

# SEASONAL VARIATION IN THE SPATIAL DISTRIBUTION OF THE RENIFORM NEMATODE IN MISSISSIPPI COTTON

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## Abstract

A study was conducted from 2000 to 2002 to examine the horizontal and vertical distribution of the reniform nematode (*Rotylenchulus reniformis*) in Mississippi cotton. Two separated cotton fields were selected which were naturally infested with the reniform nematode. Nematodes were found at all sample points and all sample depths. The reniform nematodes were uniformly distributed in the cotton fields. Nematode numbers were influenced by time and depth. Cotton-Corn as a rotation system had an effect on nematode distribution in relation to soil depth.

## Introduction

Cotton (*Gossypium hirsutum* L.) is the most important fiber crop in the world. In the United States 16 states across the southern region grow 14.4 million acres and produced 17.8 million bales in 2002. Mississippi is considered the second highest cotton producing state in the number of harvested acres. Plant-parasitic nematodes are the most important pathogens associated with cotton, beltwide, and cause yield losses averaging 4 % annually. In Mississippi cotton yield losses caused by nematodes average greater than 7 % annually.

Studies on reniform nematode population and distribution are limited. In Mississippi a preliminary study on the horizontal and vertical distribution of the reniform nematodes was reported by Lawrence et al., in 1994. They determined that the reniform nematode was distributed across a 0.52 hectare test plot and were found at a depth of 46 cm. However, population numbers varied at each sample point.

A more in-depth study is needed to better understand the population distribution of the reniform nematode. Therefore objective of our research was to examine the vertical and horizontal distribution of the reniform nematode in a continuous cotton producing system and in a cotton-corn rotation system.

## Materials and Methods

The study was conducted in a continuous cotton production field and cotton-corn rotation field. Each field was in 50 hectares and were naturally infested with the reniform nematode (*Rotylenchulus reniformis*). Each field was grid mapped with sixteen points on 0.52 hectare grids using a Global Positioning System (GPS). A single core, dimensions 5.08 cm diameter x 121.92 cm deep, was collected from each grid intersections using a Model 4804 Concord Soil Sampler. Each single core was divided into 8 depths : 0-15 cm, 16-30 cm, 31-45 cm, 46-60 cm, 61-75 cm, 76-90 cm, 91-105 cm, and 106-120 cm. Soil samples were collected in the spring and in the fall. Nematodes were extracted using the gravity screening and centrifugal flotation method and counted with a stereo-microscope.

## Results

Reniform nematodes (*Rotylenchulus reniformis*) were found at each of the sixteen sample points. This nematode appeared to have an even horizontal distributions across an established cotton production and cotton-corn rotation fields. However, the numbers of the reniform nematodes varied at each sample points.

In the continuous cotton production field, the number of nematodes / 100 cc across the sixteen points ranged from 2,996 to 11,433 nematodes in 2000. In 2001 the number of nematodes / 100 cc from the spring sample ranged from 669 to 16,042 nematodes

which averaged lower than samples in 2000. In the fall nematode numbers ranged from 1,596 to 6,308 nematodes higher than spring. In 2002 the number of nematodes / 100 cc for sixteen points in the spring ranged from 812 to 6,720 nematodes.

The vertical distribution of reniform nematode at 0-15 cm, 31-45 cm, 46-60 cm, 61-75 cm, 76-90 cm, 91-105 cm, and 106-120 cm averaged 899, 1,030, 1,198, 1,420, 1,258, 791, 765, and 370 nematodes, respectively in 2000. The highest number of nematodes were found at 46-60 cm depths. In 2001 the average nematode numbers for each depth were 354, 409, 546, 654, 938, 1,228, 930, and 610 at the spring sample. The highest number of nematodes were found at 76-90 cm depths. In the fall the average nematode numbers for each depth were 766, 649, 394, 523, 720, 579, 391, and 220. The highest number of nematodes were found at the 0-15 cm depths. In the fall higher nematode numbers were found upper soil profiles than the spring. In 2002 the average nematode numbers for each depth were 716, 650, 335, 539, 649, 306, 287, and 190 in the spring. The highest number of nematodes were found at 0-15 cm depths.

In the cotton-corn rotation field, the number of nematodes / 100 cc for the sixteen points ranged from 566 to 20,986 nematodes in 2000 after harvesting corn.. In 2001 the number of nematodes ranged from 180 to 5,613 nematodes before planting the cotton. In the fall nematode numbers / 100 cc ranged from 592 to 9,013 nematodes. In fall nematode numbers were higher than the spring. In 2002 the number of nematodes / 100 cc for sixteen points in the spring ranged from 1,650 to 19,106 nematodes. After planting with cotton nematode numbers reached high levels again. The reniform nematode was uniformly distributed across the 20 acres test site.

The vertical distribution of reniform nematode at 0-15 cm, 16-30 cm, 31-45 cm, 46-60 cm, 61-75 cm, 76-90 cm, 91-105 cm, and 106-120 cm averaged 373, 460, 554, 500, 573, 1,011, 843, and 319 nematodes, respectively in 2000. The highest number of nematodes were found at 76-90 cm depths. When corn was planted in the field, more nematodes were found deeper soil profile. In 2001 the average nematode numbers for each depth were 34, 156, 346, 474, 437, 465, 268, and 238 from the spring samples. The highest number of nematodes were found at 46-60 cm depths. In the fall the average nematode numbers for each depth were 1,111, 377, 329, 657, 685, 493, 399, and 222. The highest number of nematodes were found at the 0-15 cm depths. After cotton was planted more nematodes were recovered in the upper soil profile. In 2002, in the spring, the average nematode numbers for each depth were 1,329, 331, 428, 1,553, 1,626, 1,338, 980, and 680. The highest number of nematodes were found at 61-75 cm depths.

Reniform nematode numbers varied depending on seasonal changes. In general nematode numbers decreased by depth in a continuous cotton production system. In the spring nematodes were found deeper in soil profile than in the fall. In the fall nematodes were found more in the upper soil profile. The recovery of the reniform nematode at the lower soil sampling depths may help explain why nematode numbers are capable of reaching high levels after a single year rotation with corn.