1. Spring applications of growth regulator herbicides in wheat

Over the last couple years we’ve had quite a few questions about 2,4-D and MCPA on wheat in regards to application timing, crop injury, and when you might choose one product over the other. There even seems to be some confusion about whether they are the same chemical.

Although both herbicides have the same mode of action and are chemically similar, they are not the same. 2,4-D has two chlorines attached to the phenoxy ring (2,4-dichlorophenoxy acetic acid), while MCPA (2-methyl-4-chlorophenoxy acetic acid) has one chlorine and one methyl (CH3) group attached to the phenoxy ring.

The difference in the substitution of a methyl group instead of chlorine on the phenoxy ring affects the biological activity and metabolic interactions in plants. Consequently, crops and weeds often respond somewhat differently to the two herbicides. For example, 2,4-D provides good control of Russian thistle, while MCPA is not effective. Both herbicides generally provide good control of most mustard species if applied before plants start to bolt, but neither is effective for control of kochia or wild buckwheat. MCPA is more injurious to corn and sorghum than 2,4-D, and thus is not even labeled for use on those crops.

Both 2,4-D and MCPA can be used on wheat, but have different application guidelines. In general, MCPA is safer on wheat than 2,4-D, especially when applied prior to tillering. We recommend that 2,4-D not be applied to wheat in the fall, or until it is well-tillered in the spring. Application of 2,4-D prior to tillering hinders the tillering process, causes general stunting and can result in significant yield loss.
2,4-D is labeled for application to wheat from the full-tiller stage until prior to boot stage of growth, but is probably safest between full-tiller and jointing stages of growth. Wheat will sometimes exhibit prostrate growth from 2,4-D applications applied in jointing stage of growth, but yields generally are not significantly affected if applied before the boot stage of growth.

MCPA is relatively safe on young wheat and can be applied after the wheat is in the three-leaf stage (may vary by product label) until it reaches the boot stage of growth. Consequently, MCPA would be preferred over 2,4-D if spraying in the fall or anytime before wheat is well-tillered. Neither herbicide should be applied once the wheat is near or reaches the boot stage of growth, as application at that time can result in malformed heads, sterility, and significant yield loss (Figure 2).
Confusion about 2,4-D and MCPA can be further complicated by the fact that each herbicide is available in ester or amine formulations. Ester formulations generally provide a little better weed control than amine formulations at the same application rates, but are more susceptible to vapor drift. Ester formulations generally are compatible for use with fertilizer carriers, while amine formulations often have physical compatibility problems when mixed with liquid fertilizer.

Dicamba products such as Banvel, Clarity, or Sterling Blue are also growth regulator herbicides, but again have different application timing guidelines and weed control spectrums. Dicamba can be applied to wheat between the 2-leaf and jointing stages of wheat. Application of dicamba after wheat reaches the jointing stage of growth causes severe prostrate growth of wheat and significant risk of yield loss. Dicamba is effective for control of kochia, Russian thistle, and wild buckwheat, but is not good for control of mustard species. Kochia, Russian thistle, and wild buckwheat are summer annual weeds that may emerge before or after wheat starts to joint, so timing of dicamba for control of these weeds can sometimes be difficult. Fortunately, dicamba provides some residual control of these weeds following application.

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2. Nutrient deficiency symptoms of wheat in spring

Several fields of wheat around the state are currently showing some off-color symptoms, such as yellowing or browning. Some of this may be due to freeze injury, and some may be due to nutrient deficiencies or toxicities.

The most common nutrient deficiencies on wheat in Kansas at this time of year are nitrogen and phosphorus. The most common nutrient toxicity is aluminum, which is associated with acid soils. Iron chlorosis will also sometimes occur on wheat.

**Nitrogen (N) deficiency**

Severe N deficiency will show up as a yellowing of lower leaves, while emerging leaves are green to pale green. Tillering will be reduced. But N deficiency isn’t always severe, and less severe cases of N deficiency may not be easy to diagnose. Lower leaves may be pale in color, and will die earlier than normal. There may be increased tiller die back. If the nitrogen deficiency is only slight to moderate, the main symptoms may simply be smaller-than-normal heads on primary tillers, or heads on secondary and tertiary tillers that do not fill.

Nitrogen deficiency. Photo courtesy of CIMMYT.
Phosphorus (P) deficiency

Phosphorus deficiency in wheat is hard to diagnose in the field. A soil test or plant analysis is normally needed to verify the diagnosis. The most common symptom of moderate to severe P deficiency is stunted growth or thin stands because of excessive tiller die back by heading time. Wheat that is P deficient will grow more slowly than normal. Although lower leaves and stems are sometimes purplish due to P deficiency, leaf discoloration from P deficiency is often not pronounced in wheat, and may not be seen at all. If P deficiency is only slight to moderate, the only symptoms may be lower yields due to small heads.

Aluminum (Al) toxicity

The most common symptoms of Al toxicity in wheat include stunting and poor tillering. Root growth will also be stunted and brownish in color and the root tips may have a burned appearance. A soil test will be necessary to accurately diagnose Al toxicity. Older leaves may appear drought stressed and withered. Plants will either be stunted throughout the season even with adequate moisture and nitrogen, or may even die.

Aluminum toxicity is directly associated with soil pH and typically begins to occur with soil pH levels of less than 5.0 and KCl-extractable free aluminum levels greater than 25 ppm.
Iron chlorosis

Iron chlorosis is not common on wheat in Kansas, but does occur on certain high-pH, calcareous soils in western Kansas. Newly emerging leaves will have green veins, with yellow striping between the veins. Eventually, the entire leaf may turn yellow or white.
Chloride (Cl) deficiency

The main Cl deficiency symptom is leaf spotting, also known as Physiological Leaf Spot Syndrome. This appears similar to tan spot disease but is not caused by a microorganism. Also, the spots caused by Cl deficiency are typically smaller than those of tan spot, and do not have the characteristic “halo” at the edge of the spot. When soil Cl is less than 30 lbs/acre (0-24” depth) there is a high probability of yield response to Cl fertilization. Wheat response to Cl fertilizer is most often observed where there is no history of KCl use and fungal disease pressure is high. Response to Cl fertilizer is often associated with foliar fungal disease suppression.

Other nutrient deficiencies

There are other nutrient deficiencies that can occur on wheat in Kansas, but not as often as those listed above. Sulfur deficiency can occur on sandy soils with low organic matter, and results in a general yellowing (including younger leaves) and stunting. Sulfur deficiency usually develops in eroded areas of the field first (see picture below). Copper and zinc deficiencies have not been documented in Kansas.
3. Wheat freeze update: Southeast and eastern southcentral Kansas

On a field visit made Monday, April 13, the wheat in Woodson, Coffey, Anderson, and Allen counties and the wheat looked fine. The most advanced wheat found was a field planted Oct. 3 which had one or two nodes, with the growing point on the most advanced tillers above the ground 3-4 inches or so. There was no head or stem damage on this wheat despite temperatures falling to 20 degrees in Leroy the morning of April 7.

Wheat in Sumner County, however, was damaged by the freeze. Southwest of Wellington on Tuesday, April 14, Sumner County Extension agent Johnny Roberts and I found some wheat head damage (around 60-80%) along with some stem damage. Most of the fields did not have the flag leaf fully expanded. As expected, wheat that was planted September or early October, or Overley planted in mid-October, seemed to have the most damage. Later planted wheat had some head damage, but not as severe.

South of Wellington we looked at some Fuller that had the flag leaf expanded on the most advanced tillers. There was about 20-30% head damage on this wheat, but not as much damage as the fields southwest of Wellington. This level of head damage (about 20-40%) seemed to be in the range for most of the rest of the wheat in Sumner County as well.
Gary Cramer, Sedgwick County Extension agent, reported on Wednesday, April 15, that he is seeing similar symptoms (about 20-30% head damage) and some stem damage on some of the wheat in his county.

Freeze injury in Cowley County is similar to the level of injury found in Sumner County. In Cowley County, head damage ranged from 20-50% on early planted wheat with 2-3 joints. There was little to no injury on late-planted wheat.

I stopped at a few fields in Chautauqua County and did not see any damage despite temperatures in the low to mid 20’s. The wheat had around 2-3 joints on the most advanced tillers.

In Montgomery County, some wheat had the awns showing as of April 15. This would be some of the most advanced wheat found during the period of April 13-15. Temperatures got down to 24 degrees on the morning of April 7. Surprisingly, I found essentially no damage to this wheat. The heads were green and there was no stem damage. There was just some cosmetic leaf burn from a sleet storm on April 2. Why? Possibly because there was very little wind the morning of the freeze, there was adequate moisture, and the wheat was very healthy. Montgomery County Extension agent Scott Gordon and I looked at Fuller, Overley, Endurance, Duster, Santa Fe, and Jackpot (planted October 3) and there were just two freeze-damaged heads (in Fuller) among all the plots.
Cowley Co. Wheat where earlier planted has head injury and later planted wheat little to no head damage. West of Winfield.

Early-Mid October planted wheat 20-40% head damage
No noticeable stem damage

Late planted wheat minimal to no head damage
No noticeable stem damage

Cosmetic leaf damage from cold and sleet on April 2nd. Coffeyville.
4. Effect of the freezes on wheat in southwest Kansas

The current hot topic is spring freeze damage to the wheat crop. There was some damage to wheat in the Harper-Barber-Comanche County region. There was less damage in other areas of southwest Kansas, west and north of those counties. Wheat growth stages in southwest Kansas varied at the time of the freeze and specific evaluations will depend on each individual field. There are, however, some interesting observations that producers, county agents and consultants may want to consider. The following is an overview:

Maturity
- When wheat variety plots were evaluated across the area, it was clear that the earlier maturing varieties were hardest hit by the freeze. These wheat plants had the growing point higher above the ground and were more susceptible to freeze damage. Many counties have wheat that can still recover from cosmetic damage by production of new tillers and leaves.

Tillage
- No-till and conventional till fields showed some subtle differences. Since the southwest was extremely dry, the moisture accumulation and retention from no-till fields reduced the severity of the freeze. Some fields that had residue standing higher than the wheat helped to catch snow from the last snowstorm and helped to block winds during the freeze.
Grazing

- Many producers in the southern portion of the state pasture their wheat. Grazed wheat tends to be further behind in growth, which generally has reduced the severity of the freeze damage and has kept the wheat in the mode of tiller production.

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These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, or Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader 785-532-0397 jshroyer@ksu.edu