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Wheat Stand Assessment, Winterkill Yield loss, and Nitrogen Application

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Most winterkill that growers experienced in 2008 was related to prolonged ice sheets that limited plant respiration and ultimately lead to plant death. In 2009, Wisconsin wheat growers are again dealing with winterkill; however the culprit this year appears to be death by exposure (lack of snow cover). As you drive around the countryside and survey the wheat crop, distinct patterns begin to emerge. In general the wheat that is nearest the tree lines and held the snow the longest appears to be in the best shape, whereas those areas that were most exposed to cold, driving winds appear to be in the toughest condition. We also see a dramatic impact of planting date (early wheat looks better than late planted) and variety on winterkill (Image 1).

Many growers have been slow to pull the trigger on nitrogen applications due to the slow green-up we have experienced, however the warm weather forecast for this weekend should make winterkill decisions and N recommendations much easier as we progress into next week. As you scout, remember brown, dried leaves evident in some fields do not necessarily indicate winter injury, and green leaves are not a sure sign that the crop has survived either. (Image 2) The only way to properly assess the condition of individual plants is to examine the crown for the development of new white roots. If the crown appears white and healthy, and new roots are developing, the plant is probably in good condition.

Image 1. Planting date and variety impact on winterkill.

Image 2. Brown leaves don't necessarily mean wheat has not survived.

A valuable point to remember this spring is that in wheat, nitrogen serves two important functions. Nitrogen fertilizer may be used to manipulate the population (increase tiller number) as well as supply the nutritional needs of the crop to produce protein (Maowski et al. 1999; Soon and Clayton, 2002; Vaughan et al. 1990; Weisz et al. 2001). Therefore, wheat tiller number is an important indicator of

nitrogen application timing. Research indicates that if tiller (stem) number is greater than 70 per square foot, it may be beneficial to delay nitrogen application until just prior to jointing (Scharf et al., 1993). The advantage of a delayed nitrogen application is an increase in nitrogen use efficiency and a potential yield increase, however if tiller number is less than 70 per square foot, it is recommended to apply nitrogen at green-up in order to increase the effective plant population.

Nitrogen is a key component to producing good wheat yields; however, applying too much N fertilizer can have detrimental effects on yield. Excessive N fertilization encourages excess vegetative growth, which increases the possibility of lodging, making harvest more difficult and also increases disease potential due to a dense canopy. With the current high price of N fertilizer and very good wheat prices, some growers are wondering if 70 lb N/a for soil with 2.0 to 9.9% organic matter is still valid (Laboski et al., 2008). To answer this question, data collected over the past 12 years in southern Wisconsin was re-evaluated using current wheat and N fertilizer prices following the maximum return to N (MRTN) approach we use for corn N recommendations. The amount of N needed for wheat is strongly related to preplant soil nitrate levels (PPNT). PPNT for wheat is determined on 0-1' and 1-2' soil samples taken in late summer prior to planting wheat in the fall. If the PPNT is < 50 lb NO_3-N/a, then the MRTN rate is 70 lb N/a (with a profitable range of 65 to 80 lb N/a) which matches our recommendations for soils with 2 to 9.9% organic matter. If the PPNT is between 50 and 100 lb NO_3-N/a, then the MRTN rate is 45 lb N/a. And if the PPNT is > 100 lb NO_3-N/a, then the MRTN is 0 lb N/a (no N is needed). In these studies, if wheat followed soybean, then the MRTN rate was about 20 lb/a less. If PPNT soil samples were not collected last year, then it would be appropriate to use 70 lb N/a on soils with 2.0-9.9%. Also remember to take any N credits for manure applications or forage legumes if appropriate.

Nitrogen applications to wheat should be made in early spring at Feekes GS3 to GS5 (green-up to pre-joint). Applying N on slightly frozen ground in mid to late April in southern WI minimizes wheel traffic problems and meets the early season N needs of wheat, however off-site movement of N can occur.

Spring N management decisions are often difficult for growers when winter wheat stands are thin at green-up. The common questions are:

- What will this stand yield?
- How much N should I invest into this poor looking wheat stand?
- And finally, should I even keep this crop?

A good assessment of live plants is an essential first step. We recommend a minimum of 12-15 live plants per sq ft as a cutoff. It will usually not be economical to keep a wheat crop with less plant density than this. Use Table 1 as a guide when counting plants in various row widths. When counting, be sure to distinguish between whole plants and tillers. These recommendations are for plants per square foot. Whole fields do not have to be abandoned if one area is low in stand. Before you tear up a poor stand of wheat, be sure to calculate the input costs you have in the existing wheat crop, the costs of establishing another crop in relation to the expected yields of either crop, and lastly, current crop prices. Net profits from wheat are competitive with soybean and corn when you add in the return for the straw and the rotation benefits.

Table 1. Wisconsin Winter Wheat - Spring Plant Stand Recommendations

Minimum spring stands Good spring stands Excellent spring stands				
		Row Width (inches)		
Plants/acre		6	7	7.5
million	plants/sq ft	Plants per foot of row		
0.3	7	3	4	4
0.4	9	5	5	6
0.5	11	6	7	7
0.6	14	7	8	9
0.7	16	8	9	10
0.8	18	9	11	11
0.9	21	10	12	13
1.0	23	11	13	14
1.1	25	13	15	16
1.2	28	14	16	17
1.3	30	15	17	19
1.4	32	16	19	20
1.5	34	17	20	22
1.6	37	18	21	23
1.7	39	20	23	24
1.8	41	21	24	26
1.9	44	22	25	27
2.0	46	23	27	29
2.1	48	24	28	30
2.2	51	25	29	32
2.3	53	26	31	33

In 2008, we initiated a set of experiments to further quantify the impact of winter kill on grain yield and nitrogen needs for Wisconsin growers (Figures 1 and 2). Preliminary data suggests that at our Arlington site, 60 pounds of nitrogen was optimal for maximum yield regardless of the percent winterkill, whereas at Chilton a yield response to nitrogen was noted in some of our winterkill treatments. The value of this response is directly related to the cost of N applied. This research is being funded by the Wisconsin Fertilizer Research Program in 2009 and 2010.

Figure 1. Effect of Winterkill and Spring Nitrogen Rate on Soft Red Winter Wheat Yield at Arlington, WI in 2008.

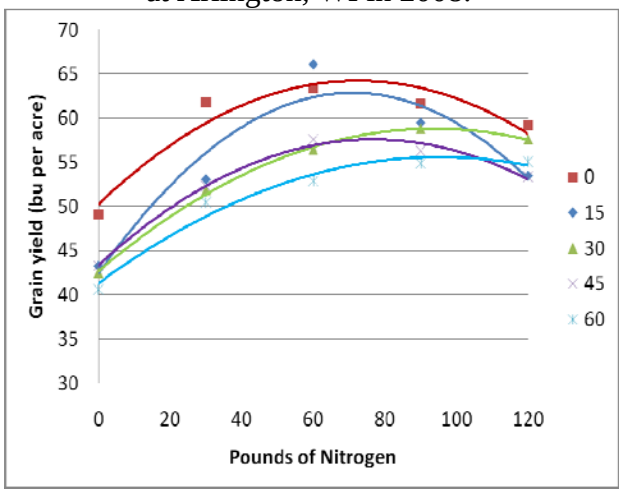
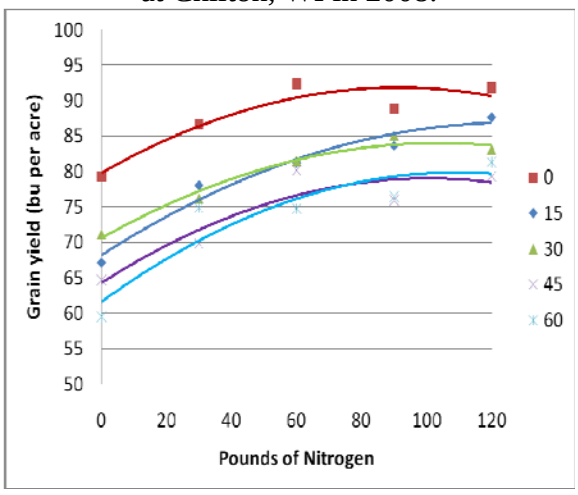


Figure 2. Effect of Winterkill and Spring Nitrogen Rate on Soft Red Winter Wheat Yield at Chilton, WI in 2008.



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