

Tips and Tools for Assessing Freeze Injury in Wheat

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Do Not Be Discouraged About Freeze Injury Assessment in Small Grains

If you are reading this document then you most likely are dealing with a potential or obvious freeze injury situation for wheat for grain or wheat and other small grains to be used for forage. We want to assure you that even experienced professionals may never be completely comfortable with assessing small grains for injury. There is some guesswork involved, and sometimes this process drives us nuts!

With many years of experience, after walking into dozens and dozens of fields, assessing hundreds of samples brought to us for evaluation, and splitting thousands of stems to assess the growing point, we still learn something new for just about every freeze we encounter in Texas wheat and other small grains.

Our companion Texas A&M AgriLife Extension publication "Wheat Freeze Injury in Texas" (Neely, Trostle, & Welch, 2014) summarizes many of the most common freeze injury symptoms and questions you will encounter in assessing small grain field for freeze injury. This document (available at <http://wheatfreezeinjury.tamu.edu>) replaces the older 'Freeze Injury on Wheat' which was derived from Kansas State University's seminal "Spring Freeze Injury in Kansas Wheat" (<http://www.ksre.ksu.edu/bookstore/pubs/c646.pdf>).

As we describe different symptoms and their implications for the assessment of wheat freeze injury, Texas A&M AgriLife Extension's years of assessment have generally concluded the following: **"Wheat freeze injury is usually never as bad as it looks."** Yes, sometimes it is indeed pretty bad and rarely worse than we first thought. But given time, we get a better assessment of the condition of the growing points, the growth and compensation of additional tillers (especially if the freeze is relatively early) and the overall recovery of the wheat. Sometimes producers indeed act too soon in terminating a wheat crop that has suffered moderate or apparent freeze injury.

In assessing wheat freeze injury, with all its uncertainties, we have learned to value greatly the opportunity to re-assess the same location in a field about one week later.

- Was our first assessment relatively accurate?
- Is there another symptom that is showing up?
- What evidence do we see that the injury indeed may not be as pronounced as feared?

These re-assessments are very helpful and will give anyone confidence when you return to the same spot in the field you did the first time. And usually there is time for these follow-up assessments unless an immediate decision is at hand such as swathing for hay just before a bearded wheat crop may head out, or you were ready to apply more irrigation, or spray for disease control.

In addition to this document, we organized <http://wheatfreezeinjury.tamu.edu> in 2013 with additional resources to support you in your needed assessment of freeze injury on wheat and other small grains.

For additional pictures with a description of wheat freeze injury symptoms, see “Wheat Freeze Injury Picture Library” at <http://wheatfreezeinjury.tamu.edu> (to be posted late April, 2014).

Freeze Injury Assessment—Helpful Strategies

Here are some tips to help you improve your accuracy of assessment and better ensure representative sampling.

- 1) How quickly specific symptoms from freeze injury develop will depend on the part of the wheat plant and the severity of the potential freeze. Immediate symptoms may include a dark water-soaked appearance on the foliage (damage) which might be accompanied by frozen ‘silage’ smell in the field (damaged foliage). Small developing kernels of grain can shrivel quickly. In contrast, determining if a growing point is dead or if the most recently emerged leaf from the whorl is dead may take a week for the brown color to develop (necrotic, or dead tissue). Most qualitative freeze assessments require about a week after the initial freeze to assess the potential impact.
- 2) The first time you try to evaluate a wheat crop for freeze injury is the hardest. Have someone with you who has done this before. Cutting a stem to check for freeze injury to the growing point looks easy, but don’t just watch others do it. Do it yourself! When conducting freeze assessment clinics or assessing an individual field or specific sample with a producer, we insist you make the cuts also. Then it will be easier to do on your own.
- 3) Sample low areas of the field first. Normally, if there is not damage there, then mid-elevation and higher areas of the field are no worse. This may not be true if it is very windy when exposed areas are just as cold or in fact may be more subject to freezing conditions, or prolonged windy conditions circulate cold air further into the canopy.
- 4) Be patient. This could keep you from doing something you shouldn’t (give up on wheat). It may take up to an hour to assess an individual field accurately for a possible decision on haying, allowing the field to continue, etc. And this is after waiting 7 days or so to make initial assessments. Sometimes you may never know what the outcome was on a field, but consider returning to the same point in selected fields after 7 days to evaluate the progress of potential wheat recovery.

- 5) When examining plants there will often be small tillers that trail the main crop by up to two weeks. They will be small and many inches shorter, 50% or less than the size of the main tillers. You may discount these small stems as they have little to no significant yield potential. In the case of late freezes and especially repeated freezes these small tiller may become important (if the production season is prolonged), but they are otherwise not expected to contribute much to grain yield (if at all) thus are generally unharvestable. When you are counting stems to calculate percentages of damaged stems/heads do not include these small stems even if they are not damaged by the freeze.
- 6) When selecting stems or heads to evaluate for freeze injury a representative sample is important. One means to select random stems for examination of growing points, latest emerged flag leaf, head (e.g., for your count of 20 stems noted above) is to place your hands into the wheat canopy and “let your fingers do the walking” down the row (easier) or across rows. Take every fifth stem for assessment as you count through the canopy (but do not include very small tillers (#5)). This is one way to potentially minimize visual bias in selecting stems for assessment, counting, or splitting.
- 7) When you need to examine a wheat crop, especially in the stem or growing point for damage (a visual assessment without cutting the stem won't do), you may pull a clump of many plants all grouped together. They are bound together by soil and roots. Gently sort out these plants until you find that you have perhaps 4 to 6 plants in that one clump. For an individual plant select the largest stem (there is sometimes two or three that are about the same size, usually the main stem and 1 or 2 tillers that emerged about a month later). Observe for any stems where the most recently emerged leaf is dead. There is no need to assess those stems further. If the leaf is light green or yellow the growing point may be dead, but it will take another week to generate a dead leaf in the whorl. Pick a larger stem and assess the growing point by cutting.
- 8) To find the growing point, find the node on the stem that is visible, then using your thumb and forefinger, run up the stem feeling other node(s) underneath the surface of the stem. (it will feel like a bee-bee inside the stem) then initiate a cut from below the topmost stem toward the growing point (node) and on further up the plant until you are past the growing point (cut from the base of the plant upward. If this older stem is OK, then younger stems probably are, too (but check a few).
- 9) If you find a stem that has a dead emerged leaf that individual stem will not grow any more, limiting not only grain but also forage production from that stem. If an emerged leaf is dead, there is no need to but the stem to find the growing point (unless you simply wish to confirm)—it is dead. Other stems that remain undamaged on the plant will likely compensate for vegetative growth and grain.
- 10) A quick count in a specific site in the field can include as little as 20 stems, randomly selected. If you have 90 or 95% good (each stem = 5%), or 30 or 35% bad, then you get a pretty good initial picture of the surrounding area. But verify further as needed. The harder calls are the fields that initially appear to have 20 to 60% damage as you have to assess more samples to ensure you have a more accurate general picture of the condition of the field area you are in.
- 11) If you have many samples from different fields to assess and you need to cut the stems, take the plants somewhere (e.g., pickup tail gate, garage) where you have good light and can work quickly. When you may need to cut a hundred stems practice and experience should allow you to cut at least two stems and assess them every minute.

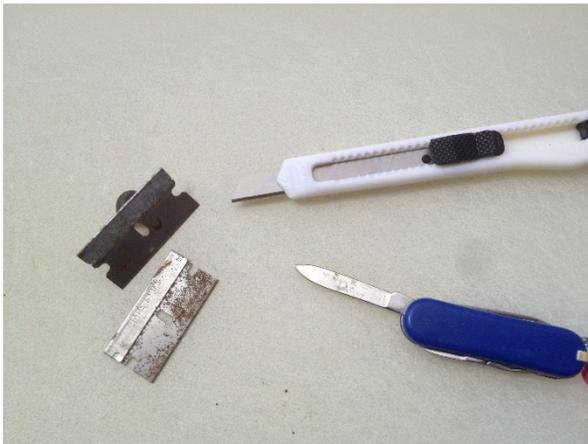
- 12) Remember that tillers that die will not grow anymore (#7 & 8). The most confused I (Trostle) have ever been in assessing wheat samples was in April 17, 2013 when I was faced with numerous plants in Lynn Co., Texas where many growing points on smaller stems were dead, easily recognized because the last emerged leaf on numerous stems were dead. This did not make sense as we know that older stems (usually they are the biggest) are more advanced in growth stage, more susceptible to freeze injury (higher on the plant, approaching heading, etc.). After looking at many samples I concluded that these smaller tillers had died in an earlier freeze (most likely March 25, 2013).
- 13) Conflicting symptoms—jointing and later: Russian wheat aphid is very injurious to wheat, at much lower numbers than greenbugs, due to the toxicity of the injected toxin. White striping on leaves, sometimes white and purplish leaf sheaths are not related to freeze. If you look at fields, note aphid presence. Have they been sprayed? RWA tend to feed often above the collar on the leaf blade, and the leaf blade curls or rolls up around them for protection.

Freeze Injury Assessment—Helpful Tools

A few simple items can enhance your ability to accurately assess freeze injury:

- Razor blade, exacto knife, or small pocket knife with a sharp blade (Fig. 1A). When cutting stems to find the growing point, always cut away from your fingers, etc. Also, slicing stems works best when you cut from the base of the stem through the node and growing point into to the leafy portion of the upper stem.

1A



1B



Fig. 1A & 1B. Helpful tools for wheat freeze injury assessment. A) Cutting: Razor blades or exacto knife (both preferred due to much sharper edges for fine, clean cuts) or small, sharp pocket knife. B) Magnification: various hand lenses or a pocket 'credit card' magnifying strip.

- Hand lens, magnifying glass, etc. (Fig. 1b). Use anything to help you magnify the floral structures more closely, and also the growing point when it is small or you are trying to determine the color (white vs. tan or brown).

- Digital camera. This is especially helpful to record pictures of the field down to small growing points. Newer smart phones can take surprisingly focused and up-close images of something as small as a growing point from ~6" away. These can be shared quickly with others via messaging or e-mail to help verify assessment. A series of four shots from field scale to the size of your living room to about 1 yard square to up-close pics of a small group of plants are often helpful for others you may send the pics to in having a feel for your field conditions.
- Wood block, thick cardboard, or soft plastic slab. This is to lay the plants on when you slice stems, especially if you have dozens or more to cut and quickly. You can firmly hold the stem in place and make a swift cut on a firm base. You will make better cuts this way.
- Your reading glasses if you use them.
- A bright light if you are assessing large numbers of samples gathered from the field.
- Brightly colored wire flags. Place these in the field in a particular spot where you collected samples for freeze injury assessment. You can return to the exact same spot a week later for follow-up assessment.
- Magic marker. If you may need to return to the same spot in a field, you can mark individual plants or heads to look at them again to see if they grew out of the initial symptoms, e.g. a head that you were suspect about is or is not setting grain.
- Notebook. A place to write down field observations especially information like counts of percent damaged heads, which you may re-assess later.

For further wheat freeze information consult <http://wheatfreezeinjury.tamu.edu> or more general Texas wheat production information at <http://varietytesting.tamu.edu/wheat/index.htm>

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