Optimum Time and Rate of Trinexapac-ethyl Plant Growth Regulator to Reduce Lodging in Hard Red Spring Wheat

Jochum Wiersma and Beverly Durgan
Extension Agronomist and Extension Weed Scientist, University of Minnesota, St. Paul, MN 55108

INTRODUCTION

Straw strength is an important agronomic characteristic and a prerequisite to approach a wheat cultivar's genetic yield potential. Depending on the growth stage of the crop, lodging can result in yield reductions up to 50% as well as reductions in test weight and kernel weight. Lodged grain also hinders mechanical harvest.

Plant growth regulators (PGR) are a class of chemistry that decreases plant height in cereals by reducing the length of the internodes. The shortening of the internodes combined with a higher density of the tissues result in an improved stiffness of the plant and reduce the potential for lodging. Ethephon (Cerone), chloromequat-chloride (Cycocel), and trinexapac-ethyl (Palisade EC) are three PGRs labeled for use in cereal production in Europe. Prior research in the USA has shown that both ethephon and chloromequat-chloride are effective in Hard Red Spring Wheat (HRSW) (1,2,3,4). Trinexapac-ethyl has not been tested on HRSW before.

The objectives of this research were to:
1. Evaluate the efficacy of trinexapac-ethyl to reduce plant height and improve straw strength in HRSW.
2. Evaluate crop safety of trinexapac-ethyl.

Materials & Methods

Trinexapac-ethyl was tested at 3 different growth stages and 4 different rates on the cultivar 'Walworth' using a randomized complete block with 4 replicates. Both an untreated control and a labeled rate of ethephon were included at each application timing.

The experiment was conducted in Crookston, MN, in 2004, and repeated in 2005 in both Crookston, MN, and Rosemount, MN. Crop injury, days to heading, days to maturity, lodging, straw strength, and grain yield were recorded and evaluated. Straw strength was measured using a method first described by Spink et al. (5) (Photo 1).

The applications were made at GS 30, GS 32 and GS 37.
1. GS 30 = jointing.
2. GS 32 = 2nd node detectable.
3. GS 37 = flag leaf just visible.

The rates of trinexapac-ethyl and ethephon were:
- Untreated control.
- 62.5 g ai/ha trinexapac-ethyl.
- 93.75 g ai/ha trinexapac-ethyl.
- 125 g ai/ha trinexapac-ethyl.
- 250 g ai/ha trinexapac-ethyl.
- 280 g ai/ha ethephon (labeled rate).

Results & Discussion

Trinexapac-ethyl caused up to 5% phototoxicity (chlorosis) immediately following application as the rate of trinexapac-ethyl applied increased (data not shown). The crop injury was transient and could no longer be detected 14 days after application. The timing of the application had no effect on the amount of crop injury. However, trinexapac-ethyl delayed maturity in all three environments (Figures 1 and 2). The linear increase in days to heading was greater as the application was made later. Trinexapac-ethyl reduced plant height linearly (Figures 3, 4, and 5). The reduction decreased lodging in Crookston 04.

No lodging was detected in either Crookston 05 or Rosemount 05 for any of the treatments to allow the effect of trinexapac-ethyl on lodging to be assessed (data not shown). However, trinexapac-ethyl improved straw strength linearly as measured by the straw strength meter in Rosemount 05. The improvement in straw strength was the greatest for the application at GS 37 (Figure 8). Straw strength did not improve in Crookston 05 (Figure 7). Errors in the protocol to measure straw strength, as evidenced by the large variability in the untreated check, may be debit to this result.

The effect of trinexapac-ethyl on grain yield varied. In Crookston 05 the application at GS 30 yielded higher than either applications at GS 32 or GS 37. Both other site years, the effect of timing was not significant (Table 2).

The rate of application was only significant at Rosemount 05 with the 250 g ai/ha application yielding 520 kg/ha less than the untreated check (Table 1).

Conclusion

Trinexapac-ethyl had good crop safety at time of application but delayed maturity. This effect was greater when trinexapac-ethyl was applied at later growth stages. Plant height decreased linearly. This decrease in plant height improved lodging scores and/or straw strength in two of the three years. The highest rate of 250 g ai/ha decreased grain yield in one site year. Based on the data collected to date, an optimum rate and timing of trinexapac-ethyl is 125 g ai/ha applied at GS 37.

Table 1

<table>
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<tr>
<th>Rate</th>
<th>Crookston 04</th>
<th>Crookston 05</th>
<th>Rosemount 05</th>
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<td>(g ai/ha)</td>
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<td>LSD (5%)</td>
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Table 2

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<td>LSD (5%)</td>
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References