

Plant Growth Regulators Trial

In 2012 and 2013, trials looking at Plant Growth Regulator (PGR) use on barley were resulting in yield increases with the use of the PGR trinexapac-ethyl (Moddus Evo or Marvel) despite little effect on crop height or lodging.

The 2014 trial was sown to see if the yield improvement could be repeated and to expand the trial to examine the effects the effect of a range of PGRs on canola, fabas and wheat.

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®, Chlomequat®, Pix®
- iii. Triazoles eg propiconazole, Orius® (tebuconazole)
- 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

Commander barley, sown on May 8th, was treated with either Marvel @570 ml/ha, tebuconazole (Orius) at above label rate or “grazed” (with a mower) at Z32 (second node detectable) on July 8th. Follow-up treatments of Marvel at 285 ml/ha were applied at Z39 (full flag emergence).

Barley	Treatment	Yield (t/ha)	Height (cm)	Lodging	Protein %	Retention %
	Orius @Z32 Marvel@Z39	7.55	76.8 ^c	7.3 ^b	8.9 ^a	95.1 ^a
	Orius @Z32	7.47	79.9 ^c	7.3 ^b	8.9 ^a	95.1 ^a
	Marvel @Z32	7.43	60.0 ^a	8.3 ^a	9.0 ^a	89.0 ^b
	Marvel @ Z32&39	7.32	60.0 ^a	8.7 ^a	8.8 ^a	90.8 ^b
	Control	7.25	79.1 ^c	6.3 ^c	9.0 ^a	93.4 ^a
	Grazed	6.66	69.9 ^b	6.7 ^{bc}	8.4 ^b	94.6 ^a
p		0.092	0.001	<0.001	0.041	<0.001
lsd		NS	6.655	0.79	0.35	1.95
cv%			4.2	13.2	2.7	1.1

Treatments with similar superscripts are not statistically different.

The yield improvement from using Moddus Evo or Marvel seen in 2012 and 2013 failed to be realised in 2014. All treatments were statistically similar. However Marvel did result in the reduced grain retention.

The application of Marvel at Z32 did result in a shorter crop, with continued reduction of crop height through to harvest. Previous trials have seen some crops “bounce back” and the shortening effect disappear as crops approached maturity, and hence the reason for the treatment with a repeat application of Marvel @ 285 ml/ha at Z39. The original plan was to also repeat the application of tebuconazole, but no growth regulator effect was noted from the earlier application, and Marvel was used instead. It was not surprising that the Marvel at this late stage had no effect on crop height. Grazing did reduce crop height, although not as effective as Marvel, but better than either tebuconazole or the control.

While tebuconazole did not result in any height reduction, it did improve lodging slightly. The crop standing straight up is scored as a “9” while crop completely on the ground would be scored a “0”. Marvel was more effective than tebuconazole at reducing lodging, and grazing was no better than the control despite the crop being shorter.

Grain protein was reduced by grazing, which was not an unexpected result as the loss of vegetative matter (0.68 t/ha) was not compensated for by extra N being topdressed above the other treatments.

Another effect observed by either grazing or the application of Marvel was the delay in development of the crop. These two treatments delayed flowering by approximately 1 week.



Barley plots on September 12th, with the Marvel treated plots on the left hand side and the tebuconazole treated plots on the right, with heads emerged.

As stated in the introduction, the results obtained by the use of PGRs can be variable. PGR application did not result in extra yield, and the reduction of lodging would not have aided harvestability all that much.