ARE NEMATICIDES APPLIED TO COTTON FOLLOWING ROTATION WITH NON-HOST CROPS BENEFICIAL?

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Abstract

Reniform nematode (*Rotylenchulus reniformis)*, a major nematode cotton pest, has caused serious losses in cotton production for the past twenty years in Alabama. In 2005, this rotation study was implemented to determine if a nematicide would improve cotton yield following a rotation with non-host summer crops. Results thus far have been mixed. In 2006, Telone improved cotton yields in cotton following one year of peanut, soybean, and also in continuous cotton but not in cotton rotated with soybean. In 2007 cotton yields were drastically reduced by a severe drought. Telone failed to improve yields in any of the rotations including continuous cotton that year. In 2008, Telone increased seed cotton yields (621 LB/A) in continuous cotton but did not increase yields significantly in cotton rotated with peanut, corn, or soybean. In 2008, all rotations increased cotton yields substantially. Both 1- and 2- year rotations with peanut produced the largest seed cotton yield increases. As in previous years, peanut, corn, and soybean reduced reniform populations to safe level at the end of the 2008 season. However, reniform nematodes returned to damaging levels after just one season of cotton.

Introduction

Reniform nematode (*Rotylenchulus reniformis)* was responsible for an 8.5% (i.e., >53,000 bales) loss in cotton production in Alabama. Historically, cotton farmers have relied on nematicides to manage moderate or moderately high reniform populations. However, use of nematicides alone has not been successful in managing extremely high reniform populations. Rotating cotton with non-susceptible summer crops has succeeded in reducing reniform populations as well as improving cotton yields in these cases. While crop rotation has been successful, it is still not known if the addition of a nematicide to cotton following rotation would further enhance cotton yields. A rotation study was begun in 2005 to determine if the addition of a nematicide to cotton (*Gossypium hirsutum*) that had been previously cropped for 1- or 2- years with a non-host crop such as corn (*Zea mays*), soybean (*Glycine max*), or peanut (*Arachis hypogaea*) would improve cotton yield. Since cotton damage from reniform nematodes varies greatly from year to year depending upon growing conditions, the test was designed to compare cotton yield and reniform nematode populations following 1 or 2-year rotations with non-host crops in the current year every year beginning in 2007 (Table 1).

Materials and Methods

A cotton field near Huxford, AL was selected for the test. The field had been cropped continuously with cotton for several years and had a history of severe reniform damage. The soil in this field is a Ruston very fine sandy loam (49 – 56 % sand, 15 - 34 % silt, 12 - 17 % clay, 2.2 - 1.9% OM, and pH 6.0- 6.2). The field trial is a split-plot design with the nematicide, Telone II, as the primary factor and summer non-host crops as the secondary factor with 4 replications. All non-host crop plots and continuous cotton plots are 8 rows wide and 40 ft long. Cotton plots are further split into two 4-row subplots. One subplot is selected at random and treated with the fumigant, Telone II. Corn (Pioneer 33M53RR) was planted on 4 Apr 08. The fumigant/nematicide, Telone II, was injected 18 inches deep at a rate of 3 gal/a into raised seedbeds to designated nematicide plots three weeks before planting (22 Apr 08). Cotton seeds (DPL-555BG/RR) were treated with Cruiser® for early season insect control and planted on 7 May 08. Peanut (AP3), and soybean (DPL5634RR) were planted on 14 May 08. Agronomic, weed control, insect and disease control practices

were implemented for all crops according to Auburn University recommendations. Soil samples for nematode analyses were collected at planting and at harvest. Twenty soil cores, 1 in. diam. and 6 in. deep, were collected using a zigzag sampling pattern. Plot samples were placed in plastic bags, labeled, and transported in an ice chest to the Auburn University Plant Diagnostic Laboratory. Nematodes were extracted from the soil by combined gravity screening and sucrose centrifugal flotation and enumerated with a stereo-microscope. All data including soil samples, stand counts, and cotton yields were collected from the two center rows of each plot. *Statistical analysis:* Nematode numbers and cotton yields were analyzed using GLM. Least square means for treatments were separated using Fishers LSD ($P \leq 0.10$). When interactions were significant, ($P \leq 0.10$), appropriate interaction least square means separation were examined and least square means separation was calculated. Where there was an absence of treatment interactions on nematode population or seed cotton yield, the main effects were compared.

Results and Discussion

Peanut was the most effective rotation crop for cotton in 2008 (Table 2). Seed cotton yields were greatest in cotton following 1- and 2- years of peanut (Table 2). Telone applied to cotton rotated with 1- and 2-years of peanut produced a slight but not statistically significant increase in seed cotton production (135 LB/A and 111 LB/A, respectively). Telone when applied to continuous cotton did produce a much larger yield increase (621 LB/A) and was equivalent to 1- and 2- year rotations with soybean or corn. Telone failed to increase seed cotton yields following 1- and 2- year soybean rotations or 2-year corn rotation (Fig 1). In 2006, Telone produced similar results where it improved cotton yields significantly in continuous cotton. That same year, Telone improved yields in cotton following one year of peanut, corn but not soybean. However in 2007, when cotton yields following both 1- and 2- year rotations could be compared directly, overall cotton production was so severely reduced by a prolonged drought that Telone had no affect on cotton yields (Fig 2). As in previous years, non-host crops (i.e., peanut, corn, and soybean) reduced reniform populations to a safe level by the end of the 2008 growing season (Table 2). Telone also reduced reniform populations to a lower but still lethal level in cotton by the end of the season. Reniform populations still remained sufficiently high in Telone treated cotton to require corrective action the following spring.

Summary

Our rotation study results indicate crop rotation is an effective tool in improving cotton yields and in reducing reniform nematode populations in a cotton field with high reniform nematode densities. Peanut appears the most effective rotation crop for increasing cotton yields and reducing reniform numbers. Corn and soybean are also effective affective at reducing reniform numbers and thus increasing cotton yields, according to our results in 2006, 2007 and 2008. As in previous years, reniform populations in 2008 returned to damaging levels following just one growing season of cotton. Telone II appears to be most effective when applied to continuous cotton. However, current commodity prices will dictate if the nematicide application to cotton following rotation with peanut, corn or soybean is economically feasible.

Table 1. Rotation scheme for the non host rotation/nematicide study:

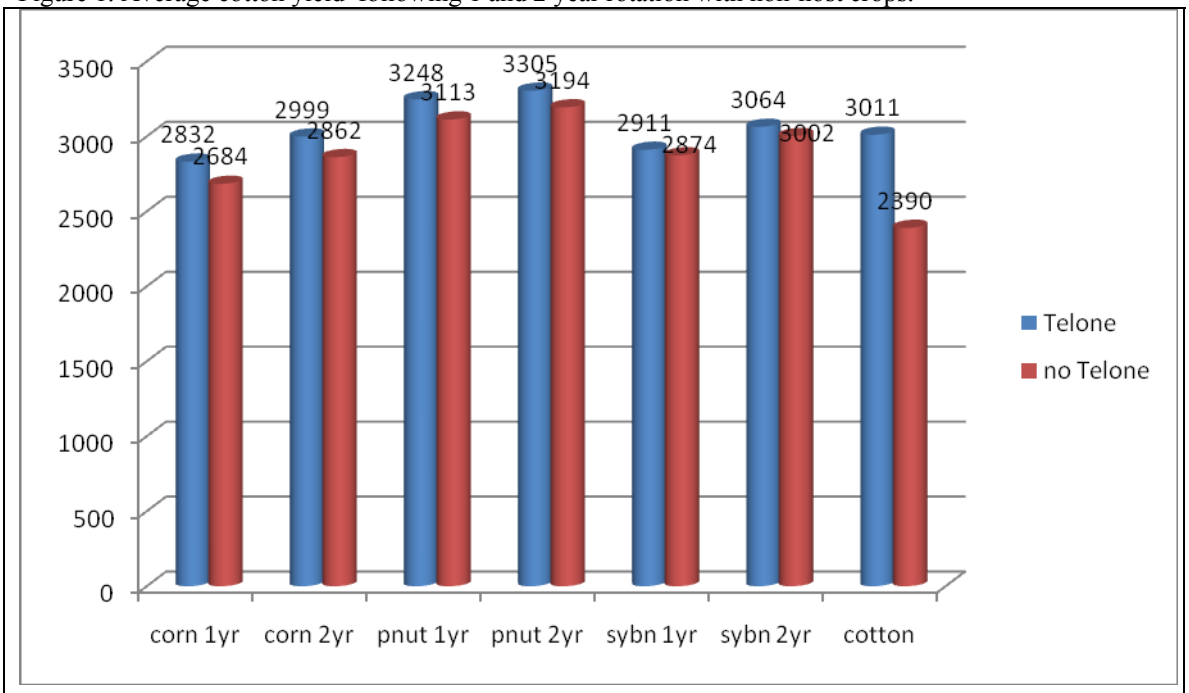
	Rotation*	Telone II	2005	2006	2007	2008	2009
1	corn 1 year	+/-	cotton	corn	cotton	corn	cotton
2	peanut 1 year	+/-	cotton	peanut	cotton	peanut	cotton
3	soybean 1 year	+/-	cotton	soybean	cotton	soybean	cotton
4	corn 2 year	+/-	corn	corn	cotton	corn	corn
5	peanut 2 year	+/-	peanut	peanut	cotton	peanut	peanut
6	soybean 2 year	+/-	soybean	soybean	cotton	soybean	soybean
7	cont. cotton	+/-	cotton	cotton	cotton	cotton	cotton
8	corn 1 year	+/-	corn	cotton	corn	cotton	corn
9	peanut 1 year	+/-	peanut	cotton	peanut	cotton	peanut
10	soybean 1 year	+/-	soybean	cotton	soybean	cotton	soybean
11	corn 2 year	+/-	cotton	corn	corn	cotton	corn
12	peanut 2 year	+/-	cotton	peanut	peanut	cotton	peanut
13	soybean 2 year	+/-	cotton	soybean	soybean	cotton	soybean
14	corn 2 year	+/-	cotton	cotton	corn	corn	cotton
15	peanut 2 year	+/-	cotton	cotton	peanut	peanut	cotton
16	soybean 2 year	+/-	cotton	cotton	soybean	soybean	cotton

*Non-host crops are soybean (*Glycine max*), peanut (*Arachis hypogaea*), corn (*Zea mays*).

Table 2. Effect of crop rotation and nematicide treatment on reniform nematode populations and cotton yield in 2008.

Crops				+Telone	- Telone	+Telone	- Telone
2005	2006	2007	2008	Reniform/ 100CC Soil		Seed cotton lb/A	
cotton	corn	cotton	corn	78	168		
cotton	peanut	cotton	peanut	142	232		
cotton	soybean	cotton	soybean	142	206		
corn	corn	cotton	corn	271	271		
peanut	peanut	cotton	peanut	129	116		
soybean	soybean	cotton	soybean	310	181		
cotton	cotton	cotton	cotton	1043	1854	3011	2390
corn	cotton	corn	cotton	1442	2511	2832	2684
peanut	cotton	peanut	cotton	464	683	3248	3113
soybean	cotton	soybean	cotton	1236	1301	2911	2874
cotton	corn	corn	cotton	1018	1056	2999	2868
cotton	peanut	peanut	cotton	1005	1120	3305	3194
cotton	soybean	soybean	cotton	399	541	3002	3064
cotton	cotton	corn	corn	65	65		
cotton	cotton	peanut	peanut	65	65		
cotton	cotton	soybean	soybean	103	144		
LSD (P≤0.10)							
Pr>F	Rotation			0.0001		0.0001	
Pr>F	Nematicide			0.0604		0.0004	
Pr>F	Rotation x Nematicide			0.5949		0.0001	

Figure 1. Average cotton yield following 1 and 2 year rotation with non-host crops.



Previous crops

Figure 2. Seed cotton yield (LB/A) by rotation and nematicide for 2007 and 2008.