4.11 Combining Cycocel with Moddus to reduce lodging risk in winter wheat - Hagley, Tas

Location: Hagley, Tasmania

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Summary of findings:
- The greatest height reduction was achieved by the Cycocel and Moddus in combination which included an application at the start of stem elongation (GS 30).
- Reduced height was correlated with an increase in lodging resistance and was achieved without yield penalty; there was a minor trend for yield increases with PGR treatments.
- Cycocel was associated with a minor reduction in screenings > 3.2mm.

Background/Aim:
Crop lodging can increase the cost and time of harvesting and reduce the harvested yield and quality. The longer growing season, greater use of nitrogen and higher rainfall and/or irrigation in the high rainfall zone all increase the risk of lodging. Many of the wheats originating from European/north American regions are more prone to lodging and may require PGR's to reach their potential yield. This trial evaluated the individual and combined effects of two growth regulators, Cycocel (Chlormequat) and Moddus (Trinexapac-ethyl) on lodging, yield and yield parameters. Nitrogen and gibberellic acid treatments were also included to investigate their impacts on lodging.

Trial information:
The trial area was selected from a commercially sown paddock of Brennan wheat at Hagley Tasmania. Plots were aligned perpendicular to the sowing direction and the borders sprayed out with roundup. PGR's were applied at mid tillering (GS 24) and stem elongation (GS 30) as per Table 1. Nitrogen, as urea, was applied over the whole paddock on the 31st of August at a rate of 46 kg/ha of N.

Rainfall:

Avg. Annual:	694mm
Avg. G.S.R. (Apr-Dec):	519mm
2011 Total:	750mm
2011 G.S.R. (Apr-Dec):	452mm

Paddock History:

2010:	Onions
2009:	Poppies

Soil Characteristics:

Soil Type:	Clay loam, brown dermasol of the Cressy Association.
Soil Nutrients:	172 kg/ha ammonia and nitrate nitrogen (0-100cm)
Grazing Pressure:	ungrazed

Variety: Brennan

Sowing rate: 100 kg/ha

Sowing date: 16/6/2011

Fertiliser: 250kg/ha single super phosphate

Harvest date: 13/1/2012

Plot size: 10m x 1.7m x 4 replications.

Measurements: Plant samples were collected at late flowering (GS 69) and at full maturity. Yield parameters of leaf, stem and grain dry weights were obtained from both sampling times and green leaf dry matter and area were measured on the late flowering sample. Lodging risk was scored in the mature crop by observing the evenness of stem alignment (0 – 1; where 0 is regular straight stems and 1 is fully lodged). Stem strength (bending resistance) was measured based on a system by Nolte & Fonseca (2007). Grain was harvested with a plot harvester and dried seed tested for 100 seed weight, bulk density and screenings (2.5 mm, 2.8 mm and 3.2 mm).

Table 1. Plant growth regulator and nitrogen treatments.

	Cycocel	Modus	ProGibb	Nitrogen	Growth
	L/ha	L/ha	kg/ha	kg/ha	stage
Cyc	1.25				24
Cyc + Mod 24	1.25	0.2L			24
Cyc + Mod 24 + 30	1.25+1.25	0.2+0.2			24+30
Cyc + Mod 30	1.25	0.2			30
Mod 24		0.2			24
Mod 24 x 2		0.4			24
ProGibb +N			0.02	15	24
early N				15	24
late (extra) N				15	45

Results and Discussion:

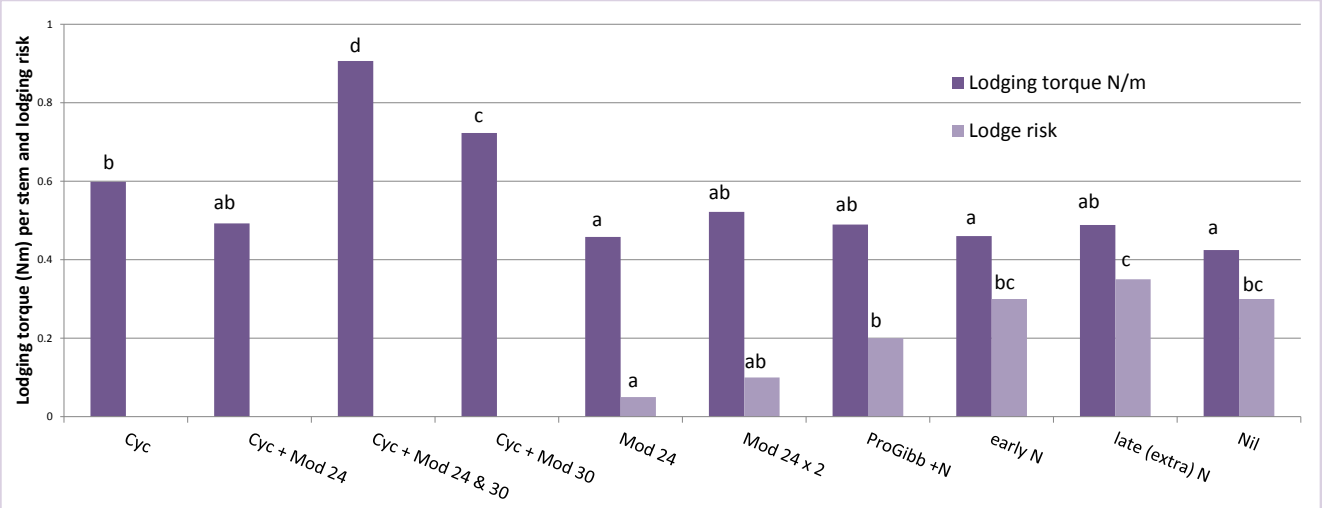
The Cycocel with Moddus combined treatments with an application at GS 30 had a significantly reduced height, green leaf area and stem dry weight (Table 2). Late extra N and Cycocel applied on its own increased the green leaf area but did not affect height or stem dry weight. Green leaf and total leaf showed a trend to decrease across most Moddus treatments.

Table 2. Yield components at late flowering (GS69).

	Stem (g)	Green Leaf (g)	Dead Leaf (g)	Total Leaf (g)	Ear (g)	Total dry matter t/ha	Tillersm^2	Green Leaf Area	Plant Height (cm)
Cyc	1.49	0.37	0.14	0.51	0.39	15.7	704	9.05	88.1
Cyc + Mod 24	1.46	0.37	0.14	0.50	0.40	15.8	707	8.39	85.8
Cyc + Mod 24 & 30	1.25	0.31	0.15	0.46	0.37	14.9	721	6.73	71.9
Cyc + Mod 30	1.28	0.33	0.14	0.47	0.38	16.8	819	6.18	75.6
Mod 24	1.50	0.35	0.12	0.47	0.39	16.6	707	8.03	91.9
Mod 24 x 2	1.60	0.37	0.13	0.51	0.43	16.6	686	8.06	88.4
ProGibb +N	1.45	0.34	0.13	0.47	0.39	16.6	772	7.44	89.4
early N	1.56	0.37	0.12	0.50	0.41	17.1	693	7.14	93.1
late (extra) N	1.53	0.36	0.14	0.50	0.41	16.5	715	8.99	90.0
Nil	1.55	0.35	0.13	0.48	0.42	16.3	694	7.86	88.1
F Prob	*0.002*	*0.058*	*NS*	*0.018*	*NS*	*NS*	*NS*	*<.001*	*<.001*
s.e.d.	*0.080*	*0.020*	*0.010*	*0.015*	*0.026*	*1.18*	*57*	*0.51*	*2.65*

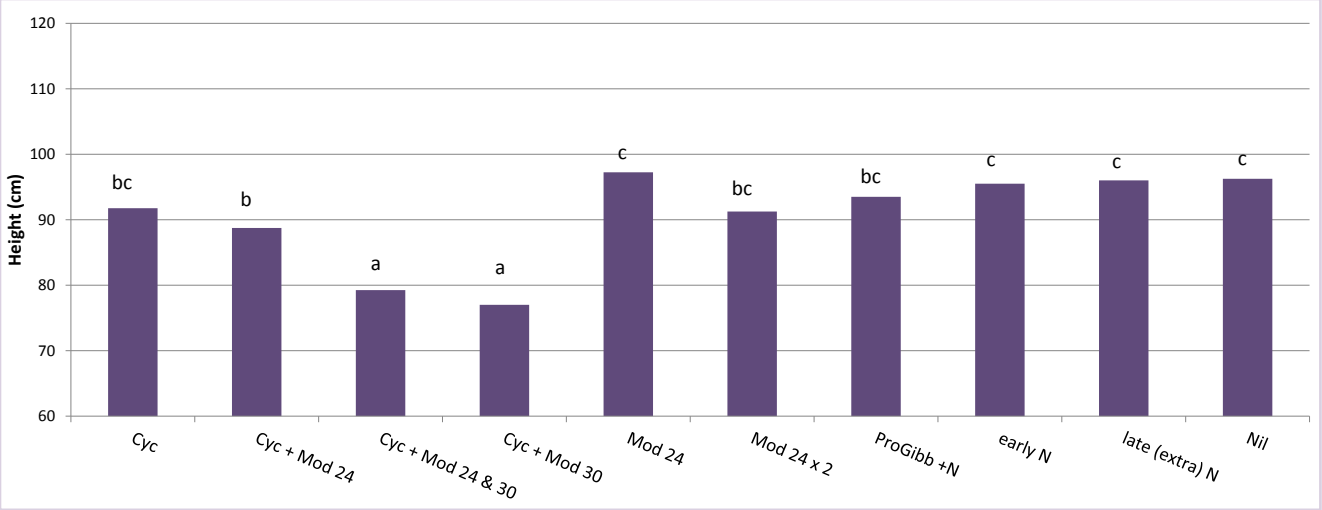
At maturity a substantial reduction in height occurred only with the combined Cycocel and Moddus treatments (Figure 1). There was a minor, but not significant, reduction in height in response to the single application of Cycocel or Moddus. The most pronounced height reduction occurred where both growth regulators were applied in combination at GS 30. Plant height was similar to the control in the early and late nitrogen and the GA treatments, though individual node length may be affected, which will be analysed later.

Figure 1. Height of mature plants in response to PGR, N and GA treatments. Letters represent significance (P = 0.05) between treatments.



Partial lodging was observed in some of the nil and nitrogen treatments, while fully lodged plants were found in only one buffer plot. None of the Cycocel treated plots showed any symptoms of lodging but the Moddus only treatments, while less prone to lodging, were not always significantly less affected than the nil (Figure 3). Lodging torque was significantly higher in the treatments containing both Cycocel and Moddus with an application at GS 30 (Cyc + Mod 24 & 30, Cyc + Mod 30). Cycocel on its own led to a significant increase in lodging torque compared to the nil.

Figure 2. Lodging torque and lodging risk of mature plants. Letters represent significance (P = 0.05) between treatments



At maturity, stem dry weight was similarly reduced in the combined Moddus and Cycocel treatments with an application at GS 30 (Table 3). There was no effect on stem dry weight from Moddus applied on its own at growth stage 24. Leaf dry weight was highest for the combined Cycocel and Moddus treatment applied at GS 30 only. The trend appeared to be Cycocel and nitrogen increase leaf DM while Moddus reduces leaf DM. The screenings over 3.2mm was reduced by Cycocel, the effect being more pronounced in the later stem elongation (GS30) application than the mid tillering (GS24) application. Harvested grain yield showed a trend to increase with both Cycocel and Moddus applications. Grain bulk density and 100 seed weight was not affected by any treatments.

Table 3. Mature plant yield components

	Stem (g)	Leaf (g)	Ear (g)	Yield t/ha	Screenings >3.2 mm (%)
Cyc	1.15	0.33	2.2	10.1	38.2
Cyc + Mod 24	1.12	0.33	2.1	10.0	34.8
Cyc + Mod 24 & 30	0.96	0.31	2.2	10.3	27.1
Cyc + Mod 30	1.05	0.35	2.2	10.1	24.0
Mod 24	1.19	0.30	2.2	10.0	40.9
Mod 24 x 2	1.20	0.31	2.2	9.8	39.8
ProGibb +N	1.15	0.31	2.1	9.6	40.7
early N	1.20	0.33	2.2	9.8	49.5
late (extra) N	1.16	0.32	2.0	9.8	39.5
Nil	1.19	0.30	2.1	9.8	44.7
F Prob	*0.001*	*0.018*	*NS*	*0.011*	*<.001*
s.e.d.	*0.052*	*0.014*	*0.11*	*0.16*	*3.3*

Summary:
Two growth regulators applied individually and in combination were assessed for the effects on height, lodging, yield and yield parameters over two application timings. The greatest height reduction was achieved by the Cycocel and Moddus in combination, which included an application at GS 30. The reduction in height was achieved without any yield penalty but there was a small but significant reduction in grain > 3.2mm. An additional earlier application at GS 24 had no greater affect on height but did significantly further increase the lodging resistance. Grain quality measured by 100 seed weight and bulk density was not affected by growth regulators or nitrogen treatments.

References:
K. D. Nolte and J. M. Fonseca (2007). Evaluating the plant growth regulator, Trinexapac-ethyl, for lodging resistance in spring wheat. Arizona Grain Research and Promotion Council 2007 Final Progress Report.