Evaluating Plant Growth Regulators

(Interim Report)

Purpose:

Plant growth regulators (PGR) are widely used throughout the highest yielding wheat regions in the world. This trial is designed to evaluate the impact PGR's could have on winter wheat production in Ontario. Recent Ontario research has shown significant improvements in winter wheat yields in 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. PGR's could 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 (stem wall thickness).

Methods:

Two replicate field scale trials were established at 10 locations (5 sites 2011, 5 sites 2012) across southwestern Ontario. Only sites with a high lodging potential were chosen. At least 120 pounds of nitrogen was applied at 9 of the 10 locations. The treatments are listed below:

1. Control (No Growth Regulator applied)
2. 0.5 litre/acre Cycocel
3. 1 litre/acre Cycocel
4. 0.4 litre/acre experimental EAC1106

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

Results:

PGR impacts on height were much smaller than anticipated (Table 1). On average Cycocel (CCC) reduced plant height by 3 centimeters (cm). There was little difference in height between 0.5L/acre and 1L/acre. Based on 2012 data EAC1106 has even less impact on plant height.

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 2nd and 3rd node, with the internode length reduced 10%. CCC had no impact on the distance between the 3rd 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 1: Plant Height (cm)

Treatment	2011	2012	Trial Average
Control	89.4	78.4 a[1]	83.3
0.5 L/ac Cycocel	87.0	75.1 b	80.4
1.0 L/ac Cycocel	85.9	75.9 b	80.3
0.4 L/ac EAC1106		77.7 ab	[1]means with same letter are not sign. different at 5%

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/ac	15.4	29.8	46.5	80.5
1.0L/ac	15.1	28.9	45.7	80.2

In 2012 the PGR effect on stem diameter and wall thickness was evaluated (Table 3). PGR's showed little to no increase stem thickness. PGR's showed a consistent increase in stem wall thickness across all 5 locations.

Table 3: Caliper Measurements (mm)

Treatment	Stem Thickness	Stem Wall Thickness
Control	1.90nsd	0.383 b
0.5 L/ac Cycocel	1.83	0.405 ab
1.0 L/ac Cycocel	1.85	0.417 a
0.4 L/ac EAC1106	1.90	0.403 ab

Yield results are summarized in table 4. Over the 2 years, CCC has shown a small yield increase of 1.9 bu/ac at the 0.5l/acre rate and 3.6 bu/ac at 1l/acre rate. 7 out of 10 locations had a yield response to growth regulators. Based on 2012 data only EAC1106 had an average yield advantage over CCC but most of this advantage came from 2 of the 5 locations.

Table 4: Yield Results (bushels/acre)

Treatment	2011	2012	2 Year Average
Control	104.4 b	94.2 b	98.8
0.5 L/ac Cycocel	105.9 a	96.6 ab	100.7
1.0 L/ac Cycocel	106.9 a	98.7 a	102.3
0.4 L/ac EAC1106	-	99.8 a	-

Over the 2 years this trial has been conducted, lodging has occurred at only 2 sites. The yield results from these 2 locations are summarized in Table 5 compared to the yield average from the other 7 locations without lodging. Gains from CCC in the absence of lodging are slightly less than the trial average at 1.6 bushels at the 0.5l rate and 2.8 bushels at the 1l of rate. Response to PGR application increased when lodging

occurred. Yields increased by 3.3 bu/ac at the 0.5Ll/ac rate and 6.1 bu/ac at the 1L/ac rate. The additional response is the result of reduced lodging in the treated strips.

Table 5: Lodging vs. No Lodging Sites

Treatment	Lodging	No Lodging
Control	85.7	102.5
0.5 L/ac Cycocel	89.0	104.0
1 L/ac Cycocel	91.8	105.3

Growth regulators did not have a significant impact on moisture, test weight, 1000 kernel weight, or protein.

Summary:

Growth regulators have the potential to allow producers to increase nitrogen levels and thus yield. Cycocel and EAC1106 reduce plant height slightly and strengthen the stem by increasing the thickness of the stem wall. There was little difference in plant height between the 0.5L/ac and the 1L/ac of CCC. The high rate of CCC slightly increased stem wall thickness compared to the half rate. The most significant yield results from PGR application came when lodging occurred. Response to growth regulators doubled under lodging conditions. Based on 1 year of data EAC1106 had a similar impact on stem wall thickness as CCC but had less of an effect on plant height (limited data). EAC1106 had a slight numeric yield benefit over Cycocel but differences are marginal. The yield response to PGR's without lodging has come as a surprise and investigation of possible reasons will occur in 2013. Growth regulators have shown the potential to reduce lodging, but some lodging has still occurred in treated strips.

Next Steps:

The use and impacts of growth regulators will be examined again in 2013 (year 3). We will continue to examine the effectiveness of growth regulators in Ontario for reducing lodging potential, as well as investigating if PGR's are increasing wheat yield. Anyone who is having lodging problems and is interested in participating in this trial is encouraged to contact Peter Johnson at peter.johnson@ontario.ca, or Shane McClure at shane.mcclure@ontario.ca

Acknowledgements:

We are indebted to our many co-operators, many of whom stick with us year after year. Thanks to all the summer assistants. Special thanks to technician Shane McClure and administrator Marian Desjardine, and statistician Ken Janovicek. This project would not be possible without the financial support of Agriculture and Agrifood Canada through the Can Advance and Farm Innovation Programs, the Grain Farmers of Ontario and their staff with ongoing support, the many Soil and Crop Improvement Associations that work with us both as cooperators and with financial support, and many and varied sources of agribusiness support. Dr. David Hooker, Scott Jay, Gerald Backx and the wheat research team at the University of Guelph are valued contributors to many of our projects as well.

Project Contacts:

Peter Johnson, OMAFRA, peter.johnson@ontario.ca

Shane McClure, Middlesex SCIA , shane.mcclure@ontario.ca

Location of Project Final Report:
Peter Johnson