Plant Growth Regulators Trials - Barley

The ICC has been trialling the use of Plant Growth Regulator (PGR) for many years. Results have been mixed, but their use on barley appears to be promising with yield increases in 3 out of 4 seasons, using the PGR trinexapac-ethyl (Moddus Evo or Marvel) despite little effect on crop height or lodging. Other crops have had mixed results - wheat has seen variable response to crop height control and little yield response, minimal height response in canola with no change in yield and no response at all in fabas.

PGR Overview

Plant Growth Regulator is a term that describes many agricultural and horticultural chemicals that influence plant growth and development. This influence can be positive, eg larger fruit or more pasture growth, and negative eg shorter stems or smaller plant canopies. Most of the broadacre use of PGRs is to have a negative influence on plant growth, ie they are applied with the intention of producing a smaller plant that is resistant to lodging or reduce excessive growth in the crop.
There are 4 broad groups of PGRs in use in Australian crops. **NOTE: Not all products are registered for use on all crop types, and some products are registered for use but not as PGRs which may have different rates and timings from that on the label.**

i. Ethephon eg Ethrel®

ii. Onium types eg Cycocel®, Chlormequat®, Pix®

iii. Triazoles eg propiconazole, tebuconazole, paclobutrazol

iv. Trinexapac-ethyl eg Moddus Evo®, Marvel®

These PGRs act by reducing plant cell expansion, resulting in, among other things, shorter and possibly thicker stems. If the stems are stronger and shorter, then the crop is less likely to lodge.
The majority of the PGRs (groups ii to iv) reduce crop height by reducing the effect of the plant hormone gibberellin. These are applied at early stem elongation (Z30-32). Ethephon is applied from flag leaf emerging (Z37) to booting (Z45) and reduces stem elongation through the increase in concentration of ethylene gas in the expanding cells.
Other benefits claimed by the producers of various products include;

1. better root development that allows for increased root anchorage
2. better root development providing greater opportunity for water and nutrient scavenging
3. may offer improved grain quality
4. reduction in shedding in barley
5. increased Harvest Index (the ratio between grain and total dry matter)
6. faster harvest speeds and reduced stress at harvest.

An alternative to the chemical PGRs is grazing. Demonstrated in the Grain and Graze project on a number of sites was the effect grazing had on the crops where

the grazed treatments/crops were shorter than the non-grazed and were less prone to lodging.

Barley Results

The barley trial examined the use of trinexapac-ethyl (Moddus Evo or Marvel), plus high rates of triazole fungicides. To date, our PGR work has focussed on Commander, but in 2016, Commander and LaTrobe were sown.
The PGR treatments were:

1. Moddus Evo at 400 ml/ha at Z32 (second node)
2. Moddus Evo at 400 ml/ha at Z32 and 200 ml/ha at Z39 (full flag emergence)
3. Prosaro at a high rate at Z32
4. Tebuconazole at a high rate at Z32

Plots treated with Moddus Evo became evident with reduced plant height as stem elongation progressed. No height effect was noted with the triazole fungicides. At harvest, most plots were lodged to varying degrees. No treatment stood out as improving lodging resistance as the rain event in mid-September seemed to overcome any benefit of a shorter plant produced by the Moddus Evo (20 cm in Commander and 10 cm in LaTrobe).
The trial was harvested on November 28th.

	Yield t/ha		Protein %		Screenings %		Retention %	
Treatment	Comm	LaTrobe	Comm	LaTrobe	Comm	LaTrobe	Comm	LaTrobe
Moddus Evo@Z32&39	6.88[a]	7.29	11.5	11.4	5.5[a]	5.2	83.0[b]	84.1[a]
Tebuconazole @Z32 HR	6.41[b]	7.26	11.4	11.7	3.4[b]	4.9	87.8[a]	80.5[ab]
Moddus Evo @Z32	6.32[b]	7.32	11.1	11.5	6.3[a]	4.7	80.9[b]	82.9[ab]
Prosaro @32 HR	6.25[b]	7.43	11.4	11.3	2.5[b]	3.8	91.2[a]	82.7[ab]
Control	5.70[c]	7.08	11.3	11.7	3.2[b]	5.9	88.1[a]	77.9[c]
p	<0.001	0.814	0.743	0.071	0.002	0.118	<0.001	0.030
lsd	0.325	NS	NS	NS	0.9	NS	4.1	3.7
cv%	4.1	6.3	1.6	1.7	10.1	18.3	1.6	2.6

What does it mean?
Commander again responded with increased yield to the use of Moddus Evo, as well as the high rates of triazole fungicides, although this yield response is more likely to be as a result of the fungicide action that any growth regulator effect (see barley fungicide trial report). Commander also saw an increase in screenings and reduction in retention, although it would have had no impact on delivery standards. However LaTrobe yield and grain quality did not respond to the PGRs in any form apart from slightly reduced retention which would not have impacted on delivery grade.