FLUID DIGEST

Research Update from the Fluid Fertilizer Foundation

Volume 2, Number 2 — *June 1989*

Late-season foliar applications boost wheat/potato yields

FFF research by Alley in Virginia shows that a late-season foliar urea/KCl spray increased winter wheat yields up to 7 bu/A and test weights up to 1.3 lbs/bu (Figure 1). In this study, two foliar applications of urea/KCl were made at advanced flag leaf and late grain-fill stages. Note that rate of N applied in all treatments was the same (150 lbs/A).

Table 1

Effect of foliar urea and fungicide on yield and plant disease in winter wheat (Kettlewell, Harper Adams Agricultural College, England, 1987).

Treatment Urea*	Treatment Fungicide**	Yield bu/A	Flagleaf Septoria (%)
		104	7.5
+		110	3.8
	+	117	0.1
+	+	122	0.6

*Sprayed 13 lbs/A N in volume of 20 gals/A at flagleaf and head emergence.
**Applied with urea solution as propiconazole + tridemorph

Late-season foliar nitrogen sprays (as dilute urea solutions to minimize leaf burn and maximize uptake) by Kettlewell of Harper Adams Agricultural College, England, have increased winter wheat yields up to 18 bu/A and reduced disease (Table 1). Additional data show improvement in grain protein content for relevant varieties.

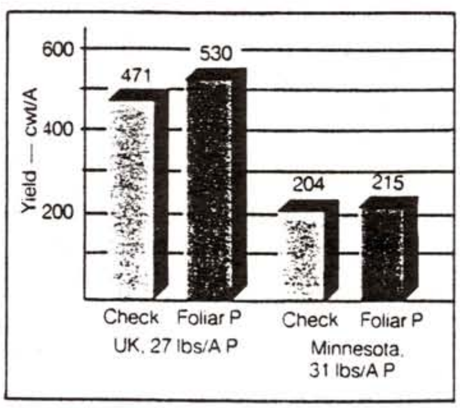

Figure 2. Effect of foliar phosphate sprays on yield of potatoes (Burn, J. W. Chafer, UK, 1987 and Trcka, Minnesota, 1988)

Other studies by Kettlewell in England have also demonstrated the effectiveness of late-season urea and sulfur sprays for wheat. In addition, foliar-applied P studies by Westerman of Oklahoma State University have shown positive results when applied during tillering to wheat planted in cold soils where root development is slowed.

Recent research on potatoes in the United States and England has produced supporting data for foliar applications of P as part of season-long fertility programs. Burn of J. W. Chafer in England increased potato yields 59 cwt/A and Trcka in Minnesota increased potato yields 11 cwt/A with foliar P applications of 27 lbs/A P and 31 lbs/A P, respectively (Figure 2). Foliar P, which is a key in the tuberization process, may be particularly useful in supplementing fluid fertilizer placement for potatoes, since the crop is often a poor user of applied P. Supporting data also show benefits of foliar applications of N.

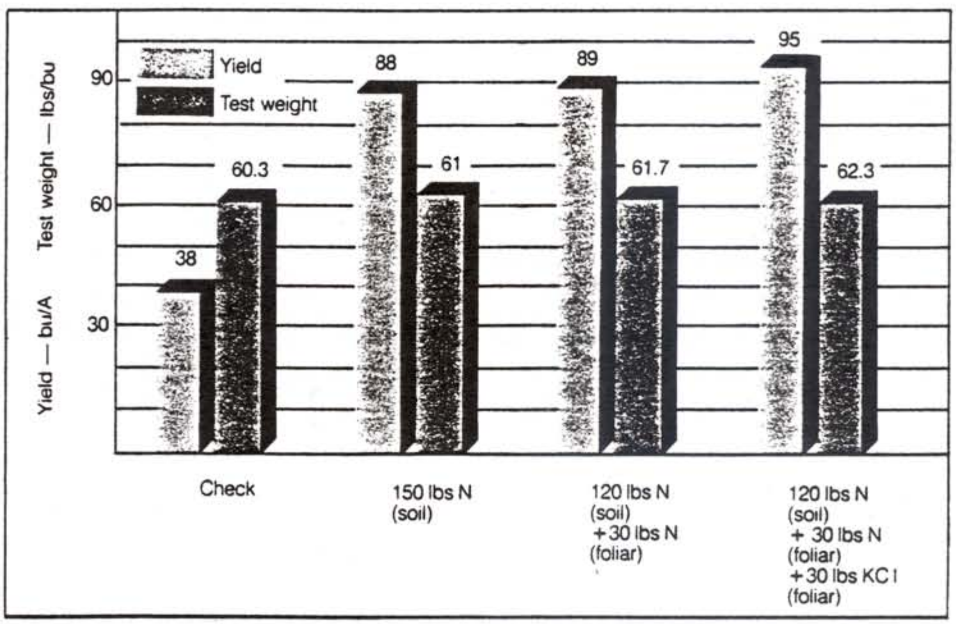

Figure 1. Effect of late-season urea and KCl sprays on yield and test weight of winter wheat (Alley, VPI, 1987).

While foliar sprays have long been recognized as an effective means of applying micronutrients to crops during the growing season, a strong case is now being built by current fluid fertilizer research for using late-season foliar sprays to apply the major nutrients (NPKS) to boost crop yields.

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Foundation News
from your Research Director, Julian Smith

In many areas, erratic spring rainfall, coupled with low soil-profile moisture in the wake of the '88 drought, means some growers have adopted a "wait and see" attitude toward fertilization plans for the '89 growing season. It's still not too late, however, to carefully assess hybrid, plant stand, and available moisture conditions. All impact on nitrogen sidedressing management — an option still open for this growing season. Fluids are ideally suited to such post-planting work, offering a complete array of products that includes PK and S for optimal fertilization levels and maximum crop yields. This is especially true when sidedressing is applied as dribble band or injected.

At the same time, we face another threat that could jeopardize the future of agriculture. A bill recently introduced in the U.S. Senate, if enacted, would greatly restrict fertilization and crop protection practices. For many, adoption of the "low input sustainable agriculture" (LISA) legislation in the Senate hopper could mean substantial reduction in farm profitability and weaken the competitive position of U.S. agricultural products in the world marketplace. In this and future issues of *Fluid Digest*, the FFF's commitment to *truly* sustainable agricultural practices will be made clear regarding efficiencies of fluids that promote economic and environmentally responsible use of crop nutrient inputs!

Finally, I urge you to take time *now* to fine-tune your fertilization programs by keeping an eye on growing crops. Time spent scouting and trouble-shooting is a good investment. Watch for areas of uneven and poor growth. Use tissue and soil analysis to recognize nutrient problems and record on film mounts for next season's reference. And, above all, capitalize on the *flexibility* of fluid fertilizers to maximize environmental safety and farm profits!

J. Julian Smith, PhD.
Vice President Research

UAN as an adjuvant?

Why not? It's a practice increasingly endorsed by agronomists as an additional major benefit of weed and feed. In addition to supplying 50 to 75 lbs/A of N as part of a sound nitrogen regime, UAN can improve the effectiveness of certain herbicides (vs herbicide/water mixtures). Nebraska studies in 1986 by Sander of the University of Nebraska, using UAN/herbicide combinations, improved weed control by 5 to 25%. Recent farm studies in Indiana show a 19% improvement in velvet leaf control when using UAN as the primary adjuvant in herbicides.

Other practical benefits that are making weed and feed (UAN/herbicide combinations) more and more popular with farmers include:

- reduced energy costs
- labor savings
- reduced yield-robbing compaction on certain soils

Remember, crops need to be weed-free to exploit a nutrient-rich environment. Maximum return from nitrogen relies on herbicide use and, perhaps, *vice versa*.

Corn and Soybeans
In-season PK applications net up to $22/A

Sidedressing nitrogen, the practice of matching application timing and peak crop demand, has been well established. But what about P and K, where research and farm practice dictate that they should be applied ahead of crop planting? Research by Buchholz of the University of Missouri in 1988 shows that sidedressing fluid P and K outyielded preplant applications in corn and soybeans by 7 and 3 bu/A, respectively, where basal soil fertility was ideal (Figure 3). This translated into an added economic benefit of $18 and $22/A, respectively!

Thus, if it happens decisions were made to omit P and K applications this spring, the above and similar research

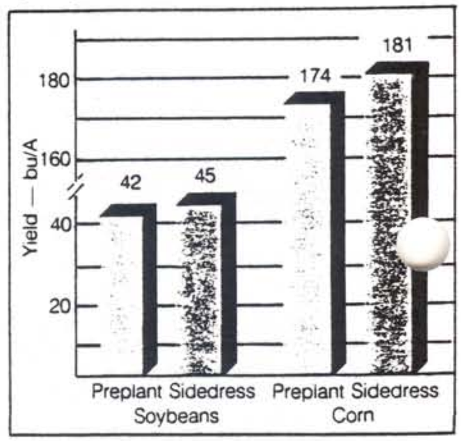

Figure 3. Post-planting applications of P and K (knifed 9-30-80) vs preplant applications on corn and soybeans (Buchholz, University of Missouri, 1988).

provide a strong case for making in-season P and K applications to provide adequate crop nutrition. In the absence of preplant fertilization, postemergent placement (knife or dribble) of fluid P and K can still lead to profitable yield responses.

This is especially pertinent for those whose crops have not received optimum levels of P and K because of uncertainty about nutrient carryover from 1988 and continuing erratic rainfall patterns. Where conditions improve and crops enter rapid growth phases, shortages of essential nutrients will hamper yield returns and reduce or erase profits. Fundamental is the fact that an adequate supply of nutrients is required to carry crops through the season. Equally basic is the flexibility of fluids that makes them ideal for such in-season applications of P and K.

Up to 112 lbs/A

Midseason applications raise cotton yields

Research by Krieg of Texas Tech clearly demonstrates the benefits of midseason applications of fluid N and P. In a 1987 study on a sandy, irrigated soil, he recorded cotton yield increases as high as 112 lbs/A by sidedressing fluid N and P at rates of 45 lbs/A (Figure 4). Where water was non-limiting, sidedress N proved effective when applied at early squaring. Fluid nitrogen applied at this time maintained leaf development and supplied crucial nutrition through squaring and early boll development. As a result, N response was evidenced by increases in both boll number and size.

In another recent study on cotton, Hutchinson of Louisiana State University has shown the benefits of using fluids in combination and band applying them instead of broadcasting. Data collected during 1986-87 show that NPK combinations produced as high as 98-lb/A yield increases and that yields where banding occurred exceeded those where broadcasting took place by as much as 185 lbs/A (Figure 5). Interestingly, one of the highest yields in the study was recorded where boron, sulfur and zinc were also applied.

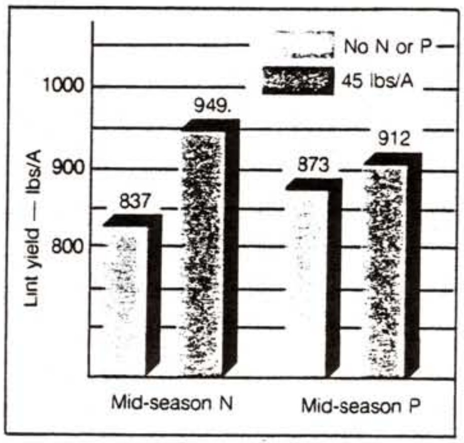

Figure 4. Cotton lint yield response on a sandy soil to mid-season N and P applications (Krieg, Texas Tech, 1987).

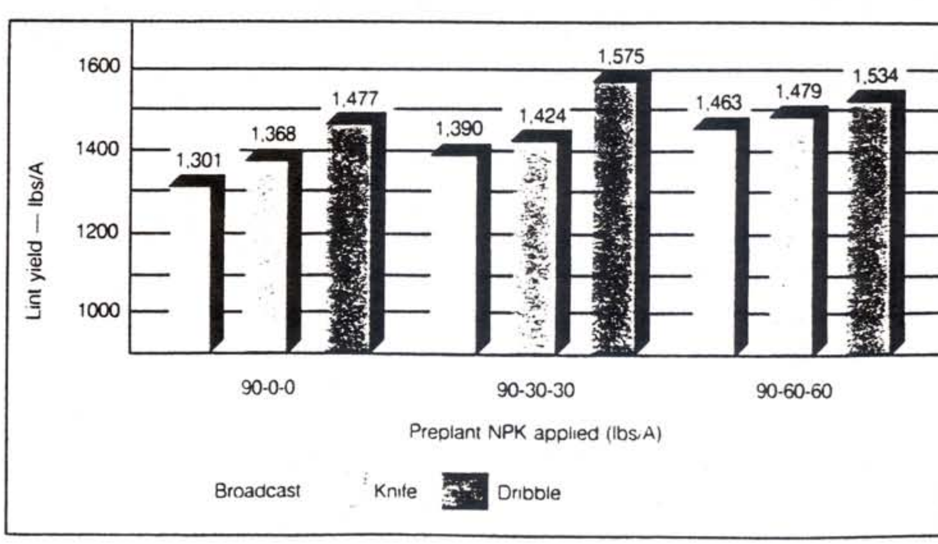

Figure 5. Effects of fertilizer combinations and placement on lint yield of cotton (Hutchinson, LSU, 1986-87).

Up to 7 bu/A on wheat

Banding Fluid N and P at planting increases yields

Studies by Westfall of Colorado State University show that dribbling 30 lbs/A of fluid phosphate on no-till soil in a band over the seed produced 5-bu/A more grain than when broadcasting the same amount of P. The results were even higher at 7 bu/A when nitrogen solutions were applied in the same manner (Figure 6). For P, the yield advantage translated into approximately $23/A.

An interesting aspect of this Great Plains research is that surface banding fluids produced yields slightly higher than banding below the seed. The configuration of the press wheel on the planter and the way it meets the soil may account for this, placing the surface-banded fluid essentially in the bottom of the furrow, since dry surface soil is moved aside to facilitate planting of the seed in moist soil. With time, the force of wind and rain moves soil from the ridge top into the furrow. As crown roots develop at the 3- to 5-leaf stage (1/2 to 3/4 inches below the soil surface), they are able to intercept the fertilizer band placed over the seed row after closure. As a result, plants make efficient use of N and P to produce yields similar to or better than fertilizer banded below the seed.

Dribble banding N and P fluids at planting is a technique well worth considering. Drills can be converted with ease, requiring only a fluid pump and tubing to apply fluid fertilizers behind the press wheel after row closure. New planter shoes, disk openers and other parts are not required.

The move to no-till in the Great Plains is altering methods for applying fertilizers, since broadcast, incorporated and various injection methods cause excessive residue disturbance. Thus, the appeal of dribble banding on no-till soils.

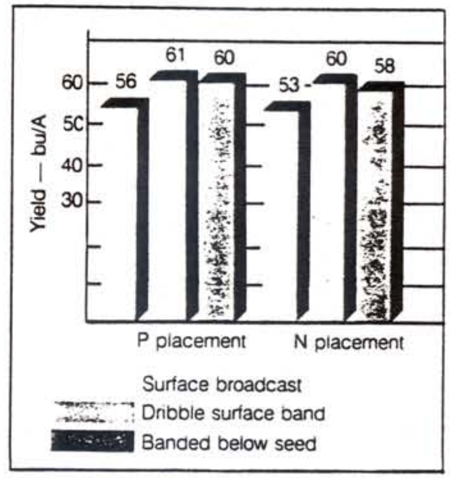

Figure 6. Yield comparisons of different application methods used in applying NP fluids on no-till dryland wheat (Westfall, Colorado State University, 1986).

Climate, where rainfall is only 12 to 22 inches annually, has been the main impetus in the trend toward no-till in the Great Plains. Adoption of no-till has improved soil water availability, reduced erosion and resulted in more residual plant nutrients in the soil.

Nearly 1 ton/A
Accurate fluid placement improves alfalfa yields

Data produced in 1988 by Sweeney of Kansas State University show that fall preplant knifing or dribble banding of P and K fluids will produce profitable yield responses in first-year alfalfa production. Over three cuttings, banded fluids increased yields as high as 0.8 ton/A, when compared with broadcast plots (Figure 7). NPK uptake was also improved by banding.

Applying fluids in the proper volume is also fundamental in achieving yields of 8-10 tons/A. Generally recommended is to apply in excess of 200 lbs/A P and 600 lbs/A K together with boron and up to 50 lbs/A S. Studies by Vough of the University of Maryland have demonstrated the profitability of even higher nutrient rates where over 500 lbs/A P and 700 lbs/A K were applied to produce high alfalfa yields.

Thus, shooting for high yields in alfalfa demands high fertility, blended with other management aspects. Ideally suited to the task are fluids. For example, stand establishment is easily achieved by a mix of a PK suspension, alfalfa seed, inoculant and insecticide. Followed by rolling, such a "seed and feed" operation is timely and profitable. Alternatively, particularly where soil tests are lower, fluids may be applied as a separate operation.

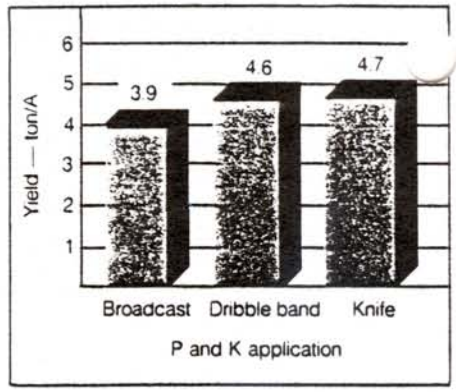

Figure 7. Banding vs broadcasting in fall preplant applications of fluid P and K on first-year alfalfa in southeastern Kansas (Sweeney, Kansas State University, 1988).

42 bu/A increase
Sidedressing pays in grain sorghum

Research by Touchton of Auburn University shows yield increases as high as 42 bu/A with fluid starter applications followed by sidedress applications of N fluids on grain sorghum at the rate of 120 lbs/A N (Figure 8). Note benefits occur in either no-till or conventional-till situations.

While the figure depicts the positive response of grain sorghum to starters and N applied separately, the optimum response is when the starter is followed by an N sidedressing application in no-till fields.

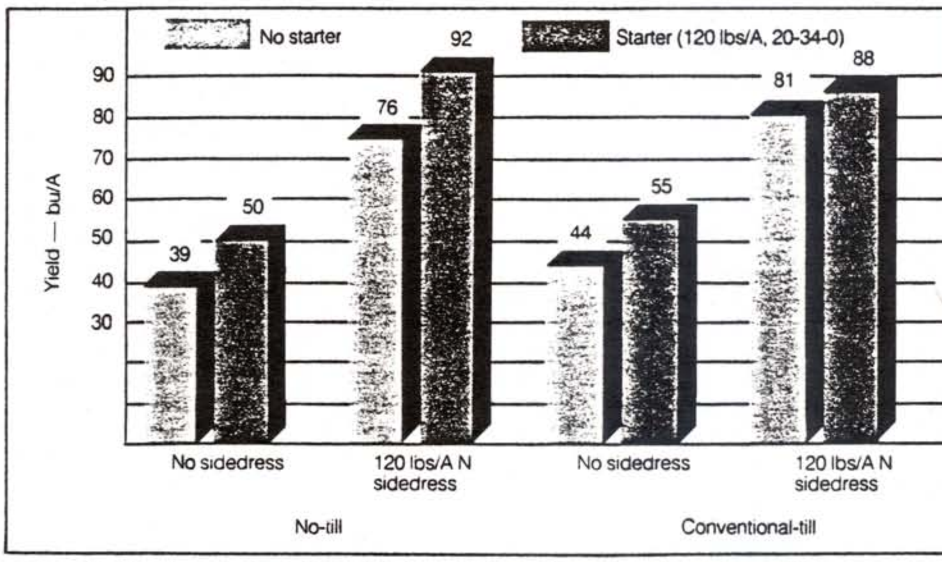

Figure 8. Effects of starter fertilizer, sidedressed N and tillage on grain sorghum yield (Touchton, Auburn University, 1986).

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