

# Potential Causes of Yellowing During the Tillering Stage of Wheat in Texas

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Yellowing (chlorosis) of wheat leaves in Texas is a problematic symptom during winter and early spring. The difficulty in addressing chlorosis appropriately, is that it can be caused by nutrient deficiency, herbicide injury, freeze damage, moisture stress, disease and insect issues—or any combination thereof. If yellowing is occurring in your field, you can use the factors listed below to evaluate your crop, determine the potential cause(s) of the symptom, and select an appropriate management strategy.

## Nutrient deficiency

### *Yellowing in the older leaves without interveinal chlorosis: N deficiency*

Where a nutrient deficiency symptom appears depends on plant nutrient mobility. Nutrient demand is greatest in the part of the wheat plant that is actively growing. As the plant grows, it will translocate mobile nutrients from older growth to the actively growing region. Therefore, nutrient deficiency symptoms of mobile nutrients such as nitrogen (N) appear

in the older leaves first. With N deficiency, yellowing starts from the tip of the lower (older) leaves progressing to the base of the leaf without interveinal chlorosis (Fig. 1). Nitrogen deficiency often occurs in water-logged conditions. Although it is rarely found in Texas, molybdenum (Mo) and manganese (Mn) deficiency symptoms also show chlorosis in older leaves. Nitrogen deficiency is a common nutrient deficiency symptom in the Rolling Plains, High Plains, and in west Texas, especially in wheat planted after cotton.



Figure 1. Healthy wheat (left) and nitrogen deficiency symptom in wheat (right) (Photo courtesy of CIMMYT)

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### **Yellowing of younger leaves without interveinal chlorosis: S deficiency**

Sulfur (S) emissions from coal-fired electric power plants have been reduced dramatically, leading to lower deposition of S on agricultural lands by rain or snow. This reduction creates a greater need for soil-applied S to meet plant demand.

Sulfur is an important constituent of S proteins in plants. We may see increased S deficiency symptoms in the Rolling Plains because sandy, low-organic-matter soils accelerate the development of S deficiency in wheat. Unlike N, S does not move within a plant. Once the nutrient is transported from the soil through the plant's root system, S will remain where it was initially assimilated. As a result, chlorosis starts in the emerging and young leaves (Fig. 2).

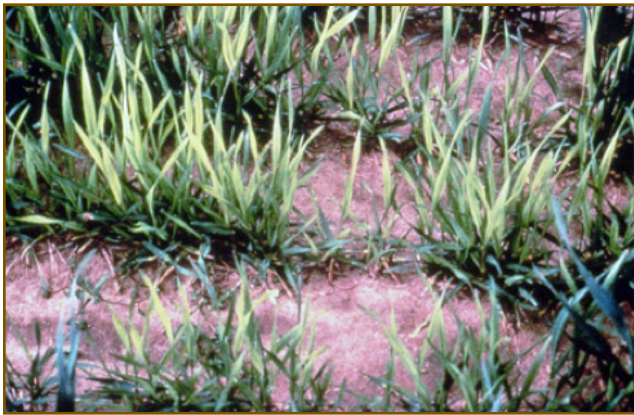


Figure 2. Sulfur deficiency symptom in wheat (Photo courtesy of UNL Extension)

### **Yellowing in the younger leaves with interveinal chlorosis: Fe deficiency**

Iron (Fe) is also an immobile nutrient; however, it can be distinguished from S deficiency symptom by the unique pattern of chlorosis. This shows up as green and yellow striping between the veins (interveinal chlorosis) (Fig. 3). Iron deficiency is most common on highly alkaline soils (pH 7.5-8.2), recently limed soil, or soil high in P, Cu, Mn, and Zn.



Figure 3. Iron deficiency symptom in wheat (Photo courtesy of CIMMY)

## **Herbicide injury**

Interveinal chlorosis may also be caused by damage from group B herbicides, which include the sulfonylureas (SUs), sulfonamides, imidazolinones (IMIs), and triazo-lopymidine. Refer to your spray records to check the rate and timing of herbicide applications made in the field. Also, observe if the yellowing in the field occurs in streaks that could be attributed to spray patterns. Herbicide damaged wheat may recover depending upon the severity. Tank contamination by other herbicides such as Roundup (glyphosate) can cause chlorosis of the entire plant, often accompanied by necrotic tips and leaf death (Fig. 4).



Figure 4. Glyphosate injury (Photo courtesy of Texas A&M AgriLife Extension)

## **Liquid fertilizer burn**

Top dressing a liquid fertilizer, such as urea-ammonium-nitrate (UAN, 32-0-0) can yellow leaves higher up in the canopy (Fig. 5). Leaf burn may increase with an application rate greater than 50 pounds of actual N per acre and air temperature greater than 60 °F. In general, leaf burn caused by UAN foliar application has little effect on grain yield; however, the weakened stand may be susceptible to disease, insect, and freeze injury.



Figure 5. Fertilizer burn in wheat (Photo courtesy of Texas A&M AgriLife Extension)

## Freeze injury

A sudden drop in temperature can cause leaf burn. This yellowing may be more concentrated in the low areas of a field where cold settles when there is no air movement (Fig. 6). Freeze injury during the tillering stage has little effect on final grain yield. Wheat can recover from freeze injury by developing new leaves from the growing point assuming it was not damaged during tillering or jointing. However,



Figure 6. Freeze injury in wheat (Photo courtesy of Texas A&M AgriLife Extension)

freeze injury after flag leaf formation may decrease yield potential and seed quality. More details on freeze injury in wheat can be found in *Wheat Freeze Injury in Texas* (ESC-026).

## Diseases

There are three viral pathogens that commonly infect wheat in Texas' Rolling and High Plains: Wheat Streak Mosaic Virus (WSMV), Triticum Mosaic Virus (TriMV), and High Plains Virus (HPV), which is more properly referred to as Wheat Mosaic Virus (WMoV). Light green to yellow streaking and mottling appear on the leaf in the spring (Fig. 7). Often, early symptoms are confused for N deficiency and/or water stress. Many producers attempt to rectify the symptoms with fertilizer and irrigation, but the infection prevents the plant from using these. A less common viral disease is Wheat Soilborne Mosaic Virus, which regularly occurs in Oklahoma and may occur in the Rolling Plains. Symptoms are similar to other mosaic viruses and generally appear in early spring as wheat breaks dormancy. It also can show up in wetter, low-yielding areas of a field. In central and South Texas, rust often overwinters and during mild winter, rust pressure can lead to yellow spotting or yellowing leaves.



Figure 7. Rust infestation in wheat (Photo courtesy of Texas A&M AgriLife Extension)

In west Texas, Barley Yellow Dwarf Virus (BYDV) symptoms are often mistaken as leaf yellowing, however it tends to concentrate in parts of the field that are infested with aphids—BYDV also has a characteristic red tint and often black spots from aphid feeding sites on leaves, distinguishing it from other symptoms (Fig. 8). Other diseases and fungi that affect lower leaves and cause yellowing or off coloring include rusts, tan spot, and Septoria leaf blotch. Additionally, older yellow or nutrient deficient leaves can be colonized by fungi that feed on dead



Figure 8. Wheat Streak Mosaic Virus (Photo courtesy of Texas A&M AgriLife Research)

tissue (saprophytic fungi) and are often mistaken for diseases that might require control. If you suspect any of these diseases may be affecting your wheat, Texas A&M AgriLife pathologists can help you diagnose and identify them (<http://amarillo.tamu.edu/amarillo-center-programs/extension-plant-pathology/>).

## Insects

Greenbugs are pale green aphids that are approximately  $\frac{1}{16}$  inch long. Initial damage appears as tiny reddish spots on leaves in fall or spring. Toxins injected by greenbugs during feeding cause yellowing in young leaves and orange-red spots in older leaves; this forms irregularly shaped yellow or reddish-brown patches in the field. Heavily infested wheat will eventually die and create a dead spot from which the infestation radiates. Greenbugs also carry BYDV.

Larvae of the Hessian fly cause stress and leaf discoloration when they feed on the tillers at the base of the wheat plant. Other crown and root feeding insects such as grubs, army cutworm, and the lesser corn borer will cause symptoms in the field. These symptoms, however, are generally in smaller areas

and the insect can be found by inspecting plants and soil in the affected location. As plants die and the stand is reduced, damage caused by insects can be distinguished from symptoms caused by other factors. More details on insect and mite damage can be found in *Managing Insect and Mite Pests of Texas Small Grains* (E-399).

## Other factors to consider

- ◆ **Stage of maturity:** Young plants are more susceptible to all of the causes above because their root systems are less developed. Compare fields that are planted early to fields that are planted later. Fields that are planted earlier typically have better established and more vigorous root systems which take up more nutrients. These plants are likely to be more tolerant to external damage than wheat that is planted later. Has the soil been too dry or too wet? Dig up sample wheat plants to observe root growth.
- ◆ **Field pattern:** Does the field have a streaked yellowing pattern or is the yellowing more sporadic? A streaked pattern may be due to herbicide drift, tank contamination, and/or uneven fertility application—perhaps from a malfunctioning nozzle. If the pattern is sporadic, soil conditions, insects, and/or disease may be causing it. Yellowing that is uniform throughout the field may be caused by nutrient deficiency and/or fertilizer burn.
- ◆ **Moisture stress:** Wheat plants experiencing drought or waterlogged soils cannot take up soil nutrients effectively. Often, these plants have a stunted root system. As a result, the plant cannot “reach” available nutrients. So, while there may be sufficient nutrients in the soil, the plants inability to take them up will appear as nutrient deficiency.

## Summary

Yellowing of wheat leaves can have a variety of causes, such as nutrient deficiency, herbicide injury, liquid fertilizer burn, freeze injury, moisture stress, and disease and insects. It is important to determine the source of the yellowing because some problems must be addressed while others may be temporary. As part of a producer’s ongoing effort to minimize costs, sampling soil for fertility and plant tissue for disease identification can help minimize unnecessary inputs. Weather related damage is beyond the producer’s control; however, establishing a good stand with a healthy root system can minimize injury due to temperature and moisture stress.

## Further information

For additional information on Texas wheat production, consult the following on-line resources:

- ◆ Uniform Variety Trial  
<http://varietytesting.tamu.edu/wheat/index.htm>
- ◆ Wheat publications at Texas AgriLife at Amarillo  
<http://amarillo.tamu.edu/amarillo-center-programs/agronomy/wheat-publications/>
- ◆ Wheat disease publications  
<http://amarillo.tamu.edu/amarillo-center-programs/extension-plant-pathology/wheat-publications/wheat-disease-fact-sheets/>

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