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1. Zinc deficiency and starter applications in corn

In Kansas, zinc is a micronutrient that can be deficient in corn and grain sorghum production. Wheat has seldom responded to Zn fertilization in research trials, and the K-State Soil Test Lab does not recommend Zn for wheat at any Zn soil test level. Similarly, no Zn recommendation is made for alfalfa, cool-season grasses, or sunflowers.

Corn exhibits Zn deficiency at a relatively early growth stage as stunted plants (shortened internodes) with a broad, chlorotic strip between the midrib and leaf margin on fully expanded leaves. There may be some reddening associated with the chlorotic tissue, depending on the corn hybrid.

The most severe deficiencies typically have been where topsoil has been removed, either by erosion or mechanically in building terraces or land leveling for floor irrigation. Sandy soils are more likely to be low in available Zn than medium- and fine-textured soils. Starter phosphorus fertilizer on soils that are marginal to deficient in zinc has increased the severity of Zn deficiency. This interaction is considered to be physiological at the plant level. When soil Zn levels are already low, increased P concentrations may exacerbate Zn deficiencies.

If corn yields in a research test or producer field are significantly lower where starter P fertilizer has been applied than where no starter has been applied, then you can suspect that the soil is low in zinc and needs to have some zinc applied with the starter. Here are a couple examples from past K-State research by former researchers Larry Murphy and Ray Lamond:

Effect of Phosphorus and Zinc as Starter Fertilizers on Corn Yields on Low-Zinc Soils				
P_2O_5 in starter (lbs/acre)	Zn in starter (lbs/acre)	Corn yield (bu/acre)	P (%) in leaf tissue	Zn (ppm) in leaf tissue
0	0	101	0.14	12
80	0	73	0.73	10
0	10	102	0.16	24
80	10	162	0.41	17

Phosphorus and Zinc Effects on Corn Yields on Low-Zinc Soils			
P_2O_5 (lbs/acre)	Zn (lbs/acre)	Application method	Corn yield (bu/acre)
0	0	--	107
40	0	Broadcast	121
		Starter	93
0	10	Broadcast	121
		Starter	115
40	10	Broadcast	139
		Starter	140

In both cases, corn yields were significantly reduced when P was applied as a starter, if no Zn was included in the starter. Large amounts of starter-applied P can actually enhance Zn deficiency if the soil is low in zinc and no zinc fertilizer is applied.

Zinc is an essential nutrient for plant growth, involved in protein synthesis and necessary for growth regulation and enzyme systems. Plants absorb Zn as inorganic cations, which are held on exchange sites on clay and organic matter. Zinc is found in mineral complexes and in organic matter, with the organic fraction being the dominant source in most Kansas soils.

How can producers know whether to apply Zn for their corn, grain sorghum, or soybeans? A soil test is the best way to assess Zn needs. Similar to other micronutrients, Zn is needed in low amounts for optimum yields, and for Kansas soils the critical soil test level is 1 ppm. Zinc is an immobile nutrient that can be tested using the same sample as used for the routine soil test (0 to 6 inch depth). Fertilizer Zn application is not recommended if soil test levels are above 1 ppm. Care should be used in collecting the sample to avoid potential contamination by not using a collection bucket made of rubber or galvanized steel. Both contain Zn. A plastic collection bucket and a stainless steel or chrome-plated soil probe is recommended.

Zinc can be banded as a starter or broadcast and incorporated with equal response. Banded Zn rates can be lower than broadcast rates because of greater efficiency. However, residual Zn levels will be lower from banded than broadcast applications. On newly terraced fields, a broadcast application of Zn fertilizer and/or manure to the new terrace channels should be considered. A broadcast rate of 5 to 10 pounds per acre of Zn will substantially increase Zn soil test levels to the point where additional Zn application will not be needed for several years. However, producers should continue to test their soils and monitor Zn levels.

Several sources of Zn fertilizer are available. Zinc sulfate and liquid Zn products are the most common sources. Liquid Zn products include chelates, lignin sulfonates/polyflavonoids, and Zn-ammonium complexes. Zinc chelate (EDTA) banded as a starter is more efficient than other sources, and Zn rates can be reduced by half or three-quarters compared to the full recommended rates with similar performance.

If banded, an application rate of 0.5 lb zinc/acre of inorganic zinc is generally sufficient, although this will need to be done annually on low-testing soils. If broadcast, higher rates will be needed. When broadcasting, inorganic zinc will be more economical than chelates.

Zinc oxide is not recommended because of its very low solubility in all soils, especially in neutral to alkaline pH soils. Zinc oxy-sulfate products are available, in which Zn oxide is partially acidified with sulfuric acid. At least 50 percent water solubility of Zn in the Zn oxy-sulfate products is needed. Manure also is an excellent source of Zn.

Application of Zn when soil levels are deficient (less than 1 ppm) can be a high-return investment. However, before applying Zn, producers should determine whether it is needed by soil testing.

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2. Diagnosing a mysterious case of light-colored streaks in wheat

On May 15 of last year, a producer in Cowley County noticed that there were light-colored streaks across a field of wheat. The streaks ran the length of the field, and corresponded exactly to the width of tires tracks from a sprayer that applied 90 pounds of liquid UAN fertilizer in January.

Pattern of light-colored tracks in wheat on May 15. Photos by Doug Shoup, Southeast Area Crops and Soils Specialist.

Did the fertilizer cause these symptoms? That wouldn't make sense, since it was the heads, not the leaves, that had turned color. No other equipment had gone over the field since the sprayer made the UAN application in January.

At further inspection the wheat heads were showing signs of head scab.

What happened is that the tracks created in January caused some compaction, which led to a slight change in maturity due to plant stress. That was just enough to cause the wheat in the tracks to flower when head scab infection was the highest, while the wheat in the remainder of the field flowered slightly later. Wheat in the remainder of the field had some head scab, but not as severe as the wheat in the tracks.

Head scab is most common in the eastern third of the state, but can also be found at low levels in parts of central Kansas. The symptoms of head scab include large tan or white lesions that encompass one or more spikelets. Heads infected by scab will often have a brown discoloration of the rachis (central stem of the wheat head) and the developing kernels will have a white chalky appearance. The base of diseased spikelets may also have a small pink mass that is produced by the fungus that causes head scab.

The symptoms of head scab become most obvious as the wheat moves into late milk and early dough stages of development. It is common to see the incidence of scab symptoms increase dramatically in a 3- to 5-day period.

The infection typically takes place during flowering and the early stages of grain fill. Cropping systems and tillage systems have an effect on the development of head scab in wheat. The head scab fungus, *Fusarium graminearum*, also causes stalk rot and ear rot of corn, and can infect other grasses. Corn residue and infected wheat residue are considered major sources of the fungus that causes head scab infections in the spring near flowering time.

Wheat planted into or near corn residue, or continuous wheat planted into fields with infected wheat residue or infected wheat seed, is often more likely to have head scab infections than wheat planted after a broadleaf crop, grain sorghum, or on fallow ground. However, wheat planted after a broadleaf crop or grain sorghum may still get infected with head scab some years since the *Fusarium* fungus is airborne and may travel great distances from the original source of inoculum (corn, wheat, or grass residues).

Broadleaf crops such as soybeans, sunflowers, canola, and cotton are not good hosts of the *Fusarium* head scab fungus. Where scab has been a problem, producers may want to rotate to one of those crops the following year.

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3. Atrazine runoff can be minimized this spring

The potential for atrazine runoff peaks during the spring months in Kansas. That's when storm intensity levels are normally highest, and producers should be most careful about their atrazine application methods.

Reducing atrazine runoff is important because surface water in many watersheds throughout eastern and central Kansas has been impaired by atrazine in recent years, and a few areas currently have drinking water concerns.

Atrazine runoff continues to be a potential problem that corn and grain sorghum producers can and should address. There are several best management practices (BMPs) that have been proven to reduce atrazine in Kansas. Some of the BMPs involve application timing and methods, and every producer should be able to use one or more of these BMPs. A few of the possible application-related atrazine BMPs include:

* Use alternative herbicides. This may seem obvious, but it is increasingly a good solution in many cases. There are several good herbicide alternatives now to atrazine, especially for use with corn. It's hard to beat the low cost of atrazine, but using one of the alternatives can help prevent the development of triazine-resistant weeds, while eliminating the chance of atrazine runoff.

* Early spring (or fall) applications. Atrazine runoff can potentially be reduced by applying atrazine prior to April 15 of the current cropping year, or during the previous fall. Rainfall intensity, duration, and amount are typically lower at these times than in late April, May, and June. This is a good BMP for no-till.

* Split application. Apply one-half to two-thirds of the atrazine prior to April 15, and one-third to one-half of the atrazine just prior to or immediately following planting. This can potentially reduce atrazine runoff compared to applying all the atrazine at planting time. This is another good BMP for no-till.

* Reduced rates at planting time by a postemergence application. A low rate of atrazine -- one pound per acre or less -- can be used as a soil-applied treatment at planting time, followed by a postemergence application of a premix product that contains low rates of atrazine. In addition to reducing runoff potential, this two-step approach has consistently resulted in good weed control

over a broad spectrum of broadleaf and grassy weeds in corn and sorghum (except on triazine-resistant weeds), and is well suited for no-till.

* Reduce rates of soil-applied atrazine. There is a direct relationship between atrazine application rate and runoff amount. Using lower atrazine rates, and/or formulations with lower atrazine rates (for example, "Lite" formulations of atrazine premixes), can reduce runoff potential while providing excellent control of pigweed and other small-seeded broadleaf weeds – except on triazine-resistant weeds.

* Use postemerge atrazine premix products. Postemerge herbicide products that contain low rates of atrazine in mixtures with other herbicides are widely used in Kansas, and help reduce the amount of atrazine runoff. These postemerge products typically contain atrazine rates that are lower than soil-applied atrazine application rates. In addition, the growing crop foliage helps reduce atrazine runoff potential by intercepting some of the atrazine and reducing the impact of storm events at the soil surface.

* Incorporate atrazine in the top two inches of soil. Although this is not appropriate for no-till situations, this is an excellent BMP for fields where tillage is used prior to planting corn or grain sorghum.

* Band herbicides at planting. Applying atrazine only in a 10- to 15-inch band over the row instead of broadcast over the entire field is a possible BMP for producers using ridge-till or where cultivation will be used.

For more information, see K-State Extension publication MF-2182 titled "Best Management Practices for Atrazine" at: www.ksre.ksu.edu/library/h20ql2/mf2182.pdf

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4. Videos of 2010 In-Depth Agronomy Training sessions available on web

Videos of the sessions from the 2010 In-Depth Agronomy Training offered to County/District Agents in January are now available on the web at:
http://www.agronomy.ksu.edu/extension/DesktopDefault.aspx?tabid=113

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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