Nitrogen Requirements

SEASONAL

Nitrogen is best supplied to wheat in split applications because large quantities of preplant N may be leached or denitrified during the winter, which reduces fertilizer use efficiency. Additionally, because preplant N applications generally have a small effect on grain protein content, protein content is better managed with topdressing or water-run applications.

Therefore, preplant and early-season N should be applied to achieve yield goals, while a late-season N application is often needed to achieve the required grain protein content.

Soil Sampling

Sampling close to planting or shortly before the first topdress application is recommended to determine available soil nitrate-N. Residual soil nitrate often contributes an additional 30-80 lbs N/ac, but can also be higher following alfalfa or a vegetable crop.

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 also reflected in the leaf color, with light green leaves indicating low N availability and dark green leaves indicating 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.

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

Application Timing

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 near tillering so that the N is available when demand by the wheat plants increases at stem elongation.

When a threshold grain protein content is important, some N should be supplied late in the season for high-yielding crops. An application of 30-60 lbs/acre, applied between boot and flowering, has been found to effectively increase grain protein content.

Application Rates

There is a wide range of wheat varieties in CA, and therefore a wide range of appropriate rates. For an average yielding crop (5500-6000 lb/acre), recent studies have found that a total N application rate of 150-200lbs is sufficient to match crop uptake.

Application Mode

When N fertilizer is broadcast, it needs to be applied before an irrigation or rainfall to incorporate the N into the soil. Moisture 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.

Foliar Applications

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, particularly in warm temperatures (>80°F), 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. Water-run applications of N can also reduce the risk.

Preplant

Wheat plants take up approximately 20-25% of the total N before stem elongation (jointing). Therefore, wheat, planted in the fall, generally does not require more than 40-60 lbs N/acre before spring. The optimal preplant N application rate is also dependent on residual nitrate-N concentrations.

Sowing

The amount of starter fertilizer that can be safely applied near the seed is limited because high ammonium concentrations may injure the seedlings. Munier and coauthors recommend limiting the amount of N applied near the seed to no more than 25-30 lbs/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. Higher rates of fertilizer can be broadcast and incorporated via light tillage prior to seeding.

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