

## ■ FFF Review

# Efficiency: Key To Boosting Bottom Line!

If there was ever a time to pay attention to efficient means of nutrient application, it is now.



With commodity and input prices at or near all-time highs, dealers and growers need to pay attention to what we know about efficiency that can boost the bottom line for everyone. Fast and easy doesn't necessarily equate to highest profitability. The Fluid Fertilizer Foundation (FFF) has been sponsoring research on efficient use of fluid fertilizers and extending that information to dealers and growers since it was established in 1982. What follows is a review of some of what we've learned about proper placement, timing, additives, and starters that ultimately affect the bottom line of both the dealer and grower.

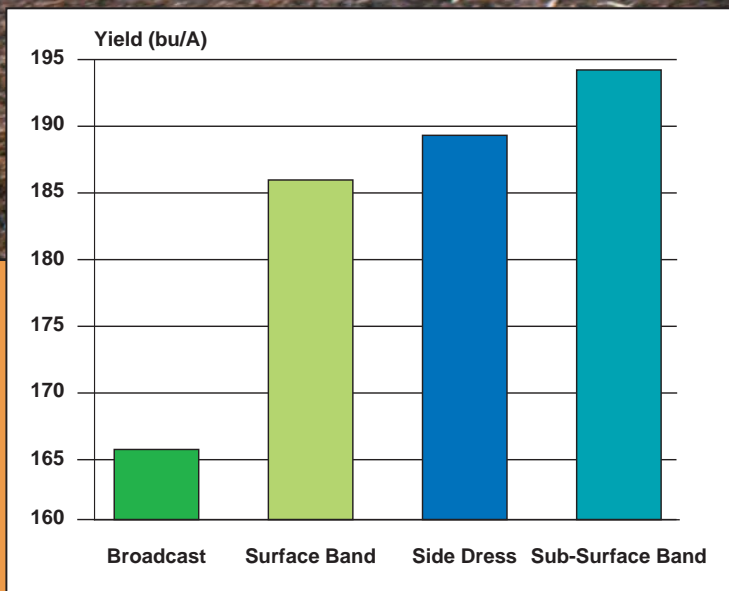


Figure 1. Yield increase on no-till irrigated corn, showing banding and sidedress vs. broadcast, University of Nebraska, 1985.

### Placement

**Surface banding.** From university research we know that high residue row crop systems are particularly prone to less nitrogen (N) use efficiency (NUE) when fertilizer applications are made preplant or pre-emergence. The reasons for better performance by banded

N are based on getting applied N through the residue to the soil surface, reducing the possibility of ammonia volatilization from urea-based materials and diminishing N immobilization via residue contact. Just how much more efficient banded N will be over broadcast N depends on a number of factors: 1) amount of residue, 2) climatic conditions, 3) soil conditions, and 4) rainfall after application. Many of these factors cannot be controlled so they have to be managed

around. Surface banding is also a great way of improving NUE on small grains and forage grasses for the same reasons as for row crops (Figure 1). Banding does eliminate the efficiency of dual applications of N and herbicides. Expect less foliage burn with surface bands compared with broad-

cast UAN.

**Subsurface banding.** Sub-surface banding (Figure 1) can overcome some of the problems of NUE such as ammonia volatilization from urea breakdown and positional unavailability on dry soils. But that's not always feasible, especially in no-till systems and it doesn't fit very well with custom application. Thus, thinking about advantages of surface banding is a practical consideration. However, banding (whether it be surface or subsurface) has to take into account potential problems, such as leaching of nitrate. Split N applications cut down on nitrate leaching potential and are a good way of improving NUE.

**Timing**

**Split applications.** Split N applications can improve NUE by

nutrition can benefit crop yields, especially of high yield capacity hybrids and varieties. Sidedressing part of the N for row crops can help with all of these factors. Fertigation is a great means of splitting N applications and extending ammonium availability.

**N at planting.** At first the idea of more gallons of starter and added logistical problems is not attractive, but research has consistently shown that applying starter N at the rate of 20 to 30 lbs/A close to the emerging corn plant is crucial for setting yield capacity. Broadcast N, even pre-plant surface or subsurface banded N, doesn't accomplish what a banded starter N application can provide. High concentrations of ammonium N in that band have the added benefit of boosting

volatilization, leaching and denitrification can be important factors that improve crop response to applied N. These additives include 1) nitrification inhibitors that diminish leaching and denitrification losses, 2) urease inhibitors that slow urea breakdown and diminish surface N losses by ammonia volatilization and 3) combinations of these chemistries. Space doesn't permit a detailed description of all of these products, but they can be very cost effective, particularly when conditions are right for N availability problems.

Similarly, products are now on the market to reduce P fixation in the soil, improving availability, plant uptake, and P use efficiency (PUE). Visit the FFF website ([www.fluidfertilizer.com](http://www.fluidfertilizer.com)) for articles in the Fluid Journal that

demonstrate the efficacy and profitability of these products.

**Starters**

**P and K.** Banding P and K can be a substantial advantage in NUE. Purdue and Kansas State research has demonstrated the benefits of banding both nutrients. Banding diminishes P fixation and improves PUE. Both preplant and band at planting (starters) benefit PUE for row crops. Higher concentrations of potassium (K) in surface bands of PK suspensions recently have been shown to improve K movement into the soil. High concentrations of K in bands can improve availability

by diminishing K fixation when it occurs and can help plants take more K early by countering environmental stresses.

In a three-year Kansas State University study, the yield effects of different starter formulations

lowering the possibility of nitrate leaching and decreasing the possibilities of N losses via denitrification under wet soil conditions (Table 1). Research has shown that extending the availability of ammonium N in corn and wheat

early absorption of phosphorus (P), even on high-P soils.

**Additives**

Nitrogen availability and use can be and is affected by a number of factors. Additives that slow or control N losses by ammonia

Time of Application and Source of N					
Fall Ammonia	Preplant	Planting	Sidedressed	Yield, bu/A	% N Recovery
0	0	0	0	118	-----
100 NH <sub>3</sub> + N-Serve	-----	-----	-----	167	63
80 NH <sub>3</sub> + N-Serve	-----	-----	20 UAN, coulter	169	60
-----	100 NH <sub>3</sub>	-----	-----	164	60
-----	100 UAN b'cast	-----	-----	163	59
-----	-----	40 UAN dribble	60 UAN, coulter	175	65
-----	-----	40 UAN b'cast	60 UAN, coulter	177	73

*Table 1. Corn grain yield and N recovery increased by split applications with UAN, Randall, Univ. of Minnesota*

and placement on corn are shown in Table 2. In another Kansas State study, the starter N rate effects on whole plant P uptake are shown in Figure 2. Starter N can have a huge effect on P uptake early in the growing season, improving PUE even when P soil tests are high.

### Good Beginning

High-use efficiency for all nutrients depends on a good beginning. For crops planted into cold soils, this is particularly important (spring grains, corn). Be sure to include sulfur (S) and zinc (Zn) in starters, besides N, P, and K. Environmental stresses (cold, compaction, excess soil water) create a need for a high concentration of these nutrients close to the developing seedling. Overall amounts needed may not be great but a ready supply of these nutrients concentrated close to the seedling helps overcome these problems, even on high-testing soils. Plant development and yield potential can be significantly affected by early-season problems in nutrient uptake even with high soil test levels. That doesn't mean soil testing is not helpful but it does emphasize that some factors not measured by soil testing need to be addressed in nutrient management.

Starter lbs/A	In-Furrow	2 X 2	Dribble	Row Band
5-15-5	172	194	190	179
15-15-5	177	197	198	180
30-15-5	174	216	212	192
45-15-5	171	215	213	195
60-15-5	163	214	213	201
<b>Average</b>	<b>171</b>	<b>207</b>	<b>205</b>	<b>189</b>

Table 2. Starter N effects on corn yield, 3-year average, Kansas State U., Gordon.

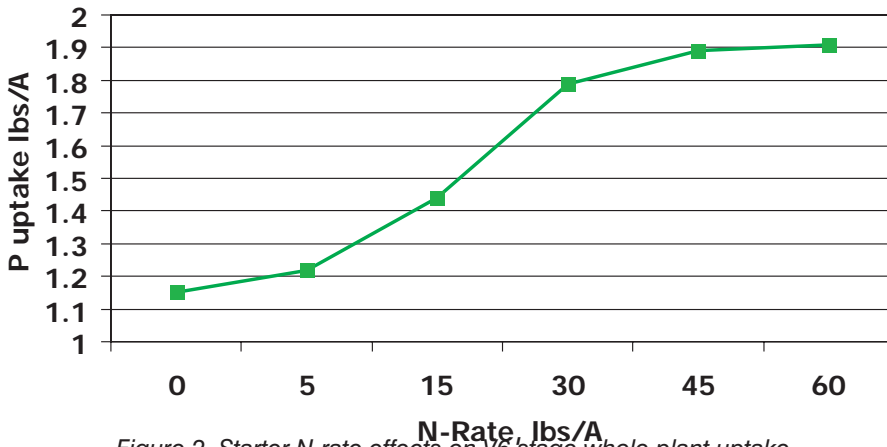


Figure 2. Starter N-rate effects on V6 stage whole plant uptake, Kansas State University.

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