

6. MFMG Barley Germplasm Management Interaction Trial

Sown: 18 April 2018

Harvested: 24 December 2018

Location: Millicent, South Australia

GPS: Latitude: -37.504987°, **Longitude:** 140.222334°

Rotation Position: 1st Cereal after canola (Lucerne previous)

Soil Type: Neutral-slightly alkaline Organosol (Peat soil) – high organic matter (0-30cm)

Treatment & plot number: 5 cultivars x 3 levels of management x 4 replicates = 60 plots

Soil Nitrogen Available (1st August): 132 kg N/ha (0 – 60cm)

FAR Australia gratefully acknowledges the funding support of Mackillop Farm Management Group in order to generate this independent research in the region and the collaborative input of SARDI and James and Chris Gilbertson in managing this research trial.

KEY MESSAGES

- All cultivars gave their highest yield under higher fungicide and nitrogen input (High input management), but cultivars differed in their response to increasing input with Westminster being the least responsive (1.69t/ha increase from low to high input) and Oxford the most responsive (3.09t/ha).
- RGT Planet was the highest yielding cultivar, although its advantage over Westminster was only apparent at higher levels of input, under low input both yielded similarly.
- Disease control resulting from the later fungicide application at GS37 and GS59 was strongly implicated in the yield differences, particularly between low and standard input where there was no difference in N input.
- Disease (net form of net blotch) in Oxford was uncontrollable in this trial even under high input where yield was maximised.
- RGT Planet, RGT Conquest and Westminster showed no significant difference in grain protein across the three management levels, whilst the proteins of Granger and Oxford decreased as yield increased from low to high input.
- Granger and RGT Planet recorded the lowest grain screenings. There was no significant effect of management level on screenings with these two cultivars or Westminster.
- In contrast, Oxford and Conquest that gave the largest responses to higher input showed significant decreases in grain screenings as input was increased.
- The devastating effect of NFNB on Oxford in this HRZ environment was very evident in both yield and screening results. As later fungicide input was removed from the management program so was the yield with significant reductions in yield and increased screenings.
- Under the lowest input RGT Planet and Westminster were significantly higher yielding than other cultivars tested.
- Under the highest input RGT Planet was significantly higher yielding than all other cultivars tested and produced the highest gross margins at each management level.
- With the very high disease pressure in this trial, the higher fungicide input associated with the High Input management made this the most cost effective management program of the Crop Technology Centre trials.
- As a result of higher disease pressure unlike wheat (Protocol 1) higher inputs of fungicide were generally more cost effective in barley sown early, irrespective of cultivar.

Table 1: Influence of cultivar on grain yield (t/ha) under three management levels.

Management Level (Grain Yield t/ha)							
	Low Input		Standard Input		High Input		Difference
							Low / High Input
Cultivar	t/ha		t/ha		t/ha		t/ha
Westminster (control)	6.28	e	7.08	c	7.97	b	1.69
Granger	5.73	f	6.76	cd	7.65	b	1.92
RGT Planet	6.35	de	7.78	b	8.56	a	2.21
RGT Conquest	4.93	g	6.23	e	7.58	b	2.65
Oxford	3.28	i	4.49	h	6.35	de	3.07
LSD Cultivar p = 0.05	0.25 t/ha		P val				<0.001
LSD Management p=0.05	0.47 t/ha		P val				<0.001
LSD Cultivar x Man. P=0.05	0.44 t/ha		P val				<0.002

Yield figures followed by the same letter are not considered to be statistically different ($p=0.05$), for example

a yield of 6.76 cd is considered statistically different to 7.65b but not to a yield of 7.08c.

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).

The statistical interaction ($p = <0.002$) between cultivar and crop management on grain yield illustrated that although all five cultivars gave their highest yields under high input, the response to increasing input varied with barley cultivar (Table 1). Westminster was the least responsive to higher input and Oxford the most responsive to the move to higher input. The level of disease control was a very visual difference between cultivars and management treatments. The significant interaction between cultivar and management was also evident in the grain

quality (Table 2 & 3) with RGT Planet showing no significant effect of management level on grain protein or screenings, despite over 2t/ha differences in yield. In contrast, cultivars such as Oxford and Conquest showed significant effects of management on grain quality linked to larger differences between low and high input.

The exact differences in input level between the three management levels is presented in Table 4.

Table 2: Influence of cultivar on grain protein (%) under three management levels.

Management Level (% Grain Protein)						
	Low Input		Standard Input		High Input	
Cultivar	%		%		%	
Westminster (control)	13.1	b	12.9	bcd	13.2	b
Granger	12.9	bc	12.6	d-h	12.6	c-g
RGT Planet	12.3	h	12.3	gh	12.3	fgh
RGT Conquest	12.7	cde	12.7	c-f	12.5	e-h
Oxford	13.6	a	13.1	b	12.8	bcd
LSD Cultivar p = 0.05	0.3%		P val		<0.001	
LSD Management p=0.05	0.2%		P val		0.22	
LSD Cultivar x Man. P=0.05	0.3%		P val		<0.03	

Table 3: Influence of cultivar on screening (%) under three management levels.

Management Level (% Screenings)						
	Low Input		Standard Input		High Input	
Cultivar	%		%		%	
Westminster (control)	7.7	def	7.0	d-g	5.2	fgh
Granger	3.8	hi	3.4	hi	2.1	i
RGT Planet	4.9	gh	5.0	gh	3.2	hi
RGT Conquest	8.2	de	9.0	d	6.5	efg
Oxford	32.0	a	24.0	b	16.0	c
LSD Cultivar p = 0.05	1.4%		P val		<0.001	
LSD Management p=0.05	1.8%		P val		0.002	
LSD Cultivar x Man. P=0.05	2.5%		P val		<0.001	

Table 4: Details of the three management levels applied to the five cultivars (kg, g, ml/ha).

Plant pop'n:	180 seeds/m ² (150 plants/m ² target) - all three managements			
		Low Input	Standard Input	High Input
Grazing:		----	----	----
Seed treatment:		Rancona Dimension/Gaucha	Rancona Dimension/Gaucha	As standard + Systiva
Basal Fertiliser:	18 April	80kg MAP	80kg MAP	80kg MAP
		Low Input	Standard Input	High Input
Nitrogen:	16 August (GS31-32)	130 kg Urea (60 N)	130 kg Urea (60 N)	130 kg Urea (60 N)
	29 August (GS32-33)	130 kg Urea (60 N)	130 kg Urea (60 N)	130 kg Urea (60 N)
	30 August (GS32-33)	---	----	87 kg Urea (40 N)
PGR:	1 August	----	Mod. 100ml	Mod. 200ml
	22 August	----	Mod. 100ml	Mod. 200ml
Fungicide:	GS31-32	Prosaro 150ml	Prosaro 150ml	Prosaro 150ml
	GS37	----	Amistar Xtra 200ml	Amistar Xtra 400ml
	GS59	----	----	Prosaro 300ml + A 1%v/v

All other inputs of insecticides and herbicides were standard across the trial. Mod. – Moddus. A = adjuvant
Available Soil Nitrogen (1st August) – 132 kg N/ha (0 – 60cm) prior to fertiliser application

Disease infection

The principal effect of the different management input levels was due to the disease management strategies. The research trial was under high disease pressure (scald, net blotch, leaf rust and powdery mildew) and it was differences in disease levels that were the most noticeable differences between plots in the

trial. The superiority of higher fungicide input in the high input management where four fungicides were applied was very effective at reducing disease infection on F-1 in all cultivars, except Oxford, where even the high input plots had high disease infection (Oxford red points in Figure 1).

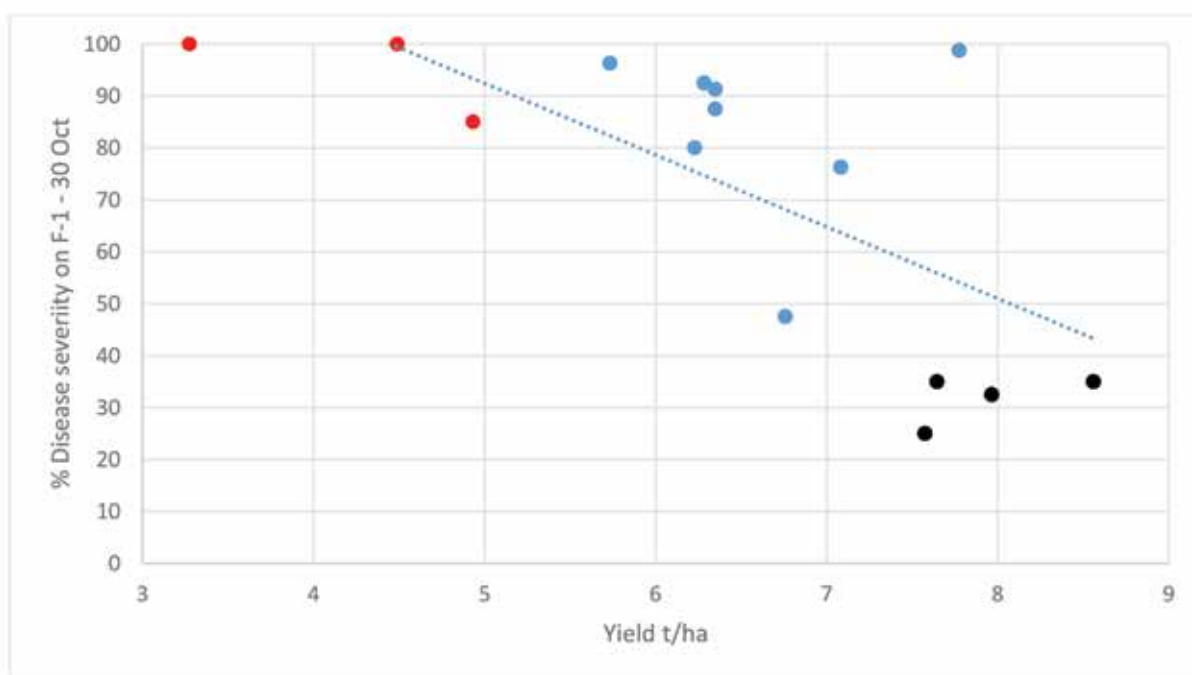


Figure 1: Negative correlation between level of disease infection on flag – 1 and grain yield (t/ha)
Red points are Oxford. Black points represent the other four cultivars (except Oxford) under high fungicide input.

The decline in green leaf area as result of differences in disease susceptibility was observed in NDVI recordings taken over the period from July to late November (Figure 2 & 3). The low input management with RGT Planet (dark blue) produced lower NDVIs in the grain fill stage (September – October) than RGT Planet with higher input or Westminster (all management levels) (Figure 2).

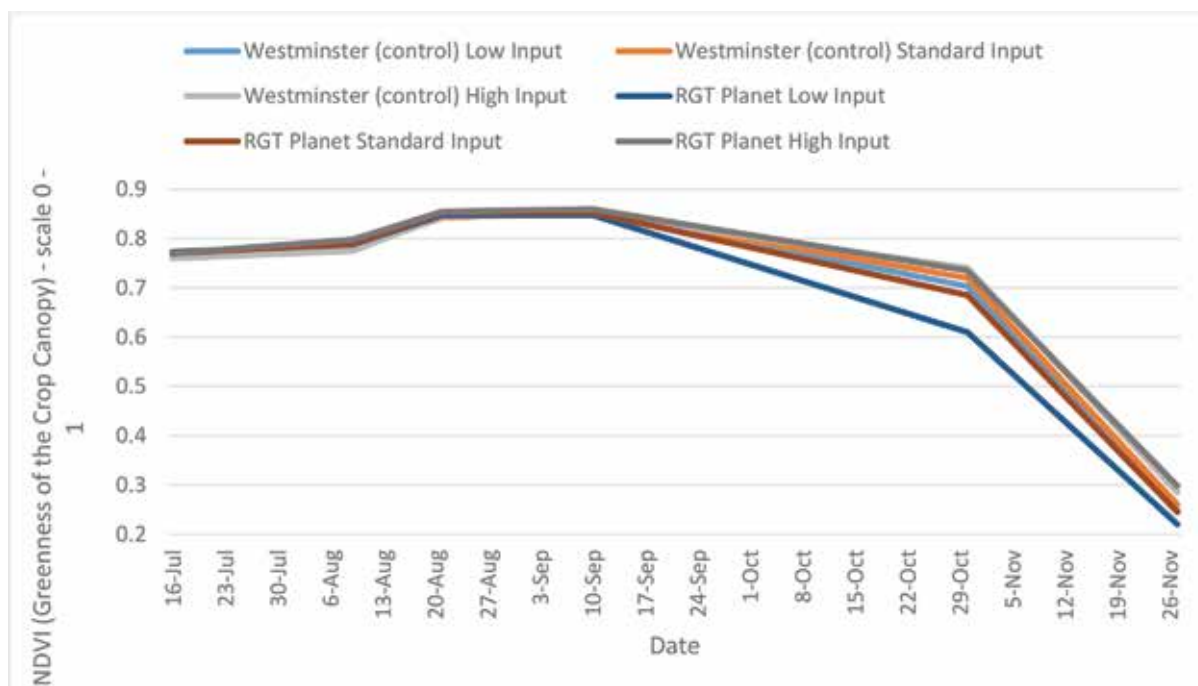


Figure 2: Influence of cultivar and management level on crop reflectance measured in NDVI (July – November) with a Greenseeker (measure of crop canopy greenness) – RGT Planet v Westminster.

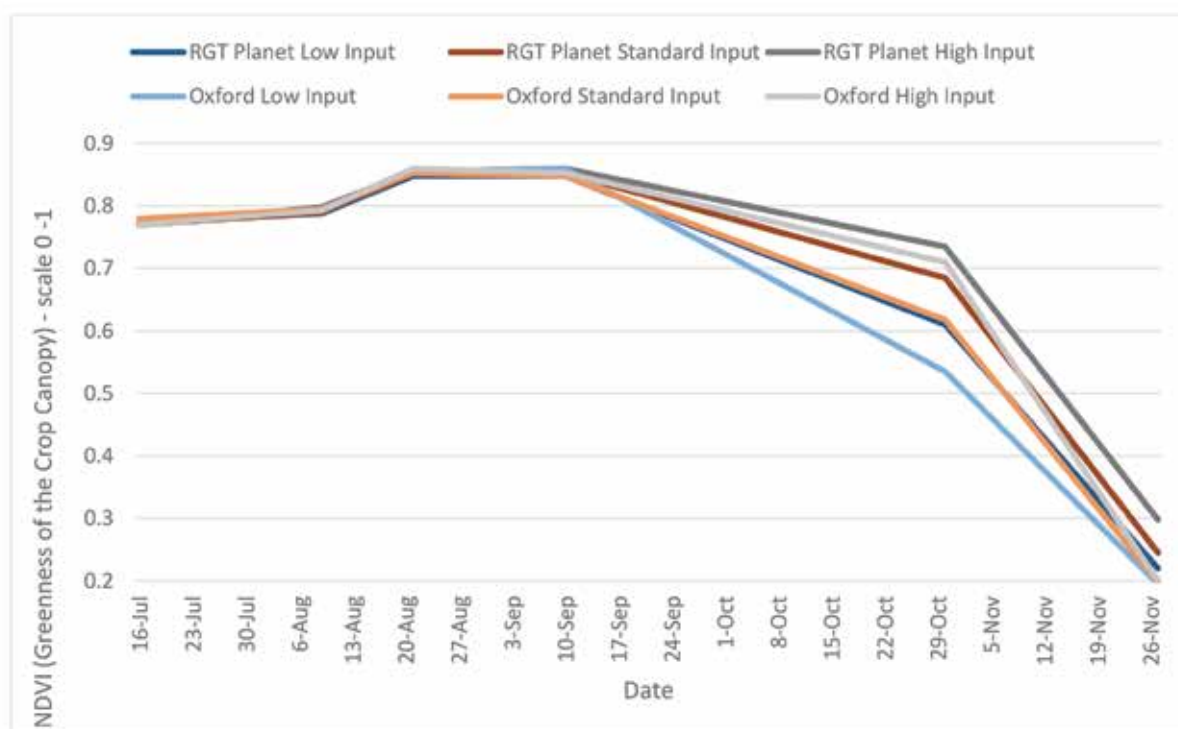


Figure 3: Influence of cultivar and management level on crop reflectance measured in NDVI (July – November) with a Greenseeker (measure of crop canopy greenness) – RGT Planet v Oxford.

With Oxford versus RGT Planet there is clear separation of Oxford management levels in terms of crop canopy greenness, with the lowest NDVI line during September/October being Oxford low input (Figure 3).

Brackling

The influence of cultivar, fungicide and PGR management was observed in differences in brackling (where the stem bends over in the upper internodes at crop maturity) in the trial. Where no PGR and a single fungicide was applied there was significantly more brackling prior to harvest. Where PGRs were applied in conjunction with greater end of season fungicide input brackling levels were reduced. However in Oxford where disease pressure was severe in all management levels brackling was close to 100% in all management levels tested (Figure 4). Irrespective of management level Granger produced significantly lower levels of brackling than other cultivars. Although there is a relationship

with PGR application (low input management treatments had no PGR) it cannot be separated from the lower fungicide input in this management treatment and the general relationship to disease infection (evident in the Oxford assessments). In addition when assessed at the same time (11 Dec) PGRs did not generate significant differences in the crop canopy height (data not shown).

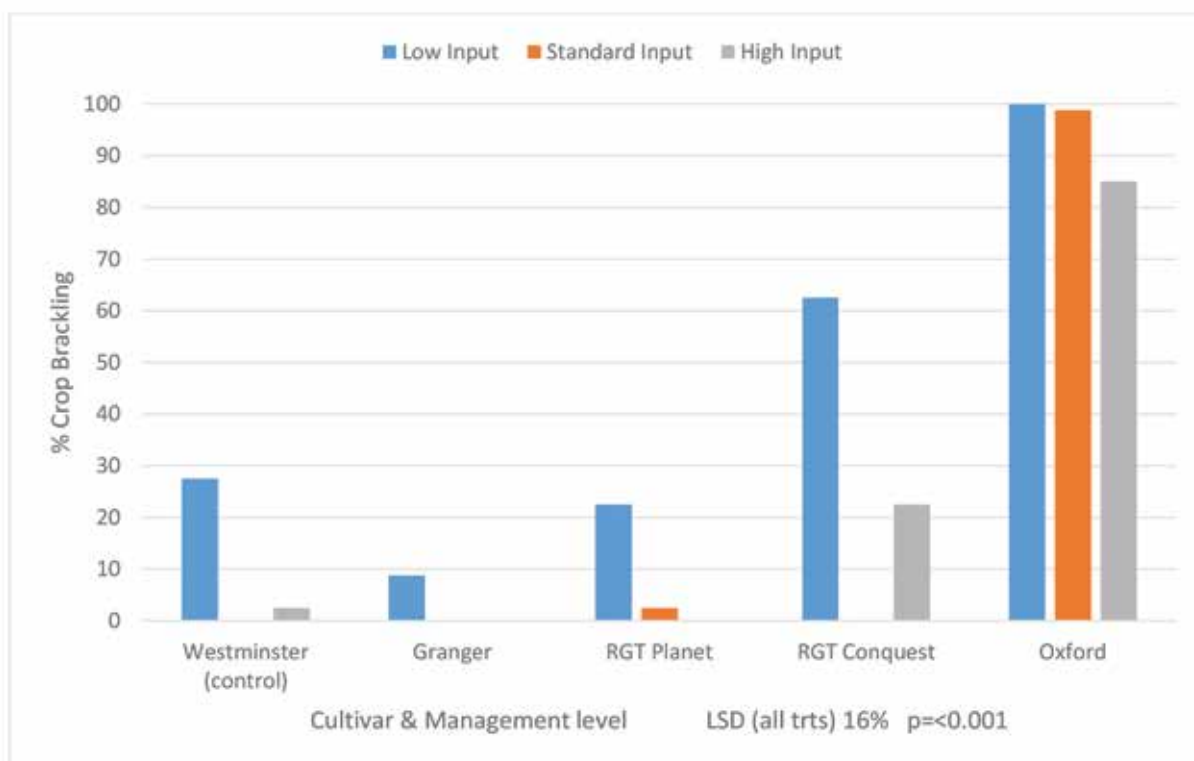


Figure 4: Influence of cultivar and management level on brackling prior to harvest – 11 December.

Final harvest dry matters

As was the case with higher yields in wheat there were large differences in final crop canopy dry matter content with differences due to both cultivar and management. Greater input with High Input management resulted in significantly more dry matter at harvest irrespective of cultivar (Figure 5). The lower grain yields of Oxford are reflected in the lower grain yields (see Table 1). The greatest difference in harvest dry matters due to management levels were observed in the most disease susceptible cultivars RGT Conquest and RGT Planet.

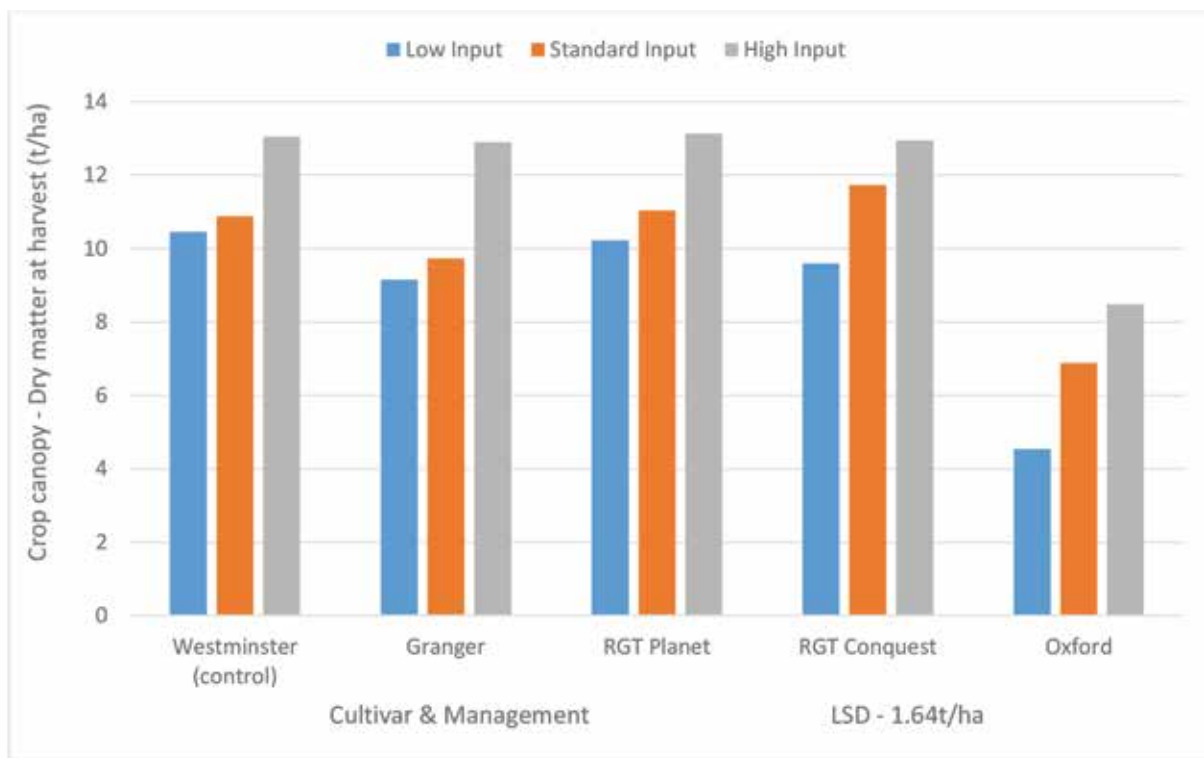


Figure 5: Influence of germplasm and management on final harvest dry matter (t/ha).

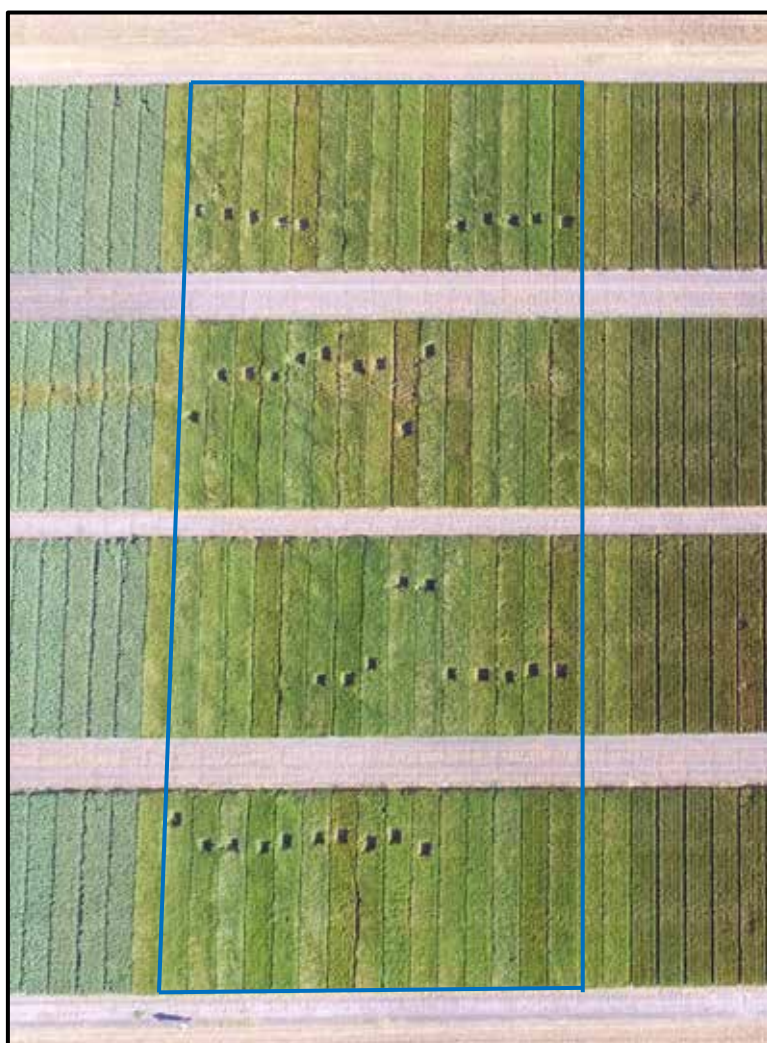
Gross margin (\$/ha)

Unlike wheat (Protocol 1) the High input management strategy produced the highest gross margins, primarily because it was associated with higher fungicide input and better disease control in this very high disease pressure situation (Table 5). RGT Planet produced the highest margins irrespective of management strategy.

Table 5: Influence of cultivar on gross margin (\$/ha) under three management levels.

	Management Level (Gross Margin \$/ha)		
	Low Input	Standard Input	High Input
Cultivar	%	%	%
Westminster (control)	\$ 744	\$ 922	\$ 1,059*
Granger	\$ 565	\$ 814	\$ 950*
RGT Planet	\$ 764	\$ 1,148	\$ 1,856
RGT Conquest	\$ 303	\$ 641	\$ 1,532
Oxford	-\$ 240	\$ 813	\$ 1,130
Mean	\$ 427	\$ 867	\$ 1,305

* Malt quality



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