No-till Nitrogen Management Research in Missouri

D. D. Buchholz, J. A. Stecker, K. A. McVay, and N. C. Wollenhaupt
MU Agronomy Department
University of Missouri-Columbia

Abstract:

No-till nitrogen management research on corn in Missouri has focused on the field response of N sources and placement. Results suggest consistent significant response to the use of a non-volatile N source when broadcast on the soil surface compared to N sources that contain urea and potentially can lose ammonia through volatilization. Knifed application of N in no-till has consistently provided higher yields and N uptake compared to either surface band or broadcast application of potentially volatile N sources.

Objectives:

Research was conducted to address N management in no-till under Missouri soil and climatic conditions. The objectives include evaluation of: N sources broadcast on the soil and residue of both continuous corn and corn following soybean; and N placement effects in continuous no-till corn management.

Methods:

Field studies have been established on claypan soils of central (Columbia) and northeast (Novelty) Missouri as well as the deep loess river hill soils of northwest (Corning) Missouri. These soils are neutral in soil reaction at the surface. The various studies have incorporated N source evaluations into both broadcast fertilizer management and specific placement of the N sources.

Broadcast N sources applied at planting have been evaluated in continuous no-till corn and corn/soybean rotations. N sources included ammonium nitrate (a non-volatile check), urea, UAN, and UAN + ATS (32-0-0-5S). N rates of 60, 120, and 180 pounds N/acre were also included.

Placement studies included broadcast, surface band, and knife injection methods. In the study evaluating with UAN only, N rates and timings were also included. The second placement study included evaluation of N rates and N sources also.

Results and Discussion:

In studies evaluating N sources broadcast at planting, ammonium nitrate (AN) (34-0-0) has consistently out-performed urea (46-0-0), UAN solution (32-0-0), and UAN + ATS solution (32-0-0-5S) (Table 1). Ammonium nitrate has produced

the highest yield in all seven comparisons of N sources in continuous corn and in five of seven comparisons in a corn/soybean rotation. Urea has generally been intermediate, with UAN + ATS and UAN trailing the group. Previous crop has not affected the order among N sources with respect to yield. Only in one case was there a significant interaction between previous crop and N source. In that case, the order of the N sources changed from UAN + ATS being lowest in continuous corn to UAN being lowest in the corn/soybean rotation. However, ammonium nitrate remained superior, followed by urea and then the fluid N sources. In all site years, significant response to N application rate was noted (data not presented).

Knifed application of potentially volatile N sources has significantly outperformed surface band or broadcast applications in six of ten site years from two separate studies in 1987, 1988, and 1989 (Tables 2 and 3). No significant response to application timing (at planting vs. sidedress) was obtained on studies pertaining to Table 2 (data not presented). No significant differences were obtained among N sources (urea, UNP, UAN, and UAN + ATS) in the studies pertaining to Table 3 (data not presented). Significant response to N application rate was obtained at all site years of data presented in Tables 2 and 3 (N rate data not presented).

For consistent yield and performance of no-till managed corn and grain sorghum in Missouri, knifed application of the N source is best. Use of a non-volatile N source broadcast has produced similar yields. However, where a potentially volatile N source has been broadcast in no-till, results have been inconsistent and disappointing.

Table 1. Nitrogen source effects on no-till corn yields.[1]

N Source	Location							
	Columbia			Corning		Novelty		
	1988	1989	1990	1989	1990	1988	1989	Average
	bu/a							
Continuous Corn								
Am. Nitrate	148	111	54	129	118	125	138	117
Urea	137	88	44	119	107	112	121	104
UAN	126	70	40	126	96	113	100	96
UAN+ATS	131	67	30	121	99	119	105	96
Corn/Soybean Rotation								
Am. Nitrate	162	170	138	140	127	150	168	151
Urea	153	161	126	137	132	146	160	145
UAN	144	142	111	128	124	147	147	134
UAN+ATS	151	154	112	127	126	156	138	138
Analysis of Variance								
	PR>F							
N Source	.0001	.0001	.0001	0.05	0.01	0.08	.0001	.0001
Rotation	0.04	0.01	.004	0.13	0.01	0.21	0.02	.0001
Source x Rotation	0.77	0.001	0.08	0.14	0.08	0.46	0.36	0.06

[1]Yields are averaged over application rates of 60, 120, and 180 lbs N/a.

Table 2. Nitrogen (UAN) placement effect on no-till continuous corn yield.[1]

N Placement	Location							
	Columbia			Corning		Novelty		
	1987	1988	1989	1988	1989	1987	1988	1989
	bu/a							
Broadcast	116	126	84	114	114	120	107	93
Surface Band	120	127	98	108	120	127	108	91
Knife	118	132	117	123	119	129	108	103
Analysis of Variance								
	PR>F							
Placement	0.32	0.14	0.0001	0.001	0.33	0.01	0.96	0.03

[1]Average of 2 timings and 3 N rates.

Table 3. N placement effect on no-till corn following soybeans (1989).[1]

N Placement	Location	
	Columbia	Novelty
	bu/a	
Broadcast	175	98
Surface Band	178	102
Knife	186	106
$lsd_{.05}$	8	6

[1]Average of 4 N sources and 2 N rates.

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Department of Agronomy
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