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Optimizing Greenhouse Corn Production: Can Growth Regulators Be Used to Keep Plants Short?

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Purdue Methods:
Optimizing Greenhouse Corn Production

Can growth regulators be used to keep corn short?

We were first motivated to experiment with growth regulators so that we could keep corn short enough to fit in our 3.3-meter tall corn chamber. In Experiment 8, corn plants grown in the proposed system reached 4 meters tall at tassel. Hand pollination and insect scouting might be made easier with shorter plants, as well. Several studies had shown the potential to control excessive height, particularly Straub (1989). Craig Schluttenhofer of the Cary Mitchell lab in our department devised a method of controlling height of corn through application of uniconazole (publication in press). We applied this method in Experiment 13 as described in the Materials and Methods document. The chemical was applied as a 1 ppm drench to the root medium when plants were at V4 leaf stage.

Final plant height of treated plants was significantly less, at 2.71 meters than the 4.00 meters of control plants ($p=0.005$). See Figures 1 and 2.

A side effect of the chemical was a failure to unroll emerging leaves. The stems bent or curved (see Figure 2). Tassels failed to emerge out of leaf sheaths on many plants, which may have contributed to lower yield. Another side effect of uniconazole was that none of the tassels branched (see Figure 3).

Tillering increased with application of uniconazole. A total of 64 tillers (secondary shoots arising from the crown) formed on treated plants, compared to 8 tillers from control plants. These tillers were removed as they emerged, so that all plants would have uniform number of shoots. Markham and Stoltenberg (2010) report that corn plants exposed to high red:far-red light ratios typically had more tillers, some of which formed ears. Perhaps the application of uniconazole mimics this signal. Schluttenhofer also documented fertile ears from tillers in one of his experiments.

<u>What about yield?</u>
Height was successfully controlled with uniconazole but yield was significantly reduced, with treated plants having 446 seeds/plant compared to 531 of controls. However, on another set of plants that were treated with the same growth regulator but that pollen from cold-stored tassels were applied, yield was significantly higher than controls at 629 seeds/plant. The increased yield

was due to successful pollination of subapical ears: There was no statistically significant difference in seed number of primary ears between the two groups.

A third set of plants was not treated with uniconazole but had the stored pollen applied. It, too, had significantly greater yield than the controls, at 580 seeds/plant. There was no statistical significance between the 580 seeds of this set and the 629 seeds of the uniconazole + stored pollen set. The latter set had high variability because only about half the plants had fertilized subapical ears. Had the whole set had fertilized subapical ears—perhaps with greater plant spacing or higher light—the yield potential would have been outstanding.

For more on the pollen storage technique, see our report *Can seed yield be improved using cold-stored tassels?*

<u>More labor?</u>

Our experience was that the use of uniconazole was effective in controlling height but was more labor intensive. Along with making the application, tillers had to be removed about every other day for three weeks. Unfurling tassels from sheaths would require more time. If tassel storage is combined with the pollen application, yet more tasks would be required. However, had controlled pollinations been required, time would have been saved climbing up and down ladders!

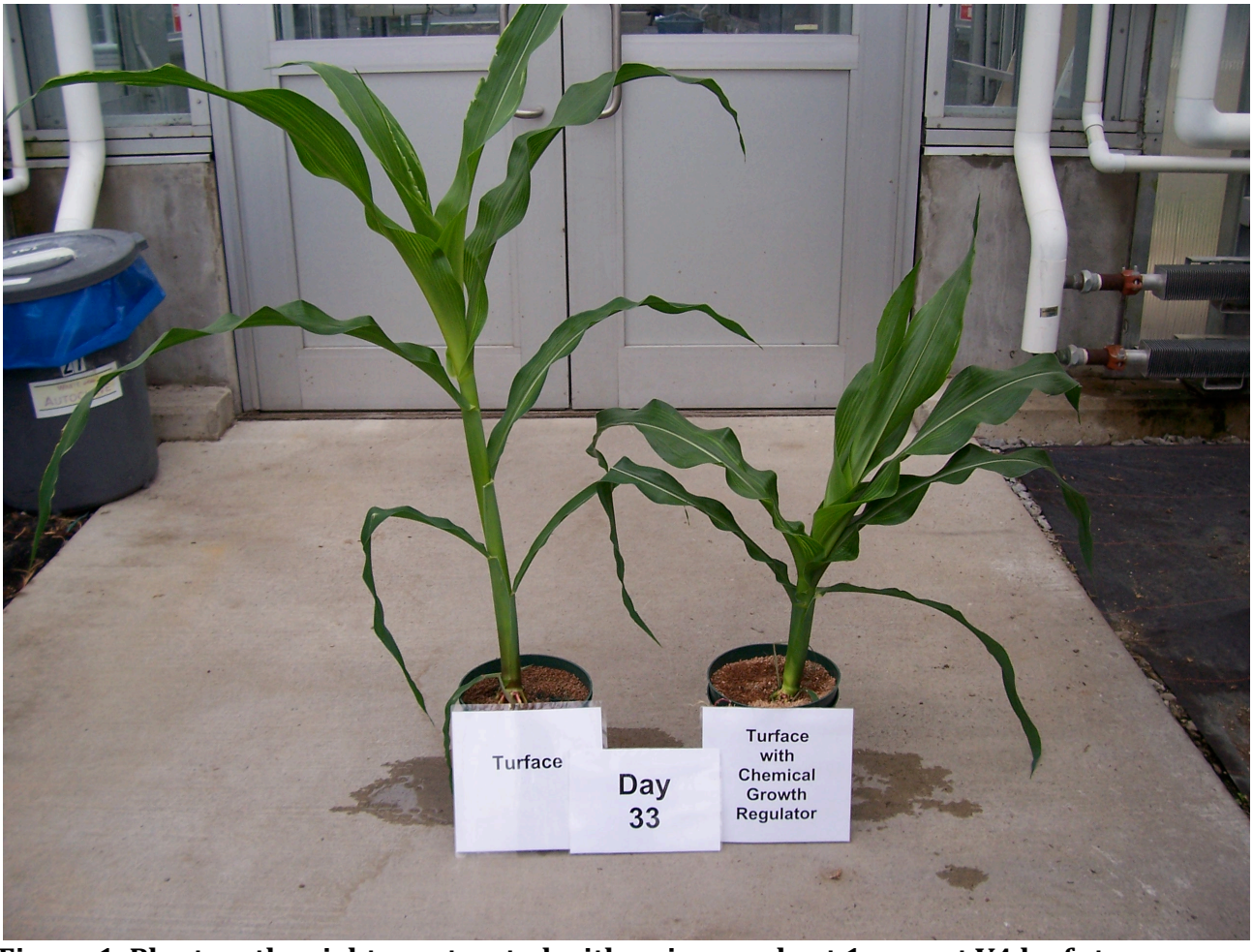

Figure 1. Plant on the right was treated with uniconazole at 1 ppm at V4 leaf stage.

Figure 2. Set of plants in foreground has been treated. Note height is controlled compared to controls (background), and also the bending of stems from failure to unfurl.

Figure 3. Top: Uniconazole-treated plants tassels failed to branch. Below: untreated plants.

Figure 4. Tillers arising from crown.

Figure 4. Prolific ears on treated plants.

Figure 5. Final height successfully controlled at 2.7 m.