RENIFORM NEMATODE AND ITS INFLUENCE ON THE COTTON INDUSTRY IN THE UNITED STATES

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Abstract

Reniform nematode (*Rotylenchulus renifomis*) has rapidly developed into a major nematode pest of cotton during the last decade. Eleven of the 16 states that produce cotton have some acreage infested with this nematode. Mississippi and Louisiana have reported the highest incidence of reniform nematode with approximately 700,000 and 510,000 acres, respectively, for each state. Reniform nematode may cause considerable yield loss with reports as high as 40-60%. Nematicides, variety selection, and crop rotation are important in managing this pest. If the reniform nematode continues to spread at the same rates experienced during the 1980s and early 1990s, a high percentage of acreage in the mid-south and southeast regions will be infested.

Introduction

Reniform nematode was first reported as a pest of cotton by Smith in 1940 from Georgia and by Smith and Taylor in 1941 in Louisiana. Survey work conducted in Louisiana during 1961 indicated only about 2,000 acres of cotton with this nematode pest (Figure 1). A survey that was conducted during 1994-1995 in Louisiana found that approximately 510,000 acres of cotton were infested with reniform nematode (Figure 2). Reniform nematode is also found extensively throughout the northeast, northwest, and central regions of the state where cotton is now produced. Reniform nematode is now known to occur in 11 states (Figure 3) that produce cotton. Table 1 lists acreage infested with this nematode from a number of states. Mississippi has about 700,000 acres infested followed by Louisiana with 510,000 acres. At least 1.5 million acres are known to have the reniform nematode present out of 12.8 million acres harvested in 1996. If reniform continues to spread into new locations at the apparent rate of the last decade, a large percentage of the cotton acreage in the midsouth and southeast U.S. will become infested. Currently, the western region of the Cotton Belt including California, Arizona, and New Mexico are not known to be infested with the reniform nematode.

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Discussion

Losses attributed to plant-parasitic nematodes have been steadily increasing during the past 7 years (Figure 4) based on loss estimates presented each year at the Beltwide Cotton Conference. Although specific losses have not been determined for each of the major nematode species (southern root-knot, reniform, and columbia lance), incidence of reniform nematode has certainly increased in many states during this time.

Reniform nematode doesn't produce any dramatic symptoms on plants that make recognition easy. Damage is often difficult to observe in a field in some cases but quite distinct in others. Some of the earliest losses by this nematode were reported by Jones and Newsom in 1959. They reported losses of 30-50%. Birchfield and Jones in 1961 reported losses of 40-60%. Some recent findings by Rush and Gazaway in a 1994 variety trial indicated yield losses that ranged from 18-84%. Varieties were treated with the nematicide Temik 15%G at the rate of 7.0 pounds per acre infurrow or the insecticide Di-Syston. The variety CB 1135 was the overall highest yielding variety and also had the lowest loss (18%) to reniform. DES 119, with an 84% loss, was the variety most severely impacted.

Nematicides, variety selection, and crop rotation are currently utilized to manage the reniform nematode. Nematicides are extensively used as a primary management tool in most areas where reniform nematode has been identified. In some states such as Louisiana, 70-75% of the cotton acreage that is infected with this nematode is treated with a nematicide. Nematicide trials against reniform nematode have been conducted extensively throughout the midsouth and southeast Cotton Belt. Temik 15G at the rates of 3.5-7.0 pounds per acre as an infurrow application is the most widely used granular nematicide. The only soil fumigants that are used are Telone II and Telone C-17. Neither fumigant is used as extensively as Temik 15G. Yield responses from a number of nematicide trials in Louisiana during the past 15 years have indicated an average 13% increase when even a low rate of nematicide is used (Table 2). Yield increases from nematicides have averaged 28% by G. Lawrence in Mississippi over a number of years.

Variety trials have been extensively conducted in fields with reniform nematode. There are currently no commercial varieties that have any resistance against the reniform nematode. An extensive test in Louisiana was conducted over two years to evaluate six varieties at several locations. All of the varieties with treated with a standard rate of Temik 15%G at 3.5 pounds per acre. Figure 5 shows the yields of each of these varieties. Although there were significant differences observed among varieties at some of the locations and across years, none of the varieties were significantly better overall. Since some varieties do perform better at different locations, producers may have to select

specific varieties for an individual location. Tolerance to reniform has been identified in breeding lines of upland cotton and may provide some help in managing this pest until true resistance can be developed.

Rotations have not been used extensively in the past because of the high value of cotton compared to many other crops and the need to maintain cotton acreage to stay in farm programs. These limitations will change in the future and rotations may become more important. There are a limited number of agronomic crops that are resistant against the reniform nematode including corn, milo, rice, and resistant soybean varieties. Peanuts and sugarcane are considered resistant but in some cases have been found to be susceptible. Lawrence and McLean (1993) and Rush et al. (1996) showed the enhancement of cotton yields and suppression of reniform nematode populations when rotated with crops such as grain sorghum.

Currently, there are two described races of the reniform nematode. However, there are now a number of differences that have been found as to the pathogenicity and fecundity of different populations of the reniform nematode on both cotton and soybean. These differences with various populations could explain some of the discrepancies with variety performance at different locations. Differences in host susceptibility on several crops including peanut and sugarcane further indicate that reniform may have developed races or biotypes similar to other nematodes such as soybean cyst, potato cyst, stem nematode in alfalfa, or even root-knot on many crops.

Summary

Reniform nematode has certainly become a major pest of the cotton industry in the U.S. during the past decade. It is very likely that this pest will gain even greater importance as it spreads to new locations. Combinations of nematicides, varieties, and rotations will continue to be used to manage this pest in the immediate future. Resistance will become an important management tool at some point in the distant future. Biotechnology may speed up the development of resistant varieties against this nematode pest since there are currently compatibility problems with crosses with other *Gossypium* spp. It will become more imperative to understand the race or biotype issue of the reniform nematode as resistant varieties are developed or as rotation crops are more widely utilized in the future.

References

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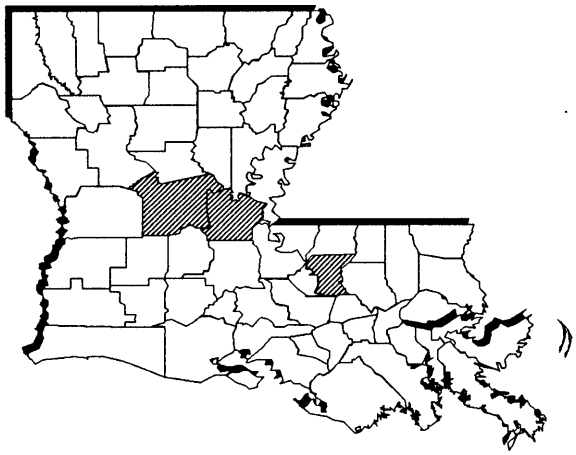

Figure 1. Incidence of reniform nematode in Louisiana during 1961.

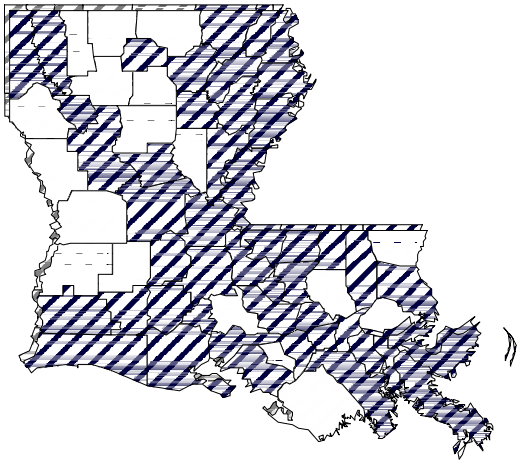

Figure 2. Incidence of reniform nematode in Louisiana during 1994-95.

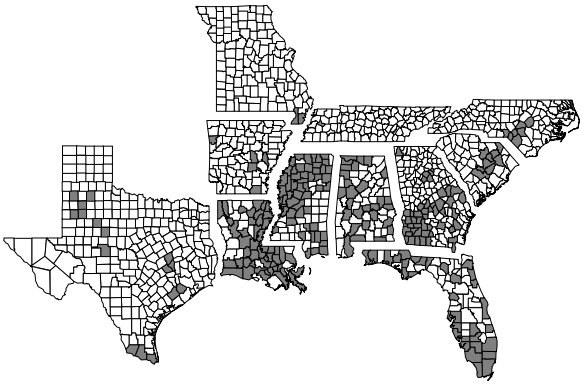

Figure 3. Darkened counties or parishes indicate areas where the reniform nematode has been reported from cotton, soybeans, or other crops in the U.S.

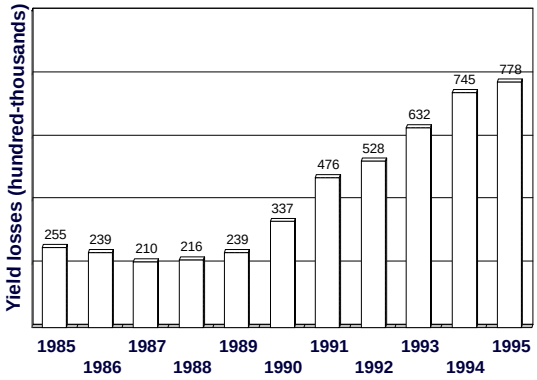

Figure 4. Bales of cotton lost to nematodes throughout the U.S. from 1985-1995.

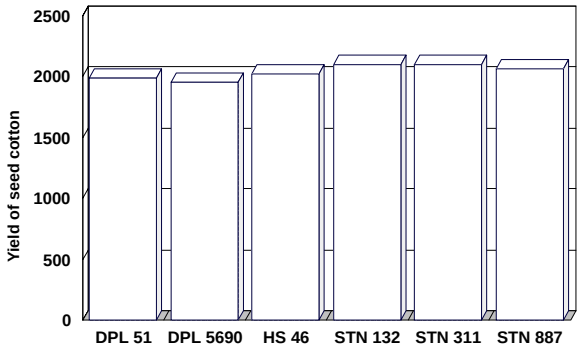

Figure 5. Average cotton yields of six varieties from reniform infested fields in Louisiana across locations and years (12 tests total) during 1993-94.

Table 1. Acres infested with the reniform nematode in the United States from several states (1996).

State	Acres infested
Arkansas	110,000
Alabama	30,000
Florida	17,000
Louisiana	510,000
Mississippi	700,000
South Carolina	10,000
Texas	242,000

Table 2. Average cotton yields from 27 nematicide trials in Louisiana during 1981-1996 in fields infested with the reniform nematode.

Treatment	Yield in pounds per acre
Untreated	2075
Temik 3.3-3.5 lb.	2348
Difference	273