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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.

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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?

Table 1. Wisconsin Winter Wheat - Spring Plant Stand Recommendations

Minimum spring stands
Good spring stands
Excellent spring stands

Plants/acre		Row Width (inches)		
		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

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.

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.

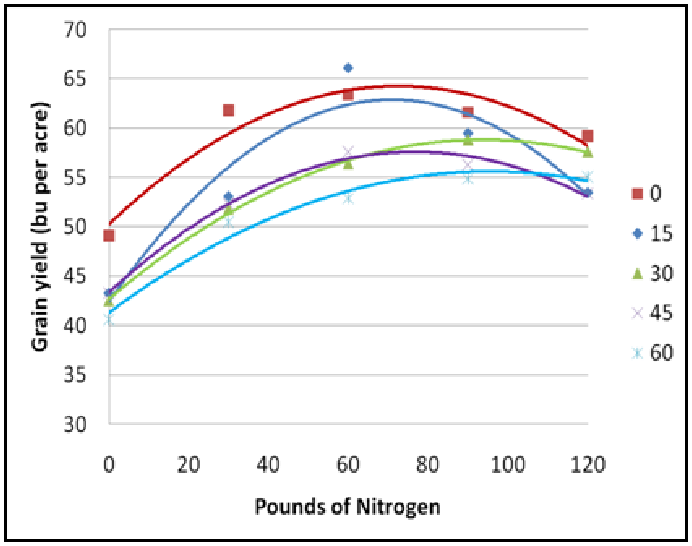
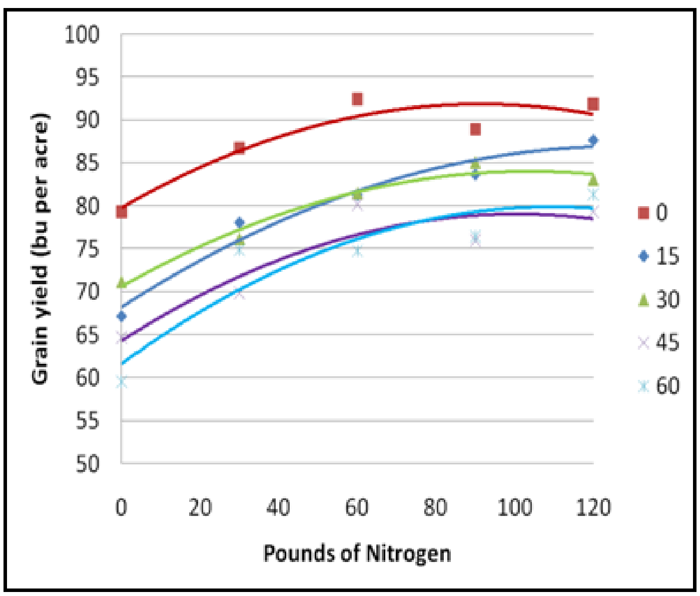


Figure 2. Effect of Winterkill and Spring Nitrogen Rate on Soft Red Winter Wheat Yield at Chilton, WI in 2008.



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Managing the Impact of Construction Compaction on Crop Land

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In the last several months I have received numerous queries about soil compaction caused by the construction of pipelines, high voltage transmission lines, highways, and wind turbines. Producers are concerned that compaction from heavy equipment will negatively affect soil quality factors such as bulk density, porosity, aggregation, and drainage; causing yield reduction that may persist for several years. While the effect will vary by soil type, soil moisture content, and vehicle load; soil compaction has been shown to have negative impact on yield in almost all situations. Where the soil has been aggressively disturbed, as it will be when a pipeline is buried, the effects can be long-lasting. Examples of compaction effects on crop yield collected from various research studies are shown in Table 1 (next page).

Compaction has the effect of re-arranging the soil aggregates to form a denser, less porous soil. Severe compaction will destroy these aggregates further reducing porosity. The denser soil has fewer large pores to conduct water, so increased runoff and ponding in depressions are common symptoms of compaction. The smaller pores hold water tighter resulting in a Awetter@ soil that dries more slowly. Soil gas exchange is slowed and oxygen can become limiting to roots. The soil strength increases, requiring more power for tillage and impeding root growth. These problems are made worse when the soil is near field capacity as the water acts as a lubricant between soil particles. The problem is also worsened as the clay content of the soil increases.

It has been estimated that over 70 percent of the compaction effect occurs in the first pass across the field. The heavier the equipment, the more severe the effect. Factors such as increased tire size, proper inflation pressure, and the addition of tracks, duals, or tandem axles can offset some of the effect, but in many cases with very heavy equipment there will be a limited reduction in compaction.

A treatment that is often suggested to alleviate compaction is deep tillage, more commonly known as subsoiling. If done use a subsoiler with L-shaped legs (e.g. para-plow) that lifts the soil with minimal surface disturbance. Subsoiling will loosen the soil, but it will not re-create structure or the biopores from roots and earthworm activity. These redevelop over time once the site is returned to crop production. Natural forces, such as wetting/drying, freezing/thawing, and biological activity will take many years to restore a severely compacted soil. A study conducted in western Minnesota demonstrated that the compaction caused by covered wagons in the 1880's could still be detected over a century later.

Table 1. Effect of soil compaction on crop yield in several Wisconsin studies.

County	Crop	Units	Compaction load: Minimal	Moderate	Heavy
Manitowoc	Corn	bu/a	120	103	69
Grant	Corn	bu/a	106	101	91
Winnebago	Corn	bu/a	156	152	142
Columbia	Corn	bu/a	156	--	112
Columbia	Alfalfa	ton/a	3.7	--	3.3
Waushara	Potato	cwt/a	458	--	440

Note: Not all differences at any specific site were statistically significant at p=0.05.

The best advice for managing compaction is to avoid compaction. When possible stay off wet soils, operate with lighter loads, confine traffic to existing lanes, and use tracked vehicles when possible. These recommendations are easily disregarded in the construction process. Producers should attempt to estimate a fair price to compensate for the yield loss from compaction based on the area affected, commodity prices, and other inconveniences. A yield reduction estimate of 12 to 25 % is not unreasonable. Some situation may lend themselves to comparing yield in affected and un-affected areas. Be sure to average multiple paired yield measurements to account for natural field variability.

It is recommended that producers have a clear agreement with contractors before construction begins. The agreement should outline construction particulars, and describe compensation for crop loss and responsibility for mitigating impacts. Producers should keep records of discussions with representatives of the construction companies. According to State Statutes the WDATCP is required to prepare an Agricultural Impact Statement when the potential for the exercise of eminent domain powers would result in the acquisition of more than five acres. These documents often contain the practices that the company will use to manage post-construction compaction.

UW-Extension/Madison Plant Disease Diagnostic Clinic (PDDC) Update

Brian Hudelson, Ann Joy, Amy Gibbs, and Brooke Weber, Plant Disease Diagnostics Clinic

The PDDC receives samples of many plant samples from around the state. The following diseases/disorders have been identified at the PDDC since January 1, 2009:

PLANT/SAMPLE TYPE	DISEASE/DISORDER	PATHOGEN	COUNTY
FRUITS			
Apple	Phomopsis Canker	*Phomopsis* sp.	Walworth
SOILS			
Alfalfa Soil	Aphanomyes Seedling Blight/Root Rot	*Aphanomyces euteiches* race 2	Jefferson
Alfalfa Soil	Phytophthora Seedling Blight/Root Rot	*Phytophthora medicaginis*	Jefferson
VEGETABLES			
Carrot	Black Rot	*Alternaria radacina*	Dane
	Fusarium Dry Rot	*Fusarium* sp.	Dane
Tomato	Root Rot	*Pythium* sp.	Waushara
	Salt Injury	None (High soluble salts in soil)	Dane

For additional information on plant diseases and their control, visit the PDDC website at pddc.wisc.edu.