Spring Wheat Nitrogen Response X Fungicide Interactions

Purpose:

Recent research has shown a significant synergy between fungicide and nitrogen in winter wheat. This trial was designed to investigate if a similar synergy exists in spring wheat. . The data generated from this trial will also be used to update the nitrogen recommendations for spring wheat, with and without fungicide (Agronomy Guide, Publication 811). Maximum Economic Rate of Nitrogen (MER-N) will be determined and compared with and without fungicide.

Methods:

Four field scale trials were established across southwestern Ontario (target 5 locations). Plot design was field scale, two replicate, randomized with 5 N rates, both with and without fungicides (total 20 plots/site). Post-harvest soil nitrate tests were collected to evaluate soil residual N and potential environmental impact from higher N applications.

Other than the nitrogen rate and fungicide applications, all variables at each field location were consistent across all treatments, following the normal production practices based on the producer. At all of the sites spring nitrogen was applied by broadcasting urea with a Valmar airflow applicator. The treatments are as followed

1. Check (No nitrogen applied) with fungicide
2. 60lbs Nitrogen (60N) with fungicide
3. 90lbs Nitrogen (90N) with fungicide
4. 120lbs Nitrogen (120N) with fungicide
5. 150lbs Nitrogen (150N) with fungicide
6. Check (No nitrogen applied) without fungicide
7. 60lbs Nitrogen (60N) without fungicide
8. 90lbs Nitrogen (90N) without fungicide
9. 120lbs Nitrogen (120N) without fungicide
10. 150lbs Nitrogen (150N) without fungicide

Data collected from these sites included yield, moisture, test weight, 1000 kernel weights, protein, disease ratings and lodging. Post-harvest soil nitrate samples were collected to observe environmental impact with increase nitrogen application. Fusarium damaged kernel (FDK) counts were complete on sites with high fusarium levels.

Results:

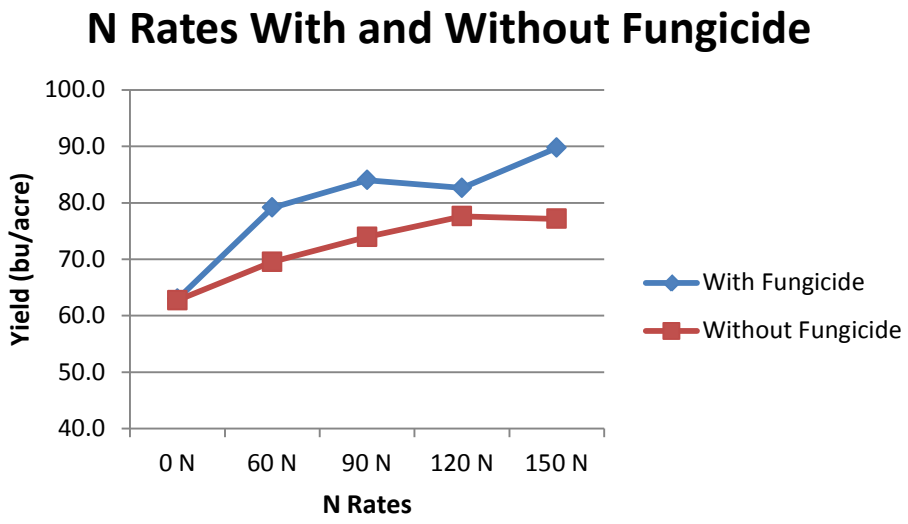
Zero N treatments average yield was the same, at 63 bu/acre, for both the fungicide and no fungicide treatments (Table 1). This is consistent with winter wheat data, but different than spring barley. As N was added the yields with fungicide increased faster than without fungicide but began to stabilize once we reached 90 N. There is a significant dip in yield for the 120 N fungicide treatment: this is likely just experimental error. The

results are from a small dataset and only one year results. We would expect yields at 120 N to follow the yield curve graphed in Figure 1 and fall somewhere between the 90 N and 150 N treatments. However, this dip makes it difficult to determine what the real nitrogen need of spring wheat with fungicides might be.
When no fungicide is applied yields increased at a slower rate up to 120 N where they seem to reach a maximum yield.

Table 1: Breakdown of Yields With and Without Fungicide (bu/ac)

Treatment	With Fungicide	Incremental Gain	No Fungicide	Incremental Gain
0 N	63.0	-	62.7	-
60 N	79.1	16.2	69.5	6.8
90 N	84.0	4.9	73.9	4.4
120 N	82.6	-1.4	77.6	3.7
150 N	89.7	7.1	77.2	-0.4

Figure 1:



Economic Analysis: Using urea at $586/tonne ($0.58/lb of actual N) and hard red spring wheat at $6.36/bushel (current values at time of writing), 2.8 bushels of wheat are required to cover the cost of 30lbs of N ($0.58/lb*30lbs= $17.40/$6.36/bu= 2.8 bushels). With the addition of fungicide application, you increase your costs by $24.00/ac (fusarium fungicide $14.00/ac + $10.00/ac application). To cover the cost of the fungicide, you would need an additional 3.8 bushels/ac ($24.00/$6.36)=3.8 bu). Based on the assumptions and calculations, 90 N/ac appears to be the MER-N application for both with and without fungicides. This is a different outcome than winter wheat. More data will need to be generated to determine how spring wheat responds to N rates above 90. A previous study (Johnson, McClure 2012 CropAdvances) found a 2.8 bu/ac

yield increase between 90 N and 150 N when a fungicide was applied. This supports 90 N being the most economic rate.

The average protein results are summarized in table 2. Protein response to nitrogen was extremely variable across locations making it hard to draw any conclusions. One site had very little change in protein across all treatments, while another site had a 2% increase in protein from 0 N to 150 N. In general, protein increased with additional N, which is the expected response.

Table 2: Breakdown of Protein With and Without Fungicide

Treatment	With Fungicide	No Fungicide
0 N	11.3	11.3
60 N	12.0	12.2
90 N	12.0	12.4
120 N	12.4	12.5
150 N	12.4	12.8

The FDK results from a site near Owen Sound are summarized in table 3. Due to wet weather harvest was delayed until late September which may have contributed to the high FDK counts. The results once again support the use of a fusarium fungicide in spring wheat production. FDK counts were significantly lower where a fusarium fungicide was used, and made the difference between Grade 2/3 wheat and feed.

Table 3: FDK Results

Treatment	With Fungicide	No Fungicide
0 N	1.1%	2.6%
60 N	1.0%	3.0%
90 N	1.0%	3.9%
120 N	1.3%	3.3%
150 N	1.4%	2.9%

No major differences in test weight or 1000 kernel weight are evident. Post-harvest nitrate results are still pending. Results will be available once samples have been analyzed.

Summary:

Preliminary results suggest that a synergy does exist between N and fungicide in spring wheat. Based on the data to date, 90 N/ac is the most economic treatment regardless of fungicide application. However, if the fungicide response curve is adjusted without the 120N dip, 120 N would result in the highest profit where fungicides were applied. More data is needed before any conclusions on nitrogen rate are made. 2014 was an

excellent year for spring cereals. It will be interesting to see if we get similar results next year.

The benefits of using a fusarium fungicide are evident, with 3 of the 4 sites paying for the cost of the fungicide with yield alone. In the event harvest is delayed or we have a year where conditions are ideal for fusarium (like 2014), the returns from using a fungicide would be significant.

Next Steps:

This is the first year for this project. Research will be gathered and continued for another 2 years (2014-2016). Anyone who is interested in participating in this trial is encouraged to contact Peter Johnson at peter.johnson@bell.net, or Shane McClure at shane.mcclure@ontario.ca. Data collected from this trial will be used in multiple articles, as well as presentations.

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