Barley Agronomy: Nitrogen Timing and PGRs

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BACKGROUND

Achieving malting grade at harvest time is something all barley growers are looking to achieve, but this is often difficult due to the variability of the seasons. It requires timely nitrogen applications combined with a good understanding of seasonal forecasts and often some luck. Traditionally to achieve malt grade nitrogen is applied at early stem extension (GS31) when the plant has changed from vegetative growth to reproductive growth, but not too late so that the majority of the nitrogen is converted to yield rather than putting it into the grain as protein.

This trial was set up to determine whether the survival of the primary tillers, the first and strongest tillers produced, could be influenced by having an early application of nitrogen timing at tillering (GS24) compared to the more traditional GS31 timing, or whether a split nitrogen application at both GS24 and GS31 could give the best of both worlds when it comes to nitrogen applications. The trial also utilised plant growth regulators (PGRs) to see if the effect could be further influenced and improved with their use.

This trial was grown as a part of the GRDC Barley Agronomy project (DAN00173) which aims to improve grower productivity and industry sustainability through new management techniques and cultivars.

METHOD

The trial was sown at the Inverleigh trial site on June 6 using Westminster barley with flutriafol treated MAP applied at 100 kg/ha. It was set up as a two-way factorial looking at nitrogen timing and PGR application.

Nitrogen was applied on two dates, August 8 (GS24) and September 12 (GS31), and the PGR - Moddus Evo was applied on September 20 at GS32. This trial also had an application of Coptrel in mid-September due to a history and indication of low soil copper from the soil test results. Standard applications of herbicide and fungicide were given as per district practice.

Assessments on establishment, lodging, head counts and height were performed throughout the growing season.

The trial was harvested on 7 January 2017, and each treatment under went grain analysis testing for test weight, protein, retention and screenings.

RESULTS AND DISCUSSION

Nitrogen Application

While there was no significant difference ($p>0.05$) between the yield results of the nitrogen applications the results did trend toward an increased yield with treatments that had most or all their nitrogen applied at GS31. Even though having more nitrogen available at early tillering could be desirable to increase tillers per plant and their survival, nitrogen does have to be applied quite early in the growing season when the plant is not necessarily growing very actively as occurred in 2016 when it was cold and wet. The nil nitrogen treatment did have a significantly lower yield result than those that had nitrogen applications, which was to be expected.

Table 1. Yield result from different nitrogen applications (averaged across PGR treatments) on Westminster barley sown at Inverleigh, 2016.

Treatment	Yield	Protein
No N	6.3 b	9.8 c
GS22 (100%)	7.2 a	10.9 b
GS31 (100%)	7.6 a	11.5 ab
GS22 + GS31 (50:50)	7.2 a	11.1 ab
GS22 + GS31 (75:25)	7.1 a	11.6 a
GS22 + GS31 (25:75)	7.6 a	11.2 ab

Means followed by the same letter do not significantly differ (LSD p=0.05).

The bay in which the trial was sown had been a wheat crop in 2015 and there was 121 kg N/ha in the top 60cm which the barley in the trial would have accessed. A further 67 kg N/ha was measured at 60 – 90 cm but this would not have been utilised as rooting depth was limited by very high winter rainfall. Based on these readings nitrogen was applied as urea at a rate of 110 kg/ha so that grain proteins would fit in with malting barley standards. If the trial had been sown earlier it may have increased the plant's ability to take up and use more nitrogen from deeper in the profile.

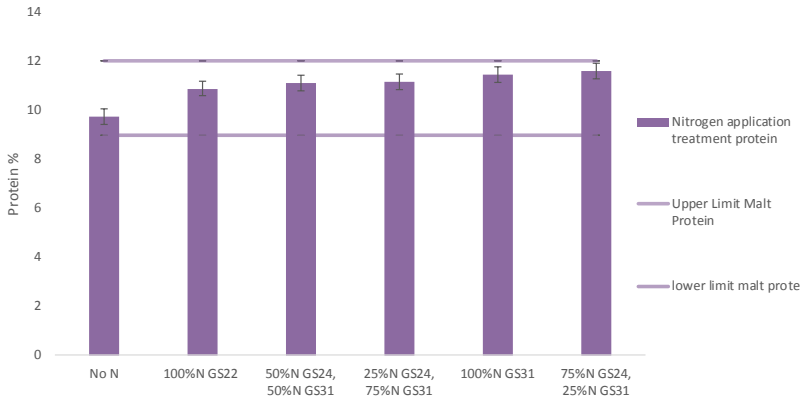

Figure1. Protein percentages against malt barley protein standards of various nitrogen treatments Inverleigh, 2016.

Table 2 Available nitrogen in bay where trial was sown at Inverleigh, 2016.

N in 0-30 cm	N in 30-60cm	N in 60-90cm	Total N in 0-90 cm
(kg/N/ha)	(kg/N/ha)	(kg/N/ha)	(kg/N/ha)
31.3	90.7	67.2	189

Even though there were no statistical differences in yield between the nitrogen treatments, there was an interesting result in grain protein difference between treatments that had nitrogen applied at tillering in comparison to later stem elongation. Table 1 shows that all treatments fell within the desired protein range for malting barley (protein must be between 9-12% to achieve a malt grade at receival), however the protein level of the treatment which had 100% nitrogen applied at GS23 was lower than the protein of the treatment with 100% nitrogen application at GS31, even though it was applied only 5 weeks later. Although the treatment at GS31 was still within the limits for malt grade, it was quite close to being too high for malt.

PGR Application

The trial received one PGR application when the barley was at GS32. As shown in table 3, the PGR had a significant effect on the height of the barley plants. While there was no significant difference in yield with the PGR application, the data indicated that PGR application did positively influence the yield result.

When the effect of the PGR was combined with the effect of the nitrogen applications, the results show that the PGR tended to enhance the effect of the nitrogen and create a bigger spread in the yield results when compared to the treatments that did not receive a PGR.

Table 3. Effect of PGR applications on height of Westminster barley, Inverleigh 2016.

Treatment	Height (cm)
+PGR	966.5 a
-PGR	1011.5 b

The PGR when combined with nitrogen showed the treatment that received 27.5 kg/ha at GS23 and 82.5 kg/ha at GS31 yielded slightly higher than the treatment that received 110 kg/ha in one application at GS31, but this was not statistically significant ($p<0.05$) There is a trend indicating that treatments receiving most of their nitrogen needs at GS31 yielded better as discussed in the previous section.

CONCLUSION

While the idea of early timings for improved tillering and survival of the key primary tillers was not necessarily any worse or better than standard timings in 2016, when applying this practice into a large farming system the cost of doing two nitrogen applications does need to be taken into account.

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