FLUID DIGEST

Research Update from the Fluid Fertilizer Foundation

Volume 1, Number 2 *December 1988*

Fluid starter corn yield increases range as high as 39 bu/A

In southern studies, Touchton of Auburn University, Alabama, has recorded corn yield improvements of 39 bu/A ($97.50/A!) using high-N, low-P fluid starters. Similarly, South Carolina research has shown as high as 21-bu/A increases.

Research by Havlin of the University of Nebraska on irrigated, no-till corn in Nebraska has shown as high as 19-bu/A increases using multi-nutrient fluid starters. As PK and S were included, yield advantages over N alone became readily apparent (Figure 1). The fluid mixtures were achieved using UAN, APP, ATS and KCL and were knife-banded at planting. The profitability of such an approach is clear in Table 1.

Table 1

Yield benefit in no-till corn from multi-nutrient fluid fertilizer application.

Nutrient addition	Yield increase bu/A	Value of increase $/A
P	9	$22.50
K	5	12.50
S	5	12.50
Total PKS	19	$47.50

An Indiana report of studies conducted by Mengel of Purdue shows up to 11-bu/A increases in corn yields, using an NP fluid starter on soil testing in excess of 100 lbs P per acre (Figure 2). In a conventional (plow) tillage system, a two-year 9-bu/A average yield increase from fluid starter was realized — an additional $22.50 gross revenue!

In the same study on corn, Mengel shows an interesting interaction between broadcast, strip or knife-banded PK suspensions and fluid starters. Yield advantages as high as 16 bu/A were shown by applying starters after PK suspensions were applied earlier.

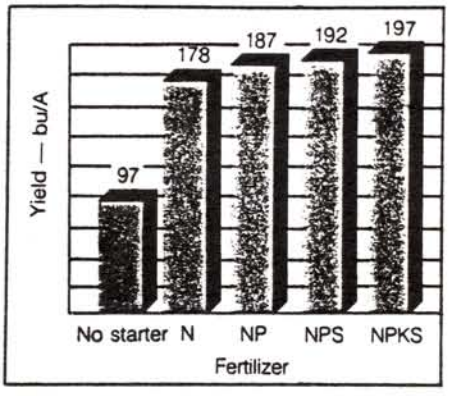

Figure 1. Yield response of no-till irrigated corn to NPKS fluids knifed (in bands) at planting (Havlin, University of Nebraska, 1985).

Clearly, the research shows that fluid fertility management is related to the overall fertility program. Results support the use of starters, placement of PK and demonstrate the interacting benefits of placement/starter combinations in fertility programs.

Increasingly, scientists, farmers and advisers are questioning the analysis of starter fertilizers. As a result, strong evidence is emerging to support the use of "complete" or multi-nutrient starters for corn. For example, Moncrief of the University of Minnesota has produced as high as 15-bu/A yield increases by adding potash to fluid starters — even on high-K soils (Figure 3). Compared to the minimal outlay for K, the return would be a hefty $37.50 an acre! Potash addition to starters is especially beneficial when early K supply to roots is restricted — particularly when compaction occurs in no-till situations.

The FFF has initiated a major project to determine correct NPKSZn ratios for corn starters in Nebraska and Minnesota. This will provide vital information for the northern corn-producing states. Another side study will examine what role nitrification inhibitors play in enhancing N (ammonium or nitrate) diet to young corn plants when used in combination with starters.

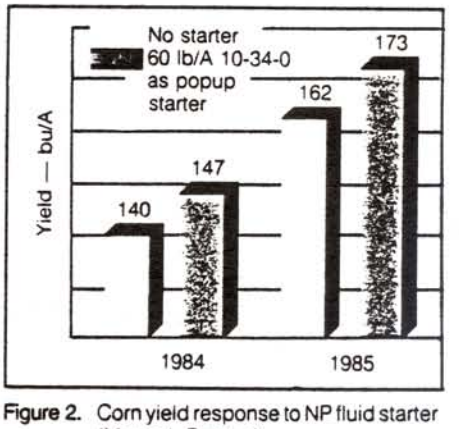

Figure 2. Corn yield response to NP fluid starter (Mengel, Purdue).

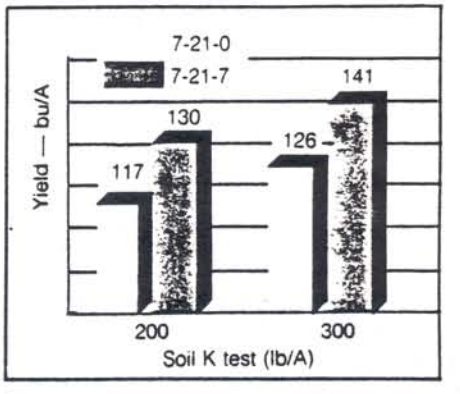

Figure 3. Corn yield responses to fluid starters with K on high-K soils (Moncrief, University of Minnesota, 1984).

INSIDE:

Foundation News
from your Research Director, Julian Smith

FFF research has consistently demonstrated the benefits of fluid starters for a number of crops. A cost-effective fluid starter application has been particularly useful in colder spring soils, no-till environments and compacted soils. However, yield benefits have been reported in a wide range of environments and soil test levels. This edition of *Fluid Digest* carries a wealth of research information that clearly supports the use of starter fertilizers (remember, a profitable end to the growing season depends on a good start!).

Although fluid starters are a must for efficient crop production, starters must be integrated into the total crop fertility program. *Every* efficiency characteristic of fluid formulation and application must be used to drive down production cost per bushel. And outlined in these pages are pointers for such efficient management of major NPK fertility regimes. Maximizing availability of nutrients to plants is a prerequisite for optimizing uptake and response. Proper *placement* of NPK and *splitting* of N applications will complement *starters* in achieving economic and environmentally sound fertilizer use. In simple terms, develop a "strip, starter, split" mentality. All good fertilizer advice is a logical function of timing, placement and concentration! Whether buying or selling, the *program approach* of fluid fertility management is essential.

A positive note arising from the drought of '88 is that fertilizer inputs and programs have been scrutinized in some detail. A wider consideration of crop nutrient removal, yield goals and soil analysis can only improve the profitability of sound fertilizer use. Beware of the sweeping "cut back" attitude! Be field and crop specific and seek out the best options for 1989. Farm profitably! Farm with *fluids!*

J. Julian Smith, PhD.
Executive Vice President, Research Director

Missed preplant P application to wheat? No worries!

Consider topdressing liquid phosphate.

Westerman of Oklahoma State has evaluated the efficacy of topdressing 10-34-0 fluids on hard red winter wheat. On low P-testing soils, topdressing NP solutions as a 3-inch band over 7-inch rows at early growth and tillering stages during winter and early spring increased yields as much as 6 bu/A over preplant broadcast and incorporated applications (Figure 5).

Band application of P produced maximum contact with young wheat plant roots to ensure optimal uptake and response.

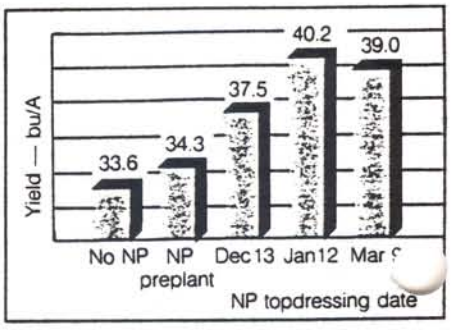

Figure 5. Winter wheat yield response to topdressed 10-34-0 (Westerman, Oklahoma State U., 1984)

Southeast

Fluid starters boost cotton yields up to 145 lbs/A in Alabama study

Data compiled in studies by Touchton of Auburn University, Alabama, present a strong case for using high NP-ratio starters on cotton, corn, sorghum, soybeans and peanuts. Applying 10 gallons per acre of 18-15-0 fluid starter on a Coastal plain soil high in P, Touchton improved cotton yields by an average of 145 lbs/A (Figure 4).

In a companion study, Touchton also demonstrated the value of applying fluid starters on sorghum, posting a 5-bu/A increase using an NP starter (55 bu/A) versus no starter (50 bu/A).

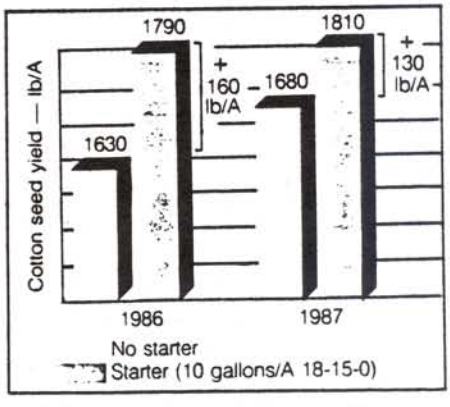

Figure 4. Cotton yield response to fluid starters (Touchton, Auburn University).

Wheat

Fluids affect germination less than dry

In wheat-producing areas of the northern states and Canada, popup (fertilizer with seed) starters are commonly used. However, rates and type of fertilizer employed can affect yield by reducing germination due to toxicity and salt injury.

Recently reported research from Mahler of the University of Idaho (Journal of Fertilizer Issues, 5[3], 1988) compares fluids with solid sources, clearly showing the superiority of UAN in minimizing toxicity and salt injury. Even at rates of 50 lbs/A p[illegible] N, wheat germination and emerg[illegible] was much greater for UAN, compared with solid ammonium nitrate.

Mahler concludes that higher N rates may be used in popup fluids, even in relatively dry soils.

Banding boosts corn yields up to 12 bu/A

The price you pay for broadcasting? Studies have shown it can be as high as $72 per acre!

Barber of Purdue has pioneered the technology of placement for maximum fertilizer efficiency. In an early Purdue 5-year study, he produced corn yield increases as high as 12 bu/A via fall preplow surface band applications of PK (Figure 6). Benefit was $27.50/A.

Barber reports that since strip fertilizer application was mixed with only 10-15% of the plowed soil volume, considerable reduction in P tieup occurred compared to broadcast applications. Result? Increased yields and soil tests showed the availability of P in the soil was improved.

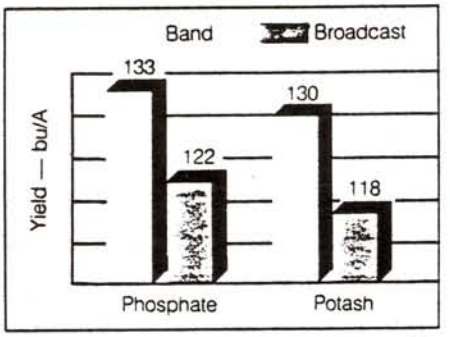

Figure 6. Superiority of band application of P and K over broadcast application on corn (Barber, Purdue).

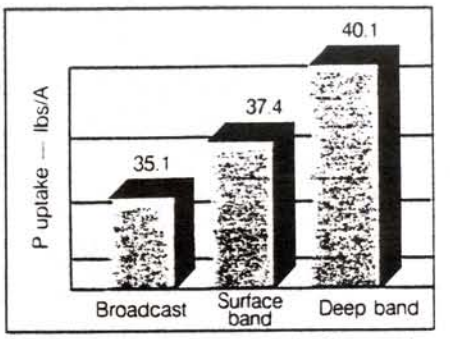

Figure 7. Effects of placement on P uptake in corn (Havlin, University of Nebraska, 1985).

Barber has continued his research to examine how the complexities of soil chemistry and root growth affect fertilizer use. The evidence for proper placement is overwhelming! After evaluating 30 diverse soil types, Barber suggests that the potential for best PK uptake by corn and soybeans is when only 2 to 20% of the soil volume is fertilized. In his studies, such placement has improved P uptake over broadcast methods by as much as 359%!

In the September issue of *Fluid Digest* we reported the 21- to 29-bu/A increase for no-till corn in placement studies by Havlin. At current prices, that yield increase would have been worth $72.50 an acre! In this same study, placement of fluids also clearly improved nutrient availability and uptake (Figure 7).

Concentrating bands of fluid fertilizer in the root zone also has produced up to 11-bu/A yield increases in corn on soils testing high in P (Figure 8) in studies conducted by Rehm of the University of Minnesota.

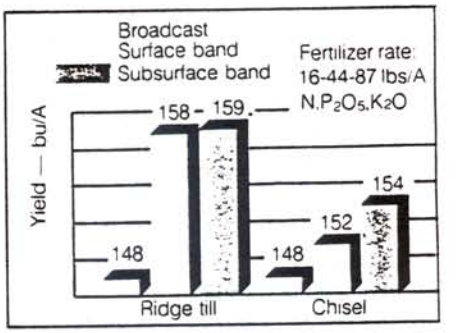

Figure 8. Banding fluids improves corn yield on high-P soils (Rehm, University of Minnesota, 1985).

Yields up 197 lbs/A

Banding outguns broadcasting on cotton

Hutchinson of LSU has showed in irrigated plots how shallow knife or dribble applications of NPK have produced up to 197 lbs/A more of cotton lint than broadcast applications (Figure 9).

Note how compaction in traffic rows reduced yield considerably, but banding still outperformed broadcasting.

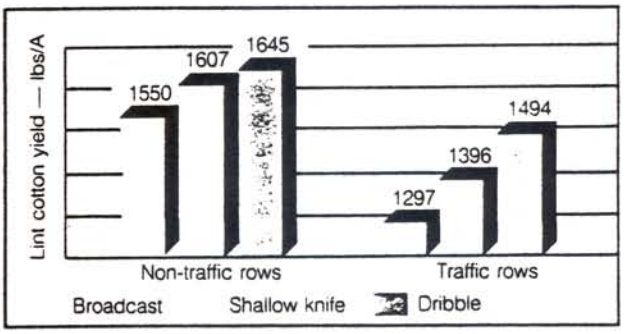

Figure 9. The role of preplant NPK placement for cotton and the effect of soil compaction (Hutchinson, LSU, 1987).

Avg. 14% yield increase

Good start helps soybeans, too

So you think starters are exclusively for corn? Wrong.

Studies from 1980-82 by Touchton of Auburn University, Alabama, have shown that soybean yield can be increased by an average of 14% over a three-year period (Figure 10). UAN + 10-34-0 (20-18-0) was applied 3 to 4 inches to the side of the row or in the row at the rate of 100 lbs/A. Based on current prices, a 5-bu/A soybean yield increase would translate to around $40/A!

Granted, the findings are preliminary and must be continued to be examined on a wider scale. However, although information thus far gathered is fragmented, fluid research does indicate positive results for starters in soybean management.

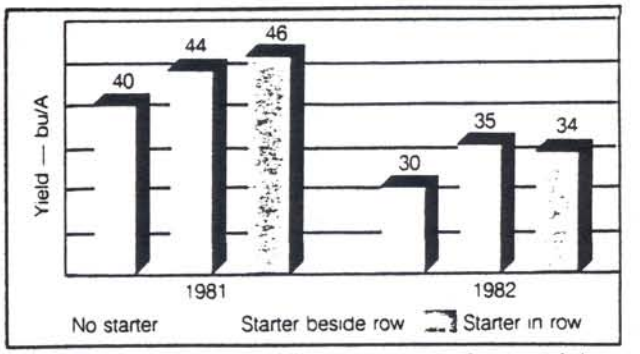

Figure 10. Soybean yield response to fluid starters (Touchton, Auburn University, J. Fertilizer Issues).

Strip application ups soybean yields

Strip application of fluids on soybeans by Johnson of Ohio State University, in a FFF-sponsored study, produced a 3-bu/A increase over broadcasting (Figure 11).

Flannery of Rutgers University has produced as high as 21-bu/A increases with nitrogen sidedressing (Figure 12).

With value on soybeans looking good for 1989, profitable production management strategies must consider direct application of fluids.

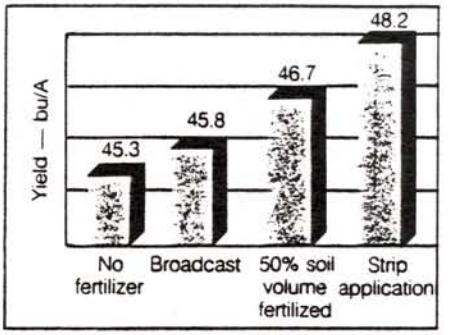

Figure 11. Effect of placement of fluids (40 lbs K_2O/A) on soybean yield (Johnson, Ohio State, 1985-86).

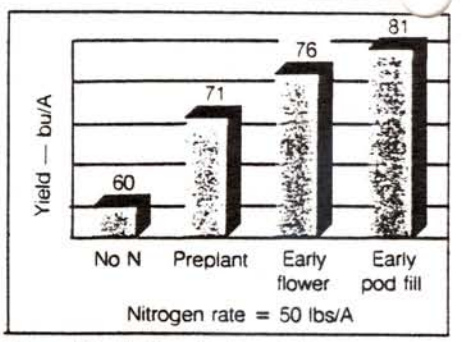

Figure 12. N effects in intensively managed soybeans (Flannery, Rutgers University).

Nitrogen management

Split applications increase corn yields 15 bu/A

An example of good nitrogen management is the work of Eckert of Ohio State University where split N applications (weed and feed/sidedress) produced 15-bu/A increases in corn (Figure 13).

For most crops, the key element in the program approach to fluid fertilizer inputs is nitrogen application. The next issue of *Fluid Digest* will carry an abundance of fluid nitrogen advice for a number of crops.

Increasingly, research has given credibility to practical corn nitrogen regimes, including sidedressing as a major component. The benefits of N sidedressing and weed and feed are:

- Environmentally sound — matching N application with crop uptake
- Increased yields
- Better management flexibility
- Late-season N responsive hybrids

Splitting N applications offers an excellent way to manage nitrogen according to plant population, in-season growing conditions and type of hybrid. In addition to helping a split-N regime, weed and feed can result in better herbicide performance. Recent farm data in Indiana suggest that UAN enhanced velvetleaf control by 19% when used as the primary adjuvant to herbicides. Other obvious weed and feed benefits include energy/labor savings and reduced field traffic, leading to less compaction.

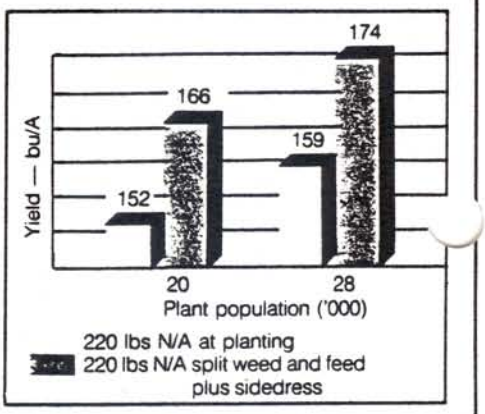

Figure 13. Influence of plant population and nitrogen solution management on no-till corn yield (Eckert, Ohio State University, 1986).