Managing Compass barley with nitrogen and PGRs

Rochelle Wheaton and Sarah Noack, Hart Field-Site Group

Key findings

- The application of a plant growth regulator (PGR) significantly reduced plant height for all nitrogen rates (0-80 kg N/ha).
- Grain yield increased with higher nitrogen rates, however PGR application had no effect.
- The highest yielding treatment was a combination of 80 kg N/ha + PGR at 4.66 t/ha.

Why do the trial?

Variety specific management has been investigated over the years with a particular focus on nitrogen rates and timing as part of the GRDC-funded 'Barley Agronomy for the Southern Region' project.

The barley variety Compass was chosen for this trial as it is a newer variety which has been rapidly adopted by growers in SA. Compass has similar traits to Commander and has also been associated with lodging problems in high yielding environments.

The aim of this trial was to investigate the effects of different rates of nitrogen +/- plant growth regulator (PGR) treatment on plant height, lodging, head loss and yield. Moddus Evo was used in this trial as is currently the only PGR registered for use in barley to reduce lodging and suppress head loss.

How was it done?

Plot size	1.75 m x 10.0 m	**Fertiliser**	No fertiliser at seeding
Seeding date	10th May 2016	**Variety**	Compass

The trial was a randomised block design with three replicates and six treatments made up of different combinations of nitrogen rates and PGR applications (Table 1). Nitrogen applications were spread on the 27th July at the beginning of stem elongation (GS31). The PGR treatment of Moddus Evo was applied during this time at a rate of 400 mL/ha.

Normalised difference vegetation index (NDVI) assessments were conducted using a Greenseeker® on the 7th July to measure plant "greenness". Plant height (base of the stem to the top of the grain head) was also measured during late October.

Fungicides and herbicides were applied as necessary to keep the crop canopy free of disease and weeds. All plots had the edge rows removed prior to harvest and were assessed for grain yield, protein, test weight, screening with a 2.2 mm screen and retention with a 2.5 mm screen.

Results and discussion

Plant height and NDVI

Nitrogen rate had a significant effect on plant height, with higher nitrogen rates associated with taller plants (Table 1). The application of a PGR also influenced plant height with an overall reduction of 9 cm or more. However, the interaction between plant height and PGR application was not statistically significant.

NDVI readings varied between the nitrogen rates applied. There was a step wise increase in NDVI with increasing nitrogen rate from 0, 40 to 80 kg N/ha (Figure 1). These lower readings indicate less crop nitrogen and biomass in these plots. The application of PGR did not affect the NDVI value for the respective nitrogen rate.

Despite differences in canopy height and biomass, significant lodging was not observed in the trial which is not reflective of many paddocks in 2016. The photos below show that the addition of PGR had little effect as the barley plants were upright in all treatments (Figure 2).

Table 1. Effect of nitrogen rate and application of a PGR on average Compass barley plant height (cm) at Hart, 2016.

	Plant height (cm)	
N rate	**- PGR**	**+ PGR**
0 kg N/ha	55.2	45.2
40 kg N/ha	70.5	59.3
80 kg N/ha	80.1	71.3
LSD (P≤0.05)		
PGR	3.4	
N rate	2.6	
PGR x N rate	ns	

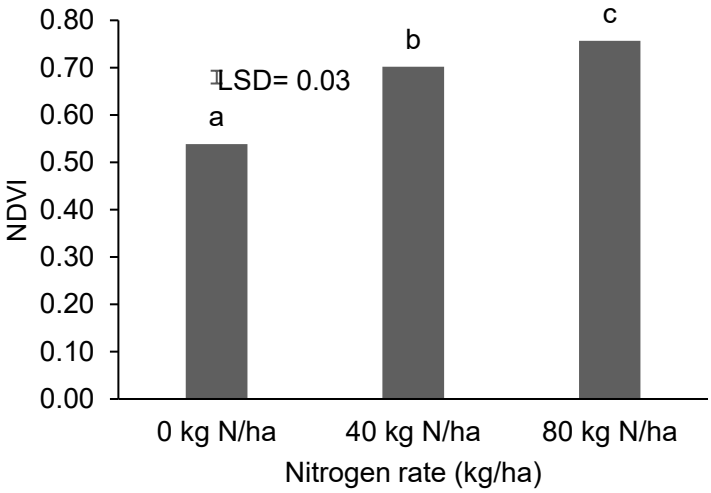

Figure 1. Effect of nitrogen rate on NDVI at Hart, 2016. Where present, different letters denote significant differences (P≤0.05) between treatments.

Figure 2. Compass barley plants treated with PGR (right) and control treatment (left) both treatments spread with urea at 0 kg N/ha, 40 kg N/ha and 80 kg N/ha (L-R in each photo).

Grain yield

As expected in 2016, higher nitrogen rates increased grain yield. The application of PGR did not increase or decrease grain yield (Table 2). The highest yielding treatment was the combination of 80 kg N/ha with a PGR application at 4.66 t/ha. Minimal lodging within the trial was observed in 2016, meaning the risk of grain yield losses due to lodging was low. Other studies have demonstrated PGR application can improve Compass grain yield (Porker *et al.* 2017). It should be noted, however, that these yield responses have generally been observed in high yielding environments. While Hart is a medium rainfall environment, the trial experienced rain and hail damage during the 2016 season.

Grain quality

Protein levels varied between treatments with a trial average of 9.4%. The varied protein levels did not reflect a clear relationship between treatments however, the application of a PGR did significantly reduce protein levels (Table 2). All treatments fell between the allowable protein range of 9-12% for malt classification.

Similarly, test weights did not indicate a particular trend between treatments. Significant differences between some nitrogen rates were present (Table 2). The combination of 80 kg N/ha + PGR resulted in the highest test weight of 63.9 kg/hL and the lowest was the 0 kg N/ha with a test weight of 62.4 kg/hL. All treatments were below the minimum test weight specification of 65 kg/hL for malt classification.

Screening levels were well below the maximum level of 7% for malt classification. The application of a PGR significantly increased screening levels (Table 2). Similarly, retention levels were well above specification with an overall trial average of 97.9% with an increasing effect as a result of higher nitrogen rates.

Table 2. Summary of average grain yield (t/ha), protein (%), test weight (kg/hL), screenings (%) and retention (%) for each treatment at Hart in 2016.

	Grain yield (t/ha)		Protein (%)		Test weight (kg/hL)		Screenings (%)		Retention (%)	
N rate	**-PGR**	**+PGR**	**-PGR**	**+PGR**	**-PGR**	**+PGR**	**-PGR**	**+PGR**	**-PGR**	**+PGR**
0 kg N/ha	2.49	3.02	9.8	9.1	62.4	63.2	0.5	0.7	97.5	97.1
40 kg N/ha	3.10	3.83	9.6	9.2	63.1	63.0	0.4	0.6	98.3	97.6
80 kg N/ha	3.85	4.66	9.5	9.5	63.5	63.9	0.3	0.4	98.5	98.5
LSD(P≤0.05)										
PGR	ns		0.3		ns		0.15		ns	
N rate	0.55		ns		0.55		ns		0.5	
PGR x N rate	ns		ns		ns		ns		ns	

Summary / implications

With many reports of lodging/crop loss in the Mid-North area during the 2016 season, the application of a PGR could be beneficial in these situations. In all cases, the economic viability of applying a PGR should be considered. On average the application of Moddus Evo provided 0.69 t/ha increase in grain yield (irrespective of N rate). Based on a $140 t/ha Feed 1 delivery price and a $35/ha cost of the application of Moddus Evo, a $61/ha return on investment would be achieved. This falls short of a two for one return on investment, indicating that an application of PGR is not a viable economic management strategy for the Hart area. In higher yielding environments the return on investment may be greater and warrant a PGR application/s.

References

Porker, K, Fettell, N, Coventry, S, Chong, P, McDonald, G and Eglinton, J (2017). *Drivers of barley yield in Southern Australia*. GRDC Update papers 2017.