## Effect of N Fertilizer Source, Rate, Placement and Application Timing on Hard Red Winter Wheat Yield and N Use Efficiency

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The development of management strategies to improve nitrogen use efficiency (NUE) of wheat is required to reduce cost of fertilizer inputs and N pollution. Our main objective was to assess the effects of N source, rate, placement and timing on grain yield, grain protein and NUE of hard red winter wheat in field experiments conducted at the Palouse Conservation Field Station in southeastern Washington during 2004-05 and 2005-06. Treatments included: (1) controlled release (CR) and conventional urea fertilizer applied at rates of 0 to 250 lb N/acre; (2) select CR and urea N placement (broadcast or banded beneath or with the seed); and (3) urea application timing (at planting, late fall, spring, and fall-spring combinations) at 150 lb N/acre. Grain yield and plant and soil N were measured to assess NUE components. Preliminary yield results indicate no significant differences between conventional urea and CR throughout the range of N application rates. There was also no significant difference in yield among N timings. The CR deep band treatment produced 1,214 lb/acre (20 bu/acre) higher grain yield than CR broadcast. Second year results and a complete evaluation of NUE components are pending.

## *Relationship between Available Water and Wheat Grain Yield

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In the years 1953 – 1957, Dr. G.E. Leggett, extension soil scientist at Washington State University, conducted a series of experiments in Eastern Washington to determine optimum nitrogen fertility for dryland wheat based on available water in the soil profile in late winter / early spring plus growing season (i.e., late March / April, May, and June) precipitation. All spring rainfall was considered "available". With 90 replicated treatments, Leggett's data showed 4.0 inches of available water was required just for vegetative growth of wheat (i.e., before grain production begins) and, for every additional inch of water, 5.6 bushels of wheat per acre could be expected (Fig. 1, dotted line). Using multiple regression, Leggett found that each inch of water stored in the soil over the winter (beyond the baseline of 4.0 inches) resulted in 5.3 bushels of grain per acre, and that for each inch of rain in the spring, 6.9 bushels of grain would be produced.

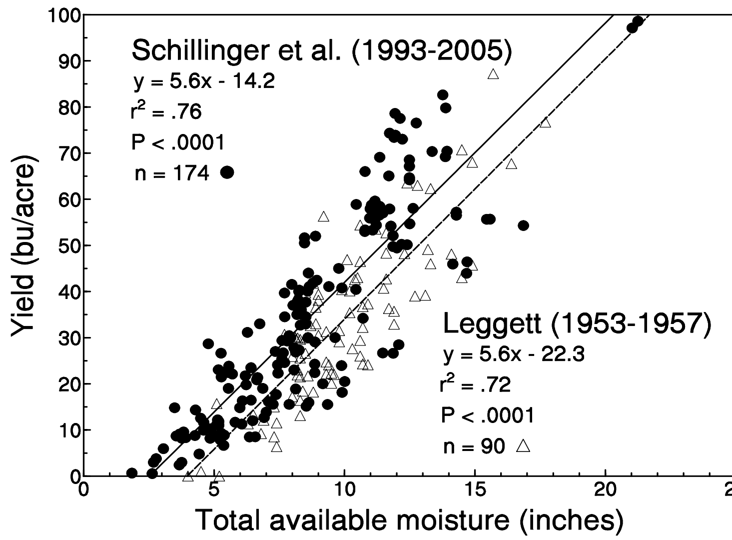


Fig. 1. The relationship between available soil water and grain yield of dryland wheat in Eastern Washington. Data were collected by G.E. Leggett (open triangles, dotted line) from 1953-1957 and by W.F. Schillinger et al. (filled circles, solid line) from 1993 – 2005.

From 1993 – 2005, W.F. Schillinger et al. conducted a series of dryland wheat-related experiments involving 174 replicated treatments where soil water content in early spring, annual precipitation, and wheat grain yield were measured. These data show that wheat requires 2.5 inches of available water just for vegetative growth. For every inch of available soil water above the 2.5-inch baseline, one inch of stored soil water provided 5.4 bushels of grain per acre and one inch of spring rainfall provided 6.9 bushels of grain per acre (Fig 1). Predicted grain yield differences between the two models may likely be due to the ability of modern wheat varieties to begin grain production with less available water compared to wheat varieties in the 1950's. The interpretation of these data on the relationship of available water and wheat grain yield is still in the preliminary stage. Data will be further evaluated and reported at a later date.