NITROGEN APPLICATIONS AND SUBSOILING FOR NO-TILL CORN

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Nitrogen loss from surface-applied urea fertilizers through ammonia volatilization can be substantial in no-till crops. The use of subsoilers to fracture root-restricting hardpans of Coastal Plain soils may provide an application method for improving the efficiency of urea-N in no-till systems.

In 1982, a study was initiated at the E. V. Smith Research Center to determine the effect of method and time of application, use of nitrification inhibitors, and planting tillage methods on the efficiency of N applied as urea or as ammonium nitrate to no-till corn. 'RA 1502' hybrid corn was planted no-till with or without in-row subsoiling (12-inch depth) into soybean residue on a Norfolk loamy sand. Nitrogen (140 lb./acre) as urea or ammonium nitrate, was applied either surface-banded or in the subsoil track at planting or 5 weeks after planting. Nitrification inhibitors, dicyandiamide (DCD) and ethylene dibromide (EDB), were also used with urea applied in the subsoil track. Nitrogen applied in the subsoil track at 5 weeks after planting was applied with between-the-row subsoiling. All plots were fertilized with 200 lb./acre 10-9-11-11 (N, P_2O_5, K_2O, S) starter fertilizer at planting.

The bulk of the applied N was utilized or lost within 6 weeks after application (Table 1). The rate of reduction of applied N was greater when N was applied 5 weeks after planting rather than at planting (Table 2). Larger plants with more extensive root systems were able to extract N from the soil at a greater rate. In-row subsoiling at planting did not affect the reduction rate of applied N (Table 2). Nitrification inhibitors did not increase N availability (data not shown).

Early season plant height was affected by time of N application and planting tillage methods (Table 3), but not by N source or method of application. Nitrogen applied 5 weeks after planting with in-row subsoiling produced the largest plants. Delaying N application to plants planted without in-row subsoiling was detrimental to early season plant growth although yields were not reduced at harvest.

Highest yields were obtained with in-row subsoiling at planting and applying N 5 weeks after planting (Table 3). Yields were lower when urea was applied surface-band without subsoiling, or when ammonium nitrate was applied with or without subsoiling (Table 4). Applications involving subsoiling and urea resulted in the best yields.

The first year's results indicate no benefit to subsoiling the middle if in-row subsoiling was done at planting; however, if corn were planted no-till without in-row subsoiling, subsoiling the middle 5 weeks after planting improved yields. Data also suggest that urea was as effective an N source as ammonium nitrate and that maximum effectiveness was obtained by applying nitrogen 5 weeks after planting with in-row subsoiling at planting time.

Table 1. Concentration over time of soil NH_4^+, NO_3^-, and total inorganic N (0 to 20-inch sample depth) in a Norfolk loamy sand fertilized with 140 lb./acre nitrogen 1/

Weeks after application	NH_4	NO_3	Total inorganic N
	ppm		
3	80	36	116
6	30	37	68
9	26	25	52
check 2/	36	28	64

1/ Values are averaged over all N application times, methods, sources, and planting tillage treatments.

2/ Check values are from samples taken 3 weeks after application of 20 lb./acre starter nitrogen only.

Table 2. Change in concentration over time of soil N (0 to 20-inch sample depth) as influenced by time of application and planting tillage treatments 1/

Time of application and tillage treatments	Weeks after application	Total inorganic N (ppm)
N at planting	3	102
	6	98
	9	80
Sidedress N applied 5 weeks after planting no-till plus in-row subsoiling	3	126
	6	49
	9	38
Sidedress N applied 5 weeks after planting no-till without in-row subsoiling	3	121
	6	57
	9	31

1/ Values are averaged over all N source and application methods listed in Table 4.

Table 3. Influence of time of application and planting tillage treatments on plant height 7 weeks after planting, and on grain yield of no-till corn[1/]

Treatment	Plant height (inches)	Grain yield (bu./acre)
N at planting	10.3	98
Sidedress N applied 5 weeks after planting no-till plus in-row subsoiling	13.4	128
Sidedress N applied 5 weeks after planting no-till without in-row subsoiling	6.5	99

1/ Values are averaged over all N source and application methods listed in Table 4.

Table 4. Influence of N source and method of application on corn grain yield 1/

N source, application method	Grain yield (bu./acre)
Subsoiled and surface-banded NH_4N0_3	94
Subsoiled and surface-banded urea	125
subsoiled, NH_4N0_3 applied in subsoil track	103
Subsoiled, urea applied in subsoil track	112
Subsoiled, urea + DCD in subsoil track	123
Not subsoiled, surface-banded NH_4NO_3	104
Not subsoiled, surface-banded urea	95

1/ Values are averaged over N applied at planting with and without in-row subsoiling, and N applied 5 weeks after planting with and without in-row subsoiling.