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EFFICACY OF ANHYDROUS AMMONIA ON RENIFORM NEMATODE IN COTTON

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Abstract

Anhydrous ammonia was a common nitrogen fertilizer in past decades. Producers have speculated the change in their standard anhydrous ammonia fertilizer applications may have facilitated the increase of the reniform nematode since anhydrous is known to kill the microbial populations in the soil in the localized region where it is injected. Twelve tests over three states have been conducted between 2000 and 2002. Anhydrous ammonia was compared to the fertilizer standards ammonium nitrate, N-sol, and urea plus ammonium nitrate at similar rates. Temik 15G, Telone II, and Vydate treatments were also included as standard nematicide comparisons. In only two of twelve tests, anhydrous significantly increase yield over the nitrogen standard. Over all tests, anhydrous ammonium increase lint yield 34.9 pounds over the nitrogen standard for an additional value of $ 7.45/acre. However, the commercial nematicide materials (Temik 15G, Telone II, and Vydate), increased lint yield an average of 101 pounds over the nitrogen standard for an additonal value of $31.88/acre.

Introduction

Cotton is one of the major agricultural crops in Alabama and it is estimated that plant-parasitic nematodes cause a yield loss in cotton annually. Plant-parasitic nematodes are an economic problem in cotton production and produced the greatest yield losses compared with all other plant diseases associated with this crop. The reniform nematode (*Rotylenchulus reniformis*) is now considered the most damaging nematode species in cotton in Alabama, Mississippi and Louisiana. Yield losses attributed to plant-parasitic nematodes in these states have been estimated in the area of 5.5% or 100,825 bales valued at 24.1 million dollars in 2002. Three nematicides are currently recommended for reniform management in cotton, however, they are labeled as restricted use and are considered high cost pesticides. Anhydrous ammonia is known to kill the microbial populations in the soil in the localized region where this nitrogen fertilizer is injected. Producers have speculated the change in their standard anhydrous ammonia fertilizer applications may have facilitated the increase of the reniform nematode. Anhydrous ammonia significantly affects the region where the fertilizer is injected. High concentrations of ammonium-releasing fertilizers such as anhydrous ammonia are toxic to the soil flora and fauna including nematodes. However, the feasibility of utilizing this non-target effect of fertilizer rates of anhydrous ammonia is unknown. Currently, three nematicides are recommended for reniform nematode management. Their application cost ranges from $24.00 to $40.00 an acre plus the addition a nitrogen fertilizer. Anhydrous ammonia cost ranges from $6.00 to $20.00 an acre. Thus the objective of this summary is to determine the efficacy and economics of anhydrous ammonia for the management of reniform nematode.

Material and Methods

Tests were conducted in cotton fields naturally infested with the reniform nematode in Alabama, Louisiana, and Mississippi. Anhydrous ammonia applied at 90 to 120 units in the spring depending on the soil test recommendations. Anhydrous ammonia was compared to the fertilizer standards ammonium nitrate, N-sol, and urea plus ammonium nitrate at similar rates. The nematicide standards Temik 15G, Telone II, and Vydate were also included s standard nematicide comparisons. Anhydrous ammonia was be injected through flow regulators mounted on stainless steel delivery tubes attached to the trailing edge of the forward-swept chisels. The anhydrous ammonia will be injected 8 inches deep with one or two chisel per row. Rows were immediately hipped and bedded to seal and prevent rapid loss of the gas. N-sol and liquid urea plus ammonium nitrate as well as Telone II were applied to there respective plots using the same applications as the anhydrous ammonia. All remaining rows were also sub-soiled, hipped and bedded. Ammonium nitrate was be applied over the row using a hand held granular applicator. Temik 15G was applied at planting using granular chemical applicators attached to the planter. Di-Syston 8EC was included in Alabama for early season insect control in the fertilizer treatments. The experimental designs for the various tests included strip

plots and randomized complete blocks with four to six replications depending on the test. Plots varied from four to twelve rows 25 to 1000 feet long with a 38 to 40 inch row spacing. All plots were maintained with standard production practices commonly used in the area.

Nematode population development were determined monthly or at planting, mid season, and at harvest. Soil cores, 1- inch in diameter and 6 to 8 inches deep were be collected from the center rows of each plot in a systematic sampling pattern. Nematodes were extracted from the soil and enumerated using a stereo microscope. Cotton plots were harvested utilizing a standard cotton picker with a weigh buggy or a one-row cotton picker to determine the effects of the treatments on cotton yields.

Results and Discussion

Cotton yields were numerically increased an average of 34.9 lb of lint cotton per acre by the application of anhydrous ammonia compared to the nitrogen alternative in twelve tests over three states. A significant increase in cotton yield was observed with anhydrous ammonia applied at 90 units/A but not at 120 units/A in Alabama. In all other tests, (five tests by G.W. Lawrece, MS; three tests by C. Overstreet, LA; and two tests by L.Young, USDA MS) anhydrous ammonia increase cotton yield only numerically compared to the nitrogen standard (Table 1). The average reniform nematode numbers from at plant, mid season, and harvest were not reduced by anhydrous ammonia compared to the nitrogen control in any of the tests. The reniform populations at plant were significantly lower in the anhydrous ammonia treatment compared to the nitrogen standard in two of the twelve tests.

Economic Analysis

An economic analysis indicates that the nematicide treatments had positive net returns above the direct cost of the materials using the assumption of current input prices and the product price of $0.50/lb of cotton. Yield data indicates an average lint yield from the anhydrous ammonium treatments of 849.2 pounds representing a 34.9 pound increase over the nitrogen standard. The value of this additional yield using a market price of $0.50/lb minus the input cost is $ 7.45/acre.

Yield data in the averaged Temik 15G, Telone II, and Vydate treatments indicated a 104.2, 117.1, and 83.1 lb increase in lint yield compared to the nitrogen standard, respectively. The value of this additional yield using $0.50 lb market price minus the average input cost is $32.43, 25.96, and 42.62/acre, respectively.

Using the commercial nematicide materials (Temik 15G, Telone II, and Vydate), the average cost per acre using rates in these experiments was $29.5/acre. Comparing the additional cost to the additional revenue of $31.88/acre return to nematicide use is realized. Therefore sufficient additional revenues are generated to cover the nematicide cost.

Disclaimer

The interpretation of data presented may change with additional experimentation. Information is not to be construed either as a recommendation for use or as an endorsement of a specific product.

Table 1. Effects of anhydrous ammonia and selected nematicides on mean cotton yield on tests from three states.

		Seed cotton yield lb/A			
Treatment	**Rates/A**	**Alabama**	**Mississippi**	**Louisiana**	**USDA**
anhydrous ammonia	90-120 units N	2056	2001	1856	2252
alternative nitrogen	90-120 units N	1871	1976	1749	2155
Temik 15G	3.5 lb		2125		
Temik 15G	5.0 lb		2075		2623
Temik 15G	5.0 + 5.0 lb				2509
Temik 15G	7.0 lb	1921			
Telone II	1.5 ga		2187	1976	
Telone II	3.0 gal	2407	2185	2030	
Vydate	16 oz		1935		2539
Temik 15G + Vydate	5.0 lb+16 oz				2468

Alabama; one location over two years, Mississippi; five locations in one year, Louisiana; one location two years, and USDA; one location one year.