# EFFECT OF CORN-COTTON ROTATIONS ON RENIFORM NEMATODE POPULATIONS AND CROP YIELD

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## ABSTRACT

Stetina, S. R., L. D. Young, W. T. Pettigrew, and H. A. Bruns. 2007. Effect of Corn-Cotton Rotations on Reniform Nematode Populations and Crop Yield. Nematropica 37:237-248.

Corn (*Zea mays*) as a rotation crop with cotton (*Gossypium hirsutum*) was evaluated in a field study conducted from 2000 through 2003 at Stoneville, MS to determine its effect on reniform nematode (*Rotylenchulus reniformis*) population density. The experimental design was a randomized block split-plot with eight replications. The main plots were crop rotations (continuous cotton, continuous corn, corn-cotton-corn-cotton, or cotton-corn-corn-cotton), and six-row subplots were one of four genotypes of either corn or cotton. Nematode populations in the center two rows of each subplot were determined at planting, midseason, and harvest. Cotton and corn yields were determined from samples taken from one or all four of the inner subplot rows, respectively. In plots planted to cotton the previous season, nematode populations at planting exceeded damaging levels for Mississippi, regardless of rotation sequence. Nematode populations remained below damaging levels throughout the season in cotton following two seasons of corn. However, when cotton followed one season of corn, nematode populations rebounded to damaging levels by the end of the season. Cotton lint yield from the cotton-corn-corn-cotton rotation was 194 kg/ha greater than yield from the continuous cotton plots in 2003. At the nematode population levels in this study, a rotation with at least two consecutive years of corn appears to be necessary to achieve reniform nematode suppression sufficient to increase cotton yield. Corn yields were either not affected or, in one year, improved when the crop was grown in rotation with cotton. Crop genotype did not affect reniform nematode population density, and there were no genotype × rotation interactions with respect to either reniform nematode population density or crop yield.

*Key words:* corn, cotton, crop rotation, *Gossypium hirsutum*, pest management, reniform nematode, *Rotylenchulus reniformis*, *Zea mays*.

## RESUMEN

Stetina, S. R., L. D. Young, W. T. Pettigrew, y H. A. Bruns. 2007. Impacto de la Rotación de Maíz y Algodón en Poblaciones del Nematodo Reniforme y en la Producción. Nematropica 37:237-248.

Se evaluó al maíz (*Zea mays*) como cultivo de rotación con algodón (*Gossypium hirsutum*) en un estudio de campo conducido desde el año 2000 hasta 2003 en Stoneville, MS para determinar su impacto en poblaciones del nematodo reniforme (*Rotylenchulus reniformis*). El diseño experimental fue de bloques al azar con arreglo de parcelas divididas, con ocho repeticiones. Las parcelas principales fueron las rotaciones de cosecha (algodón contínuo, maíz contínuo, maíz-algodón-maíz-algodón, o algodón-maíz-maíz-algodón), y las parcelas secundarias fueron los cuatro genotipos de maíz o algodón, seis hileras de cada uno. Las poblaciones del nematodo en las dos hileras del centro de cada parcela secundaria fueron determinadas al tiempo de siembra, en la mitad de la temporada, y al tiempo de la cosecha. La producción de algodón y de maíz fue determinada con las muestras tomadas a partir de una o las cuatro hileras internas en cada parcela secundaria, respectivamente. En las parcelas principales sembradas con algodón en la estación anterior, las poblaciones del nematodo al tiempo de siembra excedieron el umbral de acción para Mississippi, sin importar la secuencia de la rotación. Las poblaciones del nematodo permanecieron por debajo de niveles perjudiciales a través de la temporada en el algodón sembrado luego de dos cosechas de maíz. Sin embargo, cuando el algodón siguió a una temporada de maíz, las poblaciones del nematodo se recuperaron hacia el final de la estación. La producción de fibra de algodón en la rotación de algodón-maíz-maíz-algodón fue 194 kg/ha más que la producción de las parcelas sembradas contínuamente con algodón en 2003. Respecto a la población del nematodo en este estudio, una rotación con por lo menos dos años consecutivos de maíz parece ser necesaria para alcanzar una supresión del nematodo reniforme suficiente para aumentar la producción de algodón. La producción de maíz no fue afectada o, en un año, fue mejor cuando el cultivo estuvo en rotación con algodón. La densidad del nematodo reniforme no fue afectada por el genotipo de los cultivos, y no hubo interacción entre el genotipo y la rotación con respecto a la densidad del nematodo reniforme o la productividad de los cultivos.

*Palabras clave:* algodón, *Gossypium hirsutum*, maíz, manejo de plagas, nematodo reniforme, rotación de cosecha, *Rotylenchulus reniformis*, *Zea mays*.

## INTRODUCTION

The reniform nematode (*Rotylenchulus reniformis*) has become the predominant phytoparasitic nematode on upland cotton (*Gossypium hirsutum*) in the Mid South area of the United States. Losses to this pathogen from 2000 through 2003 averaged 5.0%, 6.9%, and 6.0% in Louisiana, Mississippi, and Alabama, respectively (Blasingame and Patel, 2001, 2002, 2003, 2004), though losses in individual fields can be considerably higher. The total cotton loss due to reniform nematode in these three states during this period was estimated at 248,200 metric tons (Blasingame and Patel, 2001, 2002, 2003, 2004). Damage by the reniform nematode and other pathogens on cotton has been implicated as a factor in cotton yield stagnation in the past two decades (Blasingame, 2002). Infected cotton plants produce fewer and smaller bolls, resulting in lower harvestable yields (Jones *et al.*, 1959; Lawrence and McLean, 2001). Reductions in lint percentage also have been reported to result from infection by reniform nematode (Jones *et al.*, 1959; Cook and Namken, 1994).

The reniform nematode is amphimictic, though only females infect cotton roots and become sedentary semiendoparasites. On average, females produce 75-80 eggs per egg mass within 3 weeks after infecting the roots. This, coupled with a relatively short life cycle of approximately 3 weeks, allows soil population densities to increase rapidly during a single growing season in the southern United States (Lawrence and McLean, 2001; Koenning *et al.*, 2004). Further, substantial numbers of reniform nematodes have been reported to exist at soil depths between 60 and 120 cm (Westphal and Smart, 2003; Robinson *et al.*, 2005a, 2005b, 2006), well below the zone that is typically affected by either tillage or application of nematicides.

Because reniform nematode is a problem in the Mid South, methods to reduce damage in this production region are needed. Research on a variety of crops has shown that effective suppression of many species of nematodes may be achieved with a combination of management tactics including growing resistant cultivars, applying nematicides, and rotating to nonhost or poor host crops.

Unfortunately, no cotton cultivars are commercially available that have resistance to reniform nematode (Robinson *et al.*, 1999; Lawrence and McLean, 2001; Koenning *et al.*, 2004; Usery *et al.*, 2005). Though breeding efforts are underway (Stewart and Robbins, 1996; Young, 2002; Bell and Robinson, 2004; Koenning *et al.*, 2004; Young *et al.*, 2004b), most germplasm releases are still several years in the future. One exception is resistance from *G. longicalyx*, which has been introgressed into a *G. hirsutum* background and is expected to be released to the public in 2007 (Robinson, 2007).

Growers commonly apply nematicides for reniform nematode suppression and have seen yields improve with their use (Lawrence and McLean, 2001; Koenning *et al.*, 2004). Aldicarb (Temik; Bayer CropScience, Research Triangle Park, NC) and 1,3-dichloropropene (Telone II; Dow AgroSciences, Indianapolis, IN) have been the most widely used nematicides (Koenning *et al.*, 2004), though recently-introduced seed-treatment nematicides such as abamectin (AVICTA; Syngenta Crop Protection, Inc., Greensboro, NC) are now being incorporated into nematode management programs (Lawrence *et al.*, 2006). Efficacy of these products depends in part on abiotic factors such as soil texture and moisture content, and there are times when the level of control is less than expected. For example, nematodes found deeper in the soil than the zone where chemicals are applied will not be controlled (Robinson, 2007), and the chemicals themselves can be degraded by soil microbes and lose efficacy (Lawrence *et al.*, 2005).

Rotation to nonhosts or resistant cultivars of other host crops has been used to suppress nematode pathogens in other annual crops. For example, rotation of corn (*Zea mays*), a nonhost, with soybean (*Glycine max*) effectively suppresses populations of soybean cyst nematode (*Heterodera glycines*) (Wrather *et al.*, 1984; Young and Hartwig, 1992; Noel and Edwards, 1996; Howard *et al.*, 1998) and is routinely employed by growers. Further, research has shown that integration of soybean cultivars resistant to specific races of the soybean cyst nematode into a corn-soybean rotation system helps suppress soil populations of the pathogen (Noel and Edwards, 1996). Similarly, suppression of root-lesion nematode (*Pratylenchus penetrans*) on potato (*Solanum tuberosum*) has been achieved by rotation with forage and grain pearl millet (*Pennisetum glaucum*) (Bélair *et al.*, 2005).

Rotation to resistant or nonhost crops has the potential to contribute to management of reniform nematode. Caswell *et al.* (1991) demonstrated that the nonhost Rhodes grass (*Chloris gayana*) and the poor hosts sunn hemp (*Crotalaria juncea*), marigold (*Tagetes patula*), and pangola grass (*Digitaria eriantha*) all reduced reniform nematode populations on pineapple (*Ananas comosus*) in Hawaii as well as or better than allowing the soil to remain fallow. Robinson and Cook (2001) also reported undetectable levels reniform nematode reproduction on sunn hemp, and reproduction on kenaf (*Hibiscus cannabinus*) was less than that occurring on cotton in their experiments. Windham and Lawrence (1992) demonstrated minimal reniform nematode reproduction on 50 commercial corn hybrids and concluded that all of the hybrids tested were poor hosts. Their findings suggest that corn grown in rotation with cotton should suppress reniform nematode populations.

A number of rotation studies have documented the suppression of reniform nematode in cotton fields. Researchers in Israel reported reniform nematode populations in soil were reduced by 50% when upland cotton was rotated with Pima cotton (*Gossypium barbadense*), and 90% when corn or wheat (*Triticum aestivum*) was the rotation crop (Orion, 1996). Royal and Hammes (2005) reported a 70% reduction in the number of reniform nematodes recovered in the fall after a single year rotation where cotton was followed by peanut (*Arachis hypogaea*), and reductions of 86% in rotations where cotton was followed by peanut and then corn in Georgia fields. Heald and Carter (1985) reported that either rotation to a nonhost crop or soil fumigation with 1,3-dichloropropene could be used to maintain yields of cotton and cantaloupe (*Cucumis melo*), both susceptible host crops, in reniform nematode infested fields. In south Texas, Westphal and Scott (2005) evaluated the ability of soybean cultivars to suppress reniform nematode populations. They found that 8 of 11 cultivars classified as resistant to reniform nematode suppressed the nematode population in trials in both fumigated and nonfumigated fields as effectively as grain sorghum (*Sorghum bicolor*), a common rotation crop in that region. Another notable finding from their study is that cotton yields were approximately 25% lower when this crop followed the reniform nematode susceptible soybean cultivars Santa Rosa-R, Vernal, and DP6880RR. Westphal *et al.* (2004) reported that population densities of reniform nematode at soil depths to 120 cm were reduced in fallow, grain sorghum, and resistant soybean plots and fiber yields were increased.

Due to its poor host status and suitability for Southern production systems, corn has been evaluated as a rotation crop for reniform nematode management by several researchers. Davis and Webster (2005) demonstrated that corn was a poor host and peanut was a nonhost for the reniform nematode in greenhouse trials. Select treatments in studies conducted in Georgia and North Carolina by Davis *et al.* (2003) compared one-year rotations to corn or resistant soybean with continuous cotton and showed that both rotation crops suppressed reniform nematode populations in the year they were grown. This suppression was still evident at planting in the following cotton crop, though the differences disappeared by midseason. Further, cotton yields were higher in plots that had been rotated to corn or resistant soybean than in plots planted to continuous cotton. Similar nematode population dynamics and yield effects were reported by Plunkett *et al.* (2002, 2003) in Arkansas and Gazaway *et al.* (1998, 2000) in Alabama. Plunkett *et al.* (2003) reported that reniform nematode populations which were not detectable during a corn crop rapidly increased to levels in excess of 10,000 per 500 $cm^3$ of soil when the same field was planted to cotton the following year. When rice was used as a rotation crop, reniform nematode populations decreased but quickly returned to damaging levels after cotton production resumed (Plunkett *et al.*, 2002). Gazaway *et al.* (1998) reported that reniform nematode populations in a field study in Alabama could be suppressed as effectively with just one year of a nonhost crop (corn, grain sorghum, or soybean) as with three years of the nonhost, though in both cases the populations returned to damaging levels after cotton culture resumed for a single growing season. In another study, Gazaway *et al.* (2000) determined that reniform nematode populations were smaller in the spring following one year of the nonhost crops peanut or corn than following soybean or cotton. Again, nematode populations rebounded quickly, returning to detrimental levels within the cotton growing season. Cabanillas *et al.* (1999) found that one season of corn or grain sorghum reduced the reniform nematode population as compared to cotton.

In this study, corn was evaluated as a rotation crop with cotton in Mississippi to determine its ability to reduce the population size of reniform nematode and to assess the impact of the resulting reniform nematode populations on crop yield. Several cotton cultivars and corn hybrids were evaluated to assess possible interactions between host genotype and crop rotation sequence. A preliminary report on the effects of crop rotation sequences on reniform nematode population density has been published (Young *et al.*, 2004a), and crop yields have been reported along with crop quality data for cotton (Pettigrew *et al.*, 2006) and corn (Bruns *et al.*, 2007).

## MATERIALS AND METHODS

In 2000, a field study was initiated at the Mississippi State University Delta Research and Extension Center in Stoneville, MS to compare four crop rotation sequences with respect to reniform nematode population size and crop yield: four years of continuous cotton, four years of continuous corn, alternating years of corn and cotton (corn-cotton-corn-cotton), and cotton followed by two consecutive years of corn (cotton-corn-corn-cotton). Plots were established in a field that had been in cotton production for multiple years prior to initiation of this study. The study was concluded after the 2003 crop season. Cotton was grown in the final year of the study in the three rotation sequences in which it occurred. The continuous cotton, continuous corn, and alternating years of corn and cotton rotations were repeated in time. A second cycle of the four-year cotton-corn-corn-cotton rotation sequence was not possible during the study period.

The experimental design used was a randomized complete block with a split-plot treatment arrangement. The main plots were the crop rotation sequences. Each rotation sequence was replicated eight times. Subplots were one of four genotypes of either corn or cotton commercially available when the study was initiated. A range of genotypes was included so rotation effects could be evaluated across diverse genetic backgrounds for both crops. Cotton cultivars Phytogen PSC 952 (Phytogen Seed Company, Dow AgroSciences, Indianapolis, IN), Paymaster 1218 BGRR (Delta and Pine Land Company, Scott, MS), SureGrow 747 (Delta and Pine Land Company, Scott, MS), and Stoneville 4691 B (Stoneville Pedigreed Seed Company, Memphis, TN) were planted each year. Three corn hybrids, Funk's 4653 (UAP Mid-South, Cordova, TN), N79-L3Bt (NK Brand Syngenta Seeds, Golden Valley, MN), and Pioneer 3223 (Pioneer Hi-Bred International, Johnston, IA), were planted each year. The fourth corn hybrid, Garst/AgriPro 9701 (AgriPro Garst Seed Company, Slater, IA), was planted in 2000 but seeds were not available in subsequent years. Therefore, this hybrid was replaced by Garst/AgriPro 9909 (AgriPro Garst Seed Company, Slater, IA) in 2001, 2002, and 2003. Subplots were 6 rows spaced 1 m apart by 7.6 m long.

The soil in the study area was a Beulah fine sandy loam (coarse-loamy, mixed, thermic, Typic Dystrochrept). Final population densities were 60,500 plants per hectare for corn and 65,000 plants per hectare for cotton. Plots were established in mid-April each year (Table 1). Fertilizer and pesticides were applied according to standard recommendations for Mississippi, except that disulfoton (DiSyston; Bayer CropScience, Research Triangle Park, NC) was substituted for aldicarb in cotton for early-season insect control and that no insecticides were applied to corn plots. Plants were furrow-irrigated as needed during each growing season to minimize moisture stress. The entire study area was disk-harrowed and sub-soiled at the end of each growing season and plots remained fallow during the winter.

Plots were harvested by hand because small plot harvest equipment was not available when the experiment was initiated. Cotton was harvested from a 4.6 m section of one of the four inner subplot rows, avoiding the ends. The row was harvested three or four times in August and September of each year (Table 1) to quantify lint yield

Table 1. Planting, harvest, and nematode sampling dates from 2000 to 2003 in a corn-cotton rotation study at Stoneville, MS.

| | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|
| Crop production dates | | | | |
| Cotton planted | 4/19 | 4/10 | 4/15 | 4/14 |
| Cotton harvested | 8/28-9/26 | 8/22-9/20 | 8/26-10/7 | 8/18-9/29 |
| Corn planted | 4/21 | 4/10 | 4/15 | 4/14 |
| Corn harvested | 8/30 | 9/06 | 9/25 | 9/10 |
| Nematode sampling dates | | | | |
| Planting | 4/19 | 4/19 | 4/15 | 4/15 |
| Midseason | 7/17 | 7/05 | 7/01 | 6/23 |
| Harvest | 9/18 | 9/13 | 8/20 | 9/05 |

production. Corn was harvested in late August or September of each year (Table 1), taking 5.2 m of each of the four center rows, and shelled using an Almaco (Nevada, IA) corn sheller. Harvested grain was weighed and a 1.1 kg subsample was tested for moisture (Seedburo GMA 128 grain moisture meter, Seedburo Equipment Company, Chicago, IL). Yields were adjusted to 15.5% moisture prior to analysis.

Reniform nematode populations were quantified from soil samples collected from each subplot at planting, midseason, and harvest (Table 1) with one exception. The samples collected at planting at the beginning of the study in 2000 represented the main plots rather than the subplots. A soil probe was used to collect 6 cores (30 cm deep and 2.5 cm in diameter) from the center two rows of each plot. The soil from all 6 cores was combined, and nematodes extracted from a 200-$cm^3$ subsample were processed by elutriation (Byrd *et al.*, 1976) and sucrose centrifugation (Jenkins, 1964) and counted.

Data from each year were analyzed independently by analysis of variance using the mixed models procedure in SAS (SAS PROC MIXED, SAS Institute, Cary, NC). Years were analyzed independently because the rotation crop changed from year to year in each main plot. Means were separated using differences of least squares means or least significant difference (LSD) at $P \leq 0.05$. Reniform nematode counts were transformed ($\log_{10}$) prior to analysis to normalize the data.

## RESULTS

Reniform nematode soil population levels throughout the course of the study fluctuated in response to host crop as illustrated in Figure 1. When the experiment was initiated, reniform nematode populations in all rotation treatments exceeded the action threshold (Fry, 1982) of 422 nematodes per 200 $cm^3$ soil for Mississippi (Patel, 1999). Though statistically significant differences were not detected among the rotation sequences in the first year of the study, the trend for reniform nematode populations to decline when corn was planted was evident. Significantly smaller nematode populations were documented in corn plots as compared to cotton plots at each sampling interval during the last three years of the study. Conversely, when cotton was planted, reniform nematode populations remained the same or

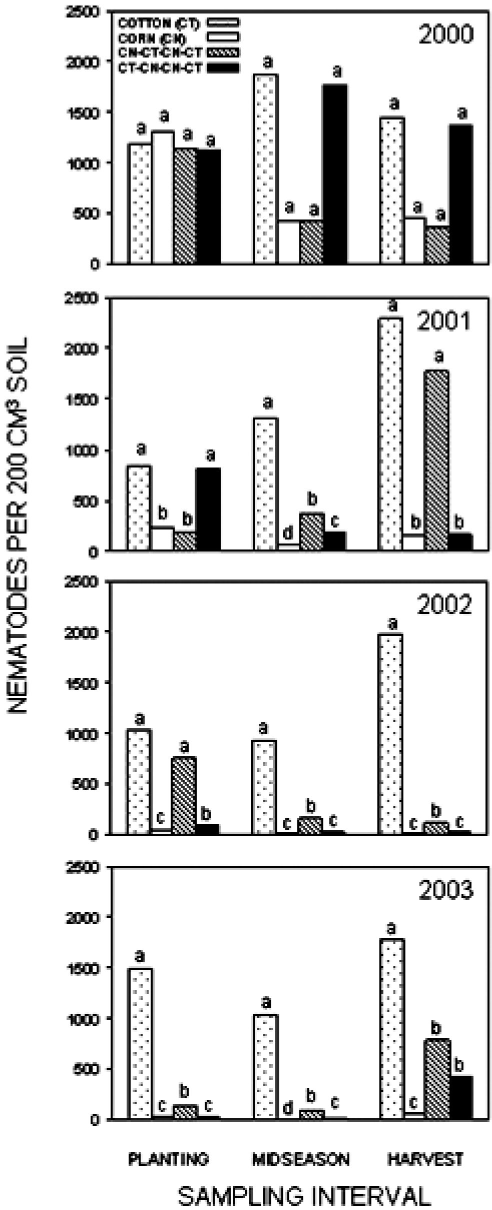


Fig. 1. Effect of crop rotation sequence on reniform nematode populations at planting, midseason, and harvest from 2000 to 2003 in Stoneville, MS. Within each sampling interval and year, means with the same letter are not significantly different from each other (differences of least squares means, $P \leq 0.05$). Nematode counts were subjected to $\log_{10}$ transformation prior to analysis; values presented are geometric means (backtransformed values) of eight replications averaged across four cotton cultivars or four corn hybrids.

increased during the growing season. Reniform nematode populations at planting in plots planted to cotton the previous season exceeded the action threshold, regardless of rotation sequence. When cotton followed one season of corn, reniform nematode populations rebounded, increasing to damaging levels by the end of the season. However, reniform nematode populations remained below damaging levels throughout the season in cotton following two seasons of corn. At the conclusion of the study, reniform nematode populations were at their highest levels in continuous cotton plots, lowest though still detectable in continuous corn plots, and intermediate in plots where cotton-corn rotations were implemented.

No significant differences were detected among either cotton cultivars or corn hybrids with respect to reniform nematode populations at harvest at any time during the study. Reniform nematode population density at harvest ranged from 627 to 2,467 nematodes per 200 $cm^3$ soil in cotton plots and from 18 to 426 nematodes per 200 $cm^3$ soil in corn plots over the course of the experiment. There were no significant genotype × rotation interactions with respect to reniform nematode populations at harvest in any year of the study.

When differences among rotation sequences occurred within any one year for either corn or cotton, higher yields were associated with corn-cotton rotations than with the continuous cropping system. However, yield differences did not repeat on a consistent basis from year to year over the course of the study. Rotation treatments were equivalent to each other with respect to cotton lint yield during the first and second years of the study (Table 2). In the final year of the study, cotton lint yield from the cotton-corn-corn-cotton rotation was 194 kg/ha greater than yield from the continuous cotton plots, and the average yield for

Table 2. Effect of crop rotation sequence on crop yield from 2000 to 2003 in Stoneville, MS.

| Crop | Rotation sequence | Yield[y] (kg/ha) | | | |
|---|---|---|---|---|---|
| | | 2000 | 2001 | 2002 | 2003 |
| Cotton | continuous cotton | 1,101 a[z] | 1,036 a | 1,257 | 1,266 b |
| | corn-cotton-corn-cotton | — | 1,068 a | — | 1,353 ab |
| | cotton-corn-corn-cotton | 1,117 a | — | — | 1,460 a |
| Corn | continuous corn | 10,364 a | 10,107 b | 7,587 a | 9,032 |
| | corn-cotton-corn-cotton | 10,297 a | — | 8,157 a | — |
| | cotton-corn-corn-cotton | — | 10,675 a | 7,730 a | — |

[y]Lint yield for cotton; grain yield at 15.5% moisture for corn; in each crop and year, values are means of eight replications averaged across four genotypes.
[z]Within each crop and year, means followed by the same letter do not differ significantly (LSD, $P \leq 0.05$).

the corn-cotton-corn-cotton rotation was intermediate but not significantly different from either of these rotation sequences (Table 2). Differences in corn yield between rotation sequences were detected only in 2001, when yield in corn planted after cotton was 568 kg/ha higher than yield in the continuous corn plots (Table 2).

Yield differences among cotton cultivars or corn hybrids were documented in each year of the study (Table 3). Cotton cultivar Paymaster 1218 BGRR was among the highest yielding each year, while the cultivar Phytogen PSC 952 was always in the lowest yielding group. Corn hybrid Pioneer 3223 was in the highest yielding group each year, but no other consistent groupings were evident for corn. No significant genotype × rotation interactions were detected in any year of the study for yield of either crop.

## DISCUSSION

Suppression of the reniform nematode population was possible with just one year of corn, but the population returned to damaging levels after just one season of cotton production. The rebound in the reniform nematode population after resuming production of a host crop was similar to that reported in previous studies conducted in North Carolina (Davis *et al.*, 2003), Georgia (Davis *et al.*, 2003), Arkansas (Plunkett *et al.*, 2003), and Alabama (Gazaway *et al.*, 1998, 2000). Even when the reniform nematode population at planting was reduced below the action threshold by one year of corn, no yield benefits were observed as compared to those treatments with significantly higher reniform nematode pressure at planting. Factors other than infection by reniform nematodes may have been limiting cotton yield in this study, though pest control, fertilization, and irrigation were implemented to minimize stress and/or damage to plants. If crop management practices were in fact working as expected to minimize crop losses, the threshold value for implementing a reniform nematode management program might need to be reexamined and possibly lowered for Mississippi.

Season-long reniform nematode suppression in cotton was only seen in the rotation with at least two consecutive years of corn preceding cotton. The cotton yield improvement in the final year of the study

Table 3. Effect of crop genotype (cotton cultivar or corn hybrid) on crop yield from 2000 to 2003 in Stoneville, MS.

| | | Yield[u] (kg/ha) | | | |
|---|---|---|---|---|---|
| Crop | Genotype | 2000[v] | 2001[v] | 2002[w] | 2003[x] |
| Cotton | Paymaster 1218 BGRR | 1,167 a[y] | 1,119 a | 1,357 a | 1,474 a |
| | Phytogen PSC 952 | 922 b | 841 b | 1,038 b | 1,276 b |
| | Stoneville 4691 B | 1,165 a | 1,142 a | 1,351 a | 1,348 b |
| | SureGrow 747 | 1,181 b | 1,105 b | 1,282 a | 1,341 b |
| Corn | Funk's 4653 | 10,381 a | 10,121 ab | 6,062 b | 8,384 b |
| | Garst/AgriPro[z] | 10,057 a | 10,960 a | 7,657 b | 9,037 ab |
| | N79-L3Bt | 10,561 a | 9,977 b | 8,705 a | 9,544 a |
| | Pioneer 3223 | 10,824 a | 11,027 a | 8,758 a | 9,676 a |

[u]Lint yield for cotton; grain yield at 15.5% moisture for corn.
[v]In 2000 and 2001, values are means of eight replications averaged across two rotation sequences for cotton and two rotation sequences for corn.
[w]In 2002, values are means of eight replications averaged across one rotation sequence for cotton and three rotation sequences for corn.
[x]In 2003, values are means of eight replications averaged across three rotation sequences for cotton and one rotation sequence for corn.
[y]Within each crop and year, means followed by the same letter do not differ significantly (LSD, $P \leq 0.05$).
[z]Garst/AgriPro 9701 was planted in 2000; Garst/AgriPro 9909 was planted in 2001, 2002, and 2003.

for the cotton-corn-corn-cotton rotation sequence coincides with the suppression of the reniform nematode population, suggesting that reduced pathogen pressure contributed to improved yield.

Even after four years of continuous corn, reniform nematodes were still detectable in soil samples throughout the growing season. Reintroduction of reniform nematodes to the corn plots during fall tillage or spring planting operations could explain early season detection, but the populations do not disappear as the season progresses. Survival in the soil (Robinson *et al.*, 2005a), utilization of weed hosts (Davis and Webster, 2005), limited reproduction on corn hybrids (Windham and Lawrence, 1992), or movement from adjacent cotton plots via irrigation water or contaminated farm equipment are factors that may help maintain reniform nematode populations in areas planted to corn. Therefore, fields returned to cotton production after several years growing corn may still be at risk of yield losses to reniform nematode.

None of the cotton or corn genotypes tested supported different levels of reniform nematode, and none of them interacted with rotation sequence with respect to either reniform nematode populations or crop yield. Yield differences among cotton cultivars or corn hybrids are probably not due to different responses to reniform nematode, as corn is generally a poor host (Windham and Lawrence, 1992) and cotton is generally susceptible (Robinson *et al.*, 1999; Lawrence and McLean, 2001; Koenning *et al.*, 2004; Usery *et al.*, 2005). Rather, inherent varietal differences in yield potential are a more probable explanation for the differences. Given the uniformity in host reaction to reniform nematode within each crop, the lack of interactions between genotype and rotation sequence is not surprising. When corn-cotton rotation is incorporated into a reniform nematode management program, the cotton cultivar or corn hybrid selected is not likely to affect the outcome and growers should select proven performers for their farm.

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