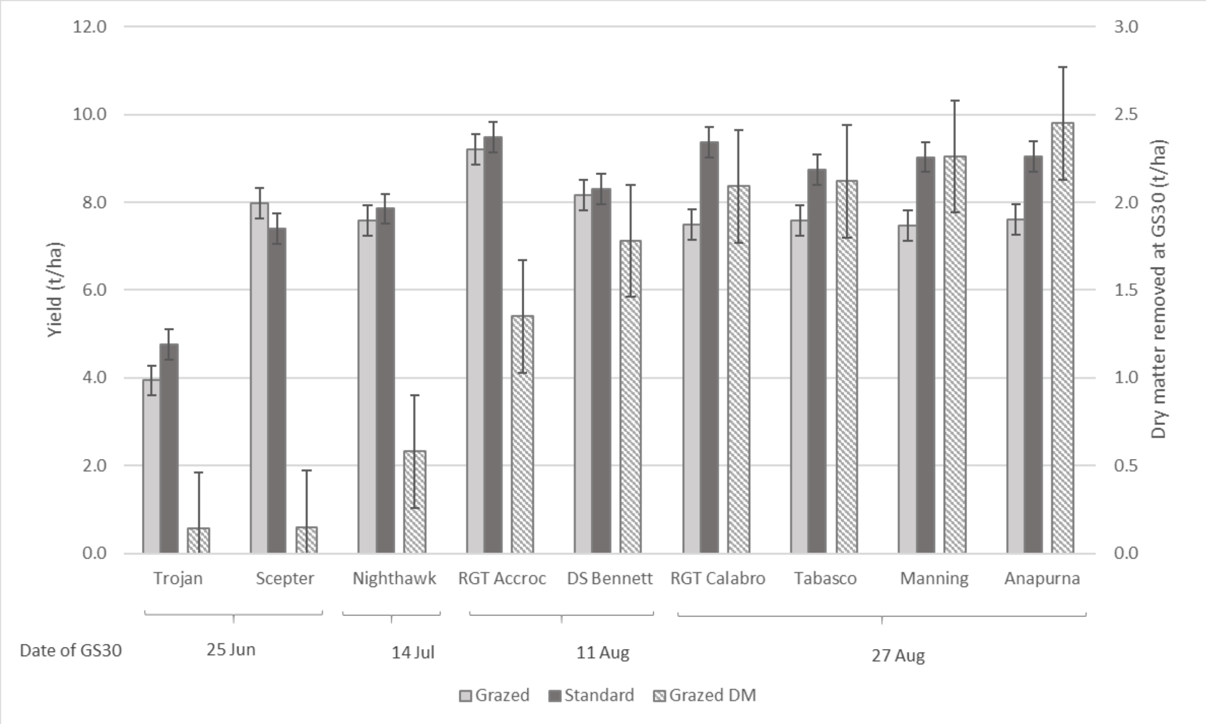

Table 2. Dry matter (t/ha) of the crop canopy at harvest.

	Management Level						
	Standard		Grazed		High		Mean
Cultivar	**DM t/ha**		**DM t/ha**		**DM t/ha**		**DM t/ha**
Trojan (spring)	20.5	a-e	13.0	k	14.4	jk	**14.1**
Scepter (spring)	19.5	a-f	15.3	g-k	18.8	a-i	**18.2**
Nighthawk (facultative)	18.4	b-j	16.4	e-k	20.6	a-d	**18.8**
Anapurna (winter)	16.7	d-k	15.2	h-k	22.3	ab	**18.6**
Acrocc (RGT) (winter)	20.2	a-e	16.5	e-k	19.3	a-g	**17.5**
Calabro (RGT) (winter)	22.6	a	16.5	e-k	17.4	d-j	**18.0**
Tabasco	18.0	c-j	16.7	d-k	20.1	a-e	**19.8**
DS Bennett	16.5	e-k	15.8	f-k	19.1	a-h	**17.6**
Manning	20.5	a-e	13.1	k	21.8	abc	**17.1**
Mean	**18.6**		**15.4**		**19.3**		
LSD Cultivar p = 0.05			2.3		**P val**		0.002
LSD Management p=0.05			1.9		**P val**		0.006
LSD Cultivar x Man. P=0.05			4.1		**P val**		0.162

Table 3. Harvest Index (HI%) at GS99.

	Management Level						
	Standard		Grazed		High		Mean
Cultivar	**HI%**		**HI%**		**HI%**		**HI%**
Trojan (spring)	28.0	gh	27.0	h	48.0	abc	34.3
Scepter (spring)	32.0	fgh	46.0	a-d	43.0	a-e	40.3

Nighthawk (facultative)	36.0	e-h	42.0	b-f	37.0	d-h	38.3
Anapurna (winter)	44.0	a-e	44.0	a-e	36.0	d-h	41.3
Acrocc (RGT) (winter)	50.0	abc	51.0	ab	48.0	abc	49.7
Calabro (RGT) (winter)	42.0	a-e	41.0	b-f	48.0	abc	43.7
Tabasco	36.0	e-h	40.0	c-f	35.0	e-h	37.0
DS Bennett	41.0	b-f	48.0	abc	42.0	b-f	43.7
Manning	49.0	abc	57.0	a	38.0	d-g	46.0
Mean	39.8		44.0		41.7		
LSD Cultivar p = 0.05			5.8		**P val**		<0.001
LSD Management p=0.05			4.3		**P val**		0.224
LSD Cultivar x Man. P=0.05			10.0		**P val**		0.001

Table 4. Flowering dates for cultivars in the GEM trial – Gnarwarre, Victoria sown 25 April

Trojan (spring)	8 Oct
Scepter (spring)	8 Oct
Nighthawk (facultative)	8 Oct
Anapurna (winter)	26 Oct
Acrocc (RGT) (winter)	26 Oct
Calabro (RGT) (winter)	5 Nov
Tabasco	18 Nov
DS Bennett	26 Oct
Manning	5 Nov

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

Sowing Date:		**25-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**	**High**
Grazing at GS30		---	✓	---
Nitrogen (N):	23 June	69 N kg/ha	69 N kg/ha	86 N kg/ha + 15 S kg/ha
	7 August	69 N kg/ha	69 N kg/ha	86 N kg/ha + 15 S kg/ha
	17 Sept			25 N kg/ha
Total N:		**148 N kg/ha**	**148 N kg/ha**	**207 N kg/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	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).*

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 fluxapyroxad (Systiva) 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 Points:

- *The feed winter wheats SF Adagio, RGT Accroc and Anapurna were the only cultivars to break through the 9t/ha threshold.*
- *SF Adagio at 9.67 t/ha was significantly superior to all other cultivars with one fungicide applied (GS39 flag leaf emergence spray).*
- *There was a significant interaction between cultivar and fungicide management with the stripe rust and Septoria tritici blotch (STB) susceptible cultivars giving large yield responses to high input fungicide input (e.g. Trojan had a 6.83 t/ha response to controlling stripe rust, Revenue a 2.87 t/ha response to fungicide as a result of STB and leaf rust control).*
- *In contrast, the STB resistant varieties SF Adagio, Tabasco and Nighthawk gave less than 1 t/ha response to 4 units of fungicide over the untreated with no statistical yield difference between 1 and 4 fungicide units. STB levels at flag leaf were observed to be less than 5%.*
- *STB was the principal disease in the majority of varieties with the more resistant cultivars SF Adagio and Anapurna being the only varieties to deliver over 8t/ha when untreated with fungicide, however all cultivars including these two generated significantly more yield with fungicide.*
- *Unfortunately, Tabasco's excellent STB resistance is combined with a phenology that is generally too long for a southern HRZ mainland environment.*

- *Systiva was less effective against Septoria (75% control) than stripe rust infection when assessed at flag leaf (GS39) but control was not complete.*

Treatments: Three levels of fungicide management applied across 10 varieties

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

	Management Level						
	Untreated		GS39 Fungicide		Full Protection		Mean
Cultivar	Yield t/ha		Yield t/ha		Yield t/ha		Yield t/ha
Trojan	2.19	p	2.97	o	9.04	c-f	**4.73**
Scepter	5.85	n	7.93	i-l	8.84	d-g	**7.54**
Nighthawk	7.21	m	7.62	lm	8.12	ijk	**7.65**
Anapurna	8.37	ghi	9.04	c-f	9.30	a-d	**8.91**
RGT Acrocc	7.94	i-l	9.24	b-e	9.69	ab	**8.96**
RGT Calabro	7.72	kl	8.69	fgh	9.01	def	**8.47**
Tabasco	7.82	jkl	7.96	i-l	8.29	hij	**8.02**
SF Adagio	8.77	e-h	9.74	a	9.51	abc	**9.34**
Revenue	5.79	n	8.02	i-l	8.70	fgh	**7.50**
Mean	**6.85**		**7.91**		**8.94**		**7.95**
LSD Cultivar p = 0.05			0.27		**P val**		<0.001
LSD Management p=0.05			0.17		**P val**		<0.001
LSD Cultivar x Man. P=0.05			0.48		**P val**		<0.001

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

	Management Level						
	Untreated		GS39 Fungicide		Full Protection		Mean
Cultivar	Yield t/ha		Yield t/ha		Yield t/ha		Yield t/ha
Trojan	2.19	p	2.97	o	9.04	d-g	**4.73**
Scepter	5.85	n	7.93	jkl	8.84	e-h	**7.54**
Nighthawk	7.21	m	7.62	lm	8.12	jk	**7.65**
Anapurna	8.37	hij	9.04	d-g	9.30	b-e	**8.91**
RGT Acrocc	7.94	jkl	9.24	c-f	9.69	abc	**8.96**
RGT Calabro	7.72	kl	8.69	ghi	9.01	efg	**8.47**
Tabasco	7.82	kl	7.96	jkl	8.29	ij	**8.02**
SF Adagio	8.77	fgh	9.74	ab	9.51	a-d	**9.34**
Revenue	5.79	n	8.02	jkl	8.70	ghi	**7.50**
Mean	**6.77**	**c**	**8.05**	**b**	**9.04**	**a**	**7.95**
LSD Cultivar p = 0.05			0.27		**P val**		<0.001
LSD Management p=0.05			0.19		**P val**		<0.001
LSD Cultivar x Man. P=0.05			0.47		**P val**		<0.001

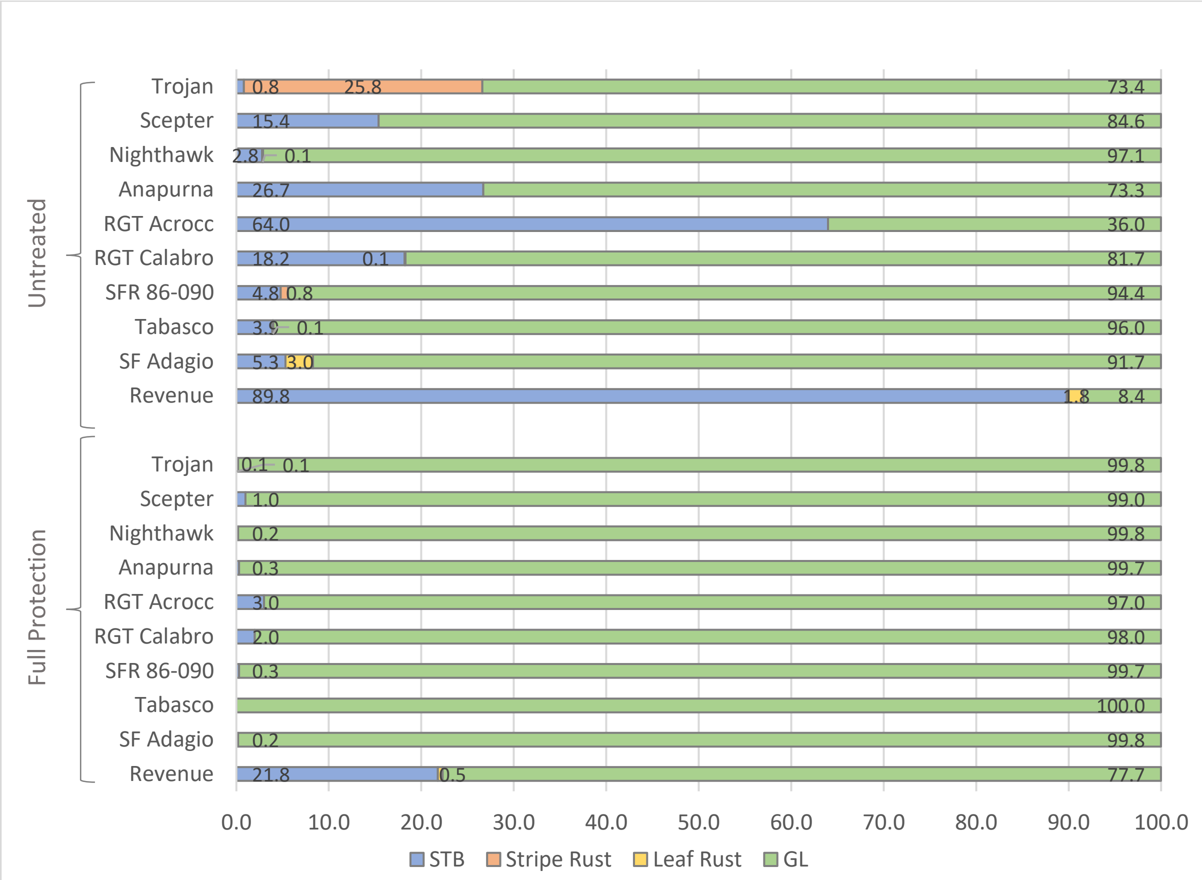

Figure 1. % Disease severity and green leaf retention of the flag-3 leaf, assessed 9 September at GS39.

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:		Vibrance & Gaucho ± treatment list		
Grazing:		Nil		
Nitrogen:	23 June	69 N kg/ha		
	7 August	69 N kg/ha		
PGR:	GS30	Moddus Evo 100mL/ha + 0.65L/ha Errex		
	GS32	Moddus Evo 100mL/ha + 0.65L/ha Errex		
		Untreated	**GS39 Fungicide**	**Full Protection**
Fungicide:	GS00	---	---	Systiva
	GS31	---	---	Prosaro 300ml/ha
	GS39	---	Radial 840ml/ha	Radial 840ml/ha
	GS61	---	---	Opus 500ml/ha

Trial 5. HYC Spring wheat "Reset" Trial

Objectives: To assess the value of pre and post GS30 defoliation in winter and spring germplasm grown in HRZ regions of different season lengths

Individual objectives specific to the trial were:

- Assess the dry matter offtake differences resulting from GS22, GS30 & GS32 defoliations and their effect on final harvest dry matter, grain yield and harvest index of spring versus winter wheat.
- Assess whether April sown spring wheat that has been "reset at GS32 (defoliated)" is higher yielding than GS30 and GS22 grazed and ungrazed crops.
- To assess whether the dry matter offtakes of longer season winter wheats at GS22 are more profitable (dry matter offtake and grain yield) than the same winter wheat defoliated at GS30.

Key Points:

- *All defoliation treatments reduced grain yield relative to the ungrazed crop except the "light graze" GS30 treatment in Trojan and the tillering defoliation (GS23) in RGT Accroc.*
- *Those defoliation treatments that removed larger amounts of dry matter at stem elongation (GS30-32) invariably reduced grain yield more.*
- *The concept of resetting Trojan at GS32 was unsuccessful in maintaining or increasing yield from a late April sow date. In addition, the undefoliated crop was not affected by frost.*
- *In Trojan both "light grazing" and "hard grazing" did not reduce yield with all treatments showing canopy compensation by flowering when assessed by canopy reflectance.*
- *With Trojan at 25 cents/kg dry matter and $300/t for grain the light grazing was the only treatment to produce a similar margin to the ungrazed control.*
- *In RGT Accroc where grazing was later than planned (and past the cut off of GS30) GS31 defoliation produced large dry matter offtakes and large reductions in grain yield but at the prices chosen would have been more profitable than the ungrazed control.*
- *The most profitable crop was the RGT Accroc defoliated at the end of tillering (GS29) which gave yields equal to the ungrazed and 3200 kg/ha dry matter removed.*

Treatments:
A winter and spring wheat (RGT Accroc and Trojan) were hard grazed and light grazed at start of stem elongation at GS30, grazed post stem elongation at second node (GS32) and left ungrazed. Defoliation was carried out with a lawn mower set at different heights at the two development stages.

The concept of "resetting" is specifically designed for early sowing spring wheat that develops too quickly from earlier sowing than would be recommended, in this case mid-April. The idea is that defoliation later than GS31 specifically removes advanced main stems that would have been frosted due to their very early development. Please note this is an experimental approach and should not yet be applied to commercial acreage.

Table 1. Influence of grazing (defoliation) and variety on grain yield (t/ha).

		Trojan		*RGT Accroc*		*Mean*	
Variety		6.62	b	7.96	a	**7.29**	
Defoliation							
Untreated		7.21	bc	8.88	a	**8.04**	**a**
Hard defoliation at GS30		6.79	c	6.80	c	**6.79**	**c**
Light defoliation at GS30		7.18	bc	7.34	b	**7.26**	**b**
Defoliated when Trojan reached GS32 (Accroc GS29)		5.30	d	8.81	a	**7.05**	**bc**
Variety	***LSD***		***0.84***	***P-Value***		***0.002***	
Defoliation	***LSD***		***0.33***	***P-Value***		***<0.001***	
Variety x Defoliation	***LSD***		***0.47***	***P-Value***		***<0.001***	

All simulated grazing treatments were carried out by mechanical defoliation (lawnmower)
Trojan mechanically defoliated on 25 June and RGT Accroc on 27 August.
** The late GS32 graze was only conducted on Trojan and RGT Accroc was defoliated at the same calendar date*

The later defoliation of RGT Accroc (GS31 not GS30) produced higher dry matters than Trojan with over 4.3t/ha dry matter when hard grazed *(please note to maintain grain yield crops should not be grazed after GS30).*

Table 2. Grazing dates and the influence of grazing management of dry matter (t/ha) removed (and total above ground biomass prior to grazing DM removal) at each grazing timing and harvest.

	GS	**Date**	**Dry Matter (t/ha)**					
			Grazed		Total		Harvest	
Trojan; untreated		---	---	---	---	---	16.2	-
Trojan; Hard graze	30	25-Jun	0.3	d	0.4	d	15.6	-
Trojan; Light graze	30	25-Jun	0.1	d	0.4	d	16.7	-
Trojan GS32 graze	32	28-Jul	2.0	c	2.6	c	13.2	-
RGT Accroc; Untreated		---					16.6	-
RGT Accroc; Hard graze	31	27-Aug	4.3	a	5.4	a	14.4	-
RGT Accroc; Light graze	31	27-Aug	3.7	ab	5.0	a	16.5	-
RGT Accroc; GS29 graze	29	12-Aug	3.2	b	4.2	b	18.3	-
LSD p=0.05			0.6		0.7		ns	
P val			0.001		<0.001		0.109	

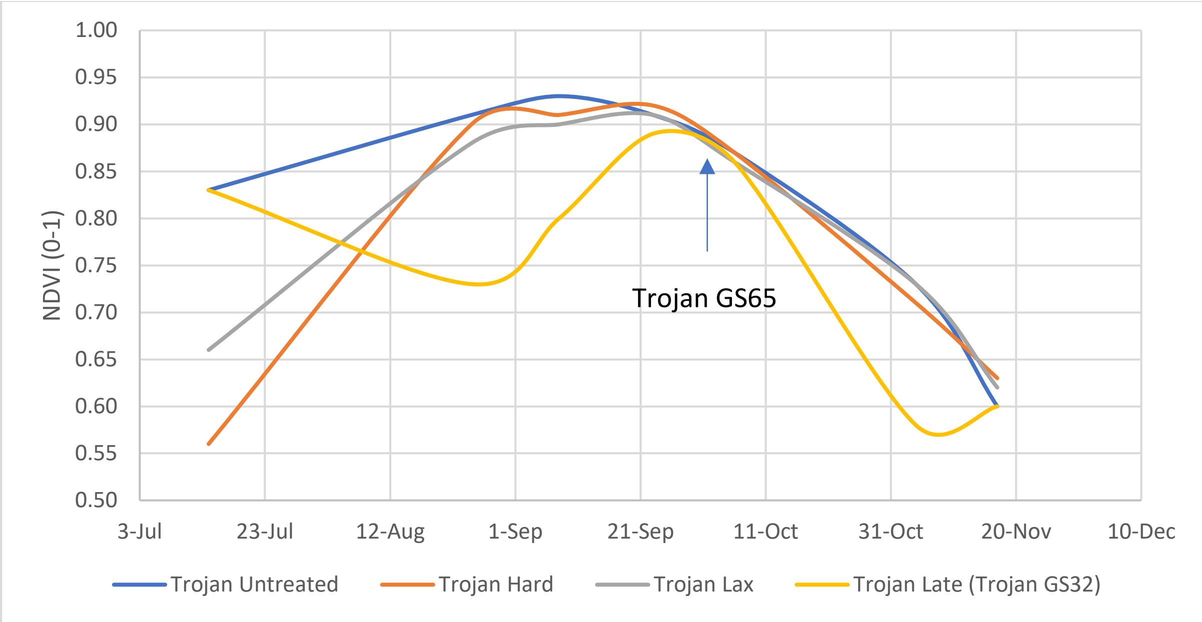

Figure 1. Trojan crop reflectance measured by the Greenseeker as NDVI (0 - 1 scale) July – December 2020.

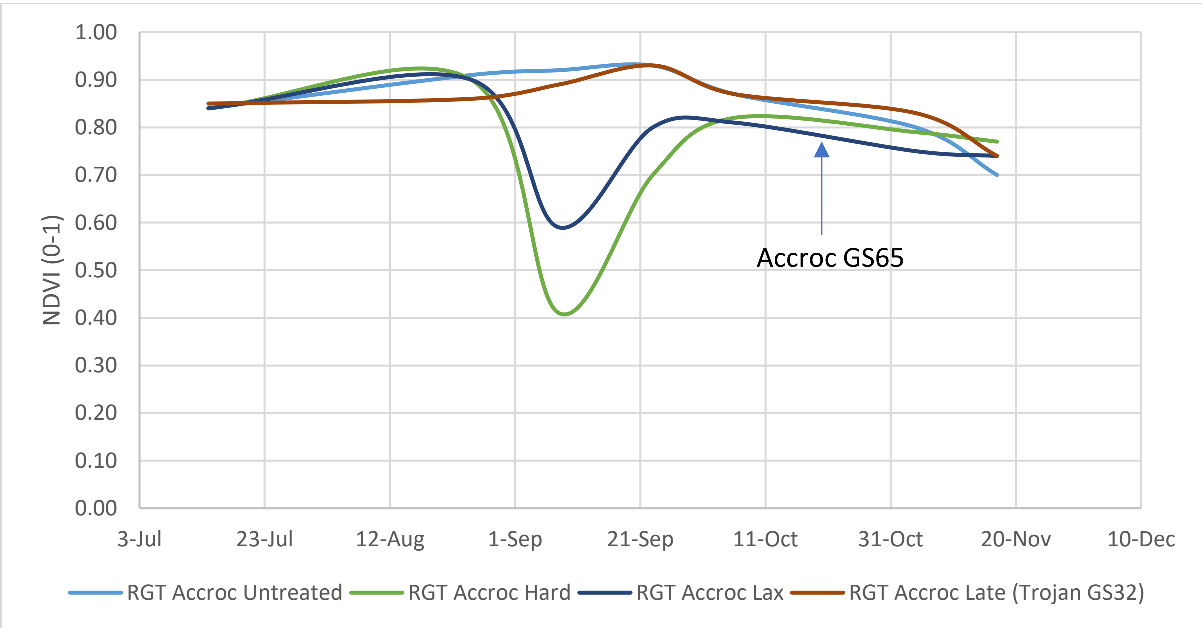

Figure 2. RGT Accroc crop reflectance measured by the Greenseeker as NDVI (0 - 1 scale) July – December 2020.

Table 3. Economic consequence of grazing management of dry matter (kg/ha) removed and grain yield (t/ha).

	Grain Yield		Grazing Yield		Grazing Value compared to grain only
	t/ha	$ (@ $300/t)	kg/ha	$ (@ $0.25/kg)	$
Trojan; untreated	7.21	2163	0	0	0
Trojan; Hard graze	6.79	2037	300	75	-51
Trojan; Light graze	7.18	2154	100	25	+16
Trojan GS32 graze	5.30	1590	2000	500	-73
RGT Accroc; Untreated	8.88	2664	0	0	0
RGT Accroc; Hard graze GS31	6.80	2040	4300	1075	+451
RGT Accroc; Light graze GS31	7.34	2202	3700	925	+463
RGT Accroc; Hard graze GS29	8.81	2643	3200	800	+779
LSD p=0.05	0.47		600		
P val	<0.001		<0.001		

Table 4. 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:		Vibrance & Gaucho
Grazing:		As per treatment list
Nitrogen:	23 June	69 N kg/ha
	7 August	69 N kg/ha
PGR:	GS30	Moddus Evo 100mL/ha + 0.65L/ha Errex
	GS32	Moddus Evo 100mL/ha + 0.65L/ha Errex
Fungicide:	GS31	Opus 500ml/ha
	GS39	Radial 840ml/ha
	GS61	Prosaro 300ml/ha

Trial 6. 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 Points:

- *There was no response above the standard N input of 148kg N/ha, which also included a standard of 100kg/ha MAP at sowing (10N, 21.9P).*
- *Protein levels in the standard control were increased from 9.7% to 11% with additional N application but the increases were not associated with higher grain yields.*
- *At harvest there was no evidence of dry matter increases associated with greater nutrition input.*
- *Test weight was unaffected by the nutrition strategy in this trial, but there was a very slight increase in screenings.*

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 103.5kg N/ha (0-60cm) taken on 21 May.

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

Trt.		**Nitrogen rate**	**Phosphorus rate**	**Sulphur rate**	**Yield**		**Mean**
		kg N/ha	**kg P/ha**	**kg S/ha**	**(t/ha)**		**(%)**
1	Current Practice	148	22	---	10.14	-	101.4
2	Current Practice +25% N	183	22	---	10.29	-	102.9
3	Current Practice +25%NPS	183	22	30	9.92	-	99.2
4	Current Practice +50% N	217	22	---	9.73	-	97.3
5	Current Practice +50%NPS	217	22	45	9.91	-	99.1
				Mean	9.99		100.0
			LSD (p=0.05)		ns		ns
				P Val	0.180		0.179

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	148	22	---	9.7	c	78.4	-	1.3	b
2	183	22	---	10.2	b	78.4	-	1.4	b
3	183	22	30	10.4	b	78.0	-	1.4	b
4	217	22	---	10.4	b	78.0	-	1.7	a
5	217	22	45	11.0	a	77.4	-	1.7	a
			Mean	10.3		78.0		1.5	
			LSD (p=0.05)	0.5		ns		0.2	
			P Val	0.001		0.829		0.005	

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

	Nitrogen rate	Phosphorus rate	Sulphur rate	Harvest Dry Matter		Heads	
Trt.	**kg N/ha**	**kg P/ha**	**kg S/ha**	**(t/ha)**		**m^2**	
1	148	22	---	16.4	-	386.4	-
2	183	22	---	17.7	-	435.5	-
3	183	22	30	18.6	-	448.9	-
4	217	22	---	17.9	-	431.6	-
5	217	22	45	18.1	-	463.2	-
			Mean	17.7		433.1	
			LSD (p=0.05)	ns		ns	
			P Val	0.497		0.398	

Table 4. Site soil test details

	Level Found
ECEC	15.9 cmol/kg
Organic Carbon W&B	2.37 %
pH 1:5 water	6.15
Total Mineral N*	103.5 kg N/ha
Colwell Phosphorus	130 mg/kg
Colwell Potassium	410 mg/kg
KCl Sulfur	21 mg/kg

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

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:		Vibrance & Gaucho
Grazing:		Nil
Nitrogen:	23 June	69 N kg/ha ± treatment list
	7 August	69 N kg/ha ± treatment list
PGR:	GS30	Moddus Evo 100mL/ha + 0.65L/ha Errex
	GS32	Moddus Evo 100mL/ha + 0.65L/ha Errex
Fungicide:	GS31	Opus 500ml/ha
	GS39	Radial 840ml/ha
	GS61	Prosaro 300ml/ha

Trial 7. 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 Anapurna) 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 Points:

- *There were small visual differences in BYDV control recorded in this trial (which were variable in effect) but no differences were assessed in erect heads at harvest.*
- *As a consequence, there were no differences in yield due to insecticide management in the BYDV tolerant (Manning) and non-tolerant variety (Anapurna) in this trial.*
- *There was a significant yield increase associated with the application of the GS31 experimental fungicide application.*
- *The effect of the fungicide had no impact on erect heads observed in the trial and was primarily associated with superior STB control compared to the other four treatments that received no GS31 fungicide.*
- *There was no advantage from the addition of azoxystrobin at GS31 added to the experimental fungicide.*
- *It should be noted that two more fungicides were applied to all treatments at flag leaf emergence (GS39) and head emergence (GS59) (see Table 3).*

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 Anapurna). 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	Anapurna	---	---	---
2	Anapurna	Gaucho	---	---
3	Anapurna	Gaucho	Karate Zeon	---
4	Anapurna	Gaucho	Karate Zeon	Karate Zeon
5	Anapurna	Gaucho	Karate Zeon	Karate Zeon & Experimental fungicide
6	Anapurna	Gaucho	Karate Zeon	Karate Zeon, Exp fungicide & Azoxystrobin
7	Manning		---	---
8	Manning	Gaucho	---	---
9	Manning	Gaucho	Karate Zeon	---
10	Manning	Gaucho	Karate Zeon	Karate Zeon
11	Manning	Gaucho	Karate Zeon	Karate Zeon & Exp. Fungicide
12	Manning	Gaucho	Karate Zeon	Karate Zeon, Exp. Fungicide & Azoxystrobin

Multiple applications of Karate Zeon applied at 18ml/ha were applied experimentally to exclude aphids and prevent BYDV in this trial ***(it is not a commercial treatment or intended to act as a recommendation),*** *Experimental fungicide applied at 2L/ha and Azoxystrobin applied at 62.5g ai/ha*

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	Anapurna	8.80	cd	97.7	12.5	a	78.4	-	3.7	a
2	Anapurna	8.82	bcd	97.9	12.3	a	78.6	-	3.6	a
3	Anapurna	8.62	d	95.7	12.6	a	78.0	-	2.9	ab
4	Anapurna	8.72	d	96.8	12.5	a	77.8	-	2.9	ab
5	Anapurna	9.55	a	106.0	12.5	a	78.5	-	2.4	bc
6	Anapurna	9.46	a	105.0	12.5	a	78.9	-	2.5	bc
Mean		**9.00**	**-**	**99.9**	**12.5**	**a**	**78.4**	**-**	**3.0**	**a**
7	Manning	8.89	bcd	98.7	11.4	b	78.1	-	1.8	c
8	Manning	8.86	bcd	98.3	11.3	b	78.4	-	1.7	c
9	Manning	9.04	a-d	100.3	11.2	b	78.4	-	1.8	c
10	Manning	8.80	cd	97.7	11.2	b	78.3	-	1.6	c
11	Manning	9.35	ab	103.8	11.1	b	78.1	-	1.6	c
12	Manning	9.27	abc	102.9	11.2	b	78.7	-	1.5	c
Mean		**9.03**	**-**	**100.3**	**11.2**	**b**	**78.3**	**-**	**1.7**	**b**
Grand mean		9.01		100.1	11.9		78.3		2.3	
LSD Var (p = 0.05)		0.22		2.4	0.2		ns		0.4	
P Val Var		0.845		0.847	0.017		0.770		0.018	
LSD Mgmt (p = 0.05)		0.37		4.2	0.4		ns		0.7	
P Val Mgmt		<0.001		<0.001	0.827		0.204		0.172	
LSD Var x Mgmt (p = 0.05)		0.53		5.9	0.5		ns		1.0	
P Val Var x Mgmt		0.011		0.011	<0.001		0.438		<0.001	
CV		4.04		4.0	3.1		0.8		30.8	

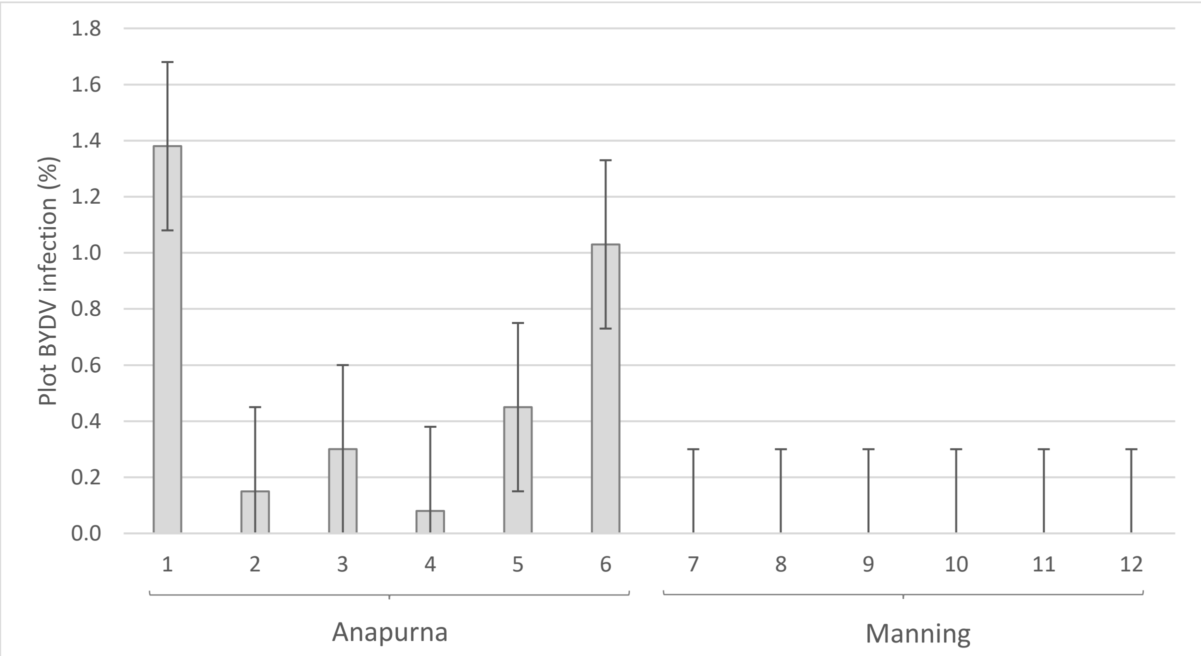

Figure 1. Plot BYDV infection (%), assessed on November 4 (GS65-69). See table 1 for treatment list.

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:	23 June	69 N kg/ha
	7 August	69 N kg/ha
PGR:	GS31	Moddus Evo 200mL/ha + 1.3L/ha Errex
Fungicide:	GS39	Prosaro 300ml/ha

2020 NSW Crop Technology Centre - Wallendbeen, New South Wales

Time of Sowing – 22nd April 2020

Sown: 22 April, 2020
Harvested: 28 November, 2020 (spring cultivars) & 14 December, 2020 (winter cultivars)
Rotation position: Canola 2018, Wheat 2019.
Soil type: Clay loam

Trial 1. HYC 1st Stage Screen

Objectives:

To examine the phenology, disease resistance and standing power of new wheat germplasm sown on 22nd April versus control varieties.

Treatments: 30 lines were sown in small plots (5m in length) with standard nitrogen management but ***NO FUNGICIDE or PGR input*** to this trial. Plots are not taken to yield.

Key Points:

- *Stripe rust (Puccinia striiformis f. sp. tritici) was the most destructive disease in the untreated screen, severely affecting Trojan and LPB17-4713 (95% and 75% plot infection respectively).*
- *Septoria tritici blotch (STB) caused by the pathogen Zymoseptoria tritici was notable in terms of green leaf area lost, with between 15-20% infection severity in GSUQ-19-48-W, IGW6563, IGW6496 and V12069-076.*
- *Powdery Mildew (Blumeria graminis f. sp. tritici) was only evident in Nighthawk.*
- *Since Anapurna and RGT Accroc produced the highest yields in the germplasm management trial (GEM Trial 2) the following varieties had similar phenology and as good as or better than disease resistance and standing power (straw strength). Of the varieties were V13079-049, BX7932-074, BX7932-039 and SFR86-090 codes.*

Table 1. Growth stage assessments from 1 June, 15 July, 11 August, 10 September, 6 October, and 1 November – recorded on the Zadoks scale 0 - 99.

Variety	11-Jun	15-Jul	11-Aug	10-Sep	6-Oct	1-Nov
Scepter	22	31	33	46	65	83
Trojan	22	31	33	41	62	78
Anapurna	24	29	31	34	55	76
RGT Accroc	24	28	31	37	58	76
Nighthawk	24	30	33	37	58	77
Reflection	24	26	30	31	37	61
Graham	24	28	29	32	36	61
Savello	23	28	30	32	37	59
Shabras	22	28	30	32	37	59
BX7932-039	23	28	32	37	59	79
V12069-076	22	30	32	38	59	76
LPB17-4713	24	31	33	41	60	83

SFR86-092	23	28	30	31	41	71
SFR86-071	25	28	30	32	47	71
SFR86-085	23	29	30	32	44	71
GSUQ-19-48-W	22	31	33	43	63	83
GS-18-107-W	23	31	33	47	62	82
GS-18-105-W	24	27	30	31	42	64
GSUQ-19-04-W	24	30	32	42	60	81
IGW6563	23	31	32	45	63	82
IGW6496	23	31	33	44	60	78
AGFWH004418	23	26	31	33	44	70
AGFWH004518	24	29	30	32	47	71
AGFWH004618	22	29	31	33	58	76
AGFWH004718	24	27	30	32	51	71
AGFWH004818	25	28	31	33	48	71
V13079-049	22	29	32	37	59	77
SFR86-090	24	27	31	37	55	75
BX7932-074	22	29	32	36	58	74
V10086-067-034	22	30	32	37	59	79

The northern European lines from the UK took up to 192 – 199 days from sowing to reach the flowering development stage (GS60-69) compared to 169 – 174 days with RGT Accroc and Anapurna. Scepter from the same 22nd April sowing date took 156 days to reach flowering (Figure 1).

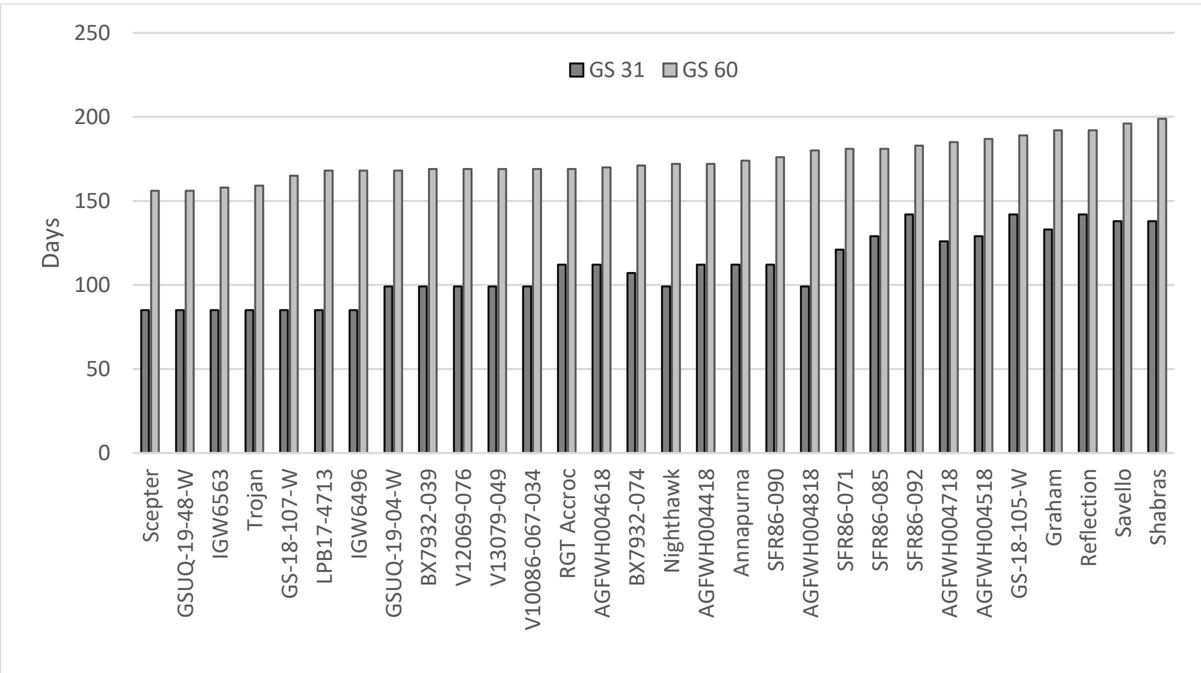

Figure 1. Approximate number of days taken to reach critical growth stage periods of 1st node (GS 31) and start of flowering (GS 60).

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

Variety	STB	YLS	Yr	Lr	PM
Scepter	✓		✓		
Trojan			✓		
Anapurna	✓		✓	✓	
RGT Accroc	✓				
Nighthawk	✓	✓			✓
Reflection			✓		
Graham					
Savello	✓			✓	
Shabras	✓	✓			
BX7932-039	✓				
V12069-076	✓		✓		
LPB17-4713			✓		
SFR86-092		✓	✓	✓	
SFR86-071	✓				
SFR86-085	✓	✓			
GSUQ-19-48-W	✓	✓	✓		
GS-18-107-W			✓	✓	
GS-18-105-W					
GSUQ-19-04-W	✓		✓		
IGW6563	✓		✓	✓	
IGW6496	✓		✓		
AGFWH004418	✓	✓			
AGFWH004518		✓			
AGFWH004618	✓		✓		
AGFWH004718					
AGFWH004818					
V13079-049		✓	✓		
SFR86-090			✓		
BX7932-074	✓				
V10086-067-034	✓	✓			

The severity of lodging experienced and disease susceptibility is presented in Figures 2 & 3 and show the most disease prone lines experienced in the trial.

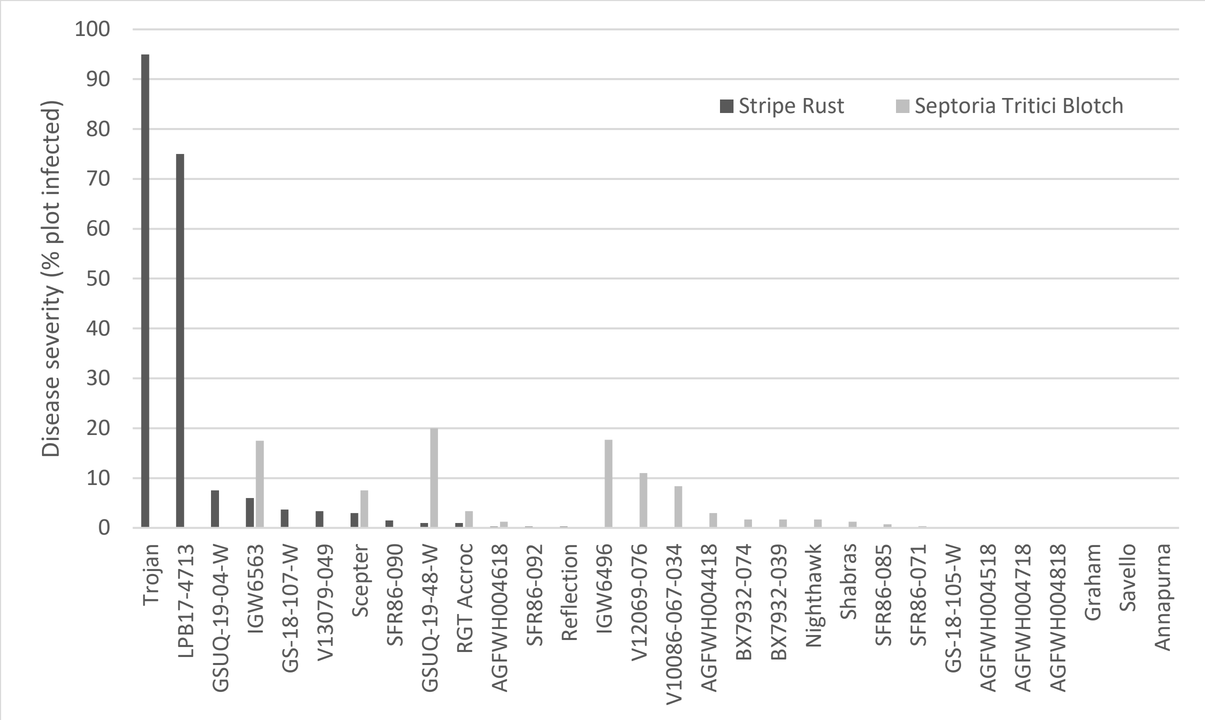

Figure 2. Disease severity of Stripe rust and Septoria tritici blotch (whole plot % score), assessed 27 October (GS57-77).

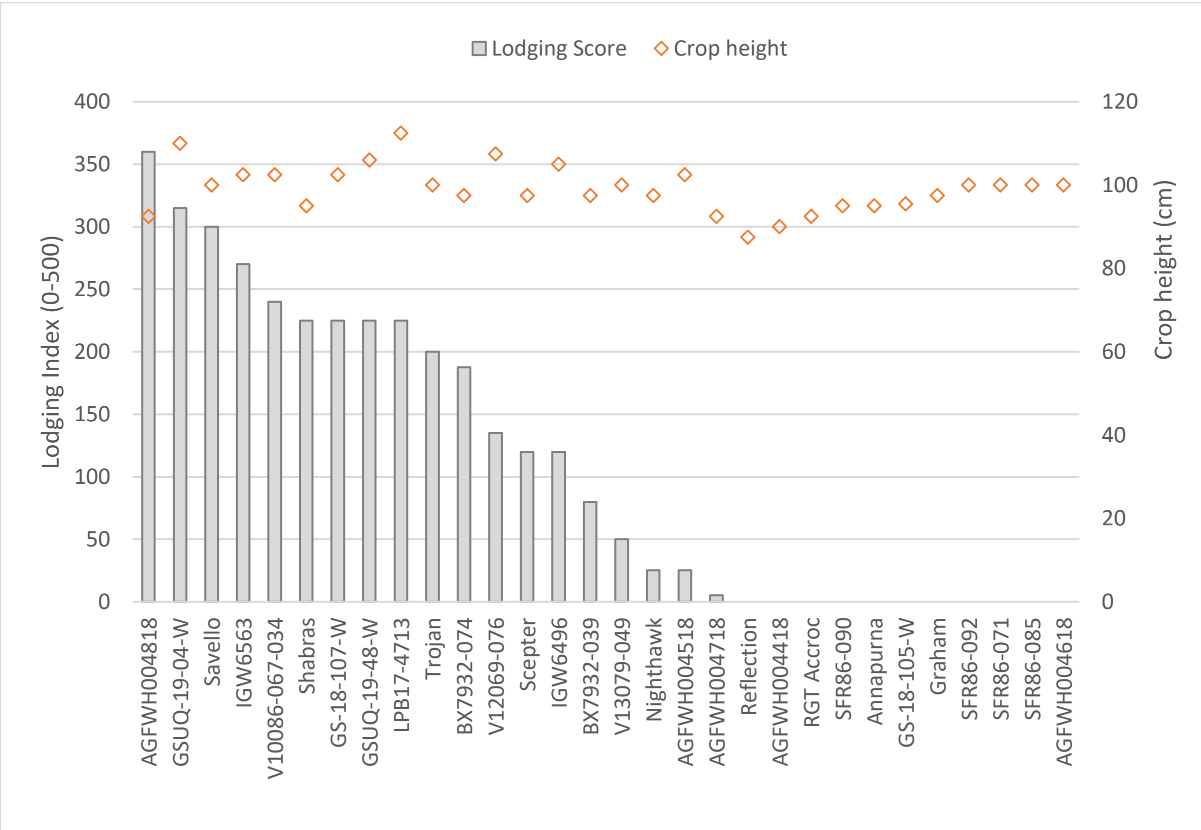

Figure 3. Crop lodging at physiological maturity assessed as Lodging index and crop height (cm) assessed on 9 December.

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

Plant pop'n:		180 seeds/m^2 (150 plants/m^2 target) - all three managements
	Timing	**Untreated**
Seed treatment:		Vibrance + Goucho
Basal Fertiliser:	21 April	120kg MAP (12 Kg N)
Nitrogen:	18 June	40kg N/ha
	29 July	70kg N/ha
Total N Applied:		**122kg N/ha**
PGR:		---
Fungicide:	GS31	---
	GS39	---
	GS59-61	---

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

Trial 2. 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 (22nd April sown).

Key Points:

- *Winter feed wheats RGT Accroc and Anapurna were significantly higher yielding than all other cultivars tested giving yields over 10t/ha and a 2t/ha advantage over Scepter.*
- *The ASW wheat DS Bennett was significantly higher yielding than all other white wheat milling varieties.*
- *Of the AH classified wheats Nighthawk and Beckom were the highest yielding (mean of the three managements).*
- *There was a significant reduction in yield as a result of defoliation (simulated grazing) at GS30 when the results from all cultivars were averaged.*
- *Although there was some evidence that the different varieties responded to management differentially the interaction was not statistically significant (p=0.06).*
- *Dry matter (DM) contents at harvest ranged from 17 – 20t/ha with significantly higher DM accumulation in the longer season winter wheats such as RGT Accroc, Anapurna and DS Bennett 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.*
- *At harvest however although there were more heads/m2 with winter wheats they were not always significantly higher than spring wheats indicating greater tiller mortality in winter wheats compared to springs.*
- *In general, disease (principally Septoria and stripe rust) has been controlled by the two spray programme set out in standard management approach, however those varieties that tended to give higher yields at higher input (not significant) were in general the more susceptible.*
- *The increased nutrition (18kg N/ha and 25kg S/ha) and PGR applied with the high input approach did not generate any notable yield gains.*
- *In those cultivars that lodged (Gregory, Catapult, Beckom and Trojan) there was no indication that the PGR application reduced lodging, although there were significant positive effects from grazing on standing power.*
- *Protein levels averaged just 11% and indicated that yields were optimised at the level of N application.*
- *Harvest indices for winter wheats were in general closer to 37-40% compared to higher yielding spring wheats that were closer to 45%.*

Treatments: Three management levels (see Table 6) differing in defoliation, nitrogen, fungicide and PGR input were applied to 10 varieties of winter and spring wheat.

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

	Management Level (Yield t/ha)							
Cultivar	**Standard**		**Grazed* Standard**		**High Input**		**Mean**	
Trojan (spring)	8.04	-	8.18	-	8.25	-	8.15	d
Scepter (spring)	7.92	-	8.29	-	8.34	-	8.18	d
Nighthawk (facultative)	8.52	-	8.25	-	8.59	-	8.45	c
Anapurna (winter)	10.37	-	9.62	-	10.35	-	10.11	a
RGT Accroc (winter)	9.94	-	9.90	-	10.34	-	10.06	a
Beckom (spring)	8.40	-	8.49	-	8.45	-	8.45	c
Catapult (spring)	7.80	-	8.03	-	8.26	-	8.03	de
Gregory (spring)	7.04	-	6.96	-	7.24	-	7.08	f
Kittyhawk (winter)	7.95	-	7.67	-	7.94	-	7.85	e
DS Bennett (Winter)	9.72	-	9.10	-	9.42	-	9.41	b
Mean	8.57	ab	8.45	b	8.72	a		
LSD Cultivar p = 0.05			0.18		P val		0.031	
LSD Management p=0.05			0.25		P val		<0.001	
LSD Cultivar x Man. P=0.05			0.43		P val		0.060	

** "Grazed" – Mechanically defoliated at GS30*

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

	Management level (Protein %)						
Cultivar	Standard		Grazed standard		High input		**Mean**
Trojan (spring)	11.4	-	11.7	-	11.3	-	11.4
Scepter (spring)	10.6	-	10.7	-	10.7	-	10.7
Nighthawk (facultative)	11.6	-	11.6	-	11.4	-	11.5
Anapurna (winter)	11.5	-	10.4	-	11.5	-	11.1
RGT Accroc (winter)	11.6	-	10.5	-	11.6	-	11.2
Beckom (spring)	11.1	-	10.8	-	11.2	-	11.0
Catapult (spring)	11.3	-	11.2	-	11.3	-	11.3
Gregory (spring)	10.9	-	11.6	-	11.4	-	11.3
Kittyhawk (winter)	11.6	-	11.6	-	11.8	-	11.7
DS Bennett (Winter)	11.3	-	11.4	-	10.7	-	11.1
Mean	11.3		11.1		11.3		
LSD Cultivar p = 0.05			0.515		P value		**0.021**
LSD Management p=0.05			0.323		P value		**0.526**
LSD Cultivar x Man. P=0.05			0.892		P value		**0.259**

Table 3. Dry matter removed (t/ha) at GS30, GS75, and GS90. *Calendar dates vary due to differences in phenology.*

Variety	**Grazing dry matter (GS30)**		**Grain development Dry Matter (GS75)**		**Harvest Dry Matter (GS90)**	
	(t/ha)		(t/ha)		(t/ha)	
Trojan (spring)	0.17	b	11.45	d	18.54	bc
Scepter (spring)	0.07	b	11.59	d	17.36	cd
Nighthawk (facultative)	0.22	b	15.71	ab	18.63	bc
Anapurna (winter)	0.68	a	15.21	abc	20.07	a
RGT Accroc (winter)	0.62	a	16.94	a	19.64	ab
Beckom (spring)	0.06	b	13.18	bcd	17.16	d
Catapult (spring)	0.14	b	11.66	d	18.60	bc
Gregory (spring)	0.12	b	12.28	cd	18.12	cd
Kittyhawk (winter)	0.62	a	13.19	bcd	17.47	cd
DS Bennett (Winter)	0.69	a	15.55	ab	20.03	a
Mean	**0.339**		**13.68**		**18.56**	
P value	**0.339**		**2.931**		**1.274**	
LSD (p=0.05)	<0.001		0.0025		<0.001	

Table 4. Approximate date of the start of stem elongation (GS30) and beginning of flowering (GS60) under standard management and dry matter removed during simulated grazing (mechanical defoliation) at GS30 and associated grain yield loss associated.

	Date	**Date**	**Dry Matter**	**Yield loss**
Variety	GS30	GS60	kg/ha	t/ha
Trojan (spring)	17-Jun	23-Sep	0.17	+0.41
Scepter (spring)	17-Jun	23-Sep	0.07	+0.37
Nighthawk (facultative)	15-Jul	8-Oct	0.22	0.26
Anapurna (winter)	11-Aug	14-Oct	0.68	0.75
RGT Accroc (winter)	29-Jul	8-Oct	0.62	0.04
Beckom (spring)	17-Jun	23-Sep	0.06	+0.09
Catapult (spring)	17-Jun	23-Sep	0.14	+0.23
Gregory (spring)	17-Jun	23-Sep	0.12	0.08
Kittyhawk (winter)	15-Jul	8-Oct	0.62	0.28
DS Bennett (Winter)	29-Jul	14-Oct	0.69	0.62

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

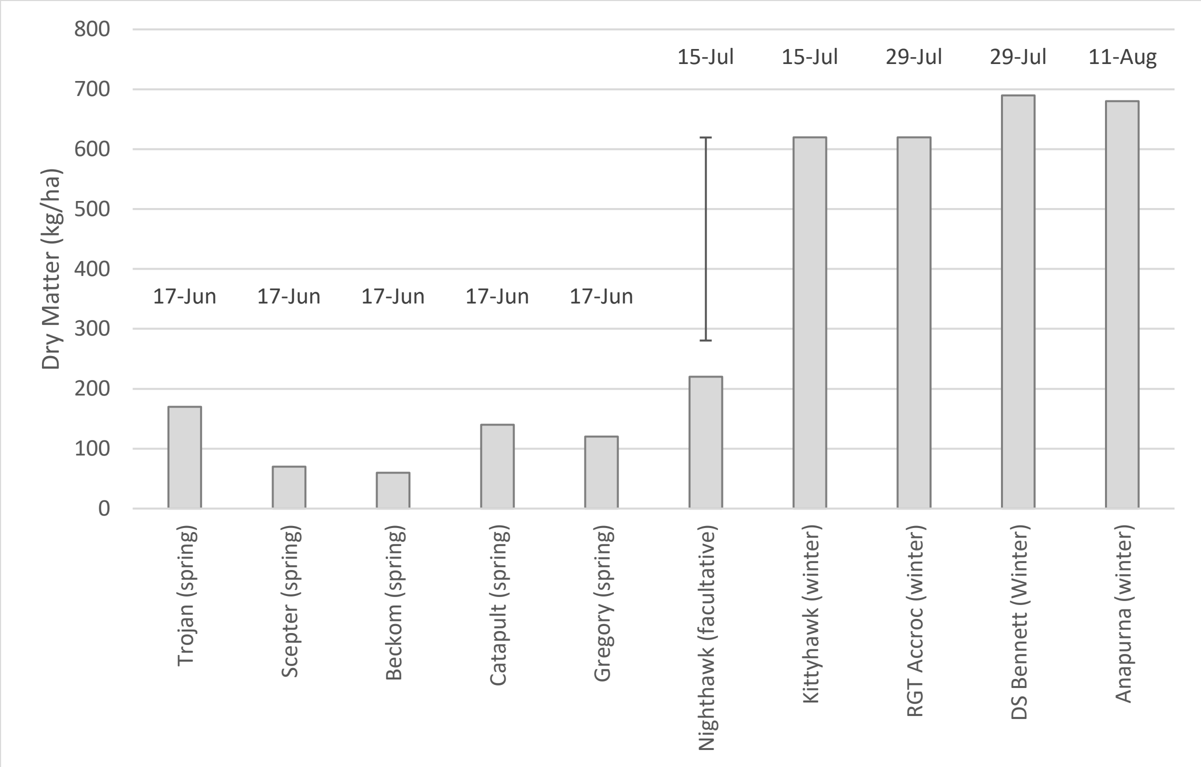

Figure 1. Dry Matter removed (kg/ha) and date of grazing at GS30, Error bar represents LSD of 340 kg/ha at p=0.05.

Table 5. Plants/m2 assessed at GS12, tillers/m2 assessed GS31, heads/m2 assessed at GS90, and the number of tillers per plant.

Variety	**Plants/m2**		**Tillers/m2**		**Heads/m2**		**Tillers/Plant**
Trojan (spring)	137	ab	324	c	494.4	cd	2.4
Scepter (spring)	125	bcd	343	c	463.3	de	2.7
Nighthawk (facultative)	143	a	484	ab	576	a	3.4
Anapurna (winter)	137	ab	517	a	520.4	bc	3.8
RGT Accroc (winter)	121	cd	518	a	554.1	ab	4.3
Beckom (spring)	122	bcd	354	c	521.5	bc	2.9
Catapult (spring)	142	a	362	c	598.9	a	2.5
Gregory (spring)	147	a	319	c	445.9	de	2.2
Kittyhawk (winter)	116	d	434	b	440.9	e	3.7
DS Bennett (Winter)	135	abc	507	a	555.6	ab	3.8
Mean	132.5		416.3		517.1		3.1
LSD	14.9		54.6		50.3		
P value	**<0.001**		**<0.001**		**<0.001**		

Table 6. Crop lodging index (0-500) at crop maturity (GS90) on 7 December.

Variety	Management level (Lodging GS90 (0-500 scale)							
	Standard		"Grazed"		High input		Mean	
Trojan (spring)	163	cd	25	gh	158	cd	**115**	**c**
Scepter (spring)	88	ef	33	fgh	111	de	**77**	**d**
Nighthawk (facultative)	5	h	0	h	6	h	**4**	**e**
Anapurna (winter)	0	h	0	h	0	h	**0**	**e**
RGT Accroc (winter)	0	h	0	h	0	h	**0**	**e**
Beckom (spring)	236	b	83	efg	248	b	**189**	**b**
Catapult (spring)	233	b	106	de	195	bc	**178**	**b**
Gregory (spring)	312	a	208	bc	329	a	**283**	**a**
Kittyhawk (winter)	0	h	0	h	0	h	**0**	**e**
DS Bennett (Winter)	0	h	0	h	0	h	**0**	**e**
Mean	**104**	**a**	**46**	**b**	**104.6**	**a**		
LSD Cultivar p = 0.05				34.1	P val		**<0.001**	
LSD Management p=0.05				21.2	P val		**<0.001**	
LSD Cultivar x Man. P=0.05				59.0	P val		**<0.001**	

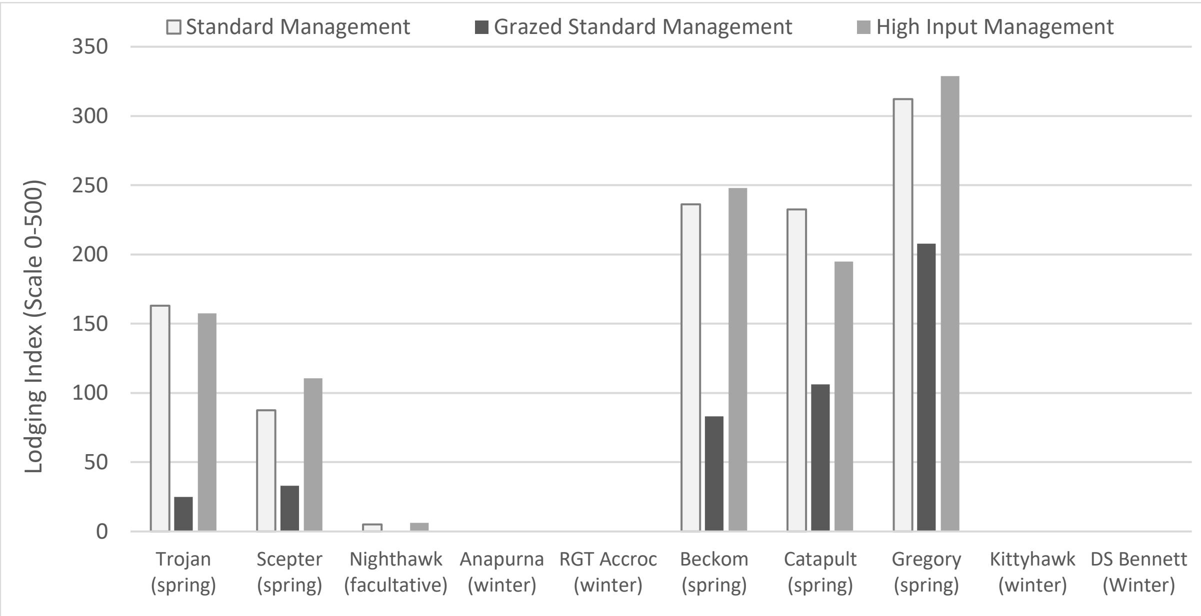

Figure 2. Influence of variety and management on crop lodging index (0-500) at crop maturity (GS90) on 7 December.

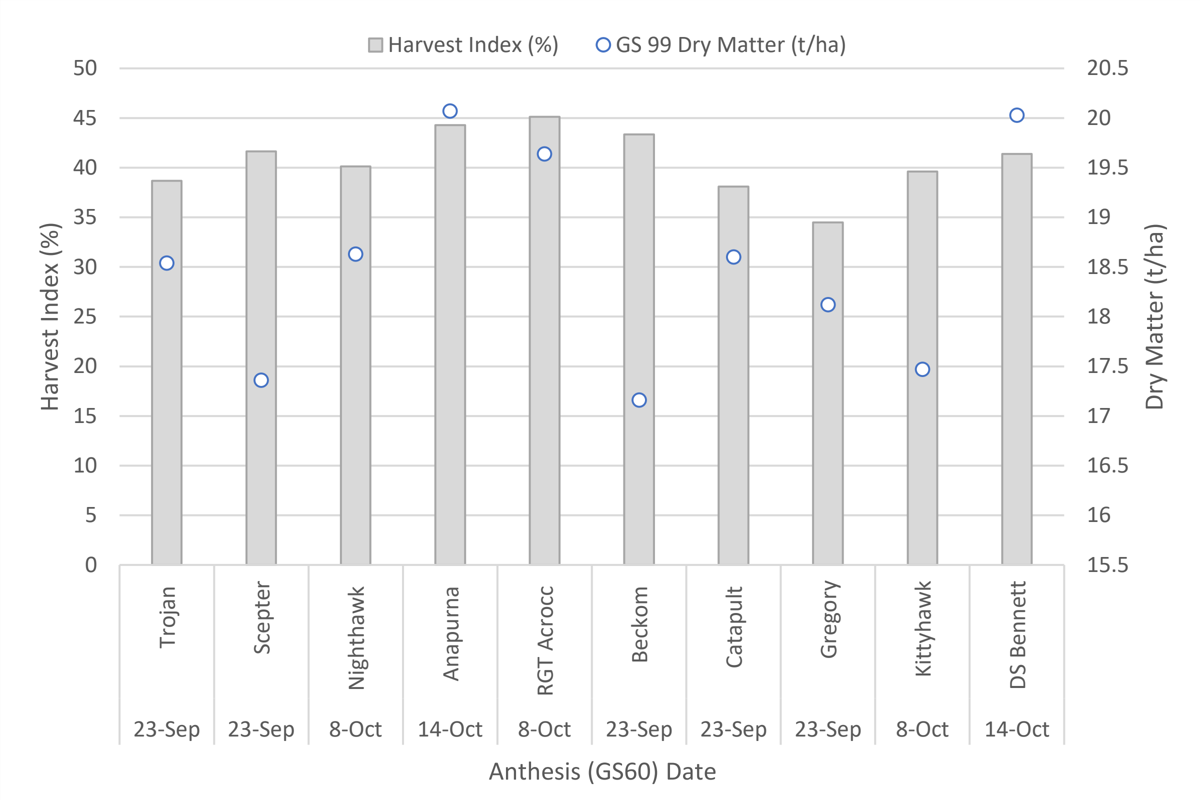

Figure 3. Influence of cultivar on dry matter at harvest (t/ha) and harvest index (%) – mean of management levels. Anthesis date shown.

Table 7. 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:	21 April	120kg MAP (12 Kg N)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)
Nutrition:	18 June	40kg N/ha	40kg N/ha	40kg N +25kg S + 25kg K/ha
	23 July	70kg N/ha	70kg N/ha	88kg N/ha
Total N Applied:		**122kg N/ha**	**122kg N/ha**	**140kg N/ha**
PGR:	11 August	---	---	Moddus Evo 100ml/ha
				Errex 0.65L/ha
Fungicide*:	GS 31	Opus 500ml/ha	Opus 500ml/ha	Prosaro 300ml/ha
	GS39	Amistar Xtra 800ml/ha	Amistar Xtra 800ml/ha	Amistar Xtra 800ml/ha
	GS61			Opus 500ml/ha

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

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

Trial 3. 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:

- Monitor the effectiveness of fluxapyroxad (Systiva) 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 Points:

- *The feed winter wheats RGT Accroc and Anapurna significantly out yielded all other cultivars at all three levels of disease management 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 DS Bennett giving yield responses of 5.27 and 3.07 t/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 was the main disease in Trojan, DS Bennett, Coolah, RGT Accroc and Catapult. Other cultivars were subject to low levels of both stripe rust and STB disease pressure.*
- *Only Trojan, Catapult, Coolah and DS Bennett gave significant yield increases to the application of four units of fungicide (seed treatment and three foliar fungicides) over a single flag spray.*
- *It was noted that compared to lower altitude locations stripe rust infection was relatively later at the Wallendbeen, NSW location (540m above sea level).*
- *Note of caution. At the southern Victorian location at Gnarwarre Trojan was almost completely defoliated in the lower canopy under the one spray regime compared to Wallendbeen and the 1 spray approach was little better than the untreated (both approaches yielding under 3t/ha).*
- *The significant interaction observed in grain yields was also apparent in the grain quality (test weights and screenings).*

Treatments: Three levels of fungicide management (untreated, 1 Fungicide unit applied GS39 & 4 Fungicide units (seed treatment, GS31, GS39 and GS61) were applied across 10 wheat varieties (Table 1).

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

	Management Level (Yield t/ha)						
Cultivar	**Untreated**		**1 Fungicide Unit**		**4 Fungicide Units**		**Mean**
Trojan (spring)	2.28	n	7.55	hij	8.13	efg	**5.98**
Scepter (spring)	7.07	kl	8.60	d	8.55	de	**8.07**
Nighthawk (facultative)	7.98	gh	8.47	def	8.54	de	**8.33**
Anapurna (winter)	9.69	c	10.22	b	10.46	ab	**10.12**
RGT Accroc (winter)	9.72	c	10.86	a	10.83	a	**10.47**
Beckom (spring)	7.75	ghi	8.46	def	8.66	d	**8.29**
Catapult (spring)	6.06	m	7.84	ghi	8.46	def	**7.45**
Gregory (spring)	6.75	l	7.15	jkl	7.40	ijk	**7.10**
Coolah (Spring)	7.26	jk	8.07	fg	8.75	d	**8.03**
DS Bennett (Winter)	5.68	m	8.75	d	9.48	c	**7.97**
Mean	**7.02**		**8.60**		**8.93**		
LSD Cultivar p = 0.05			0.26 t/ha		P val		<0.001
LSD Management p=0.05			0.28 t/ha		P val		<0.001
LSD Cultivar x Man. P=0.05			0.45 t/ha		P val		<0.001

Table 2. Influence of disease management strategy and variety on grain test weight (kg/hl)

	Management Level (Test Weight kg/hL)						
Cultivar	**Untreated**		**1 Fungicide Unit**		**4 Fungicide Units**		**Mean**
Trojan (spring)	61.3	g	76.5	ef	79.7	a-d	**72.5**
Scepter (spring)	74.9	f	80.6	a-d	81.0	ab	**78.8**
Nighthawk (facultative)	80.4	a-d	80.4	a-d	81.8	a	**80.9**
Anapurna (winter)	81.3	ab	81.7	a	81.9	a	**81.6**
RGT Accroc (winter)	78.1	cde	78.8	b-e	78.9	b-e	**78.6**
Beckom (spring)	78.6	b-e	78.8	b-e	80.1	a-d	**79.1**
Catapult (spring)	74.9	f	79.3	a-d	81.0	ab	**78.4**
Gregory (spring)	78.8	b-e	79.6	a-d	79.9	a-d	**79.4**
Coolah (Spring)	76.4	ef	77.9	de	80.2	a-d	**78.2**
DS Bennett (Winter)	79.3	a-d	81.2	ab	80.9	abc	**80.5**
Mean	**76.4**		**79.5**		**80.5**		
LSD Cultivar p = 0.05			1.6		P val		<0.001
LSD Management p=0.05			1.2		P val		<0.001
LSD Cultivar x Man. P=0.05			2.8		P val		<0.001

Table 4. Influence of disease management strategy and variety on grain protein %.

	Management Level (Protein %)						
Cultivar	**Untreated**		**1 Fungicide Unit**		**4 Fungicide Units**		**Mean**
Trojan (spring)	11.0	-	11.2	-	11.7	-	11.3
Scepter (spring)	11.8	-	11.8	-	11.9	-	11.8
Nighthawk (facultative)	11.6	-	11.7	-	11.4	-	11.6
Anapurna (winter)	11.2	-	11.4	-	11.4	-	11.4
RGT Accroc (winter)	10.0	-	10.2	-	10.6	-	10.3
Beckom (spring)	11.8	-	11.7	-	11.6	-	11.7
Catapult (spring)	11.3	-	11.4	-	11.3	-	11.3
Gregory (spring)	11.9	-	11.9	-	11.8	-	11.9
Coolah (Spring)	11.5	-	11.4	-	11.6	-	11.5
DS Bennett (Winter)	10.4	-	10.7	-	10.2	-	10.4
Mean	**11.3**		**11.3**		**11.4**		
LSD Cultivar p = 0.05			0.2		P val		<0.001
LSD Management p=0.05			0.2		P val		0.436
LSD Cultivar x Man. P=0.05			0.4		P val		0.110

Table 3. Influence of disease management strategy and variety on grain screenings (%)

	Management Level (Screening %)						
Cultivar	**Untreated**		**1 Fungicide Unit**		**4 Fungicide Units**		**Mean**
Trojan (spring)	10.7	a	1.9	c-g	1.5	d-h	4.7
Scepter (spring)	2.9	bc	0.7	h	0.7	h	1.4
Nighthawk (facultative)	0.8	gh	0.8	gh	0.7	gh	0.8
Anapurna (winter)	0.8	gh	0.7	h	0.6	h	0.7
RGT Accroc (winter)	0.8	gh	0.5	h	0.6	h	0.6
Beckom (spring)	0.9	gh	0.8	gh	0.7	h	0.8
Catapult (spring)	2.6	cd	1.2	e-h	0.8	gh	1.6
Gregory (spring)	1.2	fgh	1.2	fgh	1.2	fgh	1.2
Coolah (Spring)	1.3	e-h	1.0	gh	0.9	gh	1.1
DS Bennett (Winter)	4.0	b	2.4	cde	2.3	c-f	2.9
Mean	**2.6**		**1.1**		**1.0**		
LSD Cultivar p = 0.05			0.7		P val		<0.001
LSD Management p=0.05			0.5		P val		<0.001
LSD Cultivar x Man. P=0.05			1.2		P val		<0.001

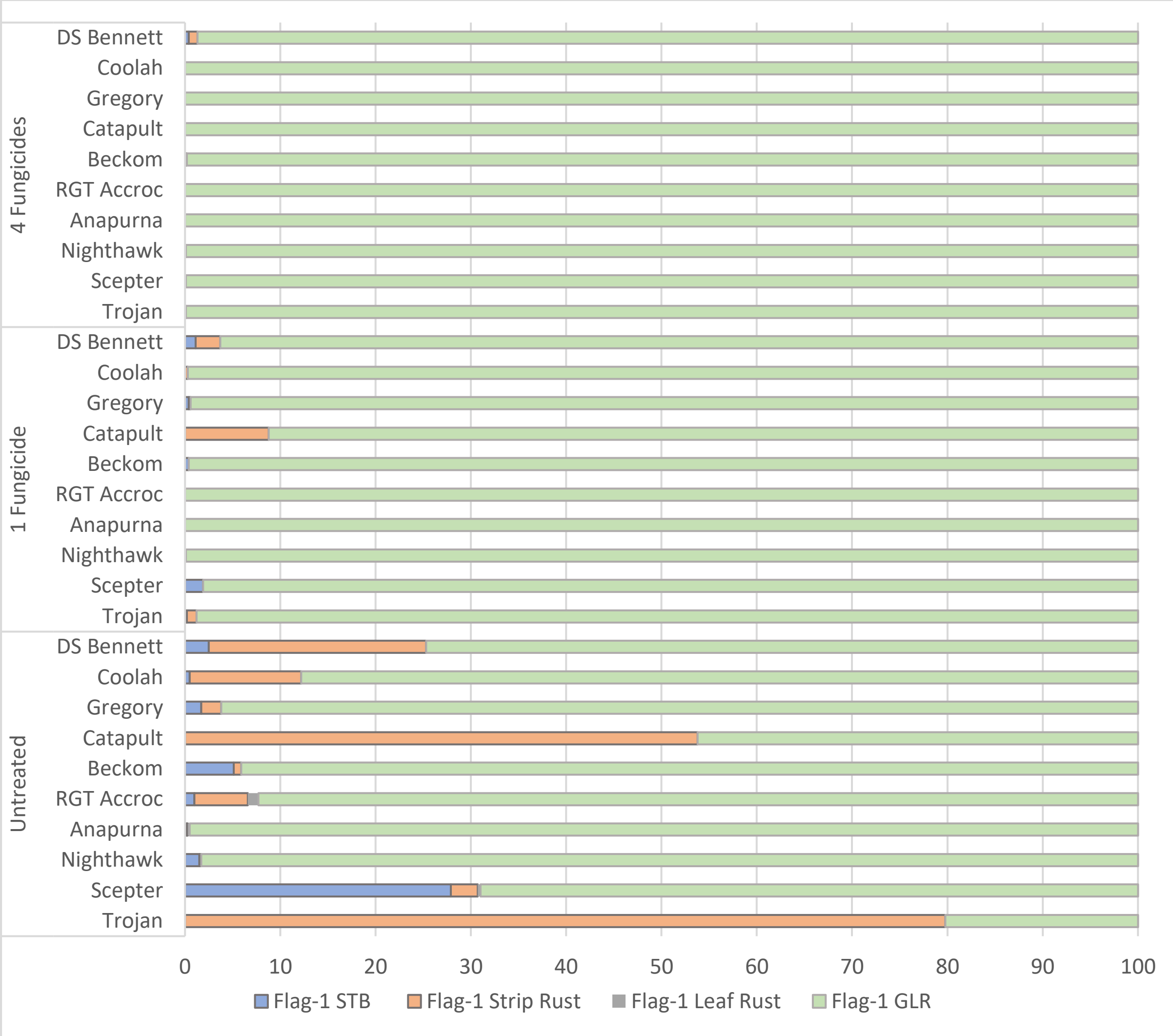

Figure 1. Influence of fungicide strategy and cultivar on disease severity on flag-1 (% LAI & GLA), 3rd November GS75-80.

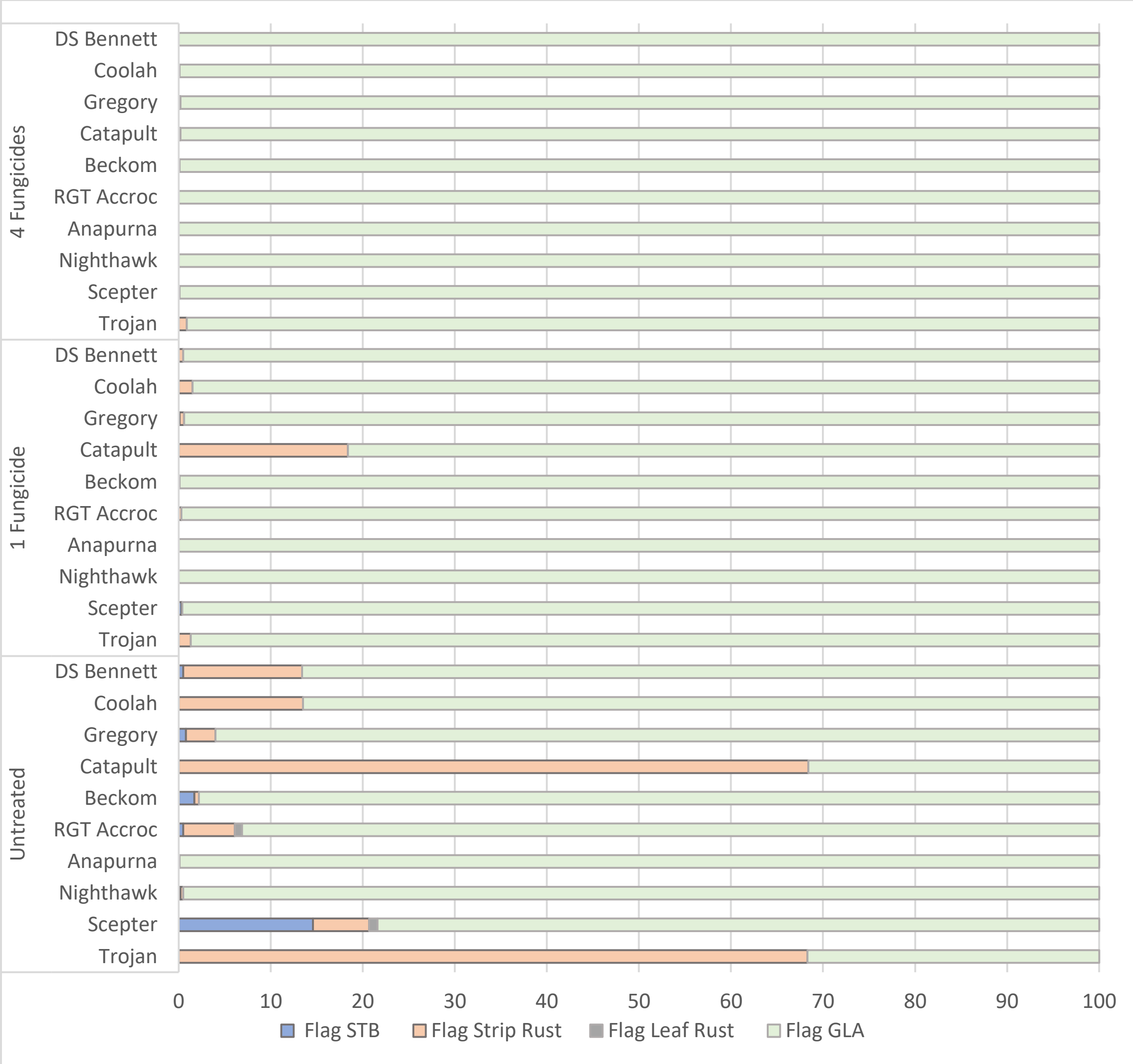

Figure 2. Influence of fungicide strategy and cultivar on disease severity on flag (% LAI & GLA), 3rd November GS75-80.

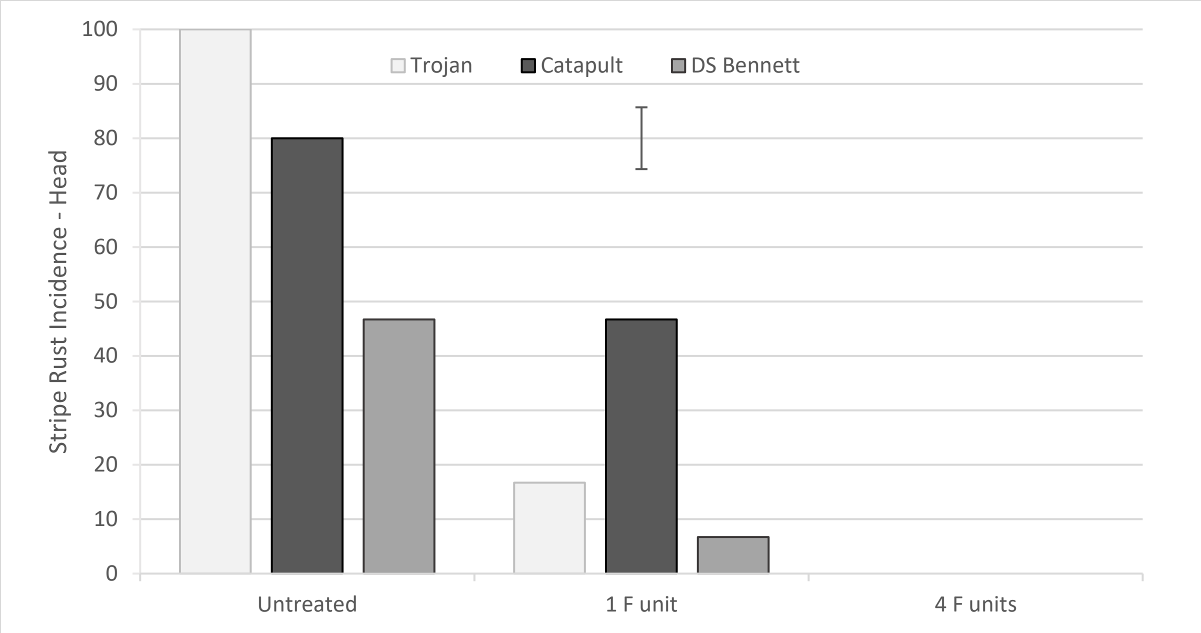

Figure 3. Stripe Rust incidence of head infection at GS75-80, only showing treatments where head infection was present. Error bar represents LSD (p= 0.05) 11.36. P value <0.001.

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

Plant pop'n:	180 seeds/m^2 (150 plants/m^2 target) - all three managements			
	Timing	**Untreated**	**1 Fungicide Unit**	**4 Fungicide Units**
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As 1 F unit + **Systiva**
Basal Fertiliser:	21 April	120kg MAP (12 Kg N)	120kg MAP (12 Kg N/ha)	120kg MAP (12 Kg N/ha)
Nitrogen:	18 June	40kg N/ha	40kg N/ha	40kg N/ha
	29 July	70kg N/ha	70kg N/ha	70kg N/ha
Total N Applied:		**122kg N/ha**	**122kg N/ha**	**122kg N/ha**
PGR:		---	---	---
Fungicide*:	GS31	---	---	Prosaro 300ml
	GS39	---	Amistar Xtra 800ml	Amistar Xtra 800ml
	GS59-61	---	---	Opus 500ml

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

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

Trial 4. HYC Spring Wheat "Reset" Trial

Objectives: To assess the value of pre and post GS30 defoliation in winter and spring germplasm grown in HRZ or high yielding regions of different season lengths.

Individual objectives specific to the trial were:

- Assess the dry matter offtake differences resulting from GS22, GS30 & GS32 defoliations and their effect on final harvest dry matter, grain yield and harvest index of spring versus winter wheat.
- Assess whether April sown spring wheat that has been "reset at GS32 (defoliated)" is higher yielding than GS30 and GS22 grazed and ungrazed crops.
- To assess whether the dry matter offtakes of longer season winter wheats at GS22 are more profitable (dry matter offtake and grain yield) than the same winter wheat defoliated at GS30.

Key Points:

- *All defoliation treatments applied post GS30 reduced grain yield relative to the ungrazed and crops grazed at GS30.*
- *Although shorter grazing (hard grazing) produced more dry matter and gave slightly larger reductions in grain yield than light grazing, the differences were not statistically significant.*
- *With later grazing dates, due to a longer vegetative period, dry matter offtakes were significantly greater with RGT Accroc than with Trojan.*
- *The concept of "resetting Trojan" at GS32 was unsuccessful in terms of grain yield with a 22 April sown crop in the absence of any frost events.*
- *The development stage of grazing and degree of grazing (hard or light) were well correlated to preventing crop lodging due to reduced crop height and in some cases significantly less harvest dry matter.*
- *Unless the crop was reset with defoliation post GS30 at GS32 there was little noticeable difference in flowering date, although as would be expected RGT Accroc flowered later than Trojan.*

Treatments:
A winter and spring wheat (RGT Accroc and Trojan) were hard grazed and light grazed at start of stem elongation at GS30, grazed post stem elongation at second node (GS32) and left ungrazed. Defoliation was carried out with a lawn mower set at different heights at the two development stages (table 1).

Table 1. Defoliation timings and growth stages.

	Trojan		**RGT Accroc**	
	Date	Growth Stage	Date	Growth Stage
Light & Hard graze	17-June	GS 30	29-July	GS29
Late graze	29-July	GS 32	10-September	GS33

The concept of "resetting" is specifically designed for early sowing spring wheat that develops too quickly from earlier sowing than would be recommended, in this case mid-late April. The idea is that defoliation later than GS31 specifically removes advanced main stems that would have been frosted due to their very early development. Please note this is an experimental approach and should not yet be applied to commercial acreage.

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

	Yield (t/ha)					
	Trojan		**Accroc**		**Mean**	
Ungrazed	7.82	b	10.58	a	9.20	a
Hard Graze	7.46	b	10.22	a	8.84	a
Light Graze	7.85	b	10.38	a	9.12	a
Late (GS32) graze	4.66	d	6.05	c	5.36	b
Mean	6.95	b	9.31	a		
LSD Variety p=0.05	0.41		P val	**<0.001**		
LSD Defoliation p=0.05	0.50		P val	**<0.001**		
LSD Var x Defoliation p=0.05	0.71		P val	**0.03**		

Table 3. Grazing dates and grazing strategy dry matter (t/ha) removal and harvest dry matter.

	Date	**GS 30**		**GS32**		**Harvest**	
		Dry Matter (t/ha)		Dry Matter (t/ha)		Dry Matter (t/ha)	
Trojan; untreated	---	---		---	---	20.96	a
Trojan; Hard graze	17-Jun	0.28	bc	---	---	19.95	a
Trojan; Light graze	17-Jun	0.19	c	---	---	18.72	a
Trojan GS32 graze	29-Jul	---	---	1.67	b	12.13	b
RGT Accroc; Untreated	---	---	---	---	---	20.23	a
RGT Accroc; Hard graze	29-Jul	0.58	a	---	---	20.22	a
RGT Accroc; Light graze	29-Jul	0.43	ab	---	---	19.87	a
RGT Accroc; GS32 graze	10-Sep	---	---	4.78	a	12.46	b
Mean		0.37		3.225		18.0675	
LSD p=0.05		0.174		1.335		3.573	
P val		**0.0031**		**0.0051**		**0.0001**	

Table 4. Influence of grazing management on crop lodging (scale 0-500) at 3 points in the growing season and final crop height (cm) at harvest – Mean of two cultivars.

	Crop Lodging (0-500)						Crop Height (cm)	
	27 Oct		18 Nov		7 Dec		7 Dec	
Ungrazed	53.1	a	48.1	a	78.1	a	93.3	a
Hard Graze	10	b	4.7	b	17.5	bc	87.4	b
Light Graze	11.9	b	14.7	b	32.5	b	88.3	ab
Late (GS32) graze	0	b	0	b	0	c	74.4	c
Mean	18.75		16.875		32.025		85.85	
LSD p=0.05	31.27		22.91		21.2		6.66	
P Value	0.033		0.018		0.002		0.027	

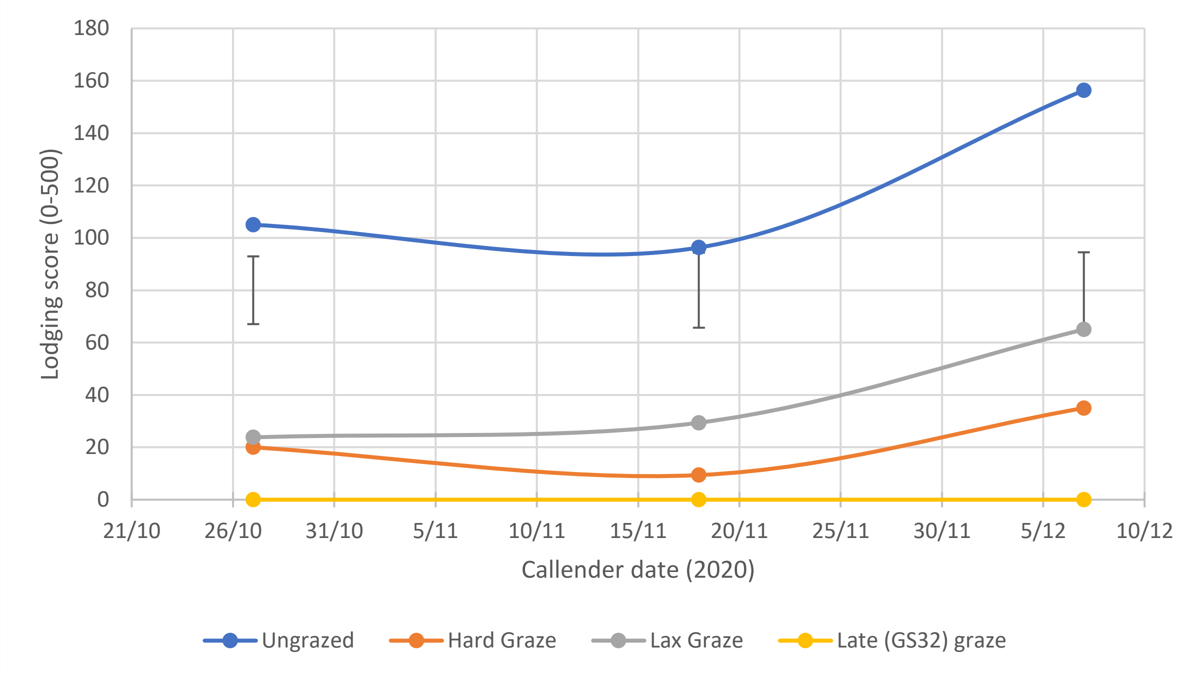

Figure 1. Influence of grazing management on Trojan during the growing season. Error bars represent LSD (p=0.05) of 25.9, 28.6, and 29.0 for 27/10, 18/11, and 7/12 respectively. P value =<0.001 at all dates.

Table 5. Influence of gazing management and variety on wheat phenology (development). Dates are approximate of critical growth stages.

	Sown	**GS30**	**GS39**	**GS51**	**GS60**	**GS65**
Trojan						
Untreated	21-Apr	17-Jun	28-Aug	17-Sep	23-Sep	27-Sep
Hard graze	21-Apr	17-Jun	6-Sep	19-Sep	25-Sep	29-Sep
Light graze	21-Apr	17-Jun	1-Sep	18-Sep	14-Sep	27-Sep
Late graze (GS32)	21-Apr	17-Jun	16-Sep	22-Sep	7-Oct	15-Oct
RGT Accroc						
Untreated	21-Apr	29-Jul	16-Sep	1-Oct	14-Oct	20-Oct
Hard graze	21-Apr	29-Jul	19-Sep	3-Oct	13-Oct	18-Oct
Light graze	21-Apr	29-Jul	22-Sep	6-Oct	15-Oct	20-Oct
Late graze (GS32)	21-Apr	29-Jul	5-Oct	17-Oct	27-Oct	5-Nov

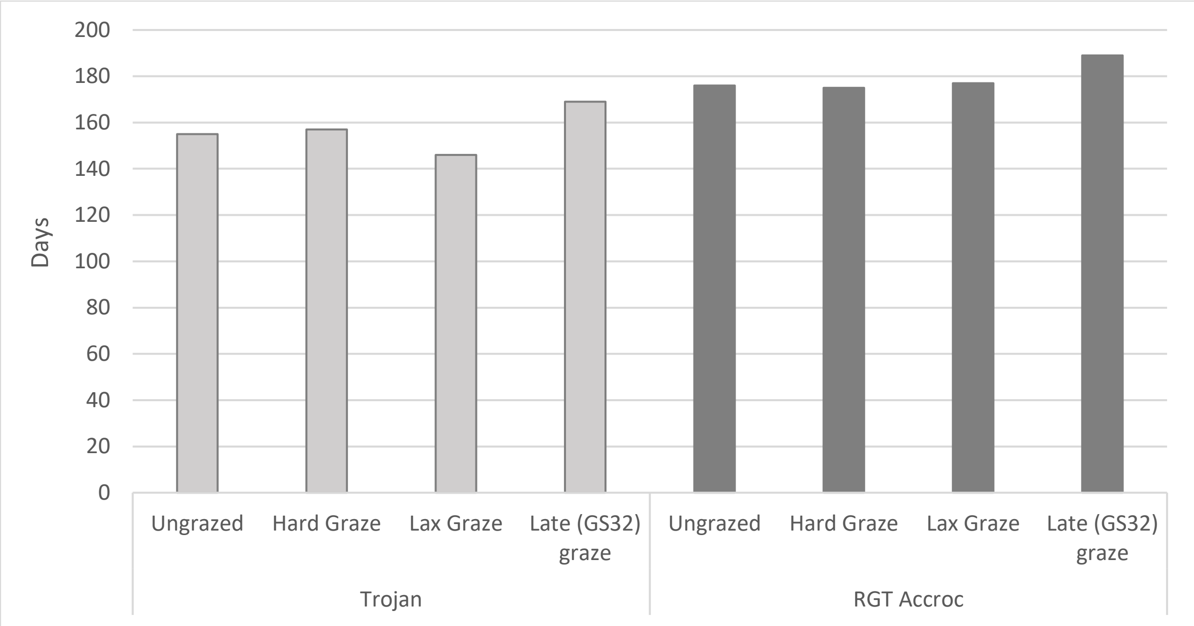

Figure 2. Approximate time taken (days) to reach critical growth period of flowering (GS 60).

Table 5. Details of the management levels applied (ml/ha).

Plant pop'n:		180 seeds/m^2 (150 plants/m2 target) - all management levels			
	Timing	**Ungrazed**	**Light Graze**	**Hard Graze**	**Late (GS32) Graze**
Seed trt:		Vibrance/Gaucho			
Basal Fertiliser:	21 April	120kg MAP (12 Kg N)			
Nitrogen:	18 June	40kg N/ha			
	23 July	70kg N/ha			
Total N Applied:		**122kg N/ha**			
PGR:		---	---	---	---
Grazing:**		---	GS30	GS30	GS32
Fungicide:*	GS31	Opus 500ml	Opus 500ml	Opus 500ml	Opus 500ml
	GS39	Amistar Xra 800ml	Amistar Xra 800ml	Amistar Xra 800ml	Amistar Xra 800ml
	GS59-61***	Prosaro 300ml	Prosaro 300ml	Prosaro 300ml	Prosaro 300ml

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

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

*** Grazing height varied to suit treatment.*

****Applied to Trojan only.*

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 Points:

- *There was no yield response with nutrient input above the standard N input of 152kg N/ha, which included a standard of 120kg/ha MAP at sowing (12N, 26P).*
- *The average yield of the trial in RGT Accroc was 10.06t/ha compared to 7.47t/ha in the milling wheat Coolah for the same treatments.*
- *Protein levels in the standard control were significantly increased from 10.8% to 11.3 – 11.6% with the additional nutrients, but the increases were not associated with higher grain yields (cv Accroc – feed wheat).*
- *With the farm crop milling wheat Coolah additional nutrition neither increased protein or yield, although protein levels with the milling wheat were higher overall (standard 11.9%).*
- *At harvest there was no evidence of dry matter increases associated with greater nutrition input.*
- *Test weight with the feed wheat was significantly reduced by the additional nutrition applied in this trial, but the differences were small and screenings were unaffected.*

Treatments: Five different nutrition strategies (Table 5) were put in place in RGT Accroc that differed in the level of nutrition (N, P, K & S). The same trial was set up in the surrounding farm crop. The starting nitrogen (N) in the soil was 68.5kg N/ha (0- 60cm) and a soil carbon of 1.06 % (0-10cm). Taken on 10-June 2020.

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

Treatment	**Yield (t/ha)**	
Standard nutrition (Farm – **152kg N/ha**)	9.98	-
Standard + 25% (N) (**214.5 kg N/ha**)	10.30	-
Standard + 50% (N) (**257 kg N/ha**)	9.99	-
Standard + 25% (N) (**214.5 kg N/ha**) + (P,K)	10.11	-
Standard + 50% (N) (**257kg N/ha**) + (P,K)	9.92	-
Grand Mean	10.06	
LSD P=.05	0.29	
Treatment Prob(F)	**0.087**	
CV	1.86	

Table 2. Influence of crop nutrition on harvest dry matter (t/ha), yield (t/ha), and grain quality

Treatment	Dry Matter (t/ha)		Yield (t/ha)		Protein (%)		Test Weight (kg/hl)		Screening (%)	
Standard nutrition (Farm – 152kg N/ha)	21.21	-	9.98	-	10.83	b	79.4	a	0.66	-
Standard + 25% (N) (214.5 kg N/ha)	20.14	-	10.30	-	11.28	a	78.8	b	0.61	-
Standard + 50% (N) (257 kg N/ha)	22.15	-	9.99	-	11.58	a	78.2	c	0.71	-
Standard + 25% (N) (214.5 kg N/ha) + (P,K)	20.31	-	10.11	-	11.20	ab	78.4	bc	0.74	-
Standard + 50% (N) (257kg N/ha) + (P,K)	20.15	-	9.92	-	11.53	a	78.4	bc	0.69	-
Grand Mean	20.79		10.06		11.28		78.64		0.68	
LSD P=.05	2.31		0.29		0.43		0.53		0.13	
Treatment Prob(F)	**0.300**		**0.087**		**0.017**		**0.002**		**0.263**	

Milling Wheat (Coolah)

Table 3. Influence of crop nutrition on wheat yields (t/ha)

Treatment	Yield (t/ha)	
Standard nutrition (Farm – 152kg N/ha)	7.53	-
Standard + 25% (N) (214.5 kg N/ha)	7.44	-
Standard + 50% (N) (257 kg N/ha)	7.50	-
Standard + 25% (N) (214.5 kg N/ha) + (P,K)	7.48	-
Standard + 50% (N) (257kg N/ha) + (P,K)	7.39	-
Grand Mean	7.47	
LSD P=.05	0.605	
Treatment Prob(F)	**0.989**	
CV	5.26	

Table 4. Influence of crop nutrition on harvest dry matter (t/ha), Yield (t/ha), and grain quality – cv Coolah

Treatment	Dry Matter (t/ha)		Yield (t/ha)		Protein (%)		Test Weight (kg/hl)		Screening (%)	
Standard nutrition (Farm – 152kg N/ha)	17.93	-	7.47	-	11.9	-	78.0	-	1.0	-
Standard + 25% (N) (214.5 kg N/ha)	18.26	-	7.33	-	12.1	-	77.2	-	1.3	-
Standard + 50% (N) (257 kg N/ha)	17.80	-	7.62	-	12.1	-	77.3	-	1.1	-
Standard + 25% (N) (214.5 kg N/ha) + (P,K)	18.60	-	7.39	-	12.0	-	76.3	-	1.4	-
Standard + 50% (N) (257kg N/ha) + (P,K)	17.43	-	7.51	-	11.7	-	77.0	-	1.1	-
Grand Mean	18.00		7.46		12.0		77.2		1.2	
LSD P=.05	2.19		0.48		0.30		2.39		0.60	
Treatment Prob(F)	**0.795**		**0.711**		**0.117**		**0.669**		**0.634**	

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

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 S)**	**+50% Yield Potential (N P K S)**
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)
Nutrition:	18 June	40N	40N	40N	40N +22P +22K	40N +22P +22K
	29 July	50N	87.5N	105N	87.5N	105N
	22 Sep	50N	75N	100N	75N	100N
Total Applied:		**152kg N**	**214.5kg N**	**257kg N**	**214.5N +22P +22K**	**257N +22P +22K**
PGR:		---	---	---	---	---
Fungicide*:	GS31	Opus 500ml	As Standard	As Standard	As Standard	As Standard
	GS39	Radial 840ml	As Standard	As Standard	As Standard	As Standard
	GS61	Prosaro 300ml	As Standard	As Standard	As Standard	As Standard

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

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

Trial 6. Erect Head Control in April Sown Wheat

Objectives:

To assess the principal causes of erect heads at harvest in April sown wheat crops

Individual objectives specific to the trial were:

- To determine the value of BYDV tolerance in HRZ wheat crops using tolerant and non-tolerant cultivars.
- 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 Points:

- *There were significant yield increases in both BYDV non-tolerant (Anapurna) and assumed tolerant germplasm (DS Bennett) due to insecticide management.*
- *The application of insecticide for BYDV control produced a significant reduction in the level of BYDV (4% plot affected – mean of two varieties).*
- *There was no significant difference amongst the insecticide strategies in terms of BYDV control with an application of neonicotinoid seed treatment (Gaucho) generating the same level of control and yield response as multiple insecticide applications.*

Treatments:

Six different treatments applying four different levels of insecticide input for aphid (BYDV) control were applied to a tolerant (cv DS Bennett) and a non-tolerant variety (cv Anapurna). Note it is assumed DS Bennett has greater tolerance than other cultivars due to its parentage. 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. Influence of management strategy and variety of wheat grain yield (t/ha).

Treatment	**Yield (t/ha)**					
	Anapurna		DS Bennett		Mean	
Untreated	9.24	-	8.02	-	8.63	b
Seed Treatment	9.76	-	8.28	-	9.02	a
Seed Treatment + 1 Insecticide	9.83	-	8.31	-	9.07	a
Seed Treatment + 2 Insecticide	9.91	-	8.29	-	9.10	a
Seed Treatment + 2 Insecticide + Exp. Fungicide 1	9.77	-	8.39	-	9.08	a
Seed Treatment + 2 Insecticide + Exp. Fungicide 2	9.95	-	8.46	-	9.21	a
Mean	9.74	a	8.29	b		
LSD Variety P=0.05	0.33		P val		<0.001	
LSD Insecticide/Fungicide P=0.05	0.35		P val		0.039	
LSD Variety x Insecticide/Fungicide P=0.05	0.50		P val		0.901	
CV	3.82					

Table 2. Influence of variety on wheat grain yield (t/ha) and quality.

Variety	Yield (t/ha)		Protein (%)		Test Weight (kg/hl)		Screenings (%)	
Anapurna	9.74	a	11.43	a	81.41	-	0.92	b
DS Bennett	8.29	b	10.56	b	80.66	-	2.54	a
Mean	9.02		11.00		81.04		1.73	
LSD P=0.05	0.33		0.26		1.05		0.95	
P value	**<0.001**		**0.002**		**0.108**		**0.012**	

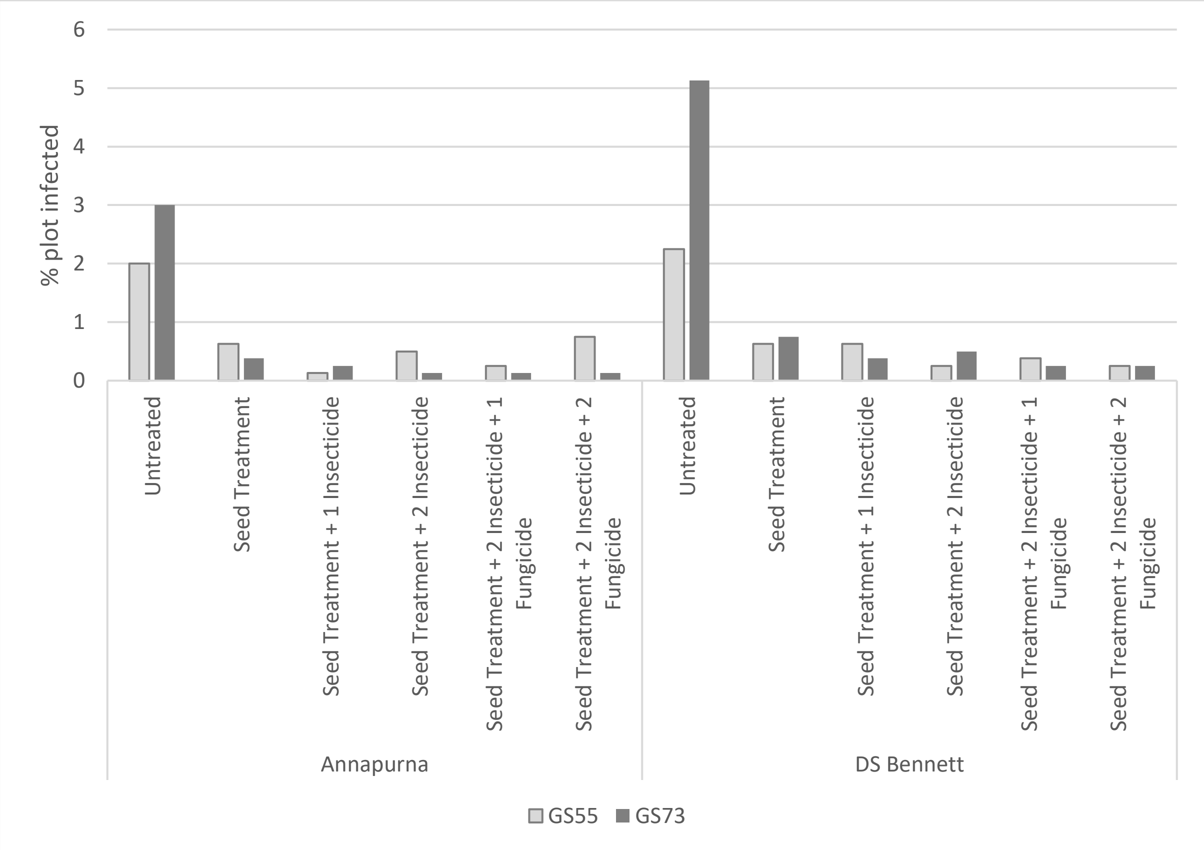

Figure 1. BYDV infection (% plot) assessed at GS55 (9/10/20) and GS73 (1/11/20).

Table 3. Management levels applied.

	Management description	
1	Untreated	Untreated
2	Seed Treatment	Gaucho
3	Seed Treatment + 1 Insecticide	Gaucho;Synthetic Pyrethroid
4	Seed Treatment + 2 Insecticide	Gaucho;Synthetic Pyrethroid;Synthetic Pyrethroid
5	Seed Treatment + 2 Insecticide + 1 Fungicide	Gaucho;Synthetic Pyrethroid;Synthetic Pyrethroid;Exp. Fungicide 2 L/ha
6	Seed Treatment + 2 Insecticide + 2 Fungicide	Gaucho;Synthetic Pyrethroid;Synthetic Pyrethroid;Exp. Fungicide;Azoxystrobin 62.5g ai/ha

Multiple applications of insecticide were applied experimentally to exclude aphids and prevent BYDV in this trial ***(it is not a commercial treatment or intended to act as a recommendation),*** *Experimental fungicide applied at 2L/ha and Azoxystrobin applied at 62.5g ai/ha*

Table 5. Details of the overall management and treatment application (/ha)

Plant pop'n:	180 seeds/m^2 (150 plants/m2 target)						
	Timing	**Trt 1**	**Trt 2**	**Trt 3**	**Trt 4**	**Trt 5**	**Trt 6**
Seed treatment:		Vibrance	Gaucho + Vibrance				
Basal Fertiliser:	21 April	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)
Nitrogen*:	18 June	40kg N/ha	40kg N/ha	40kg N/ha	40kg N/ha	40kg N/ha	40kg N/ha
	29 July	70kg N/ha	70kg N/ha	70kg N/ha	70kg N/ha	70kg N/ha	70kg N/ha
Total N Applied:		**122kg N/ha**	**122kg N/ha**	**122kg N/ha**	**122kg N/ha**	**122kg N/ha**	**122kg N/ha**
Insecticide	GS 21	---	---	Karate Zeon 40ml	Karate Zeon 40ml	Karate Zeon 40ml	Karate Zeon 40ml
	GS 31	---	---	---	Dominex Due 125 ml	Dominex Due 125 ml	Dominex Due 125 ml
Fungicide*:	GS31	---	---	---	---	Exp. Fungicide 2L	Exp. Fungicide 2L + Amistar 250ml
	GS39	Aviator Xpro 400ml	Aviator Xpro 400ml	Aviator Xpro 400ml	Aviator Xpro 400ml	Aviator Xpro 400ml	Aviator Xpro 400ml
	GS61	Radial 600ml	Radial 600ml	Radial 600ml	Radial 600ml	Radial 600ml	Radial 600ml

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

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

APPENDIX

METEOROLOGICAL DATA

Meteorological Data – South Australia Crop Technology Centre

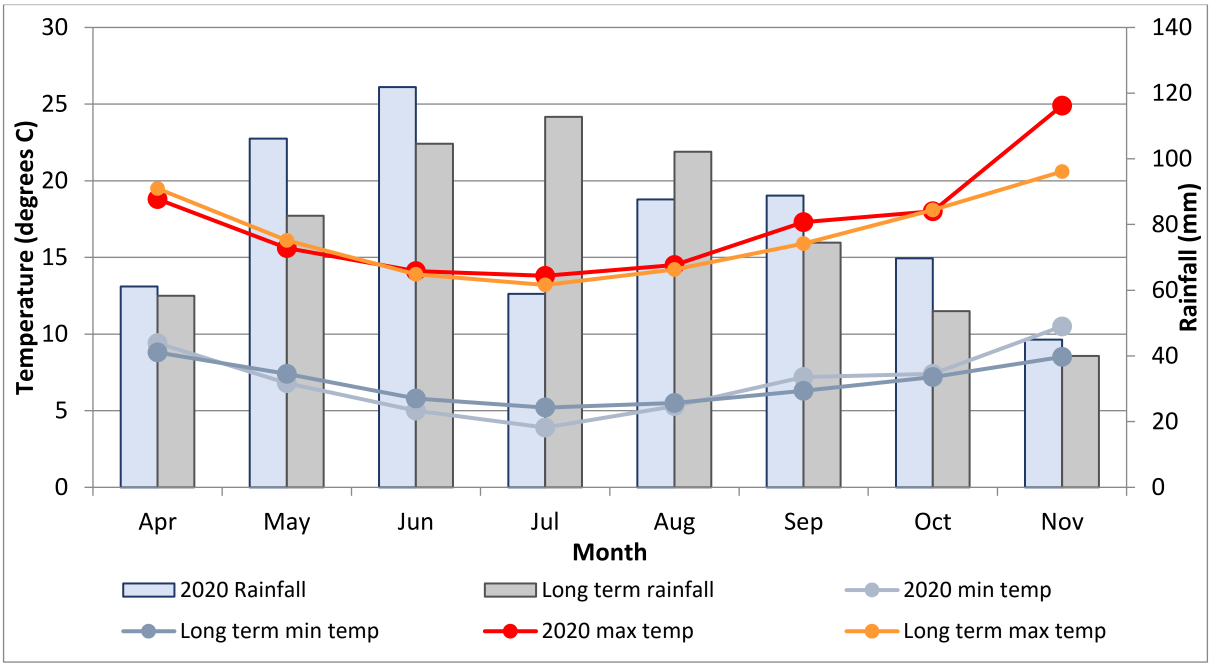

Figure 1. 2020 growing season rainfall and long-term rainfall, 2020 min and max temperatures recorded at Millicent (1877-2020) and long-term min and max temperatures recorded at Mount Gambier Aero (1941 to 2020) for the growing season (April to October). *Rainfall April to November= 639.1mm.*

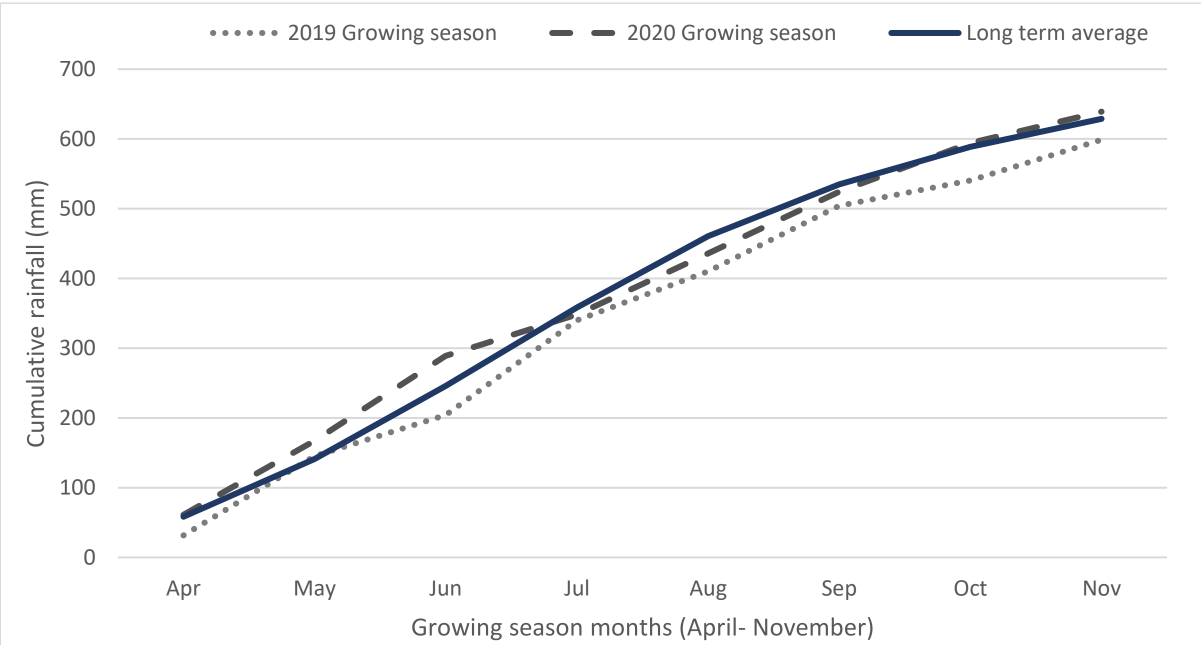

Figure 2. Cumulative growing season rainfall for 2019, 2020 and the long-term average for the growing season (April-November).

Meteorological Data – Victoria Crop Technology Centre

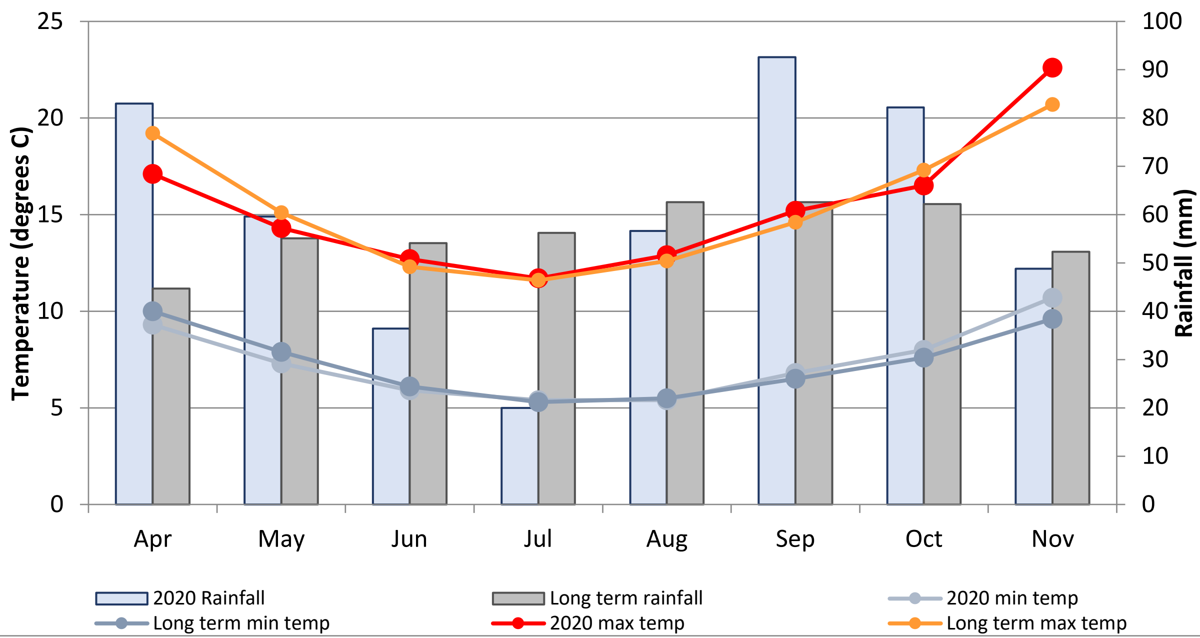

Figure 1. 2020 growing season rainfall and long-term rainfall (1968-2020) (recorded at Buckley (Balliwindi)), 2020 min and max temperatures and long-term min and max temperatures (2000-2020) (recorded at Colac (Mount Gellibrand)) for the growing season. *Rainfall April to November= 479.2mm.*

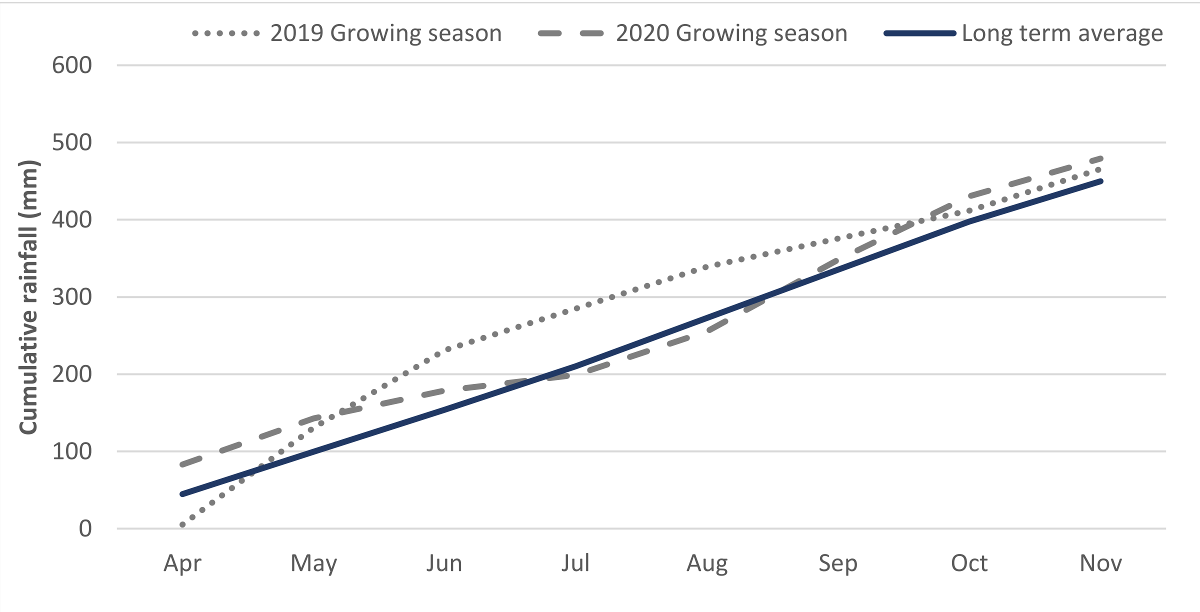

Figure 2. Cumulative growing season rainfall for 2019, 2020 and the long-term average for the growing season.

Meteorological Data – New South Wales Crop Technology Centre

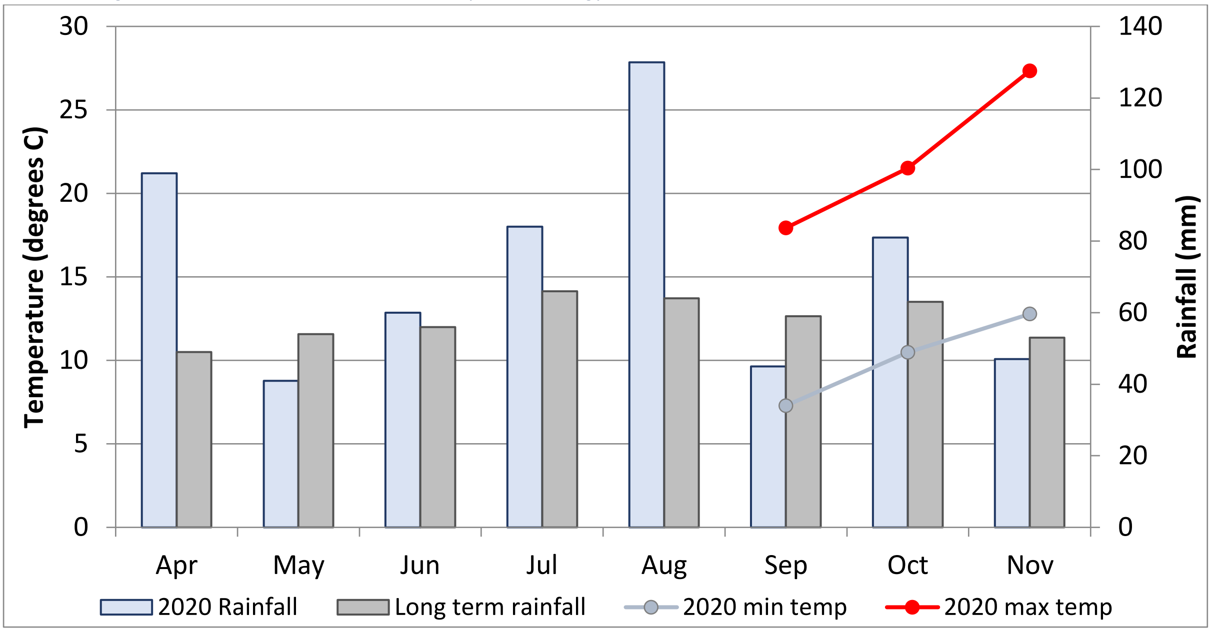

Figure 1. 2020 rainfall and long-term rainfall (1955-2020), min and max temperatures recorded at research site. Partial temperature data set due to timing of weather station installation.