Nitrogen Price and Other Fertilization Considerations for the Fall

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QUESTIONS about the effect of nitrogen (N) fertilizer price on optimum rates of application have been common over the past few months. This has come about as the result of increases in natural gas prices. Since natural gas is a feedstock for N fertilizer production, its price directly affects N fertilizer price. Anytime fertilizer prices increase, farmers and ag suppliers begin to wonder how much, if any, to cut back on rates of application. Research has shown over and over again that while fertilizer price affects economic optimum rates of application, the effect is not as great as one might expect.

Fall planting of winter wheat and other crops is just around the corner. The time for fall fertilization for spring planted crops is also coming soon. Now is a good time to start seriously considering fertilization plans for this fall.

Winter Wheat

Adequate N must be available to the wheat plant at all phases of development. Shortages of N will ultimately result in reduced tillering, reduction in head size, poor grain fill, reduced yields, and low protein content. Optimum rate of N will depend on factors such as residual soil nitrate (NO_3^-) level and the yield potential of the environment. Splitting applications of N between preplant and early spring is a best management practice (BMP) that often results in greater N use efficiency and reduced economic, environmental, and agronomic risks.

Scientists at Kansas State University have investigated the effect of N fertilization on dryland winter wheat yield in western Kansas. This study was conducted on six farmer field sites over four years. The typical cropping system was wheat-fallow using reduced tillage practices. Rates of N fertilizer application ranged from 0 to 100 lb/A (20 lb increments), and two methods of application were evaluated ...broadcast and spoke-injected. A production function that took into account N fertilizer rate, residual soil NO_3-N (0 to 24 in.), surface residue, and method of application was derived from the data collected over the course of this study. Timing of application had little effect on wheat yield. **Table 1** shows wheat yield estimated from the production function at N fertilizer rates ranging from 0 to 100 lb/A (injected), soil NO_3-N at 40 lb/A, and surface residue cover of 28%.

Table 1. Estimated wheat yield across rates of injected N fertilizer (western Kansas, Schlegel and Dhuyvetter, 1998).

N rate, lb/A	Yield, bu/A	Increase from N, %
0	35	—-
20	40	15
40	44	27
60	47	35
80	49	40
100	50	42

Soil NO_3-N 40 lb/A, residue cover 28%

A particularly interesting aspect of this work was the analysis and determination of optimum N rate. **Table 2** shows the effects of N and wheat price on profit-maximizing N fertilizer rate. At a wheat price of $3.25/bu, when N price is increased 133% (from $0.15 to 0.35/lb N) the optimum N rate decreases by only 21 lb/A, or 25%. The relative difference in cause and effect is tremendous. In other words, N price (cause) can undergo large shifts that result in relatively small changes in optimum N rate (effect). Similarly, crop price has a relatively small impact on optimum N rate. At $0.20/lb N, a decrease in crop price from $3.50 to 2.50/bu results in a decrease in optimum N rate of only 8 lb.

Table 2. Effect of N and wheat price on the estimated optimum rate of N fertilizer on dryland wheat (western Kansas, Schlegel and Dhuyvetter, 1998).

N price, $/lb	Wheat price, $/bu				
	2.50	2.75	3.00	3.25	3.50
0.15	79	81	83	84	85
0.20	72	75	77	79	80
0.25	66	69	71	73	75
0.30	59	62	66	68	70
0.35	52	56	60	63	66

Soil NO_3-N 40 lb/A, residue cover 28%

Adequate phosphorus (P) nutrition is also essential to profitable winter wheat grain and forage production. Phosphorus affects wheat growth throughout the season in several ways. Early in the season the young plant has limited root surface for absorbing P, so adequate available P in the root zone aids in uptake and early development. Sufficient P enhances root proliferation and results in increased tiller production, which in turn increases forage and grain yield potential. Adequate P fertility is also associated with reduced winterkill, maximum nutrient and water use efficiency, hastened maturity, and lower grain moisture at harvest. Growers shouldn't underestimate the importance of P nutrition for this season's wheat crop. Use soil testing to help determine optimal rates of P application. Also consider local data and experience. Furthermore, to assure maximum P fertilizer use efficiency, consider placement options and the many factors that affect wheat response to P.

Fall Fertilization for Spring Crops

Fall application of P and potassium (K) for spring planted crops is a sound practice in many situations since these nutrients are of limited mobility in most soils.

Aglime is another good candidate for fall application.

Following are some of the benefits of appropriate fall application of these inputs.

- **Saves valuable time in the spring season.** Fall application clears the way for quick spring planting and assures that lower than optimum fertility won't limit crop yield.
- **Spreads-out grower and dealer workload.** Fall applications can help smooth-out some of the peaks and valleys of activity to make the yearly workload more evenly distributed for everyone involved.
- **Reduces the probability of profit-robbing soil compaction.** Fields tend to be drier in the fall than in the spring in most areas. Dry soils are much less susceptible to compaction from application equipment. Also, fall affords greater flexibility for scheduling applications to coincide with optimum soil conditions.
- **More reaction time.** Fall application allows more time for aglime to react with the soil to neutralize acidity. In reduced tillage systems more time is provided for nutrients to move into the root zone.

Whether fall application of N fertilizer is appropriate depends on the region, site, and soil characteristics. For example, N should not be applied in the fall on sandy soils with high leaching potential. However, where the likelihood of N loss through leaching is minimal, fall application may be appropriate. The use of an ammoniacal form of N after soil temperature in the zone of application remains below 50°F until spring is usually recommended. This helps prevent the conversion of ammonium to NO_3-N, thus minimizing the possibility of NO_3^- leaching. The chances of gaseous losses of N from some fertilizer sources are also reduced below 50°F. While general guidelines are useful, it's always wise to check local best management practices before fall applying N.

Appropriate fall fertilization is an agronomically, environmentally, and economically sound practice. "Appropriate" here means that nutrients are applied such that losses prior to planting are minimized. **Fall application of nutrients for spring planted crops, like other fertilization practices, should be based on soil test data and local information and experience.** ■

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