

## Plant Growth Regulators Trials - Barley

The ICC trials have demonstrated that there are products that can work as plant growth regulators in the main irrigated crops but most are not registered, therefore not permitted, to be used.

PGRs can be useful in controlling lodging in cereals but variety selection and agronomic management may be better alternatives.

The ICC has been trialling the use of Plant Growth Regulator (PGR) for many years. Results have been mixed, but their use on Commander barley appears to be promising with yield increases in 4 out of 5 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, e.g. larger fruit or more pasture growth, and negative e.g. 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

Previous work has seen positive yield responses to the use of trinexapac-ethyl (Moddus Evo) on Commander barley, which have not been explained by reductions in lodging or head loss. One aspect that may be improving yield is reducing tiller death from shading.

To test this theory, Compass and LaTrobe barley were sown at low (140 plants/m<sup>2</sup>) and high (225 plants/m<sup>2</sup>) target populations.

The Moddus Evo treatments were applied on August 1<sup>st</sup>, at 400 ml/ha. Compass was at Z31 and LaTrobe at Z31-32.

No LaTrobe plots lodged with any of the treatments. Compass treated with the PGR did not lodge, whereas the Low population treatments scored 3 and the high scored 4 (0 = no lodging, 9 = flat on the ground) when assessments were taken 7 days before harvest.

The trial was harvested on November 29<sup>th</sup>.

## Results

### Plant Height (cm)

<b>Compass</b>	No PGR	+PGR	<b>LaTrobe</b>	No PGR	+PGR
High Pop'n	71.0	62.7	High Pop'n	67.0	66.7
Low Pop'n	73.7	63.8	Low Pop'n	68.3	63.8

The plant population had no effect on LaTrobe height, but the PGR reduced plant height in the low population only ( $p=0.047$ ,  $lsd = 3.4$ ). Population had no effect on Compass height, but did reduce plant height by approximately 8 cm. ( $p<0.001$ ,  $lsd = 4.7$ ).

### Grain Yield (t/ha)

<b>Compass</b>	No PGR	+PGR	<b>LaTrobe</b>	No PGR	+PGR
High Pop'n	9.23	9.47	High Pop'n	9.74	9.61
Low Pop'n	8.73	9.84	Low Pop'n	9.63	9.60

The population and PGR treatments had no effect on LaTrobe yields. Population had no effect on Compass yields, however the PGR had a significant effect on the low population treatment yields ( $p=0.013$ ,  $lsd = 0.697$ ).

Looking at the heads per square metre, there were no differences between treatments in Compass, but the PGR did encourage more heads in the low population treatment in LaTrobe.

#### Heads/m<sup>2</sup>

Compass	No PGR	+PGR	LaTrobe	No PGR	+PGR
High Pop'n	759	735	High Pop'n	931	952
Low Pop'n	711	841	Low Pop'n	691	989

#### Heads/plant

Compass	No PGR	+PGR	LaTrobe	No PGR	+PGR
High Pop'n	3.95	3.83	High Pop'n	4.85	4.96
Low Pop'n	5.39	6.37	Low Pop'n	5.27	7.49

When the heads/plant figures are calculated (the head and plant counts were randomly taken from the plots and so we may be introducing some variability to the data), the population and PGR did affect the head production in LaTrobe, but only the population affected heads per plant in Compass.

There were no effects from either population or PGR on grain quality for either variety (see the appendix for a full summary of the results and statistical analysis).

#### What does it mean?

Compass again responded with increased yield to the use of Moddus Evo, with a reduction in plant height, a reduction in lodging and increased yields at the lower sowing rate. There was some influence on LaTrobe from the PGR but this did not translate to a yield advantage.

While the results from the trial are not conclusive due to variability in the data, what appears to be happening in Compass is that the tiller survival is being influenced by the application of the PGR. If there are already sufficient shoots for maximising yield, i.e. a high plant population, then the PGR has little effect on yield. But if the plant numbers are lower than that required for maximising yield, then the PGR is assisting tiller survival. Comparing Compass and LaTrobe, the trial results suggest that Compass should be sown at a higher rate to ensure sufficient heads at flowering to maximise yield. But given Compass's susceptibility to lodging, you would need to apply a PGR anyway. Whereas LaTrobe has been demonstrated to be able to achieve high yields and resist lodging without the need for a PGR.