# Managing Big Wheat

**(OSCIA Tier 1 – Thamesvalley, Elgin, Middlesex SCIA)**

## Purpose:

The fall of 2015 was extremely dry throughout most of southwestern Ontario, which resulted in the majority (90%) of wheat being planted at, and even before, optimal seeding dates. The early planting dates combined with abnormally warm fall weather resulted in the most advanced wheat fields having wheat plants with 7 to 10 tillers per plant. (Figure 1) This left many producers wondering how to best manage these wheat fields to maximize yield, and in particular, how to reduce the risk of lodging. In New Zealand and the UK agronomists recommend delayed nitrogen (N) application on extremely advanced wheat. Typically N applications would be delayed until the plant has reached Zadoc stage 32 (second node), with the concept that depayed N would "starve off" some of the weaker tillers. This trial was designed to compare different nitrogen (N) strategies on extremely advanced wheat in Ontario growing conditions, to both reduce lodging and maximize yield potential.

**Figure 1: Advanced wheat with multiple well developed tillers**

**Figure 2: Advanced wheat Seaforth, fall 2016**

## Methods:

Trials were conducted at 7 sites in 2016. Only fields with at least 4 or more tillers per plant were selected for this trial. Three different nitrogen strategies were investigated and are listed below

**N Strategies**

1. 120 lbs N at Normal timing
2. 40 lbs N at Normal timing + 80 lbs N at GS 32
3. 0 lbs N at Normal timing + 120 lbs N at GS 32

Normal N timing is considered to be mid to late April, while growth stage 32 (GS 32, Zadok's scale) typically occurs during mid May. Calcium Sulphate was applied at the normal N timing to balance sulphur rate across all three treatments. A T3 fungicide was used at all locations. Stem counts were done shortly after the normal N application and head counts were done at maturity to analyze each treatments impact on tiller survival. Stems were counted in a meter of row at three different locations in each strip. The same strips were counted again at maturity.

## Results:

The fall of 2015 was abnormally warm. The ideal GDD accumulation for yield and maximum winter hardiness is 450 GDD. The Seaforth location accumulated 882 growing degree days (Base 0C) from planting (September 16) till the end of December when colder temperatures moved in. Normal fall temperatures would accumulate 694 growing degree days during this time period at this location. The result was incredibly thick wheat, with more than10 tillers/plant. The stem count data is summarized in Table 1. Due to time constraints counts were not performed at all 7 locations.

**Table 1: Stem and Head Count Results**

| Location | 120 Normal | | 40 Normal + 80 GS 32 | | 0 Normal + 120 GS32 | |
|---|---|---|---|---|---|---|
| | Stems | Heads | Stems | Heads | Stems | Heads |
| Seaforth | 192 | 129 | 176 | 105 | 203 | 121 |
| Hamilton | 165 | 138 | 166 | 133 | 169 | 134 |
| Belmont | 225 | 190 | 224 | 185 | 238 | 191 |
| Thorndale | 244 | 194 | 246 | 193 | 222 | 174 |

Regardless of N management strategy, not all tillers survived to produce a head. Variability in stem counts across treatments is not surprising, and in fact, to be expected. Wheat stands can be quite variable across a field as drill seed placement is never perfect, and microclimates in the field come into play. Typical plant establishment in winter wheat in Ontario is 70% of initial seed count, even with 98% germ seed. To get a clearer picture, Table 2 shows the percentage of stems that produced a head.

Some tillers remained at maturity that did not produce a head. These tillers were not counted. Results are interesting, although differences are small. As early N application rate is reduced, so is the percentage of wheat tillers that produce a head. The one exception to this is the Thorndale site. This site receives regular manure applications: high residual soil nitrate levels probably explain the lack of treatment differences.

**Table 2: Percent of Original Stems with Head**

| Location | 120 Normal | 40 Normal + 80 GS 32 | 0 Normal + 120 GS32 |
|---|---|---|---|
| Seaforth | 67.4% | 59.5% | 59.8% |
| Hamilton | 83.4% | 80.3% | 79.5% |
| Belmont | 84.2% | 82.4% | 80.2% |
| Thorndale | 78.2% | 79.6% | 78.7% |
| **Average** | **78.3%** | **75.4%** | **74.5%** |

The yield results are summarized in Table 3. Yields were excellent, even though all locations received below 50% of normal rainfall in May, June and July. Lodging differentials were anticipated between N treatments, but none of the wheat lodged. Lack of moisture, coupled with the coolest temperatures in 30 years throughout April and the first half of May, combined to give short internodes and excellent standability. Final yield varied by location, but on average there is little difference in yield across the 3 N strategies. Three sites showed a strong response to late N and 4 sites showed no response to late N. The Hamilton location was located in one of the driest areas of the province, and the wheat showed visible signs of drought stress (Figure 3). This site did not receive adequate rainfall to move the late N into the soil: this is always a concern with any late N applications. However, despite this concern, yields of all N applied at GS 32 equaled the yield of all N early, so the fears of N loss or “positional unavailability” were unfounded: a rather surprising outcome.

The St.Thomas site did have a significant yield loss associated with the late N treatment, while the Fingal site showed a significant yield advantage with later applied N. Perhaps St.Thomas did indeed have issues with “positional unavailability”, but this is undetermined. More research is required to fully assess delayed N applications on advanced wheat, when weather is more normal, and lodging occurs.

**Table 3: Yield Results (bushels/acre)**

| Location | 120 Normal | 40 Normal + 80 GS 32 | 0 Normal + 120 GS32 |
|---|---|---|---|
| Seaforth | 123.8 | 131.4 | 127.3 |
| Hamilton | 94.1 | 92.1 | 93.0 |
| Port Elgin | 96.5 | 103.2 | 99.4 |
| Thorndale | 90.5 | 86.5 | 87.9 |
| St.Thomas | 91.5 | 91.0 | 84.6 |
| Fingal | 102.2 | 105.7 | 110.1 |
| Belmont | 105.3 | 101.4 | 103.5 |
| **Average** | **100.6** | **101.6** | **100.8** |

The protein results are shown in table 4. Late N does appear to have an impact on protein levels, although there was no significant difference in protein levels between treatments 2 and 3. No lodging occurred at any location in 2016 so lodging notes were not taken.

**Figure 3: Hamilton site N deficiency before GS 32 application**

**Table 4: Protein Results (%)**

| Location | 120 Normal | 40 Normal+ 80 GS 32 | 0 Normal + 120 GS32 |
|---|---|---|---|
| Seaforth | 9.1 | 9.6 | 9.5 |
| Hamilton | 10.2 | 10.9 | 10.4 |
| Port Elgin | 9.0 | 9.4 | 9.6 |
| Thorndale | 10.2 | 11.3 | 11.9 |
| St.Thomas | 10.6 | 10.5 | 10.9 |
| Fingal | 8.8 | 10.0 | 9.9 |
| Belmont | 9.5 | 10.0 | 9.9 |
| **Average** | **9.6** | **10.2** | **10.3** |

## Summary:

Delaying N application until GS 32 did not result in yield loss, but only reduced tiller counts marginally. Whether this management strategy would reduce lodging remains undetermined, as no wheat lodged. A significant yield loss occurred only at one location with all N applied at GS 32, despite very dry conditions and the concern of lack of movement into the soil. With split N treatments, wheat yields were maintained or even increased, and protein levels also increased. Split N applications appear to be the best current management strategy on advanced wheat, until data is generated around lodging impacts. Hard red wheat growers should take note of the protein increase: this data supports the benefit of split N on hard red wheat for protein.

## Next Steps:

This project will be continued in 2017. Four sites were planted between September 1st and September 15th in the fall of 2016. An abnormally warm fall has again resulted in more top growth than expected at these locations with 848 growing degree days being accumulated at Seaforth between Sept 15th and Dec 3rd.

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