IPNI Plant Nutrition TODAY
Better Crops, Better Environment...through Science

From Scientific Staff of the
International Plant Nutrition Institute (IPNI)
3500 Parkway Lane, Suite 550
Peachtree Corners, Georgia 30092-2844 USA
Phone: 770-447-0335 Fax: 770-448-0439
E-mail: info@ipni.net Website: www.ipni.net

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NITROGEN NUTRITION FOR WINTER WHEAT

The nitrogen (N) nutrition of winter wheat is key to its yield and quality. Management choices for the right source, rate, time, and place of N application support the sustainable intensification of wheat production needed to continue improving food and nutrition security for people.

Source: Since winter wheat often needs a topdress application, choosing the right source can help minimize ammonia loss. Urea on the soil surface has high potential to lose ammonia. The proportion lost increases with rate of application and soil pH, and can be influenced by soil moisture. Sources containing urea can be treated with a urease inhibitor—or protected with a slow-release coating—to slow hydrolysis, reduce loss, and supply more ammonium and less nitrate for plant uptake. As the levels of carbon dioxide in the air increase, wheat increasingly favors the uptake of ammonium over nitrate. Ammonium sulfate and ammonium nitrate sources are less prone to loss. The choice between fluid urea-ammonium nitrate and granular urea is tricky. Fluids can be applied more uniformly. Less ammonia is lost with fluid, but more leaf burn can occur. Leaf burn can be minimized with streamer nozzles and early application. Inhibitors or controlled-release forms do not always pay for themselves in terms of yield increase, but the benefits of reduced loss to the environment should also be considered.

Rate: The rate to apply depends on yield potential and previous crop. Rate predictions can also be aided using sensors that provide some measure of the canopy cover and its greenness. The optimum rate depends on cultivar as well. Hard red cultivars require more N for optimum protein levels. Cultivars susceptible to disease require lower rates. Production systems with weather-specific use of fungicide and plant growth regulators can produce higher yields with higher rates of applied N. For example, research conducted in Ontario, Canada from 2008 to 2010 demonstrated that, when combined with a fungicide strategy that controlled disease, increasing rates of N in the spring topdress from 90 to 150 lb/A raised average yields from 90 to 112 bu/A in soft red winter wheat. These higher yields were accompanied by changes in grain quality considered desirable by millers, including increased protein and decreased levels of fungal toxins. Recent research in China and Turkey found that increasing rates of N increased the concentration and bioavailability of the micronutrient zinc (Zn) in wheat grain. Considering the widespread distribution of Zn deficiencies in the human diet, increased Zn is a good thing.

Time: At wheat seeding in the fall, soils often contain sufficient N to start the crop. Exceptions occur, such as in sandy soils, or soils that have recently grown a N-depleting crop. Going into winter, the plant should not be deficient, but excess N can lead to disease infection and winterkill. Thus the decision to apply a small amount at seeding should be guided by a soil test. Topdress applications need to be timed according to the growth condition of the crop. Thin stands may benefit from early applications in the tillering phase, but only a low rate should be applied to prevent excessive tillering. By the beginning of stem elongation, Zadoks growth stage 30, most of the N should be applied, since from this stage the crop takes it up rapidly. A split application at both those stages may sometimes pay. After heading, N uptake slows down, but foliar applications, or controlled-release forms applied earlier, boost protein in the grain.

Place: The logical place for N fertilizer at seeding is with the seed. Wheat seedlings can tolerate the low rates required at planting. For topdress fertilizer, broadcast is often the only choice. Ensuring uniformity of broadcast is important for avoidance of uneven maturity. Uneven applications lose yield to both deficiency and lodging.

Nitrogen nutrition for wheat offers big opportunities to sustainably improve food and nutrition security.

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For more information, contact Dr. Tom Bruulsema, IPNI Director, North American Program, Ph: 519-835-2498; E-mail: tom.bruulsema@ipni.net.