An Evaluation of Nitrogen Stabilizers on Sandy Soils

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Summary

Leaching of considerable amounts of nitrogen is a frequent problem in sandy soils. Some success has been achieved in minimizing these losses by the use of nitrogen stabilizers.

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Nitrification stabilizers contain chemicals designed to delay nitrification of ammonium nitrogen to nitrate form. This conversion takes place in a two-step process. In the first step, ammonium nitrogen that is held tightly by the soil is changed to the nitrite (NO_2) form by soil bacteria called nitrosomonas. The next step is carried out by another soil bacteria called nitrobacter which convert the nitrite nitrogen to nitrate nitrogen (NO_3). Neither the nitrites nor the nitrates are held as tightly in the soil as is ammonium nitrogen and they are both leached rapidly in sandy soils.

Nitrification inhibitors work by slowing the conversion of ammonium nitrogen to nitrite nitrogen by inhibiting the activity of nitrosomonas bacteria.

These compounds do not affect the nitrobacter bacteria or the conversion of nitrites to nitrates. Nitrites can be toxic to plants. The result is to make nitrogen available longer and in more uniform amounts.

Nitrification inhibitors are currently labeled for use on wheat, sorghum, cotton and corn and are not phytotoxic to these crops. They do not affect other bacteria, fungi, nematodes or weed seedlings although they have been reported to have had a significant effect upon some plant diseases in the northwest.

Method

Nitrification inhibitor demonstration plots were established on two selected areas of Yuma County with sandy soils. Hard red spring wheat was grown on one site and durum wheat on the other. Four treatments, including two nitrification inhibitors and an untreated check, were established on 24 ft x 10 ft plots. These included: 1) 1 qt/A N-Serve 24E + 50 lbs N/A, 2) 0.5 lbs/A Dwell + 50 lbs N/A, 3) a split application of 50 lbs N/A + 50 lbs N/A and 4) 50 lbs N/A.

N-Serve 24E is an emulsifiable formulation manufactured by DOW Chemical Co. and Dwell is an experimental compound manufactured by Olin Corp. that is impregnated onto the fertilizer. N-Serve 24E was sprayed onto the soil surface and immediately irrigated in by a center pivot sprinkler system on the T-L Irrigation plots and flood irrigated on the Bruce Church plots. Dwell was irrigated in at the same time.

All treatments were replicated four times on the Bruce Church plots and five times on the T-L Irrigation plots.

Experimental treatments of nitroen and stabilizers were made on top of the farms standard nitrogen program.

Table 1
Nitrification inhibitor Demonstration Plots
T-L Irrigation, Yuma

	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Avg.	Average Yield in LB/A
	LB Grain/Plot						
1 Qt. N-Serve + 50 Lbs N	4.34	3.65	3.70	3.53	4.35	3.91	3785
50 Lbs N + 50 Lbs N	3.55	2.97	4.14	2.19	3.54	3.28	3175
.5 lbs Dwell + 50 Lbs N	3.36	3.68	4.06	2.16	2.80	3.21	3107
50 Lbs N	3.65	2.92	3.39	2.98	2.60	3.10	3000
Farmers Program	2.81	3.09	2.66	2.19	2.92	2.73	2643

Planted: December 28, 1980

Harvested: May 12, 1981

Seeding Rate: 100 Lbs./Acre

Variety: Aldura

Previous Crop: This was the first time this land was farmed.

Irrigation: 0.6 inches of irrigation water was applied through a center pivot sprinkler system every other day beginning Dec. 28 and ending May 5. Approximately 40 inches were applied.

Fertilizer:

Source	Time of Application	Lbs.N/A	Lbs P_2O_5/A
UN32	1/15	14.5	
11-48-0	1/20	22	96
UN32	1/27	14.5	
UN32	2/03	22.02	
UN32	2/09	14.5	
UN32	2/14	14.0	
UN32	2/22	14.5	
UN32	3/07	14.5	
UN32	3/10	12.74	
20-12-0	3/18	8	4.8
UN32	3/28	14.5	
	TOTALS	165.82	100.8

Plot Size: 25' x 10' - Harvest Area of 3' x 15'
5 replications.

Soil Analysis:
pH = 8.5
EC_e = 0.33 mmhos/cm
1.75 ppm CO_2 Extractable NO_3-N
2.70 ppm CO_2 extractable PO_4-P
Soluble Salts = 231 ppm
ESP = 3.3

Soil Type: Superstition Sand

Table 2
Nitrification Inhibitor Demonstration Plots
Bruce Church Farms, Yuma

	Rep 1	Rep 2	Rep 3	Rep 4	Avg.	Average Yield in LB/A
	LB. Grain/Plot					
1 Qt. N-Serve 24E + 50 Lbs N	3.27	3.79	3.13	3.40	3.39	5947
Farmers Program	2.97	3.48	2.74	3.634	3.20	5614
50 Lbs N	2.70	2.99	3.48	2.97	3.03	5316
50 Lbs N + 0.5 Lbs Dwell	2.62	2.48	3.75	3.20	3.01	5281

Planted: December 24, 1980

Harvested: May 12, 1981

Seeding Rate: 118 lbs./Acre

Variety: Cajame

Previous Crop: Cotton

Irrigation: 8, 3-inch irrigations of Colorado River water were applied between December 24 and April 27. Total water applied: 24 inches.

Plot Size: 25 x 10 - 4 replications, harvested area of 5 x 5'

Fertilizer:

Source	Lbs N/Acre	Time of Application
NH_3	100	Dec. 24
NH_3	40	Jan. 15
NH_3	50	Feb. 18

Soil Type: Sandy Loam

Results

All treatments on the T-L Irrigation plots produced significantly higher yields than the farmers N program. These results suggest heavy leaching of nitrogen. Yield increases above the untreated check were 1142 lbs/A for N-Serve 24E, 532 lbs/A for the split application of 50 lbs N/A + 50 lbs N/A, 464 lbs/A for Dwell and 357 lbs/A for a single extra application of 50 lbs N.

N-Serve was the only material that outyielded the farms N program on the Bruce Church plots with a yield increase of 333 lbs/A. These results and the crop history indicate that leaching was a less important factor at this site.