Number 122
January 18, 2008

1. Surface applications of nitrogen on snow-covered fields of wheat

We have observed in Kansas that when nitrogen (N) is applied on top of snow cover, wheat yields are sometimes not as good as when nitrogen is applied to fields without snow cover. This applies to both dry urea and liquid UAN applications.

The reason for this is not entirely certain, since there would be no cause for volatilization. One possible reason is run-off, as N applied in this manner may sometimes move along the surface of the field as the snow melts. Nitrogen could be carried off the field or redistributed within the field, resulting in some areas of the field ending up with too much fertilizer N and some areas having an N deficiency. The end result is an overall reduction in yield, compared to fields in which there was no snow cover when the N was applied.

A December 18, 2007 article (printed below) from South Dakota State University on the Plant Management Network web site addresses this issue.

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* Wheat Growers Should Consider Snow Cover with Nitrogen *

Producers now considering nitrogen applications for no-till wheat must consider snow cover. This is according to Ron Gelderman, South Dakota State University's Soil Testing Lab manager. Gelderman said many producers, facing record-high fertilizer prices, want to apply nitrogen now to avoid the possibility of higher prices in the future or shipment delays in the spring.

"We've looked at an SDSU study, from 2006-2007, that was done at seven winter wheat locations and seven spring wheat locations, covering the wheat (growing) areas of western and central South Dakota," said Gelderman. "It showed that when there was significant snow cover and N was surface broadcast, yields averaged about 18 percent lower than where N was placed in the soil."

Gelderman said this study, which used urea nitrogen, was a good indicator that application to snow-covered fields was a poor choice.

"On locations with little snow, winter applications were similar to in-soil applications," he said. "Applications to frozen fields without snow cover are not recommended on sloping fields because of runoff potential."

While fall, early spring, and late applications, some as late as the five-leaf stage, all had similar yields, the study Gelderman mentions showed soil application led to the highest yields over all sites.

"The reason behind the lower yields is not clear since a non-volatile N fertilizer was also used and had similar yields to the urea treatment," he said. "So it doesn't appear gaseous N loss was the issue. In addition, runoff was limited on these relatively level sites."

http://www.plantmanagementnetwork.org/pub/cm/news/2007/SnowCover

2. Chloride as a fertilizer nutrient for wheat

With wheat topdressing season soon approaching, and high wheat prices, producers may be wondering if it would pay to add chloride to their topdressing blend this year.

It is difficult to predict whether chloride would benefit wheat in the absence of soil test results. Chloride (Cl^-) fertilization based on soil testing is slowly becoming an established practice in dryland wheat, grain sorghum, and corn production in central and northeast Kansas. More field testing is needed, particularly in western Kansas, to determine the extent of the chloride-deficient areas, and to improve soil test correlations and calibrations. But based on current data, the probability of a response to Cl^- in dryland wheat production in central Kansas is high.

Routine Cl^- soil tests and Cl^- fertilizer recommendations for wheat have been offered by the K-State Soil Testing Lab since the mid-90’s. Plant analysis is also offered for research or diagnostic purposes only. As with nitrate and sulfate, chloride soil testing is recommended using a 0-24" profile sample.

The interpretation of the Cl^- test and corresponding fertilizer recommendations for wheat are given in the table below. Chloride fertilizer is recommended when the soil test is below six ppm, or 45 pounds soil chloride in the 24-inch sample depth. Potassium chloride (potash) and ammonium chloride are the most commonly available and widely used fertilizer products, though other products such as calcium, magnesium and sodium chloride can also be used.

Soil Test Chloride Interpretations for Wheat in Kansas			
	Soil Chloride in a 0-24 inch sample		Chloride Recommended
Category	lbs/acre	ppm	lbs Cl/acre
Low	<30	<4	20
Medium	30-45	4-6	10
High	>45	>6	0

Plants take up Cl as the Cl^- ion from the soil solution. The primary form of chlorine found in plants is Cl^-. Like nitrate, Cl^- helps with the transport and uptake of essential cations such as Ca, K, Mg, and NH_4. Chloride also plays important roles in enzyme activation and osmotic regulation.

Perhaps one of the most important roles of Cl^- in plant growth is in the suppression of plant disease. Suppression of disease through Cl^- fertilization has been reported in many crops. In Kansas, the suppression of leaf rust, tan spot, Septoria, and take-all in wheat is important.

In the Great Plains, the most commonly observed visual symptoms from Cl^- deficiency are seen on wheat. The deficiency symptoms appear as leaf spotting and are referred to as physiological leaf spot.

The earliest field research on chloride (Cl^-) in Kansas was conducted in the early 1980's. The following is a summary of K-State research on chloride applications to wheat conducted from 1990 to present. The summary is averaged across all soil chloride levels in the experiments. Reports on the majority of these studies can be found in the Kansas Fertilizer Research Reports, published annually and available on-line at http://www.oznet.k-state.edu/library

From 1990 to 2006, 39 field experiments were conducted, primarily in the eastern half of the state, looking at the response of wheat to Cl^- fertilization. Nearly all these experiments were conducted under dryland conditions, in areas of high native soil K levels with no history of potash application. Various treatments were compared in these studies, with a focus on Cl^- application rate, Cl^- source, and time and/or method of application. Of the 39 studies, 23 (or 59 percent) showed a statistically significant response to Cl^- fertilization.

The results from 34 of those experiments (the ones which included Cl^- fertilizer rates of 0, 10 and 20 pounds per acre -- applied as KCl broadcast in the spring) were combined and analyzed using each location as a rep and the treatment means at that location as individual observations. In each of these studies non-K sources were included, allowing the separation of K response from Cl^- response. The results are summarized in the table below.

Response of Wheat to Chloride Fertilizer: Summary of K-State Research 1990-2006		
Chloride Application Rate (lbs Cl^-/acre)	Grain Yield (bu/acre)	Percent Chloride (in top leaves at boot)
0	48.4	0.29
10	51.7	0.38
20	52.5	0.43
LSD 0.05	1.3	0.03
N	34	30

A significant wheat yield response to the lowest rate of Cl^- fertilization was found in the combined analysis of these studies. Chloride fertilization also increased the Cl^- content of the top leaves at boot.

A number of different materials were used as Cl^- sources in these studies, with comparisons of different chloride fertilizers included at most sites. The most commonly used materials were KCl and NaCl, with NH_4Cl, $MgCl_2$, and $CaCl_2$ also used. While slight differences were observed in leaf Cl^- content between sources, no differences were observed between sources in yield response.

In summary, responses to chloride in wheat are common in Kansas, with nearly 60% of the studies showing a significant response to chloride application, when sites had no history of potash applications. A number of sources are effective at supplying chloride, though potash, KCl, or ammonium chloride are the most commonly used. The chances of a response to chloride on soils with a history of potash applications are limited.

For more information, see "Chloride in Kansas: Plant, Soil, and Fertilizer Considerations," MF2570: http://www.oznet.ksu.edu/library/crpsl2/mf2570.pdf/

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3. Reducing phosphorus movement into surface water: Eutrophication TMDLs

Phosphorous loss from agricultural fields is a cause for state and national concern about the health of water supplies. When too much phosphorous enters a lake or pond through runoff and erosion, the water's nutrient levels spike, causing algae and plant growth to accelerate in a process known as eutrophication. This algae growth, called an algal bloom, creates murky, discolored waters and lowered oxygen levels, and can eventually suffocate native aquatic species. Eutrophication often results in taste and odor problems in drinking water, and can interfere with recreational activities.

The Kansas Department of Health and Environment's Bureau of Water has established Eutrophication TMDLs, or Total Maximum Daily Loads, for several lakes in water basins across Kansas. TMDLs are established to improve water quality by evaluating the source of the pollution and finding ways to reduce it. For all Eutrophication TMDLs, a total phosphorus reduction is required to meet the "chlorophyll a" endpoint. Agriculture is a primary source of nutrients, both phosphorus and nitrogen, that contribute to eutrophication of ponds, lakes, and estuaries.

Phosphorous is transported into waterways through three avenues:

- Erosion – Soil erosion results in the movement of "particulate" inorganic or organic phosphorous that is incorporated into the soil.
- Runoff – Water runoff causes soluble organic phosphorous to be released from the soil and flow across the soil surface
- Source loss – Phosphorous can be lost from fertilizer or manure soon after application, before it is incorporated into the soil

Areas that tend to generate more runoff are in the eastern parts of Kansas. But runoff in the western part of the state cannot be ignored. Any area with high phosphorous levels and increased rainfall has a greater risk for phosphorus loss.

The best ways to prevent phosphorus runoff are as follows:

- Erosion control – Reduce sediment transport by maintaining surface cover through no-till methods and creating field buffers and grassed waterways.
- Reduce runoff – Maintain surface cover and keep soil test phosphorous at the optimum level for crop growth, but avoid excess soil test phosphorus.
- Source loss management – Reduce application rates, apply during times of minimal runoff, and subsurface apply or incorporate into the soil.

For more information on Phosphorus Best Management Practices, see K-State publication MF2321:
http://www.oznet.ksu.edu/library/crpsl2/mf2321.pdf

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4. Correction to herbicide name

In e-Upate No. 120, January 4, 2008, a new soybean herbicide from DuPont was incorrectly listed as "Enlive." The correct name of that herbicide is "Enlite."

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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