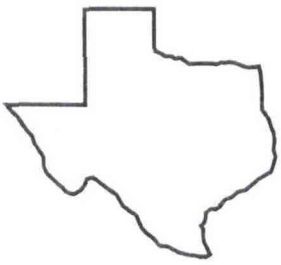
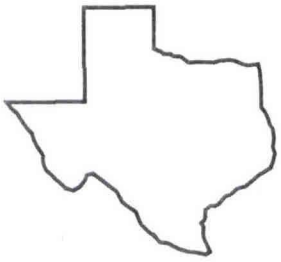
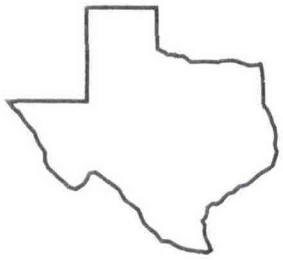
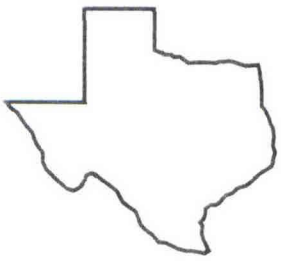
Texas Agricultural Experiment Station
Texas Agricultural Extension Service
The Texas A&M University System





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

V. A. Haby, F. M. Hons, J. V. Davis, and A. T. Leonard

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.