

## Wheat Freeze Damage

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**April 17, 2013** – With the recent freeze in the Panhandle, South Plains and Rolling Plains, many producers are anxious to examine wheat fields for damage. However, symptoms generally take five to seven days to appear on wheat plants. The length of time varies somewhat with weather, but the warmer temperatures earlier this week has accelerated wheat growth enough that symptoms should be present by now. When scouting for damage, freeze impact is usually more severe in low-lying areas where cold air settles on still nights. However, the high winds accompanying last week's freeze helped to mix air and keep temperatures more uniform. Therefore, expect to see more uniform damage across fields. Wind also pushes air further into the wheat canopy and reduces its insulating effect against the cold, which may result in greater damage.

### Wheat Susceptibility

Due to the dry conditions in the fall followed by a general rain in late December, the maturity of the wheat varies by as much as two months. At the time of the April freeze, maturity ranged from mid-jointing to flowering—sometimes within the same field. Much of the wheat in the South Plains is in the boot stage with some fields just beginning to flower. Wheat in the Panhandle is farther behind (mid-jointing), but still far enough along that damage is a real possibility. Even though temperatures in the Rolling Plains were not as severe, much of the wheat was flowering and at the most vulnerable stage of development.

Tolerance to cold decreases as the developing head or spike moves from below the soil surface into and then above the crop canopy. The growing point begins 1-1.5" below the soil surface until the vernalization requirement is met. Once enough chilling hours have occurred, winter wheat will change from the vegetative to the reproductive stage and push the growing point above the soil surface. Wheat is typically resistant to freeze damage down to 5-12°F while in the late fall and winter; however, it becomes more sensitive as it begins to joint (22°) and moves through the boot (28°), heading (30°), and flowering (32°) stages. These temperatures normally stipulate a duration of about two hours of exposure to inflict significant injury. Temperatures were consistently in the low to mid-20s well south of Lubbock with lows in the upper teens in the North Plains. Mid-teens were even recorded in the northern counties of the Panhandle and temperatures remained below freezing over much of the Rolling Plains. Given the stage of wheat in these areas, temperatures were low enough to inflict substantial damage.

### Freeze Damage Symptoms

Depending on the maturity stage and temperature, freeze damage can occur to leaves, stems, heads or growing points. Leaf damage may appear devastating as damaged leaves turn yellow or necrotic over time, but leaf damage alone generally has limited impact on yield unless



**Yellowing in wheat fields indicates foliar freeze damage near Munday, TX from the freeze in late March. Closer inspection of the growing point is required to assess potential economic damage. (Courtesy Gaylon Morgan)**

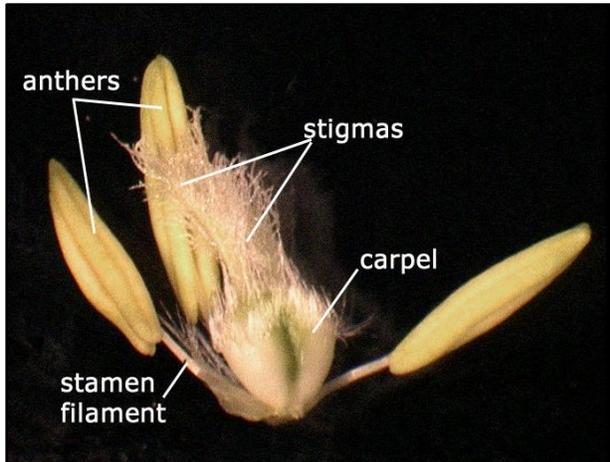


**Freeze damage to the stem is evident by the brown area below the internode. Stem damage decreases water and nutrient transport through the stem and increases risk of lodging. (Courtesy Calvin Trostle)**

flag leaves are injured. Stem damage can be exhibited as whitish to light brown rings around the stem or stem splitting. Whitish rings form around the stem where water accumulates and expands as it freezes, which ruptures cells. Damaged cells can inhibit water and nutrient transport up the stem and creates a weak spot. This type of stem damage will result in wilting, lodging or poor grain fill. Vertical splits in the stem can occur with freeze damage, and though it should not impact water and nutrient transport, it can increase susceptibility to lodging and provides a site for disease infection.

Damage to heads and growing points can be the most devastating to a wheat crop. Sometimes damage is evident by partial or complete whitening of seed heads, but in some cases, male and female flower parts may be injured without any obvious outward symptoms on the seed head. White awns will sometimes result from freeze injury. Although this will not directly influence yields, it is a good indicator that flowering parts need to be closely inspected. Prior to pollination, anthers (male flowering parts) should appear green and plump in appearance. Damaged anthers will look shriveled or misshapen and pale green or white in color.

Anthers normally turn yellow at pollination and they are expelled from the floret once pollination has occurred in healthy plants; however, anthers remain inside florets if damaged. Healthy stigmas (female flower parts) have a white feathery appearance. Upon fertilization, the developing seed has a plump, green appearance and a deep groove (crease) down its center. Similar to anthers, damaged stigmas and developing seed will appear shriveled and discolored. It is important to check flowering parts on the entire length of seed heads. Seed heads begin flowering in the center and proceed upwards and downwards on the seed head over the course of two to four days. Therefore, portions of the seed head may sustain injury while the ends or center remain unharmed.



Healthy male (anthers and stamen filament) and female (stigmas and carpel) flower parts of wheat should appear as shown above. Freeze damaged flower parts will appear withered with a bleached or brown coloration.



This seed head was killed by freeze damage and will not emerge from the boot stage or produce grain. (Courtesy Gaylon Morgan)

Growing points are critical for plant growth. Prior to jointing, growing points remain at or below the soil surface and are less susceptible to freeze damage. Once jointing initiates, growing points become more susceptible as they are elevated above the soil surface. Damaged growing points will turn yellow or brown and can be viewed by splitting the stem lengthwise. A dead growing point will terminate tiller growth and is evident by yellowing of the leaf exerting from the whorl or failure of seed heads to emerge from the boot stage.

### Yield Impacts

Freeze injury to leaves alone should not have a great impact on yield, unless flag leaves are damaged. Stem damage impact on yield is less predictable. Depending on severity and subsequent weather, wheat can sometimes repair damaged cells and reduce impact on yield; however, hot, dry weather decreases chances of recovery. If damage to primary tiller stems or growing points is severe, but occurs early on, wheat can divert resources to secondary tillers and compensate yield loss from main tillers to a limited extent. Likewise, partially damaged wheat heads can compensate for lost spikelets by producing



An example of a healthy growing point on the left and a freeze damaged growing point on the right. A tiller with a damaged growing point will cease growing and not produce a seed head. (Courtesy Calvin Trostle)

more seeds in remaining spikelets and larger grain size. It is important to note that compensatory growth and yield is greatly impacted by the weather. Cooler, wetter weather will generally facilitate wheat recovery after a freeze event. Additional subfreezing temperatures predicted later in the week may have further implication for the Texas wheat crop in the High Plains. For further information on identifying freeze damage of wheat refer to the Texas A&M AgriLife Extension Service publication SCS-1999-15 at <http://varietytesting.tamu.edu/wheat/docs/mime-4.pdf> .