# PUBLICATIONS

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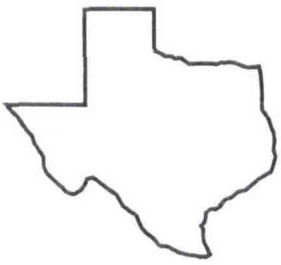
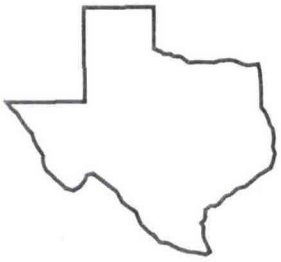
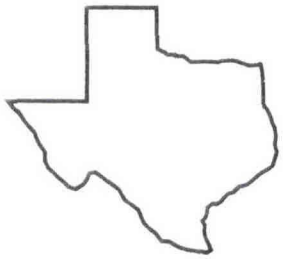
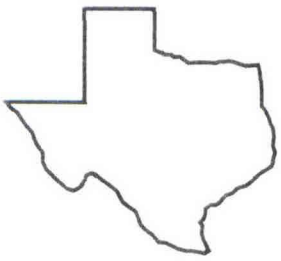




# Overton Field Day Report - 1994





## *1994 Research Center Technical Report No. 94-1*

Texas Agricultural Experiment Station • Edward A. Hiler, Director
The Texas A&M University System • College Station, Texas

# EFFECT OF FERTILIZER AMMONIUM TO NITRATE RATIOS ON SWEETCORN YIELDS

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**Background.** Environmental groups and the population in general are becoming concerned about the potential of fertilizers to contaminate surface and ground waters with nitrates ($NO_3^-$). Numerous shallow aquifers are used for domestic water supply by Texans who live in rural areas. Excess $NO_3^-$ concentrations have been found in a few shallow wells. Methodologies are needed which improve crop nitrogen (N) uptake and decrease the potential $NO_3^-$ contamination of shallow aquifers.

Both ammonium ($NH_4^+$) and $NO_3^-$ forms of N are used by plants. One possible means for lowering the risk of $NO_3^-$ pollution in ground waters may be to increase the proportion of plant available N in the ($NH_4^+$) form, particularly in acid soils. Soil acids in sufficient concentration inhibit bacterial population growth. Bacteria in the *Nitrosomonas* and *Nitrobacter* groups are responsible for conversion of $NH_4^+$ forms of N to $NO_3^-$ forms. The $NO_3^-$ form moves with water and can be moved into shallow aquifers by a process called leaching. Without these bacteria, $NH_4^+$ forms of N applied to soils with sufficient acidity to inhibit growth of these bacterial populations, but not prevent growth of certain crops, will remain in the $NH_4^+$ form for a longer period of time. The main objective of this study was to determine the effect of variable $NH_4^+$:$NO_3^-$ fertilization on sweet corn yield, N uptake, and soil residual inorganic N.

**Research Findings.** This study was conducted on a Bowie fine sandy loam near Overton. The site was fertilized with phosphorus, potassium, magnesium, sulfur, boron, copper, and zinc to prevent a deficiency of these nutrients. The plot area was subdivided into 4 replications of 7 treatments applied to 20 x 13.33 ft plots. A control plot received no N. One plot received all the N preplant in the form of ammonium nitrate ($NH_4NO_3$) fertilizer. Treatments 1 through 5 were solutions containing $NH_4^+$:$NO_3^-$ ratios that varied from zero $NH_4^+$-N with 100% of the N applied as calcium nitrate, to 100% $NH_4^+$-N applied as ammonium chloride with no $NO_3^-$. Ratios were 0:100, 25:75, 50:50, 75:25, and 100:0 $NH_4^+$:$NO_3^-$. Solutions at these ratios were applied by pressure injection through leaky pipe 6 times at 25 lb increments of N/ac at each application. Soil samples were collected from the 0 to 15, 15 to 30, and by 30-cm depths to 150-cm deep in each plot. Plots were harvested June 24.

The highest total plant fresh weight and ear weights occurred in plots fertilized with the full rate of N applied as $NH_4NO_3$ at planting time (Table 1). Solutions containing $NH_4^+$:$NO_3^-$

ratios of 0:100, 25:75, and 50:50 produced yields similar to the $NH_4NO_3$ applied at planting. Ammonium concentrations that exceeded 50% in the solution significantly decreased total plant fresh weight. Total plant fresh weight in plots fertilized with the solution $NH_4^+$:$NO_3^-$ ratio of 100:0 declined to that of the no N check plots. Fresh weight of the sweetcorn ear was lowest in the check plots. Ear fresh weight declined consistently as the $NH_4^+$:$NO_3^-$ solution $NH_4^+$ concentration increased from 50 to 75, and 100% of the fluid blend.

The ratio of ear fresh weight to total fresh weight increased as the concentration of $NH_4^+$ in solution increased. The highest ratio of ear to plant occurred at the $NH_4^+$:$NO_3^-$ ratio of 100:0 but yield of ears was low.

**Application.** Although these data are still preliminary, the $NH_4NO_3$ fertilizer applied as the total rate at planting produced the highest plant fresh weights and ear weights. Exceeding 50% $NH_4^+$ in the $NH_4^+$:$NO_3^-$ blended solution lowered yields.

Table 1. Response of sweetcorn to varying ratios of ammonium to nitrate in nitrogen fertilizers.

| Treatment $NH_4^+$:$NO_3^-$ | | Total plant fresh wt. | Total ear wt. | Ratio ear/total |
|---|---|---|---|---|
| No. | % | lb/ac | | |
| 1 | 0:100 | 4222 a[1] | 1920 ab | 0.46 bc |
| 2 | 25:75 | 4352 a | 2072 ab | 0.48 abc |
| 3 | 50:50 | 4276 a | 2032 ab | 0.48 abc |
| 4 | 75:25 | 3570 b | 1765 bc | 0.49 ab |
| 5 | 100:0 | 2965 c | 1499 c | 0.51 a |
| 6 | $NH_4NO_3$ | 4511 a | 2219 a | 0.49 ab |
| 7 | Check | 2475 c | 1084 d | 0.44 c |
| | $R^2$ | 0.86 | 0.83 | 0.70 |
| | C.V. % | 9.9 | 11.6 | 3.9 |

[1]Numbers within a column followed by a similar letter are not significantly different at the p = 0.05 level.