

## Evaluating Plant Growth Regulators on Winter Wheat

### Purpose:

Plant growth regulators (PGR) are widely used throughout the highest wheat yielding regions in the world. This trial evaluated PGR's potential to improve winter wheat production in Ontario. Recent research has shown significant improvements in winter wheat yields in Ontario utilizing increased nitrogen along with fungicides (SMART Trials).

This research has also shown the potential negative impacts increased nitrogen can have on yields if lodging occurs. Highest wheat yields are achieved when wheat is planted early: but early planting also has the highest potential for lodging. PGR's reduce the risk of lodging by shortening the height of the plant and/or making the stems stronger.

Lodging resistance can be improved in one of 3 ways: shorter plant stature (height), increased stem diameter, or increased thickness of the stem walls (cell wall thickness).

### Methods:

Two replicate field scale trials were established at 17 locations (5 sites 2011, 5 sites 2012, 1 site 2013, and 6 sites 2014) across southwestern Ontario. Only sites with a high lodging potential were chosen for this trial. At least 120 pounds of nitrogen was applied at 15 of the 16 locations. The treatments are listed below:

1. Control (No Growth Regulator applied)
2. 0.5 litre/acre Cycocel
3. 1 litre/acre Cycocel
4. 0.72 litre/acre experimental EAC1106 (trade name now Manipulator)

Treatment 4 was included at only 1 location in 2011, but included at all locations since. The target growth stage for application of these particular products is just before the growing point comes above the soil surface (Zadok's GS 30). However, weather conditions frequently cause delayed application beyond the optimal stage, and did so at several locations across the years of this trial. Heights were measured at heading (~Zadok GS 65) and again during ripening (Zadok GS 90). Starting in 2012 digital calipers were utilized to measure stem diameter and cell wall thickness during ripening. Lodging scores were taken prior to harvest. Harvest measurements included yield, moisture, test weight, 1000 kernel weight, and protein.

### Results:

All 4 treatments were not included at every site. Since only 8 sites contained treatment 4 these 8 sites have been averaged separately (Table 1) to show the impact EAC 1106 had on plant height. PGR impacts on height were much smaller than anticipated. On average Cycocel (CCC) reduced plant height by 2.5 cm (1 inch). There was little difference in height between 0.5L/acre and 1L/acre. EAC1106 has even less impact on plant height. Generally, height would be expected to be reduced by 3-8 cm (1-3 in).

**Table 1: Plant Height (cm)**

Treatment	14 Sites	8 Sites
Control	83.5	78.7
0.5 L/acre Cycocel	81.0	76.4
1 L/acre Cycocel	80.5	77.0
0.72 L/acre EAC1106	-	78.4

In 2011 two sites were evaluated to further investigate where the shortening effect takes place (Table 2). CCC had a slight impact of the length between each node but the largest difference was between the 2<sup>nd</sup> and 3<sup>rd</sup> node, with the internode length reduced 10%. CCC had no impact on the distance between the 3<sup>rd</sup> node and the wheat head (data not shown). Data from other studies has shown the largest impact on the first internode: this discrepancy may be due to the timing of when the CCC was applied.

**Table 2: Internode Impacts of Cycocel (cm)**

Treatment	1st node	2nd node	3rd node	Total
Control	15.7	30.4	49.2	83.7
0.5L/acre	15.4	29.8	46.5	80.5
1L/acre	15.1	28.9	45.7	80.2

Since 2012 the PGR effect on stem and cell wall thickness was evaluated (Table 3). PGR's showed no consistent effect on stem thickness. PGR's had a small but consistent impact on cell wall thickness.

**Table 3: Caliper Measurements (mm)**

Treatment	Stem Thickness	Cell Wall Thickness
Control	1.94	0.39
0.5 L/acre Cycocel	1.87	0.40
1 L/acre Cycocel	1.89	0.41
0.72 L/acre EAC1106	1.93	0.41

Yield results are summarized in Table 4. CCC has shown a small yield increase of 2.1 bu/ac at the 0.5L/acre rate and 2.3 bu/ac at 1L/acre rate. 60% of the locations had a

yield response to growth regulators. EAC1106 increased yield similar to CCC. These yield increases are evident even when lodging is not an issue. These PGR's have an effect on tillering removing apical dominance briefly and allowing slightly increased tiller number and more uniform tiller development, as well as an impact on stomatal closure. On years when conditions turn hostile later during grain fill, these impacts may result in reduced yield. However, during this trial, yields were either unaffected or slightly increased.

**Table 4: Yield Results (bushels/acre)**

Treatment	14 Sites	8 Sites
Control	100.7	102.5
0.5 L/acre Cycocel	102.8	104.7
1 L/acre Cycocel	103.0	105.0
0.72 L/acre EAC1106	-	105.6

Only 4 locations had severe lodging over the course of the trial. The yield results from these 4 locations are summarized in Table 5. Response varied across locations ranging from no yield response to 10 bu/ac yield increase with the use of a PGR. The lack of yield response from the Brucefield location is surprising given the amount of lodging, but the other 3 locations do show the dramatic affect lodging can have on wheat yields. All locations with lodging showed significant improvement of harvest efficiency (combine ground speed). At all 4 of these sites, lodging was evident in the PGR treated strips (although reduced): thus management decisions still need to be made carefully. However, PGR's are definitely an effective tool in these scenarios.

**Table 5: Yield Results from sites with Lodging (bushels/acre)**

Location	Mount Forest	Thorndale	Brucefield	Hawkesville
Control	102.5	97.5	122.9	78.0
0.5 L/acre Cycocel	105.4	-	120.3	82.1
1 L/acre Cycocel	109.1	107.9	117.7	84.2
0.72 L/acre EAC1106	-	106.4	122.2	84.4

PGR'S did not have a significant impact on moisture, test weight, 1000 kernel weight, or protein.

**Summary:**

PGR'S have the potential to allow producers to push input levels to increase yield. Cycocel and EAC1106 (Manipulator) reduced plant height and strengthened stems by increasing the thickness of the cell wall. There was little difference in plant height between the 0.5L/acre and the 1L/acre of Cycocel. The high rate of Cycocel did slightly increase cell wall thickness compared to the half rate. EAC1106 had a similar impact on cell wall thickness as Cycocel but had less effect on plant height. On average, across all

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sites there was a small yield advantage when PGR's were utilized. The big yield increases from these products came from the sites where lodging occurred. The small yield response to growth regulators without any lodging is surprising: the large yield gains when lodging does occur show the real benefit of PGR'S. PGR'S have shown the potential to reduce lodging but lodging still occurred in treated strips, indicating that PGR's are only one of many management affecting lodging.

### **Next Steps:**

Data has now been collected from 4 growing seasons. We will continue to examine the effectiveness of growth regulators in Southwestern Ontario for reducing lodging potential as well as investigating why growth regulators are increasing wheat yields. Anyone who is having lodging problems and is interested in participating in this trial is encouraged to contact Peter Johnson at [peter.johnson@bell.net](mailto:peter.johnson@bell.net), or Shane McClure at [shane.mcclure@ontario.ca](mailto:shane.mcclure@ontario.ca)

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### **Location of Project Final Report:**

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