Plant growth regulators: what value do they have in the HRZ of Victoria?

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Take home messages:

- Moddus Evo reduces lodging and can increase yields
- Application timing and concentration of Moddus Evo is critical
- Moddus Evo should not be applied to plants under stress
- Moddus Evo has improved formulation stability and plant uptake

Introduction

Lodging is considered one of the biggest barriers to reliably achieving high yields in intensive cereal production in Australia. When favourable season conditions combine with traditional management practices in high input cereal production systems, lodging can result in significant reductions in yield and grain quality.

The majority of crops grown in Australia are grown under conditions not usually associated with yield reductions due to lodging. However, in high input production systems such as irrigated crops and cereals grown in high rainfall zones, the risk of yield reduction due to lodging is considerably higher when seasonal conditions favour such events.

A great deal of research has been devoted to developing management strategies to reduce the incidence and severity of lodging in high input cereal production systems. These are all focussed on opening early canopies to reduce the plants response towards taller growth resulting in weakened stems and poor anchorage.

These strategies include reduced seeding rate, wider row spacings, delayed sowing time, the use of short season varieties and split or delayed nitrogen applications. The risk with these strategies is that they need to be implemented before an accurate picture of what the season will be like. Yield may be forgone if these strategies are implemented and the season is not favourable to lodging. This highlights the fact that options such as those mentioned above may not necessarily suit all growers or field situations.

By the same measure, the use of Plant Growth Regulators (PGRs) applied to reduce stem length and reduce the risk of lodging will not be appropriate in all conditions. The one advantage they do have over these cultural strategies is that they allow the grower to assess the condition and potential of the crop before deciding to apply.

In Australia, the range of PGRs available to growers is limited to chlormequat chloride (wheat only) and ethephon (barley only) and the use of these products has generally been relatively low. The principle reason for this is simply that responses are viewed as variable and growers have not regularly seen the benefit of incorporating them into their management programs. The key factor contributing to this perception is a relatively low appreciation of the conditions and situations where the use of a PGR is appropriate. A great deal of resource has been devoted to optimising crop husbandry strategies to minimise lodging but relatively little time has been devoted to identifying the best situations to use PGR's for optimum results. If the field, variety or growing conditions are not conducive to lodging then the use of a PGR will have no benefit to the grower and many of the trials undertaken with PGR's have led to conclusions that ignore the fact that a PGR did not need to be applied in the first place.

The purpose of these trials was to investigate the value of applying the PGR Moddus EVO to barley grown in the high rainfall zone of Victoria to reduce lodging and improve yields. The Moddus trials at the SFS site in Inverleigh in 2012 did not show a significant amount of lodging in either the wheat or the barley trials, however we did see significant yield improvements and crop height reduction despite the lack of lodging.

There were 5 barley trials at Inverleigh in 2012, all of which used different growing conditions to assess the value of Moddus application to cereal crops in the high rainfall zone of Victoria. These trials included:

- T1. Lodging susceptible vs. lodging resistant varieties (Buloke vs. Oxford)
- T2. Row spacing (200cm vs. 400cm)
- T3. Different plant populations (150plants/m2 vs. 300plants/m2)
- T4. High, standard and low fertility
- T5. Applying Moddus with a range of different tank mix scenarios

Trial 1 compared Oxford and Buloke whereas Westminster was sown in the other four trials. The trials were sown on the 2nd of July and harvested in the 22nd of December.

Results and Interpretation

The key message that came out of these trials is that despite the lack of lodging, a Moddus application at 400ml/ha applied at GS31, with or without a second application of Moddus at 200ml/ha at GS37, had a beneficial effect on yield and reduced crop height. These results are supported by previous research on PGR use in cereals.

T1. Susceptible vs. resistant to lodging

Oxford (MR) and Buloke (MS) were the varieties of barley grown in this trial. Although Buloke was taller than Oxford in all treatments pre harvest, the reduction in crop height compared to the untreated was much greater. Oxford was reduced by 6.42cm when Moddus was applied at GS31 and again at GS37 (400 and 200ml/ha respectively). Buloke was reduced by 14.67cm with the same treatment. This indicates that Moddus may be most beneficial when used on a tall standing variety rather than a shorter standing variety.

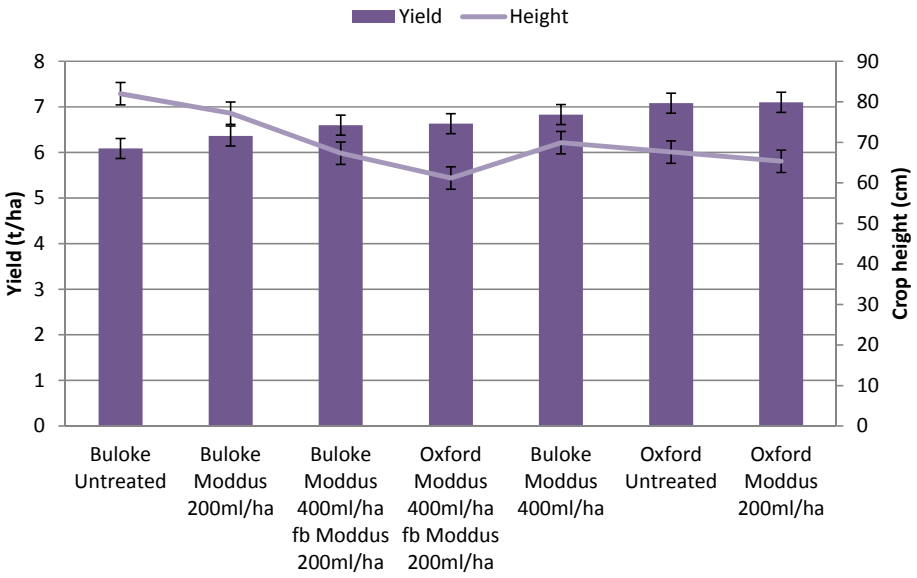

Figure 1. Height and yield of Buloke and Oxford under different PGR treatments

Figure 1 shows the interaction between crop height and yield in relation to the different PGR treatments in trial 1. It illustrates the effects of the treatments on both varieties of barley as well as what effect the PGR application had on the resulting yield.

T2. Row spacing

Crops sown at 20 cm row spacing produced higher yields than the 40cm row spacing under all treatments. For both row spacings a double application of Moddus (400ml/ha at GS31 followed by 200ml/ha at GS387) reduced the crop height significantly compared to the Moddus applied at 200ml/ha atGS31 and the untreated.

Figure 2. 40cm row spacing untreated vs 40cm row spacing treated with 400ml/ha Moddus at GS31 followed by 200ml/ha Moddus at GS37.

T3. Plant population

A double application of Moddus (400ml/ha at GS31 and 200ml/ha at GS37) and a single application of 400mls/ha at GS31 significantly reduced crop height compared to the untreated at the higher plant population (300plants/m2). At the lower plant population (150plants/m2) all Moddus treatments significantly reduced plant height compared to the untreated.

T4. Fertility

No application of Moddus Evo resulted in the tallest plants in all fertiliser regimes, none of which were significantly different from each other. A single application of Moddus at 200ml/ha at GS31, under high fertility, did not significantly reduce crop height from the untreated. A single application of Moddus at 400ml/ha and a double application of Moddus (400ml/ha at GS31 followed by 200ml/ha at GS37) significantly reduced crop height in comparison to the untreated.

The double application of Moddus under standard fertiliser conditions had a significantly reduced crop height compared to a single application at 200 or 400ml/ha and the untreated.

The single application of Moddus at a rate of 400ml/ha and the double application of Moddus under a low fertiliser regime had a significantly reduced crop height compared to the untreated and a single application of Moddus at 200ml/ha.

Figure 3. Low, medium and high fertility with an application of 400ml/ha Moddus at GS31

This illustrates that despite soil fertility, Moddus has the potential to reduce crop height, especially the double application of Moddus (400ml/ha at GS31 followed by 200ml/ha at GS37) which reduced crop height significantly from the untreated and a single application of Moddus at 200ml/ha at GS31 across the high, standard and low levels of fertility.

T5. Tank mix

There were no significant differences in yield between any of the different tank mix treatments. The treatments that included Moddus had a significantly reduced crop height compared to the treatments that did not include Moddus.

In general, the barley trials at Inverleigh showed that Moddus, when applied at a rate of 400ml/ha at GS31 with or without a follow up application of 200mlha at GS37, has the potential to increase yield even in the absence of lodging. At the same rates and timing as above, Moddus also significantly reduced crop height when compared to the lower application rate of Moddus (200ml/ha at GS31) and the untreated. These results were consistent over all of the barley trials.

Conclusion

At Inverleigh in 2012 conditions were not favourable for crop lodging, therefore insignificant amounts of lodging were seen in the PGR trials, suggesting that a PGR application was probably not necessary. However, the crop height response has and can be in this case used as a reference for the relative performance of each of the treatments.

Overall, the use of Moddus significantly reduced crop height when applied at a rate of 400ml/ha at GS31, with or without a follow up application of 200ml/ha at GS37. When conditions are more conducive to lodging, this reduction in crop height may be of great benefit when it comes to reducing lodging.

Yield was often improved as a result of a single or double application of Moddus despite the lack of lodging. Why this is the case is not fully understood at this stage, however, yield improvements are often correlated with a reduction in stem height irrespective of lodging.

References

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