Nitrogen Requirements

SEASONAL

Nitrogen is best supplied to wheat in split applications because preplant N may be leached or denitrified during the winter which reduces its efficiency. Additionally, grain protein content is better managed with topdress applications, as preplant N application rates generally have a small effect on grain protein content. Therefore, preplant and early season N should be applied to achieve the yield goal, while a late-season N application is needed to achieve the required grain protein content.

Preliminary results from a two-year study in Siskiyou and Fresno County show that yields of 4 to 4.6 tons/acre can be produced with a total N application of 150-200 lbs N/acre. In these trials, yield was maximized when most of the N was applied at tillering. In addition to fertilizer N, residual nitrate-N in the top foot of the soil profile at planting potentially contributed an additional 30-80 lbs N/acre. When well water is used for irrigation, the N in the water needs to be taken into account as well.

Soil Sampling

Sampling close to planting or in spring before the first topdress application is recommended to determine residual nitrate-N. Soil is generally sampled to a depth of 0 to 1 foot and 1 to 2 feet, where root density is highest. However, roots of irrigated wheat may reach a depth of 7 feet in the absence of restricting soil layers.

Plant Analysis

The nutrient status of wheat can be determined by analyzing leaves or stems, however, N fertilization decisions should not be based on plant analyses alone.

The N status of wheat is reflected in the leaf color, with light green leaves indicating low N availability while dark green leaves are typical for N sufficient plants. The leaf greenness of wheat plants can be determined using hand-held devices. Leaf greenness readings are best compared to a well fertilized strip in the same field.

Wheat Nitrogen Uptake and Partitioning

Seasonal N Uptake

Information regarding wheat fertility management, including placement, fertilizer source, phosphorus and potassium are available at:

www.cdfa.ca.gov/go/FREPguide

SELECTED REFERENCES


The information in this pamphlet is based on research funded by the Fertilizer Research and Education Program, California Dept. of Food and Agriculture, and from other sources.

Daniel Geisseler and William R. Horwath, Department of Land, Air and Water Resources, UC Davis, gathered and organized the guideline information through FREP grant agreement 11-0485.
Nitrogen Fertilization at SEEDING and STEM ELONGATION

The rate of N uptake is highest between the beginning of stem elongation and early heading. During this period, approximately 60% of the total N is taken up. Therefore, early season N should be applied at tillering so that the N is available when demand by the wheat plants increases at stem elongation. Recent studies have shown that yield may be maximized when most of the N is applied at tillering just ahead of the period of peak uptake.

Banded sidedress N should be applied at a distance of at least 2-3 inches from the plant to avoid root damage from high salt concentrations in the band.

When N fertilizer is broadcast, it needs to be applied before an irrigation to move the N into the soil. Irrigating the field is especially important when urea or UAN are applied, because the hydrolysis of urea by urease increases soil pH, which can result in high ammonia volatilization losses when the material is left on the surface.

Nitrogen Fertilization at HEADING and RIPENING

When grain protein content is relevant, some N should be supplied late in the season. Nitrogen acquired after flowering (anthesis) was found to be almost entirely translocated to the grains. The N uptake capacity of wheat remains reasonably constant during the three weeks following flowering unless soil drying is severe. A small application of 30-60 lbs/acre applied at flowering has been found most effective in increasing grain protein content.

When N availability in the root zone is limited, foliar N applications before flag leaf emergence may increase grain yield, while applications at flowering or during the following two weeks may increase grain protein content. Foliar application of N may damage the leaves, resulting in a discoloration of leaf tips. The risk of leaf damage appears to be lower with urea than with ammonium nitrate and ammonium sulfate.

Sowing

The amount of starter fertilizer that can be applied safely is limited because high ammonium concentrations may injure the seedlings. Munier and coauthors recommend limiting the amount of N applied as a starter fertilizer near the seed to no more than 25-30 lbs/acre, while Brittan recommended applying no more than 16 lbs N/acre. In dry soil, the application rate should be reduced even more. Starter fertilizers are generally banded two inches to the side and two inches below the seed row. Brittan recommended applying starter fertilizer at or up to one inch below seed level, but not above the seed level.

For more information about N management in wheat and references, access the crop fertilization guidelines at: www.cdfa.ca.gov/go/FREPguide