

What about winterkill?

Dr. Jeff Edwards, Extension Small Grains

The recent cold snap has put winterkill on the forefront of issues facing Oklahoma wheat farmers. Naturally the extent of damage will vary by region and crop health, but we can discuss some generalities regarding winterkill of small grains.

What causes winterkill?

One of the best references I could find on this subject was an Agronomy Journal article written by Kansas State University professor S.C. Salmon in 1917. Dr. Salmon proposed that probable causes for winterkill could easily be divided into four groupings 1.) heaving from freeze/thaw action of the soil, 2.) smothering from standing water or heavy snow, 3.) physiological drought, and 4.) direct effect of low temperature on plant tissue and protoplasm. Due to our lack of soil moisture and snow cover, any winterkill resulting from the recent cold temperatures will likely be categorized under groups 3 or 4. Therefore, let's discuss these topics further.

Cold weather and drought stress

Just as the low humidity and cold temperatures increase the evaporative demand on your skin and cause dry skin, these environmental conditions also increase the evaporative demand of the plants. When extremely cold conditions occur, the increased evaporative demand can be accompanied by the freezing of plant-available water in the rooting zone and freezing of plant xylary tissue. This situation would be comparable to the water pipes in your house freezing (xylary tissue) at the same time as your well freezing up (plant-available soil moisture).

The plant is still intercepting light

Without getting too technical, it is important to remember that the plant is still intercepting light during cold temperatures, and this light is still providing the energy requirements for photosynthesis. The problem here is that if plants are drought stressed, then plant stomata are likely closed and carbon dioxide is not entering the plant. So, there is a lot of energy available, but nowhere to use it. This is a bad situation for the plant tissue and can result in severe damage or tissue death.



Drought stress may not be all bad

The higher the concentration of solutes in the plant cells, the lower the freezing temperature of the cell's protoplasm or "fluid contents". If we have mild to moderate drought then sugars produced during photosynthesis and other solutes have less fluid to be contained in within the plant. Think of this in terms of antifreeze in your car radiator. Antifreeze works because the solutes contained within the antifreeze

lower its freezing point below that of water. If you have a higher ratio of antifreeze to water in your car's radiator, the freezing point will be lowered (i.e. you will be better protected against low temperatures). Finally, it has been shown that a small degree of drought stress improves plant hardening off and can be equivalent to temperature-based hardening off.

Damage vs. recovery

Even though aboveground plant tissue may be destroyed, this does not mean that the plant is dead. I have personally witnessed complete tissue desiccation of wheat plants, followed by complete recovery with minimal yield impact. Environmental conditions must be favorable for this to happen, though, and sufficient root reserves of carbohydrates must exist for the plant to be able to regenerate the aboveground tissue. For small wheat that has little aboveground growth, seed reserves will likely have to be the source of carbohydrate reserves for re-growth, so larger seed of good vigor would be beneficial in this situation. You may think of the ability to regenerate plant tissue after a freeze as being comparable to deep pockets in a farming operation and how sufficient financial reserves affect the ability to recover from a bad crop year.

Wait and see

This may seem like a way of avoiding the question, but the best recommendation right now is to wait and see. There are likely no critical decisions regarding your wheat crop that must be made at this time. It is likely that we will be able to fully assess the extent of winterkill prior to having to pull the trigger on top-dress nitrogen and other crop inputs. I am wagering that the majority of our wheat that had a good root system survived the recent cold snaps with little damage. My bigger concern right now is the overall lack of moisture, but that is another article.

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