



FLUID FACTS

NFSA AGRONOMIC NEWSLETTER

FLUID FERTILITY FOR CONSERVATION TILLAGE SYSTEMS

Conservation till acreage is expected to increase substantially during the next few years, as conservation practices are encouraged by various federal agencies. The USDA is standing firm on conservation compliance and the Clean Water Act calls for control of non-point-source pollution, to which soil erosion from agricultural fields is a major contributor. In addition, both the EPA and USDA agree that conservation tillage is necessary to control soil erosion on land that is classified highly erodible by the Soil Conservation Service.

The FFF has supported a number of projects involving the study of fertility management for no-till or conservation-till feed grain and cereal crops. The data from these projects contain a wealth of information that can be used in management plans for conservation tillage systems. Dr. Daryl Buchholz, University of Missouri, completed a three-year FFF supported study in 1990 on corn grown under a no-till cropping system. The results show that corn following soybeans had a big yield advantage over corn following corn at all three experimental sites in the study. (This agrees with information from other states.) At the Columbia site, the advantage was 57 bu/ac (Table 1).

Table 1.

The benefits of corn after corn compared with corn after soybeans. Cropping rotation effects on corn grain yield. Corning, Novelty and Columbia, Missouri. 1988-90. Buchholz, Univ. of MO.

ROTATION	SITES → CORNING	CORN YIELD NOVELTY (3 YR AVERAGE)	COLUMBIA
		BUAC	
Continuous Corn	114	100	87
Corn-Soybeans	130	142	144
Difference	16	42	57
LSD .05	6	13	9

In the nitrogen source component of the Buchholz project, all nitrogen sources were broadcast in a single application ahead of planting and not incorporated. Ammonium nitrate was used as a standard for evaluating N volatilization loss

from the urea-based fertilizer. A 5-17-0 starter fertilizer (2 x 2 placement) was applied at planting at all three sites. Dr. Buchholz concluded that the yield differences among UAN, UAN + ATS, urea and ammonium nitrate sources indicate that there is risk of economic N loss when urea-based N solutions are the sole N source in a surface broadcast, no-till corn system (Table 2). He recommends that UAN be injected for no-till corn. This agrees with data from an earlier study in Maryland that showed injected UAN to be more efficient than broadcast or dribble for no-till corn (Table 3).

Table 2.

Comparison of broadcast fertilizer nitrogen sources on 3-year average corn yields. Corning, Novelty and Columbia, Missouri. 1988-90. Buchholz, Univ. of MO.

NITROGEN SOURCE	SITES → CORNING	CORN YIELD NOVELTY	COLUMBIA	SITE DIFFERENCES
		BUAC		
Ammonium Nitrate	128	133	131	5
UAN + ATS	118	115	107	11
UAN	118	113	106	12
Urea	124	125	118	7
Largest N source difference	10	20	25	
LSD .05	4	5	4	

Table 3.

Effects of method of application and N rate and source on yields of no-till corn. Forage Research Farm. 1983. Bandel, Univ. of MD.

METHOD OF APPLICATION	GRAIN YIELDS* BUAC
Check (no N applied)	91.0
N rate = 120 lb/ac	
Ammonium nitrate broadcast	135.0
UAN broadcast	108.4
UAN dribbled	122.2
UAN injected	152.0
Urea broadcast	136.4
Largest difference among methods and/or N sources	43.6
LSD .05	24.4

* 15.5% moisture

7/91



Buchholz made the observation that when residues were dry, urea pellets bounced and rolled through them to the soil surface. Nearly all of the broadcast UAN solution stayed on the residue. This might explain part of the difference in performance of these two products.

TIMING ADVANTAGE

The efficiency advantage of delayed or sidedress nitrogen application has been well-documented by numerous studies. Results of an experiment on no-till corn in Kentucky nearly 30 years ago show that nitrogen applied 7 weeks after planting on a Hampshire high clay soil increased yield 27 bu/ac more than at-planting application (Table 4). A more recent study, 1988-90 research in Nebraska, showed sidedress and split application (40 lb N/ac applied preplant, with the remaining applied sidedress) averaged nearly 10 bu/ac more grain than preplant N (Figure 1).

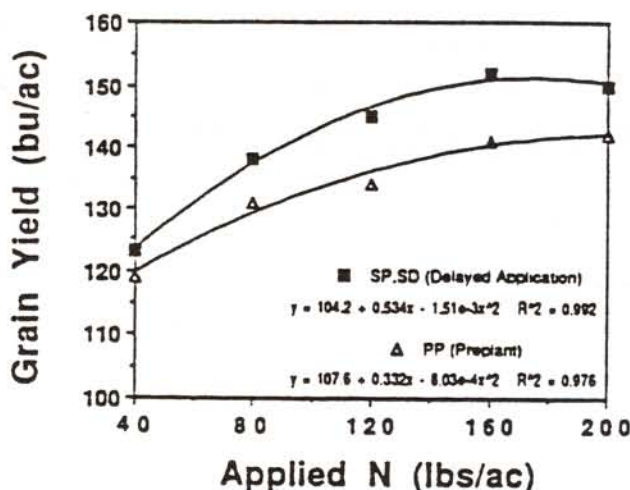
Table 4.

Effect of delayed nitrogen on yield of no-till corn grown on Hampshire soil. Univ. of KY.

LBS. (N/AC APPLIED)		YIELD (BU/AC)			
AT PLANTING	7 WKS. AFTER PLANTING	1972	1973	1974	3 YR. AVE.
0	0	91	78	60	76
150	0	100	106	105	104
0	150	123	142	127	131

Figure 1.

Fig. Relationship between applied N and grain yield as affected by preplant (PP) and delayed (SD and SP) N application across 13 locations in Nebraska, 1988-1990. Hartwell, Charles. M.S. thesis, Dept of Agronomy. 1991.



The FFF is supporting research to integrate Best Management Practices for fertilizer application with the other components of management necessary for profitable, environmentally sound crop production systems. An FFF-supported research project conducted by Dr. John Anderson, North Carolina State University, is designed to develop a total management system for corn.

In his 1990 progress report, Dr. Anderson proposed corn production packages for three environments: center pivot irrigation, dryland reduced risk and dryland for environmentally-sensitive areas. These packages were designed for North Carolina soils and climate, but with minor modification would be applicable for a number of corn producing areas. Technology transfer has been initiated by Anderson, and he reports that some growers are using the information very successfully. The major production packages for the three environments are given below.

Center Pivot Irrigation

Plant medium maturing hybrids at 29 K per acre.
Choose stalk & leaf disease tolerant hybrids.

Use 200 lb N/ac in multiple applications, 40/120/40 at planting, sidedress & pre-tassel.

Apply moderate P rate, depending upon soil test in 1:1 N:P starter fertilizer containing S. Apply additional S at > 12:1 N:S with sidedress N.

Apply 100-150 lb K₂O/ac, not less than 2:1 N:K₂O.

Dryland Reduced Risk

Match tillage system to soil type.

Plant alternate 4-6 row strips of two compensating hybrids 4 days apart in days to tasseling.

Use 130 lb N/ac in a split application with 2/3 of the N applied 4-6 weeks after planting.

Apply low P rate, depending upon soil test in 1:1 N:P starter fertilizer containing S.

Band herbicides over the corn row and cultivate row middles.

Apply soil insecticide only where field history justifies its use.

Dryland For Environmentally-Sensitive Areas

Rotate crops annually. Use corn hybrids with good seedling vigor.

Apply 50 lb N/ac plus P in starter fertilizer (2x2 placement) containing S.

Apply no herbicides or insecticides at planting. Use soil insecticide with conservation tillage.

Scout for cutworms and billbugs.

Use postemergence herbicides on weedy fields.

Sidedress with 75-100 lb N/ac placed in front of cultivator. Dribble or inject N if using conservation tillage.