Fertilizer Facts: May 1996, Number 8

Nitrogen Fertilizer Materials

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Several different N materials are available (Figure 1). They differ in chemical composition, but perform equally well if applied at the same rate using appropriate application practices. These materials are found in granular, liquid, and gaseous forms and require different application equipment. In order to use these sources most effectively, their unique characteristics and the unique management guidelines that govern their use must be understood.

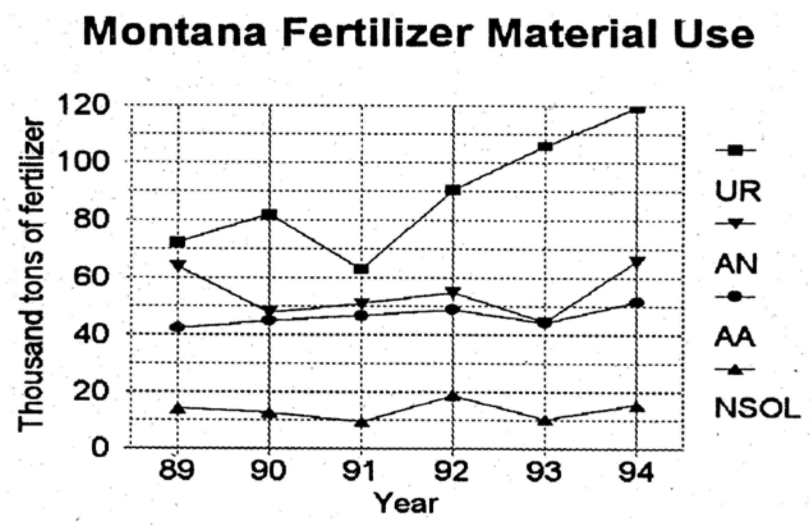

Figure 1. Use of N fertilizers in Montana from1989 to 1994. *(Data from 1995 Montana Agricultural Statistics.)*

Ammonium nitrate (AN)

- White crystalline pellets
- 34% N
- Excessive rates may reduce seed germination if placed with seed
- DOT listed "Oxidizing material"
- Flammable
- Isolate from other stored chemicals, especially organics, flammable liquids, acids, etc.
- Should not be mixed with urea

Urea (UR)

- White crystalline prills or granules
- 46% N
- Excessive rates may reduce seed germination if placed with seed
- Should not be mixed with ammonium nitrate
- Prilled pellets have low density, and will segregate while mixing, preventing even spreading

- Biuret can be produced during manufacture, which at high levels is toxic to some plants
- Soil incorporation reduces risk of N loss
- Surface application above 50^{o} F in the soil increases risk of N loss
- Clay soils hold urea better than sandy soils
- Can adsorb moisture from air

Anhydrous ammonia (AA)

- Colorless gas
- Sharp, pungent, noxious odor
- 82% N
- Gas at normal pressure
- Liquid when pressurized for transport and storage
- 265 psi minimum working pressure
- Corrosive liquid
- Inject into moist soil for best results
- Inject deep enough for gas to dissolve in soil moisture
- Clay soils trap ammonia better than sandy soils

Nitrogen solutions and suspensions (NSOL)

- Liquid solutions and suspensions provide N dissolved in water
- 28 - 32% N
- Can be applied with irrigation water
- Can be applied with some pesticides
- Liquid can be diluted or concentrated for precise, even application
- Liquids are easily handled by pipes and pumps
- Soluble nutrients can be mixed at precise rates
- Quality control easily measured by pH, specific gravity or density

Choosing a nitrogen source

Your selection depends on:

- necessary machinery available
- cost
- cropping system
- availability
- personal preference

The most important decision to make is what N application rate to use. By basing it on sound agronomic criteria and soil analysis, optimal growth rates occur, fertilizer dollars are used most economically and the environment is protected from excessive fertilizers in surface and ground water. The general recommendation for N and K_2O (potash) combined when placed with the seed is no more than 30 lbs actual/a. This amount will vary up or down depending upon soil water status, texture and the type of application equipment.

In Figures 2-5, "% of check yield" is used as a measure of plant response to fertilizer, where the fertilized treatment yield divided by check yield (no fertilizer) multiplied by 100 gives the vertical axis value.

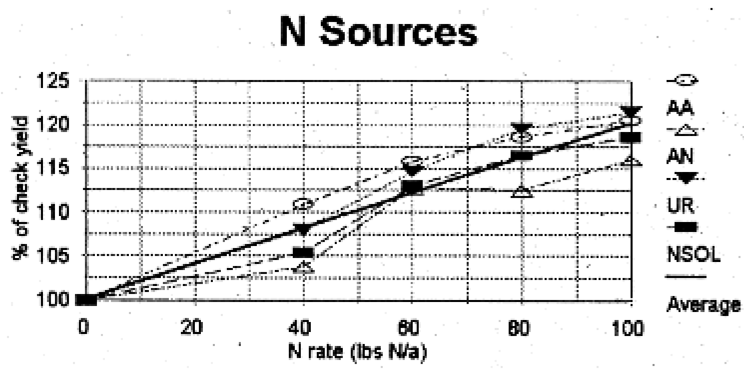

Figure 2. Spring wheat response to N sources.

In Figure 2**, urea (UR), ammonium nitrate (AN), nitrogen solution (NSOL), and anhydrous ammonia (AA) were applied to spring wheat. N sources had comparable performance at the same N rate. Each point on the graph represents four plots. A 10% increase in yield equals 4.2 bushels/acre.

In Figures 3-5, little fertilizer response is seen due mainly to drought conditions. However, the negative effect of banding UR, and to a lesser extent AN, with seed is evident, with a decrease in yield with an increase in N rate.

In Figure 3, winter wheat was grown at four locations utilizing UR or AN in three different placements. Each point represents either 16 plots (UR, AN) or 32 plots (AVGs). UR and AN banded with seed reduced yields. UR had a greater negative effect than AN at the same N rate.

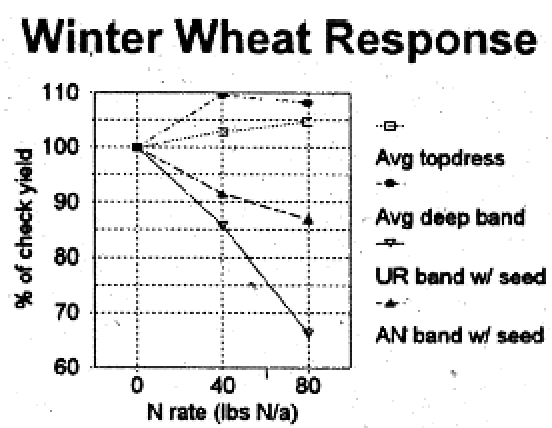

Figure 3. Winter wheat response to N source and placement.

In Figure 4, spring wheat was grown with UR and AN with three placement methods. Each point represents either 12 plots (UR, AN) or 24 plots (topdress). UR and AN banded with seed reduced yields. UR reduced spring wheat yields more than AN.

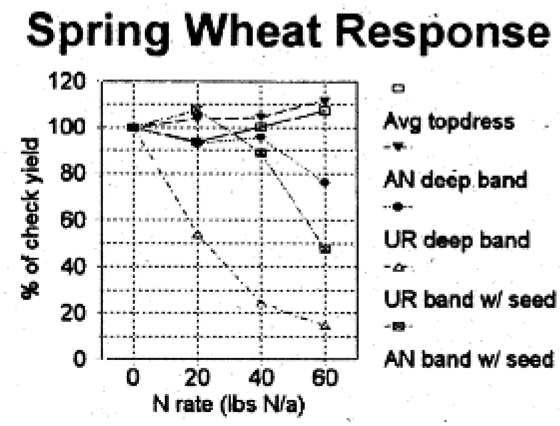

Figure 4. Spring wheat response to N source and placement.

In Figure 5, two locations of spring wheat and four locations of winter wheat were fertilized with UR with three placement methods. No real differences in yield were observed for topdress or deep band N. With each incremental increase in urea-N rate, yield decreased. Each point represents 24 plots.

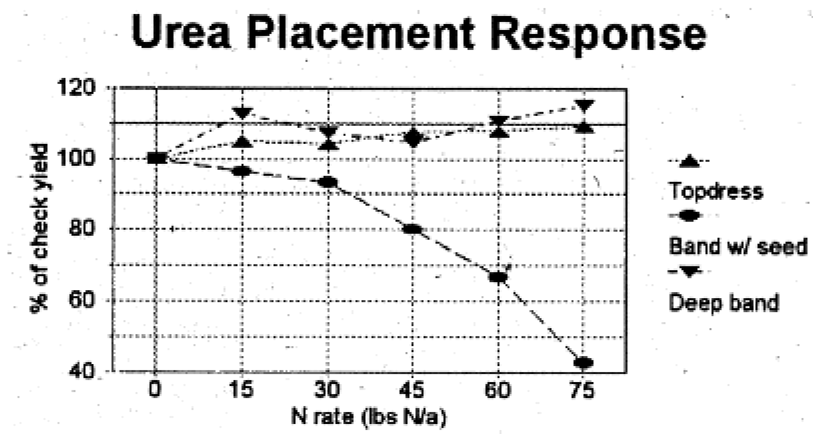

Figure 5. Wheat response to placement of urea.

***Figure 2 uses data from H. Houlton (1978) "The yield and protein results of fertilizing spring wheat with anhydrous ammonia, ammonium nitrate, urea and liquid 32-0-0". Data for Figures 3-5 are from J. Jacobsen (1988) "Summary of maximizing efficiency of nitrogen fertilizer used for dryland cereal grain production in conservation tillage systems in Montana".*