

required to achieve maximum yield, while continuing to increase protein, may begin to decrease yield.

- For hard red winter wheat, the amount of N necessary to achieve a protein goal of 11.5 percent is at or somewhat above that necessary to achieve maximum yield. This is why an accurate estimate of yield is critical to achieve a protein goal of 11.5 percent.
- Most of the N required by wheat is taken up during vegetative growth (before flowering) and used to establish yield potential (the number of heads and kernels per head). Vegetative N is later transported to the kernels to form protein during grain filling. Early season N availability is critical for yield and a moderate level of grain protein.
- Additional N taken up by wheat after flowering is used primarily to increase grain protein content. Ensuring that some N is available to wheat late in the season in active rooting regions of the soil profile is critical to reaching the final protein goal.
- The availability of N at key times during the growing season is as important as the total amount of N available in reaching hard red winter wheat yield and protein goals. Inadequate N during vegetative growth can limit yield. In dryland situations, N stranded near the soil surface when soil dries will not be available for uptake by the plant and protein formation late in the growing season.
- Sulfur (S) is also important to protein formation in hard wheat. The application of 1 lb S for each 5 lbs N up to 25 lb S/acre is a common practice for hard wheat.



Prepared in consultation with fertility experts at Washington State University, The McGregor Company, Pacer Corporation and Central Washington Grain Growers.

HARD RED WINTER WHEAT NITROGEN & PROTEIN MANAGEMENT GUIDE



Provided courtesy of the Washington Wheat Commission

This guide presents an abbreviated method for calculating nitrogen (N) fertilizer rates to meet hard red winter wheat yield and protein goals, and reviews the basic principles governing hard red winter wheat yield and protein responses to N.

The market protein goal for hard red winter wheat is 11.5 percent. For additional information on growing hard red winter wheat in your area, please consult your local agronomist and fertilizer representative.

Calculating an N fertilizer rate for hard red winter wheat

Block A. Estimate the yield goal for the site (line A1) and calculate the total N supply required by multiplying the yield goal by 3.0 to 3.2 lb N/bushel (line A2).

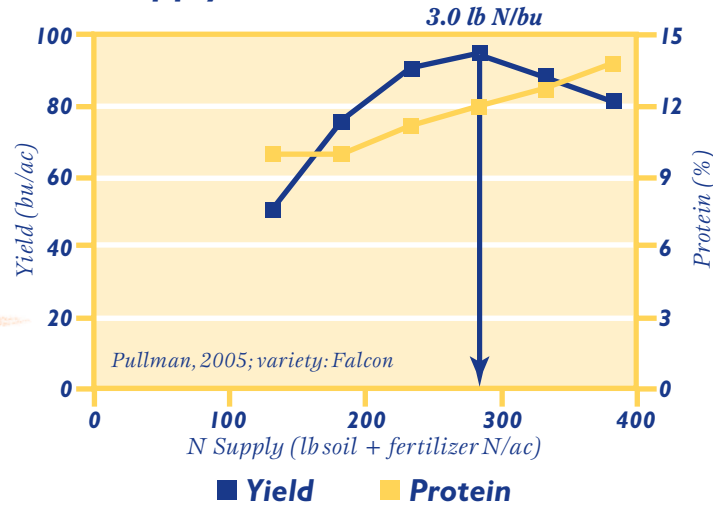
Block B. Before fertilizing, test the soil to a minimum depth of 4 feet or a restrictive layer. A pre-fertilization soil test is of value in measuring the amount of residual N available and its distribution in the profile. A soil test is also required to determine other nutrient needs.

Calculate the total soil N inventory on line B6.

Block C. Subtract the total soil N inventory (B6) from the N supply needed (A2). This is the amount of fertilizer N to apply.

In early spring, hard red winter wheat growers are encouraged to evaluate over-winter moisture conditions in order to determine if the yield potential of the crop has increased, and whether N supply is still adequate for the higher yield potential. If not, supplemental N should be applied as early as possible to adjust for the higher yield potential.

N Supply—Yield and Protein Trends



Basic principles

- Hard wheat yield and grain protein are influenced mainly by moisture and N availability. When yield potentials increase due to greater moisture availability, grain protein will decrease unless additional N is provided for the higher yield. When yield potentials decrease due to inadequate moisture and stress, grain protein levels often increase. The ability to achieve protein goals through N management is limited by the ability to accurately predict yield at the time of fertilizer application. With hard red winter wheat, growers have an additional opportunity to reevaluate yield potentials in the spring. If necessary, they can make supplemental applications of N to adjust for higher over-winter moisture, and therefore higher yield expectations than were forecasted at the time of fertilizer application the previous year.

- The total amount of N available is one of the most important factors in achieving hard red winter wheat yield and protein goals. Approximately 3.0 to 3.2 lbs. N/ bushel is required for 11.5 percent grain protein hard red winter wheat. It is not the amount of fertilizer N applied, but the total amount of N available (e.g., soil residual N, applied fertilizer N, and N immobilized and/or mineralized from the organic pool) that is important. Soil testing is critical to estimate the supply of N available to wheat.

- Wheat responses to N are predictable. In low residual N soils, low rates of fertilizer N significantly increase yield but often decrease grain protein due to a dilution effect. Intermediate rates of N increase yield and protein. Rates of N above those

Dryland Hard Red Winter Wheat Nitrogen Needs

N supply needed by the crop to meet yield and quality goals

1. Yield goal: _____ bu/ac
2. N supply needed: _____ bu/ac (A1) x 3.0-3.2 lbs N/bu = _____ lb N/ac

Soil N inventory

1. Current soil test N (*nitrate + ammonium*) _____ lb/ac
(*ammonium in the first foot only, nitrate in all depths sampled*)
2. Credit from organic matter release _____ lb/ac
(*15-20 lb N x percent organic matter in soil test*)
3. Credit from previous legume crop _____ lb/ac
(*peas or lentils—20 lb N/ac for yield >2500 lb/ac; 15 lb N/ac for yield 1500-2000 bu/ac; and 10 lb N/ac for yield <1500 lb/ac or lentils as preceding crop*)
4. Debit for residue decomposition from previous crop _____ lb/ac
(*winter wheat—35 lb/ac; spring wheat—30 lb/ac; barley—25 lb/ac*)
5. Other N credits (source: _____) _____ lb/ac
6. Total N soil inventory (lines 1 through 5) = _____ lb/ac

N to apply

1. _____ (A2) - _____ (B6) = _____ lb N/ac
(*fertilizer recommendation*)