

Site-Specific Management of Plant Growth Regulator in Wheat

Making the Most of Wheat in your Rotation



Background

Growing wheat or other small grains in a **crop rotation** can make corn and soybeans more drought tolerant and stabilize yields. It also makes it easier to plant cover crops.

Lodging in wheat is associated with **lower yields, lower quality, and decreased harvest efficiency**

Plant Growth Regulator (PGR) can **reduce lodging** in winter wheat, but lodging is rarely uniform across a farm

Wheat response to PGR application likely **varies** across areas of a field due to **soil drainage** and **texture variability**

University of Guelph researchers used soil type maps, topography, and remote sensing imagery to **evaluate the potential benefits of variable rate (VR) PGR to reduce lodging in Ontario farms** as part of an OMAFA Tier 1 project

Importance of PGR in Ontario

Variation in topsoil depth, soil organic matter and soil drainage class across fields can **heavily impact yield**.

Wet, poorly drained soils // High organic matter



Deep topsoils with **high organic matter** leads to **higher concentrations of crop-available nitrogen**

↑ **Yield** but ↑ **Risk of lodging**

Dry, easily drained soils // Low organic matter

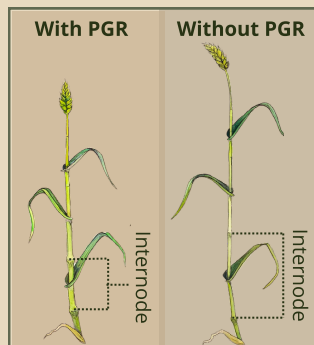


Shallow topsoils with **low organic matter** leads to **lower concentrations of crop-available nitrogen**

↓ **Yield** but ↓ **Risk of lodging**

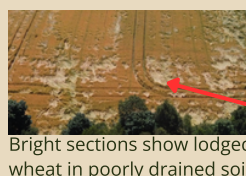
PGR products reduce internode length in wheat, resulting in shorter plants with thicker, more lignified stems. This helps withstand lodging pressure, reducing the likelihood that wheat will fall. **PGR application**

can be optimized by applying it in locations with ample soil moisture and withholding it where soil is rapidly drained. Therefore, **soil drainage maps** can be a starting point for variable rate application of PGR.

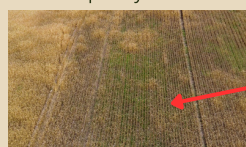


Crop Management Zones

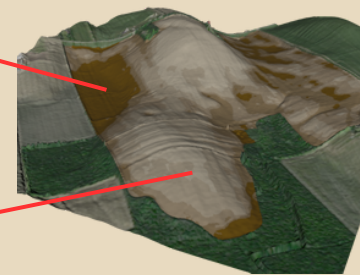
A crop management zone (MZ) is an area of an agricultural field which is predicted to be homogenous in response to crop inputs such as fertilizer or crop protection products.



Bright sections show lodged wheat in poorly drained soil

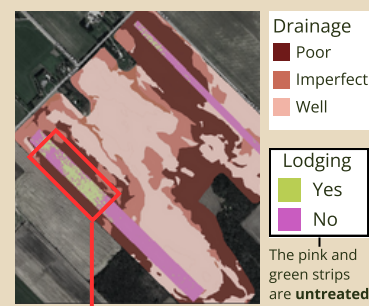


Grey wheat indicates dry, rapidly drained soil



Organic Matter
■ High
■ Low

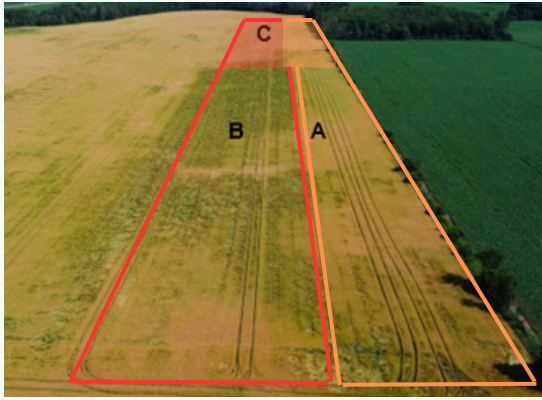
Drone imagery was used pre-harvest to delineate locations with lodging incidence. Lodging was summarized by treatment and MZ. For this study, MZs based on drainage potential were derived from soil type maps. Field-length strips were oriented **across variation in soil drainage** in ten growers' fields in 2021 and 2022. At each site, one strip received a PGR [Moddus (Trinexapac-ethyl)] at 0.988 L/ha in 138 L/ha of water and the other was left untreated.



Note how lodging occurs over the dark red areas of the drainage map, indicating higher frequency of lodging in **poorly drained soils**.

Results

1



Lodging is visible in the untreated strip (B), and less prominent in the treated strip (A). No lodging is present in either strip in section C, which is a well-drained soil type. This suggests that PGR has limited impacts on lodging in dry, well-drained soils.

2

Soil Drainage Class	% Of Area Lodged	
	Treated	Untreated
Well	13.7	16.7
Imperfect	21.6	25.1
Poor	20.0	69.5

Treated strips consistently had a lower % of area lodged than untreated strips. Poorly drained soils in untreated strips had the highest percent lodged area while well drained PGR treated soils had the lowest percent lodging.

3

27.5%

of the area **not treated** with a PGR in all 10 sites was lodged.

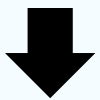
20.5 %

of the area **treated** with a PGR was lodged. Lodging was reduced at every site with the application of a PGR.

Implications for PGR management

The higher prevalence of lodging in wetter soil types lends support to the practice of **applying a PGR only in soil types where lodging risk is a concern** (i.e. wet soil types).

Trial results indicate that a PGR **may be targeted to high risk lodging areas**. This can...



Product needed



Grower profitability



Unnecessary inputs in areas of low lodging risk

Take-Home for Growers

PGR can **reduce, but not eliminate** the risk of lodging. PGR effects are **seen in poorly-drained & high yielding soils**, and **less prominent in well-drained & low yielding soils**.

- digital soil or drainage class maps can be used to **target areas of high lodging risk** for PGR application, while avoiding areas where application is not needed
 - economics of PGR application will dictate how large of a benefit this strategy may be to farmers.
- likely that the reduction in PGR chemical costs **may not justify** a second ground sprayer application
 - new drone or sprayer application technology may mitigate this by allowing for cheaper spot spraying

Limitations

A main barrier to adopting VR PGR is the fact that they are **often tank-mixed with herbicides and fungicides**. While some areas may not respond to a PGR, they still may have weed pressure and require the herbicide application. Unfortunately, separating these products into two separate passes **may negate the economic benefits of VR PGR**.

Managing limitations

1. **Stagger application times** to apply herbicide in the fall, and PGR in the spring
2. Use of **direct injection systems** on sprayers; this enables chemicals to be metered out into the spray solution as needed.