FLUID DIGEST®

Research Update from the Fluid Fertilizer Foundation

Volume 4, Number 2 *June 1991*

As high as 22 bu/A

In-season N applications boost growers' yields

As testimony bears, in-season application of N has its advantages and so does the use of fluids as the vehicle for making in-season applications. Yields improve. N-use efficiency is improved. Residual N after harvest is minimized — so are leaching and denitrification during the season. Fluids offer versatility, lending themselves to in-season application methodology and prescription blending. Fluids are easy, convenient, safe to handle.

Indiana

Boyd of Fert-A-Chem, Inc. in Lapel, Indiana, reports as high as a 22-bu/A increase over check in corn yield after sidedressing 80 lbs/A of N (24-0-2-2S) with a cultivator at 8-leaf stage in the field of customer Don Gwinn (Figure 1). Corn (Beck 62XA) followed beans and a May 10 nitrate test showed 14 ppm. Preplant (90-33-145) and starter (18-18-4) applications preceded sidedressing.

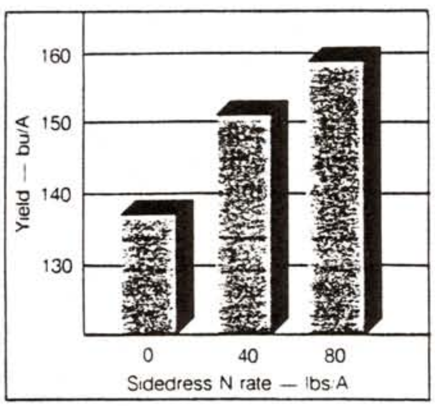


Figure 1. Response of corn to sidedress applications (24-0-2-2S fluid) in customer's field (Boyd, Fert-A-Chem, Inc., Lapel, IN, 1990).

Illinois

An 18-bu/A rise in corn yield over check was recorded by Melton of Tri-County Chemical in Eldorado, Illinois, after sidedressing 30 lbs/A of N at the 6-leaf stage on a customer's field (Figure 2). Sidedressing followed application of 160 lbs/A of N broadcast preplant (weed and feed) and a 7-21-7 starter. N source at sidedress was 28% UAN. Melton claims best yields result when sidedressed N is "cultibanded" or dribbled on with a cultivator.

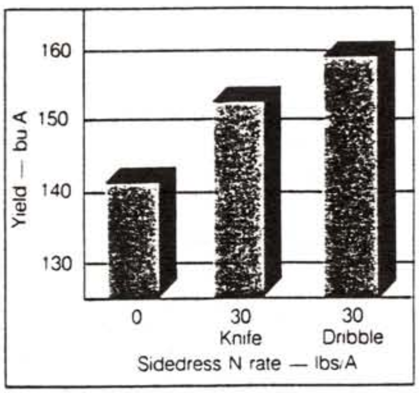


Figure 2. Response of corn to sidedressed 28% UAN in customer's field (Melton, Tri-County Chemical, Inc., Eldorado, IL).

Iowa

Yields in a Wellsburg, Iowa, corn field jumped 11 bu/A over check following a 30-lb/A sidedress application of N (Figure 3). Mitchell of Greenbelt Elevator of nearby Steamboat Rock, Iowa, states 28% UAN was applied on a customer's field in June when corn was about two feet high. Preplant (check) was 130 lbs/A of N. Preplant + sidedress was 100 lbs/A of N preplant and 30 lbs/A of N sidedress. N was also included in 7-18-5 starter. Note that the bushel increase was produced with no increase in the rate of N applied preplant and sidedress.

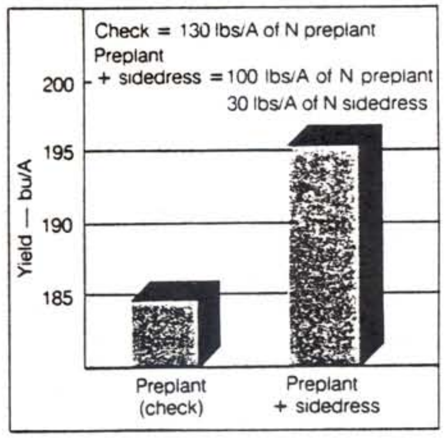


Figure 3. Comparison of yield responses in customer's corn field — preplant N vs preplant N + sidedress N (Mitchell, Greenbelt Elevator, Steamboat Rock, Iowa).

Bottom line

The economic benefits? Assuming $2.40/bu corn, the top yield gain (22 bu/A) would have produced a gross profit of $52.80/A. Input cost of N, assuming 25 cents/lb, would have totaled $20/A, for a return on investment or net profit of $32.80/A.

Keep N off residue

Researchers in Alabama have shown that surface banding N solutions or using a shallow band placement at planting time can substantially enhance N-use efficiency as compared to broadcasting N fertilizers on top of the residue. Proper placement of N in no-till and the resulting N-use efficiency is also environmentally beneficial.

INSIDE:

FFF study

Planting date affects N requirements

A four-year FFF-sponsored study on corn by Eckert of Ohio State University offers interesting insight on how planting dates can alter optimum N requirements.

Figure 4 shows that 150 lbs/A of N was the optimum rate for producing yields at the May (early) planting date. Adding another 50 lbs/A of N resulted in no change in yield. Optimum rate for June (late) planting dropped to 100 lbs/A.

Figure 5 shows that N removal in the soil almost matched N input at the 100-lb/A rate for either planting date. Thus, costs of further fertilizer additions would not be profitable. Also note that the quantity of N removed from the soil by the harvested grain exceeded that added as fertilizer when N input fell below 100 lbs/A.

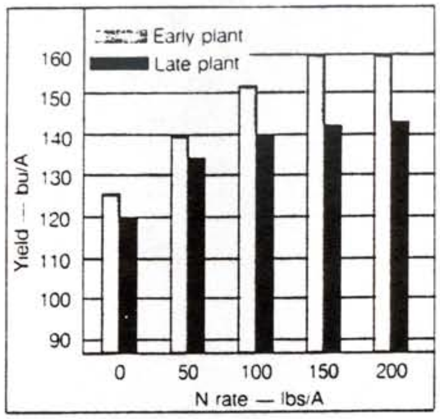


Figure 4. Effect of N rate on corn yield for two planting dates (Eckert, Ohio State University, 3-year avg.).

The message here: 1) excess N may not be utilized when you add N beyond yield potential and 2) you deplete your soils (nutrients) when inputs run short of yield potential. Either way, the bottom line of your balance sheet suffers — not to mention your image as a good steward who is trying to protect the environment.

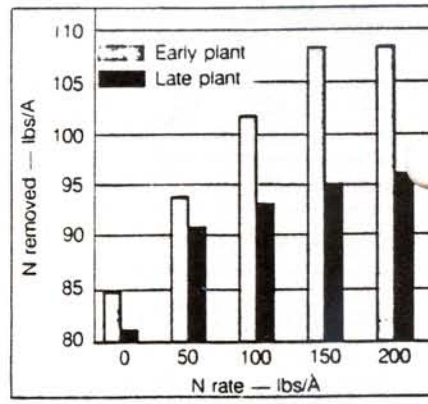


Figure 5. Comparison between N inputs made on corn and N removed from soil at varying input rates for two planting dates (Eckert, Ohio State, 3-year avg.).

A strategy Eckert calls "well-suited to fluid application systems," designed to counter factors beyond the producer's control (i.e., weather) that affect yield potential, is split-applying N. Growers can evaluate yield potential after crop emergence and then adjust N application rates accordingly to assure maximum N uptake by plant and minimum residual N left after harvest.

In-season N applications benefit wheat

FFF-sponsored research by Mulford et al. of the University of Maryland has demonstrated how fine-tuning of in-season applications of N has increased wheat yields as high as 52.7 bu/A over check.

Figure 6 shows the mean responses in 1990 to the variable rates of N applied at various growth stages, with the Poplar Hill and Clarksville sites showing the largest mean yield increases of 36 bu/A over check.

Plots were fertilized three weeks before greenup, at greenup and three weeks after greenup. Plots were also subdivided according to rate of N applied: No N (check), 60, 80, 100 and 120 lbs/A. The 120-lb/A rate was split applied (60/60) on different dates, which, according to the researchers, reduced lodging.

N fertilizer applied in-season by the researchers was a 30% nitrogen solution, selected because of its wide use among farmers and commercial applicators, as well as being the most cost-effective nitrogen source.

Preplant fertilization included: 300 lbs/A 0-20-20 plowdown, 250 lbs/A 5-10-10 preplant incorporated (Poplar Hill); no fall fertilization (Wye Center); and 250 lbs/A 6-24-24 preplant incorporated (Clarksville). All plots, including check plots, received a uniform application of 300 lbs/A 0-20-20 at spring greenup.

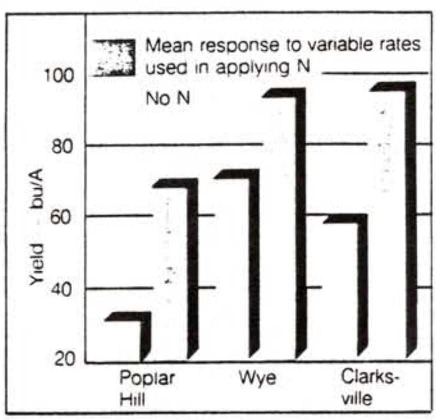


Figure 6. Mean response of wheat to various N rates applied in-season at different growth stages at three test locations (Mulford et al., University of Maryland, 1990).

Test site locations were the Poplar Hill Research & Education Center, Wye Research & Education Center and the Central Maryland Research & Education Center at Clarksville, Maryland.

Cotton thrives on nitrogen

Table 1 below shows determinations made by Miley et al. of the University of Arkansas on nitrogen levels required to produce different yields of cotton. As can be seen, they are considerable. Part of the N is supplied naturally by the soil. The remainder must be supplied by fertilizer. For 1.5 bales or more, about 40% of the required N is used for vegetative growth and about 60% for the seed and lint.

Table 1

Approximate amounts of N required to produce different lint yields of cotton (Miley et al., University of Arkansas, 1989).

Bales/A	Lbs N/A
1.0	80
1.5	110-120
2.0	130-140
2.5	150-170
3.0	180-200

DIRECT-DIAL HELP!

If you desire detailed information on studies reported in this issue.

314/256-4900

Economically sound, environmentally safe

Timing/rate of N application key to meeting challenges of best management practices

The harsh realities of current-day economics and the demands for a safer, cleaner environment have obliged growers to become not only more sparing but also wiser in the use of N fertilizers. This trend toward prudence was addressed recently at the NFSA's 1990 convention by Eckert of Ohio State University who, during his presentation, cited "three goals of responsible nitrogen management":

- maintain adequate root mass, nitrogen and water at the same place at the right time
- make sure plant always has access to adequate N
- minimize N remaining after crop harvest.

While these goals may be readily understood, only the best managers achieve them with consistency. The complex behavior of nitrogen (Figure 7), combined with the variability or fickleness of weather, presents challenges that can be met only through expert N management.

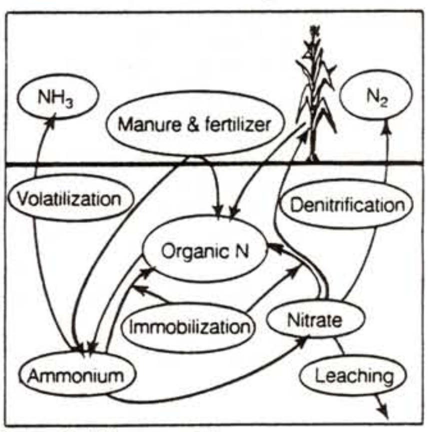


Figure 7. Nitrogen cycle.

Timing/rate right

Studies conducted by Iowa State University illustrate the importance of proper timing when making N applications on N- deficient corn (Figure 8). Note that a 21-bu/A gain was recorded when application was made two weeks after silk when compared to check. However, best response in this study was the 36-bu/A increase recorded when N was applied at the 6-leaf stage of growth.

Note also the correlation between optimum N rate and yield potential. As yield potential dropped, so did optimum rate of nitrogen applied. Accounting for this interrelationship in nitrogen management planning is essential if right measure of inputs, maximum N-use efficiency and protection of the environment are to be assured.

Compensating for loss

If weather were fully predictable, mapping out a program to meet point two (adequate N) of our goals listed above might be simpler. Problem is when we're thrown a curve by Mother Nature.

When excessive rains hit — probably the most common cause of unexpected N deficiency — the natural organic processes that produce nitrogen are upset. The deluge moves water down in the soil profile and naturally-produced nitrate (NO_3-N) is carried away. Or, if the soil becomes saturated, collecting pools on the surface, denitrification occurs at temperatures above 55 degrees F. Table 2 is a useful guide for determining nitrate-N loss via denitrification where water is pooled on saturated soils.

Table 2

Guide for estimating nitrate-N loss caused by denitrification in water-saturated soils.

Days of soil saturation	Nitrate-N loss
3-4	25-40%
6	50-60%
10	nearly all

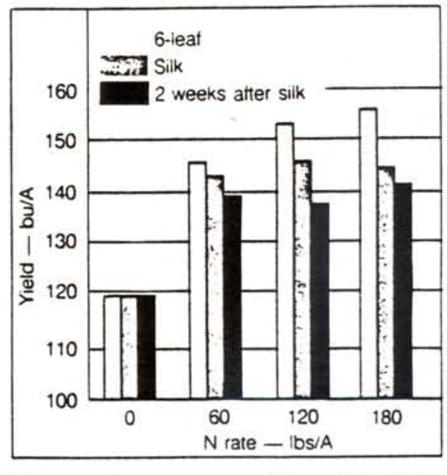


Figure 8. Timing and rate of N application by growth stage to correct N deficiency in corn (Iowa State University).

If loss of applied and naturally-produced N occurring through excess rainfall is severe enough to cause a deficiency, nitrogen fertilizer should be applied immediately. Determination should be made through soil tests and useful data, such as that supplied by Iowa State above.

Trend unmistakable

To control nitrogen loss and meet the goals of nitrogen management as outlined by Eckert above, agronomists now are climbing aboard the bandwagon and recommending applying part of the total N requirement after a crop is established and growing. This best management practice (BPM) recommendation is applicable for major feed grain, cereal, fiber, plus a large number of horticultural crops.

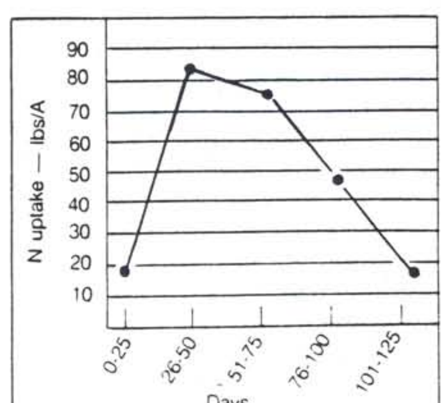
180 bu/A corn

Uptake study shows when plant's N needs are greatest

Figure 9 illustrates how N is uptaken by corn plants — in this case a field yielding 180 bu/A. Rates of uptake at seedling (0-25 days), early growth (26-50 days), silking (51-75 days), grain fill (76-100 days) and maturity (101-125 days) differ, sometimes sharply. Total uptake is 240 lbs/A of N.

The steeply sloped graph should settle any doubts about the validity or importance of splitting N in-season. Split-applying puts N in place at times of plant's greatest needs. N-use efficiency is maximized. Leaching or denitrification is minimized during season. Minimal N remains in soil after harvest.

Figure 9. Uptake of N at different growth stages for 180-bu/A corn (PPI)



On sandy soils

Split N benefits yields, protects environment

Gascho et al. of the University of Georgia have shown as high as 23 -bu/A increases in corn yield on sandy soil when split-N applications through fertigation were compared to conventional application methods (Figure 10). Fine-tuning was required over a period of six years to determine optimum timing and rates of split N applications via fertigation to assure maximum N uptake by plants and minimal residual N after harvest.

The researchers began in '78 with a conventional application method using 70 lbs N preplant, 90 lbs sidedressed at 6-leaf stage and 90 lbs at 10-leaf, resulting in 160 bu/A.

By 1984, the researchers had refined an incremental approach for split-applying N through fertigation, a system they adopted in 1979. Incremental split applications (200 lbs/A of N) through fertigation produced 208 bu/A, compared to 185 bu/A for the conventional method of application for a profit gain of $55.20/A (assuming $2.40/bu corn).

Scheduling of the split-applied N through the fertigation system was: 25% preplant, 22.5% at 6-leaf, 12-leaf and 18-leaf stages with the remaining 7.5% just prior to tasseling.

The researchers also believe data

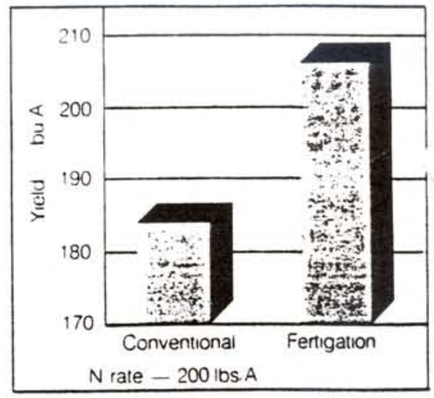


Figure 10. Response of corn in sandy soils to split N applications through fertigation vs conventional application (Gascho et al., University of Georgia, 1984).

suggest that some foliar feeding of N may have taken place during fertigation.

On flooded soils

In-season N application helps chlorotic corn

Research reported by Varsa of Southern Illinois University shows that June 18 applications of N on dried fields boosted yields as high as 42 bu/A on corn showing the chlorotic symptoms of yellowing (Figure 11). He states that three times normal spring rainfall flooded soils, causing oxygen deprivation or N deficiency through denitrification. Rates of N applied were 0 (check), 60 and 120 lbs/A. Soil was Darwin silt loam. Varsa concluded that most if not all of preplant N in the flooded fields was lost through denitrification.

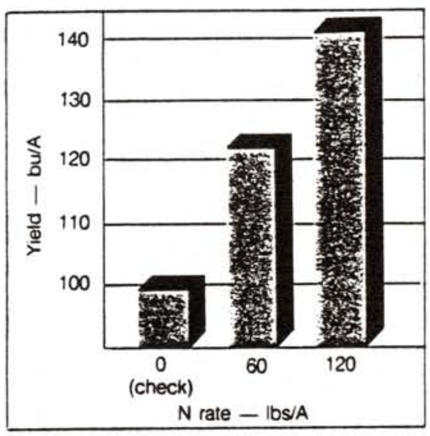


Figure 11. Effect of supplemental N on corn yields in dried fields (Varsa, Southern Illinois University, Anderson Farm, 1981).

Does foliar N Pay on cotton?

Research by Maples at the University of Arkansas offers strong evidence that it does.

In one experiment, six aerial applications of liquid urea boosted lint yield 104 lbs/A at 71 cents/lb or a gross return of $73.84/A. Total input costs/A, including fertilizer, applications, insecticides, petiole tests, petiole sampling and interest, were $25.18/A for a net return of $48.66/A.

Under the Arkansas management concept, foliar urea is applied only when petiole tissue tests show that N level in the crop has dropped below the amount that is considered adequate for the developmental stage the crop is in at the time of sampling.

FLUID FERTILIZER FOUNDATION
339 CONSORT DR.
MANCHESTER, MO 63011
(314) 256-4900