WINTER SURVIVAL - WHERE ARE WE?

There has been a quite a few questions the last few weeks asking "How is my winter wheat – will it survive?" Honestly, I couldn't tell you unless we checked the field and pulled some samples. That may not provide the final answer as the tests may respond differently than when winter wheat actually breaks dormancy in the field as the environmental conditions between now and then can have a big impact. Samples of Jerry and Overland pulled near Mandan, ND, on Friday, January 20, 2012 indicated most plants are alive, based on bag test results. For instructions on how to do your own bag test, visit: **www.wintercereals.us**

The big concern currently is that we just went through a very cold week with little if any snow-cover on many of the winter wheat fields across the northern Great Plains states. Air temperatures approaching -20° F were common across the northern tier of counties in North Dakota. Thirteen degrees F (13°) was the lowest soil temperature reading at the 1.5-inch soil depth in wheat stubble at the NDSU Farm Monitor locations (Cass, Stutstman and Golden Valley counties) on the morning of Jan. 20, 2012 in the short stubble.

Looking at NDAWN 4-inch soil depth temperatures at various locations indicates temperatures on bare soil sites to be as low as 2° F in northern North Dakota and 10° to 15° F in the central and southern part of the state on the morning of the 19th. The 4" soil depth temperature would be slightly warmer than the crown depth temperature. Crown depth soil temperatures below 0° F have been reported in some northern North Dakota locations.

Injury can occur between 10° F above to 10° F below depending on the variety winter hardiness and other factors. Other factors affecting survival are length of exposure of the crown to low temperatures, soil moisture and plant condition, stage of growth with 3-leaf better than 1-leaf (larger crown), surface and standing residue and snow cover, that impact soil temperature and moisture. Stage of growth is mainly affected by seeding date, seeding depth, phosphate starter fertilizer and moisture for germination and growth.

COLD ACCLIMATION AND VERNALIZATION

(*Source: UMN, MI-08421 - 2006 - Winter Wheat in Minnesota)*

Winter wheat undergoes two important physiological changes in the fall when the plants are exposed to cooler growing conditions, namely cold acclimation and vernalization. Cold acclimation is needed to induce the winter hardiness that allows the plant to survive the freezing temperatures during the winter months. Vernalization enables reproductive growth and allows winter wheat to reach flowering earlier the next summer. Both vernalization and cold acclimation require a period of growth when temperatures are between 30° and 60°F, with near 40°F being optimum. The period needed for vernalization differs among winter wheat varieties. Likewise, the winter hardiness differs among winter wheat varieties. The most winter hardy varieties can withstand crown temperatures as low as -15°F for a short period of time (Table 1).

TABLE 1

Temperature (ºF)	Maximum Length (days)
27	150
5	6
-15	0.5
-20	0

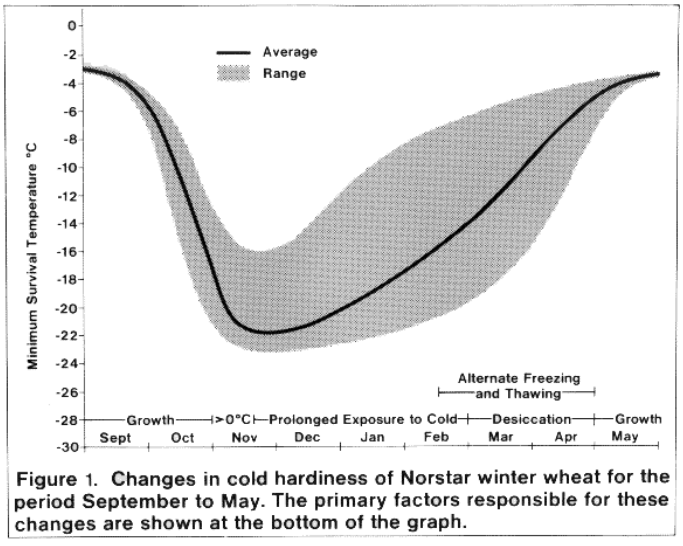

Figure 1. Changes in cold hardiness of Norstar winter wheat for the period September to May. The primary factors responsible for these changes are shown at the bottom of the graph.

Winter hardiness is not a static condition. Canadian research has demonstrated that winter hardiness follows a bell shape curve in which hardiness increases during the fall, peaks between December and February, and decreases in early spring (Figure 1). The loss of hardiness is hastened by factors such as a mid-winter thaw, alternate freezing and thawing, frost heaving, desiccation, suffocation (due to ice sheeting), and rain. (Source: Winter Wheat Production in North Dakota NDSU Extension Service) - (Figure 1. source: Dr. Brian Fowler. Winter Wheat Production Manual. Crop Development Centre, University of Saskatchewan, Saskatoon, Canada)

During the calendar winter (Dec. 22 to Mar. 20), prolonged periods of cold weather increase the potential for low temperature damage to winter wheat. In the absence of a protective snow cover, the soil gradually loses its ability to buffer the effects of low air temperatures and winterkill occurs when soil temperatures fall below the minimum crown survival temperature for winter wheat. Fowler, CA

MID-WINTER DORMANCY BREAK

The warm temperatures in late December and early January had many growers and agronomists concerned about winter wheat prematurely breaking dormancy. We have unconfirmed reports from central South Dakota and very southwestern North Dakota that some fields had broken dormancy. The fields we checked in central and northern North Dakota had not. The following is taken from a release by Jim Shroyer, KSU Extension Agronomy State Leader, January 11, 2012.

An occasional period of 1 to 3 days where nighttime temperatures do not get below freezing will not cause any significant loss of winter hardiness. But if nighttime temperatures consistently stay above freezing for a week or so, there will be some loss of winter hardiness.

The process of gaining and losing winter hardiness in winter wheat is a gradual one. Temperatures fluctuate most years as winter begins and ends, and the winter hardiness level of wheat tends to ratchet up and down with the temperatures. After a warm spell in winter, wheat will lose some winter hardiness - but wheat will regain its winter hardiness as temperatures get cold again. Every time this happens, however, the wheat will lose some winter hardiness. The peak level of winter hardiness in wheat occurs when temperatures get cold and stay cold all winter. Wheat that greens up and then goes back into dormancy will not have quite the same level of winter hardiness as wheat that remains dormant all winter.

HOW MANY PLANTS ARE NECESSARY?

More often than not, winter kill is not uniformly distributed across the field but occurs in patches throughout the field. If smaller patches have stands of 8 plants/ft² leave the whole stand. If large areas are lost, consider destroying the winter wheat and planting spring wheat in those areas. Avoid inter-seeding winter wheat and spring wheat as this creates a mixture of contrasting wheat classes which can result in marketing problems. UMN Bulletin

The target field plant population needed to optimize yields under the variable climatic conditions of the region should be about 17 plants/ft². Our data show that winter wheat yields are reduced progressively as plant populations decreased below 11 plants/ft². Winter wheat grown in the Northern Plains region has a relatively short period of time for tillering to occur. Optimum grain yields in the 40 to 50 bu/a range cannot be obtained unless the number of head-producing tillers reaches or exceeds at least 37/ft². In order for the population of head-producing tillers to reach 37 heads/ft², the plant population must be greater than 9.3 plant/ft². Of the three components of yield, number of heads per unit area, kernels per head, and kernel weight, the dominant yield component is number of heads per unit area until a head population of 3 ft² is exceeded. USDA ARS Mandan, ND

Table 2 indicates the percentage yield one can expect at various plant populations from the research conducted at Mandan, ND. This data showed that stands as low as 5 plants/ft² can produce close to 70% of the maximum yield.

University of Illinois agronomist, Emerson Nafziger, considers an adequate stand to be one that will produce enough tillers to result in 60 or more heads per square foot. The University of Wisconsin (UW) recommends a minimum of 12 to 15 live plants per square foot as a cutoff, or around 50 percent stand.

Blake Vander Vorst, DU agronomist, suggests that if you have eight (8) winter wheat plants/*ft²* across the field with as low as five (5) plants/*ft²* in small patches, the stand can be managed to produce a profitable yield. The producer will need to apply nitrogen early to enhance tillering, and pay close attention to weed management in the thin stand. Winter wheat has the ability to produce more productive tillers than spring wheat.

TABLE 2

Surviving Plants/ft 2	*Yield Bu/Ac*	*Yield % of Max*
2	15	33
3	21	46
4	26	58
5	31	68
6	34	76
7	37	83
8	40	88
9	42	92
10	43	95
11	44	97
12	44	99
13	45	99
14	45	100
15	45	100
16	45	100
17	45	100
18	45	100
19	45	100
20	46	100

SPRING MANAGEMENT OF DAMAGED WINTER WHEAT STANDS

Make the first spring nitrogen application as soon as the winter wheat breaks dormancy or as soon as the soil is no longer frozen to enhance tillering. If you have applied a substantial portion of your nitrogen in the fall at seeding or before the soil was frozen, 25 pounds of nitrogen is adequate to stimulate tillering. The key is to get some nitrogen on as soon as possible to increase the tiller numbers if stand loss and injury has occurred.

The UW recommendation is: *To enhance a thin stand, make the first spring nitrogen application at the onset of tillering to boost the number of tillers and potential number of heads. If stands are adequate (18 plants or more/ft² per row), 25 pounds of N should do the trick. If they're poor, apply 50 pounds to increase tillering. Research indicates that if stem number is greater than 70/ft² it may be beneficial to delay the N application until just prior to jointing. While N is a key component to producing good wheat yields, applying too much can be detrimental to yield. Excessive N encourages excess vegetative growth, which increases the possibility of lodging, making harvest more difficult and also increases disease potential due to a dense canopy.*

Adding a fungicide at the half rate with your herbicide application may also prove to be beneficial to retain the tillers, especially when the winter wheat is seeded in prior crop wheat stubble.