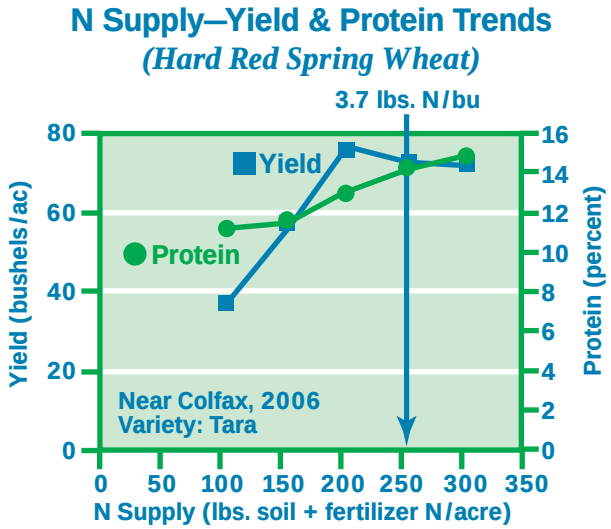
Nitrogen absorbed by wheat after flowering is used primarily to increase grain protein content. Therefore, insuring that some N is available to wheat late in the growing season, deep in the profile where roots are still actively absorbing moisture, is thought to be necessary to reach the final protein goal of 14 percent for hard red spring wheat.

Fall fertilization of ground to be planted with hard red spring wheat is one way to achieve the desired profile distribution of N for late season absorption. The exact timing of fall fertilization for spring wheat will vary by rainfall zone. In general, fall fertilization should occur earlier in lower rainfall zones to allow sufficient time for ammonia/ammonium forms of N to convert to nitrate and move down the profile during winter. Fall fertilization may not be necessary in high rainfall zones, or should be delayed until soil temperatures are below 50°F to reduce the risk of over-winter N loss. Fall fertilization is not necessary if significant residual N already exists in the profile.



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

HARD RED SPRING WHEAT NITROGEN & PROTEIN MANAGEMENT GUIDE

Provided courtesy of Washington Wheat Commission

This guide reviews the basic principles governing hard red spring wheat yield and protein responses to nitrogen (N) and presents an abbreviated method for calculating N fertilizer to meet yield and protein goals. ***The market protein target for hard red spring wheat is 14 percent.*** For additional information on growing hard red spring wheat in your area, please consult your local agronomist and fertilizer representative.

Calculating an N fertilizer rate for hard red spring 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 3.7 lbs. 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 (B1). A soil test is also required to determine other nutrient needs.
Calculate the total soil N inventory on line B5.

Block C. Subtract the total soil N inventory (B5) from the N supply needed (A2). This is the amount of fertilizer N to apply.
Sulfur (S) is also important for protein formation in hard wheat. The application of 1 lb. S for each 5 lbs. N up to 25 lbs. S/acre is a common practice for hard wheat.

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 supplied for the higher yield. When yield potentials decrease due to insufficient 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 and planting.

Options for in-season applications of N for dryland spring wheat are limited. For example, research has shown that in-season foliar applications of 20 lb. urea-N/acre may increase final grain protein by 1 percent in low-yielding (~30 bushels/acre) situations, and by 0.25 percent in high-yielding (~70 bushels/acre) situations.

The total amount of N available is one of the most important factors in achieving hard red spring wheat yield and protein goals. On average, 3.7 lbs. N supply/bushel are required to produce 14 percent grain protein hard red spring wheat. This is about 30 percent (1 lb. N/bushel) more N than is required to raise soft white wheat.

Dryland Hard Red Winter Wheat Nitrogen Needs

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

A

1. Yield goal: _____bu/ac
2. N supply needed: _____bu/ac (A1) x 3.7 lbs N/bu = _____lb N/ac

Soil N inventory

B

1. Current soil test N +_____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. Debit for residue decomposition from previous crop –_____lb/ac
   (winter wheat—35 lb/ac; spring wheat—30 lb/ac; barley—25 lb/ac)
4. Other N credits (source:_____) +_____lb/ac
5. Total N soil inventory (lines 1 through 5) =_____lb/ac

N to apply *(fertilizer recommendation)*

C

1. _____(A2) – _____(B6) = _____lb N/ac

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. Testing is critical to estimate N contributions from the soil.

For hard red spring wheat grown in low-stress (typically high rainfall) environments, the amount of N necessary to achieve a protein goal of 14 percent is above that necessary to achieve maximum yield. This is why an accurate estimate of yield is critical to achieve a protein goal of 14 percent. Protein premiums and discounts highly influence whether it is economical to fertilize for 14 percent protein. However, knowledge of protein premiums and discounts is usually unknown at the time spring wheat is planted and fertilized.

The availability of N at key times during the growing season is as important as the total amount of N available in reaching hard wheat yield and protein goals. Most of the N required by wheat is absorbed before flowering and used to establish the yield potential (the number of heads per area and kernels per head). Vegetative N is later transported to the kernels to form protein during grain filling. Early season N availability is therefore critical to establish yield and a moderate level of grain protein.