Spring nitrogen fertilizing for optimal wheat production

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With longer and warmer days, wheat seeding and fertilizing has begun across the state. Using the right fertilizer source, rate, timing and placement is important for optimal production. Montana State University Extension offers suggestions to help guide wheat producers in spring nitrogen fertilizing decisions.

Dryland winter wheat grown in Montana requires about 2.6 pounds nitrogen per bushel to maximize yield and attain at least 12.5 percent protein. Dryland spring wheat requires about 3.3 pounds available nitrogen per bushel to reach 14 percent protein, where available nitrogen is soil plus fertilizer nitrogen. These suggested rates are based on spring soil samples. Although fall soil samples are better than none, they may lead to over- or under-fertilization.

"Over three years, we found 54 percent of field soil samples were at least 20 pounds of nitrogen per acre higher or lower in August than in April," said Clain Jones, Extension soil fertility specialist in the Department of Land Resources and Environmental Sciences at Montana State University.

Jones encouraged producers to use spring soil samples especially if soils were less than 18 inches deep or fall nitrate levels were greater than 60 pounds nitrogen per acre, because those soils have the best chance for nitrogen losses and under-fertilization.

Jones suggested producers base pre-plant fertilizer rates on realistic yield

estimates. Applying high rates of nitrogen before or at seeding is risky, especially in dryland farming. High nitrogen rates can lead to excessive vegetative growth, which may deplete soil moisture before flowering and grain fill. Or, if there is not enough early soil moisture, the fertilizer may not produce additional yield or protein.

"In-season nitrogen fertilization can be used to adjust rates in a high yielding year," said Jones. In irrigated production, applying all the nitrogen needed for yield and protein early in the season can produce more tillers than are able to produce grain, and may lead to high residual soil nitrate levels.

Wheat requires 50 percent of its total nitrogen uptake by mid- to late-tillering. Winter wheat would ideally have already produced the two to three tillers which support most of the yield by early spring. These tillers will rapidly reach that 50 percent mark as they continue to grow. The remaining 50 percent of their total nitrogen requirement needs to be applied early enough to supply the high demand of these growing tillers. For example, if the total nitrogen requirement is estimated at 120 pounds nitrogen per acre, soil tests indicated there were 40 pounds nitrogen in the soil, and 60 pounds nitrogen were applied pre-plant or at seeding, the additional 20 pounds nitrogen per acre (120 total - 40 soil - 60 pre-plant = 20) should be top-dressed by mid- to late-tillering. Fertilizing just prior to the time of rapid growth results in efficient fertilizer use by the crop.

The principle is the same for spring wheat, except the time between pre-plant and in-season adjustment is shorter. On dryland spring wheat in Saskatchewan, G.P. Lafond and co-workers with Agriculture and Agri-Food Canada found that providing 33 to 50 percent of the required nitrogen at seeding, and the remaining nitrogen in-season before stem elongation, optimized yields. In dry years, the in-season nitrogen addition could be decreased or omitted, resulting in substantial fertilizer

cost savings.

If nitrogen taken up early by the crop is sufficient for yield, then it will get redistributed to help produce grain protein. In high-yielding years, additional nitrogen around heading may help reach high grain protein levels. Flag leaf nitrogen concentrations and optical sensors, such as SPAD chlorophyll meters, can be used to identify nitrogen deficiencies and adjust nitrogen rates to growing conditions.

Jones noted that rates of seed-placed urea fertilizer should not be greater than 10 pounds nitrogen per acre when narrow openers (less than one inch) are used, to prevent seedling damage, especially in dry, coarse soils. Polymer-coated urea and urea treated with urease inhibitor (such as Agrotain®) are very effective at reducing seedling damage. Research suggests that the safe rate of seed-placed nitrogen can be increased up to 50 percent when using Agrotain®, or two- to four-fold when using polymer-coated urea as compared to untreated urea.

"However, spring-applied, polymer-coated urea may be too slow to dissolve and supply the growing wheat's nitrogen demand," cautioned Jones.

Producers can evaluate the effectiveness of their nitrogen fertilization practices by looking at their past grain protein levels. If winter wheat protein has generally been under 12.5 percent, yield and protein have likely been nitrogen-limited. For spring wheat, grain protein under 13.2 percent indicates that yield and protein have been compromised by under-fertilization. The MSU Small Grains Nitrogen Economic Calculator is a resource to help calculate economically-optimum nitrogen rates based on available soil nitrate, soil organic matter, yield potential, wheat price, nitrogen price, and protein discounts and premiums. By using some general guidelines, producers can select the right fertilizer source, rate, timing and placement for optimal efficiency of nitrogen

fertilization.

For the Small Grains Nitrogen Economic Calculator and MSU Extension publications with fertilizer information, see "Fertilizer Information" on Jones' web page: landresources.montana.edu/soil … ity/fertilizers.html

Provided by Montana State University

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