Rotating knives (bottom of photo) open the soil for backswept fertilizer shank, which applies dry nitrogen fertilizer below the soil surface.

Sugarbeets responded, but wheat and bermudagrass did not, to the addition of a nitrogen stabilizer to fertilizer nitrogen.

Nitrogen stabilizer gives mixed results

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Increasing nitrogen costs in recent years have brought about the need to improve the efficiency of fertilizer use. This is particularly true of pasture crops in the Imperial Valley where large amounts of nitrogen are necessary for economic production.

Wheat, sugar beets, bermudagrass, and ryegrass pastures have been fertilized in the past by injecting ammonia into the irrigation water, combining an economical source of nitrogen with an inexpensive application procedure. However, this method may lead to considerable nitrogen loss through volatilization of ammonia during irrigation and subsequent drying of the soil surface. Unless considerable caution is exercised, much of the water-run nitrogen may be lost in the tail water, if a return flow system is not used. Soon after ammonium-nitrogen is applied, it undergoes bacterial nitrification to nitrate-nitrogen and as such is susceptible to leaching beyond the root zone or to denitrification to nitrogen gas and loss to the atmosphere. Because nitrification proceeds rapidly under optimum soil moisture and temperature conditions, appreciable quantities of nitrate-nitrogen are likely to be present and could be leached or denitrified before uptake by plants.

Growers are faced with finding alternative methods of injecting nitrogen fertilizers below the soil surface without destroying pasture crops. The Howard Rotavator machine, which has rotating straight knives, was used in these experiments. (The brand name of this equipment illustrates a specific type of construction and mechanical operation. Other brands may be available but were not tested.) This machine or a similar type places the anhydrous ammonia so that volatilization losses are minimized. If application is performed at proper soil moisture levels (moderate to low), it does not severely damage the pasture plants, and it loosens

Planting annual ryegrass and applying anhydrous ammonia simultaneously to an existing irrigated pasture. No tillage is necessary.

the compacted soil surface layer often found in irrigated pastures. In the case of the field crops, such as wheat and sugar beets, the necessity for specialized application equipment is minimal. However, it is desirable to apply the total crop needs for nitrogen before planting, if conditions suitable for leaching and denitrification can be avoided.

To keep nitrogen applied in the ammonium form from being nitrified to the nitrate form and subsequently leached or denitrified, N-Serve [2-chloro-6-(trichloromethyl) pyridine] (nitrapyrin) was evaluated as a nitrification inhibitor. This chemical inhibits nitrosomonas bacteria, the organisms that convert ammonium to nitrite in the soil. Experiments were designed using N-Serve in the Imperial Valley on bermudagrass, wheat, and sugar beets.

A trial was established in a bermudagrass pasture with a Holtville clay loam soil on April 29, 1975 (mean April air temperature, 70.9 °F). Aqua ammonia was used as the nitrogen source and injected 6 inches deep with a 12-inch lateral spacing. Treatments included 400 pounds nitrogen per acre with and without ½ pound (1 quart) of N-Serve 24E replicated three times.

Data indicated no significant differences in dry matter yields harvested on June 26 and July 30, 1975. However, a slight trend was suggested, in that the inhibitor treatment gave yields 108 and 120 percent, respectively, higher than the nitrogen-alone treatment for the two harvests.

A second trial established in Alicia bermudagrass sod included various rates of N-Serve 24 with anhydrous ammonia injected by the Howard Rotavator. This allowed for placement 6 inches deep with a 15-inch lateral spacing. Fertilizer was applied on August 21, 1975 (mean August temperature, 90.8° F), and harvest data taken on September 23, 1975. The soil was identified as a Holtville clay loam.

The graph illustrates the significant linear increase in dry matter yield with the increase in applied nitrogen. The small yield increase with more than 200 pounds nitrogen applied is responsible for the significant quadratic response of the 0.25 percent and no N-Serve treatments. No significant yield differences were observed between N-Serve rates at any of the three nitrogen rates. This is consistent with results reported by other researchers, who have observed small, if any, responses when warm soil and adequate moisture provide for rapid uptake of nitrogen and plant growth.

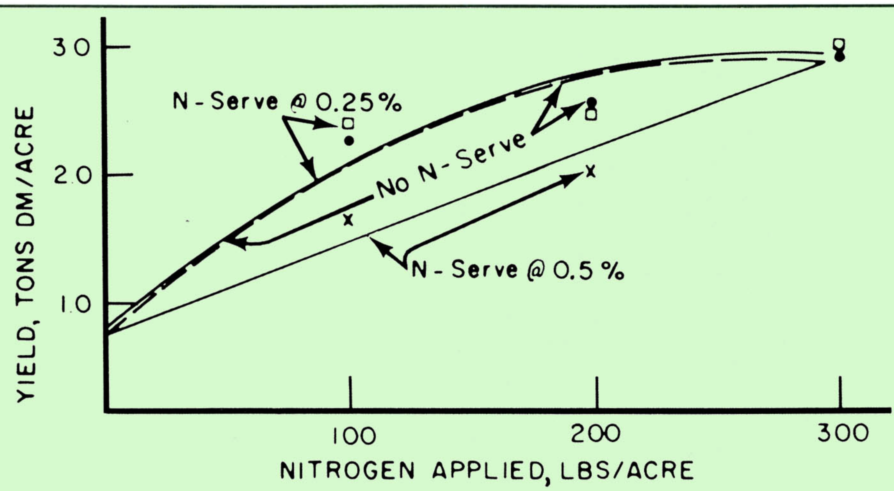
A trial was conducted on wheat using N-Serve 24E to increase the efficiency of nitrogen fertilizer on a Holtville clay loam soil. One-half pound (1 quart) of N-Serve 24E per acre was applied with 120 pounds nitrogen as aqua ammonia on January 23 (mean January temperature, 54.1° F) to a depth of 3 to 4 inches with shanks 12 inches apart. This was compared with the same amount of nitrogen without N-Serve using two replications of each treatment. The wheat variety Cajeme 71 was planted on January 25 to a depth of 1 inch and a drill spacing of 6 inches.

No significant difference in grain yield was found between the treatment with 120 pounds nitrogen per acre, yielding 4,230 pounds per acre, and that with 120 pounds nitrogen per acre plus N-Serve, yielding 4,340 pounds, as indicated by the Student t-test at the 5 percent level.

The influence of N-Serve 24 with anhydrous ammonia applied to sugar beets was evaluated. Fertilizer was injected 6 inches deep and 6 inches to the side of the seed planted in a single row on 30-inch beds. Treatments including 110 pounds nitrogen per acre as anhydrous ammonia alone and with ½ pound (1 quart) N-Serve 24 were applied November 9, 1975 (mean November temperature, 62.3° F) on a Rositas fine sandy loam soil. Each treatment was replicated 10 times. A liquid starter fertilizer (10-34-0) was applied preplant at the rate of 300 pounds per acre. Ammonium nitrate was applied at the rate of 110 pounds nitrogen per acre on January 9, 1976.

Root and sucrose yields were significantly higher from the N-Serve-treated plots than from the untreated plots (see table). No significant difference in sugar percentage was observed between the anhydrous ammonia and anhydrous ammonia plus N-Serve treatments. However, N-Serve-treated plots tended to show a decrease in percentage of sugar. This is consistent with the normal trend in which higher nitrogen rates result in lower sugar percentages.

Several investigators have reported various degrees of disease control resulting from N-Serve application in a number of crops. There were no measurements taken from this trial that might explain the yield differences observed.



Dry matter yields of Alicia bermudagrass harvested on September 23, 1975, after anyhdrous ammonia had been injected on August 21.

Yield of Sugar Beets Harvested June 6, 1976, as Influenced by N-Serve

Treatment†	Field dug (tons/A)	Percent sugar	Sucrose (tons/A)
Anhydrous ammonia	32.7*	16.1	4.95*
Anhydrous ammonia + N-Serve	36.1	15.9	5.40

†N-Serve applied with 110 pounds nitrogen per acre as anhydrous ammonia.
*Means are significantly different at the 5 percent level.

Conclusion

The nitrogen stabilizer N-Serve was applied with anhydrous ammonia or aqua ammonia to wheat, sugar beets, and irrigated bermudagrass pasture. When half of the fertilizer nitrogen was applied with N-Serve during cool weather, sugar beet tonnage and sucrose production were greater from the N-Serve-treated plots. Grain yield of wheat and forage yields of bermudagrass were not increased by the addition of N-Serve to the nitrogen fertilizer source. Because of the inconsistent response to N-Serve treatments applied to various crops, further evaluation is suggested to more clearly delineate its potential use.

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