

TECHNICAL NOTES

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FROST DAMAGE ON WINTER WHEAT

Russ Karow, Crops Agent from Oregon State University, has provided the following information about frost damage of winter wheat.

Several factors influence the degree of wheat damage caused by frost, including: 1) the physiological condition of the seedlings at the time the frost occurred, 2) varietal hardiness, and 3) snow cover and soil moisture conditions during the cold period.

Wheat requires temperatures near freezing (32-40 F) for several weeks in order to "harden". Without this hardening period, even the most winter hardy variety can sustain frost damage.

There are significant differences in the level of hardiness genetically built into current varieties. Stephens and Yamhill are least hardy while Daws has shown the greatest hardiness. Relative hardiness ratings are given below for several cultivars (1 = poor, 10 = good).

<u>VARIETY</u>	<u>RATING</u>	<u>VARIETY</u>	<u>RATING</u>
HILL 81	7	DAWS	8
STEPHENS	3	NUGAINES	7
HYSLOP	4	CREW	5
YAMHILL	3	FARO	5
LEWJAIN	5	JACMAR	7
		TYEE	5

Snow cover and soil moisture also play a significant role in frost damage prevention or enhancement. A good snow cover over hardened plants allows survival to -40 to -45 F while the same plants without a protective snow blanket will survive only to -20 to -25 F. Hardened plants in dry soil are more likely to be damaged than those in moist soil. Plants in high moisture soil are susceptible to damage but are slow to show injury symptoms on thawing.

Injury in wheat progresses from older to younger leaves. The crown and meristems are most hardy. Sugars and water-soluble proteins are in highest concentrations in these younger tissues and act as antifreeze.

If a grower believes his grain has been damaged and would like to check for damage right after the frost rather than waiting for spring, the following "rag doll" test can be used.

- 1) Collect whole plants from representative parts of the field or collect samples as you walk diagonally across the field. Use a shovel or trowel to dig the plants in order to reduce damage to roots. Be sure to collect enough plants to properly assess the degree of damage - ten plants would be a bare minimum.
- 2) Carefully wash the roots free of soil. Remove dead leaves. Be careful not to damage the crown or tillers during this process.
- 3) Lay the roots of several plants on a piece of moist paper towel (Fig. 1), then carefully roll the towel into a cylinder (a "rag doll"). Green leaves, if there are any, can stick out the top. Place the bottom end of the towel in a glass and add water (Fig. 2). The roots can be kept moist by adding water to the glass as needed. The roots must not dry out.
- 4) Place the glass in a warm room (60 - 65 F) in dim or indirect light. If the plants are alive, new leaves should appear on the main stem and/or tillers within 4-7 days.

Only part of the plant may be damaged. One or more of the tillers may be dead, but the main stem may still be alive. All above ground tissue may be dead, but new leaves may appear from the crown. If plants are alive, reseeding is probably not necessary.

When there is high soil moisture, frost heaving may also become a problem if intermittent thaws occur. Heaving can lead to root breakage which harms the plant directly and also allows ready access for disease organisms. Fields that show heaving should be carefully watched for diseases - *Cephalosporium* strips, in particular, can be a problem.

Another method of checking for frost damage of wheat is to check the older tillers. Tillers that have been damaged will develop a brown ring where they are attached to the rest of the wheat plant. When the frost damage is severe enough that a brown ring is formed, that tiller may be aborted. This will cause a loss in yield. If all or most of the tillers show the brown ring, then the plants should once again be checked with the "rag doll" test to determine if the field should be reseeded.