ALTERNATING COTTON ROW PATTERNS TO REDUCE DAMAGE FROM RENIFORM NEMATODES

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ABSTRACT


Two field trials were conducted in north Florida, U.S.A., to determine any yield advantages of planting cotton into the previous cotton crop row middle rather than the usual in-row planting. Soil at the sites was a loamy sand infested with reniform nematodes (Rotylenchulus reniformis). Initial nematode population densities were less in the row middle than in row stubble from the previous year. As the season progressed, reniform nematode population densities in cotton planted in the row middle and in-row were approximately the same. At seasons end, reniform nematode population densities in the row middle of both trials were lower than in the respective in-row plantings. Cotton lint yields were increased by 30% in one test and 40% in another test by planting in previous cotton row middles. This cultural technique requires no additional cost to growers, and allows yield improvement which would be profitable for growers.

Key words: cotton, cultural practice, Gossypium hirsutum, reniform nematode, Rotylenchulus reniformis, nematode management.

RESUMEN


Se realizaron dos ensayos de campo en el Norte de Florida, U.S.A., para determinar si representaba alguna ventaja en cuanto a produccion el plantar el algodon en las filas intercaladas respecto a las utilizadas en el cultivo previo, o bien, realizar la plantacion habitual que se hace en las mismas filas. El suelo de ambos campos era franco arenoso y estaban infestados con el nematodo reniforme (Rotylenchulus reniformis). Las densidades iniciales de poblacion del nematodo eran menores en las filas intercaladas que en las filas que tenian el rastrojo procedente del cultivo del ano anterior. Conforme avanzaba el cultivo, las densidades de poblacion del nematodo reniforme eran aproximadamente las mismas en el algodon plantado en las filas intercaladas que en las mismas filas. Las producciones de fibra de algodon incrementaron en un 30% en un ensayo y en un 40% en otro ensayo por el hecho de plantar en las filas intercaladas. Esta practica cultural no supone ningun coste adicional para los agricultores y permite mejorar la produccion, lo cual sera ventajoso economicamente para los agricultores.

Palabras clave: algodon, Gossypium hirsutum, manejo, nematodo reniforme, practicas culturales, Rotylenchulus reniformis.

INTRODUCTION

Reniform nematodes (Rotylenchulus reniformis) have become an increasingly important problem in cotton production in the U.S.A. (Beltwide Cotton Committee, 2002). Management of reniform nematodes is by crop rotation, nematicides or a
combination of these practices since resis-
tant cotton cultivars are not available (Kin-
loch and Rich, 2000). For many growers,
rotation is not seen as an option due to low
alternative commodity prices, and nemati-
cides are costly. Thus, other practices need
to be developed to provide growers more
flexibility to manage reniform nematodes.
Our research has centered on several cul-
tural practices that could potentially
reduce losses to reniform nematodes in
cotton at little cost to growers. These have
included practices such as planting cotton
between previous crop rows, increasing
cotton plant populations and destroying
cotton roots in a timely manner. In 1998,
cotton was strip-till planted between previ-
ous cotton rows and showed positive
results in a preliminary test. Cotton lint
yield was increased 29% by planting
between previous rows compared to plant-
ing into the cotton stubble. The tests
described herein were conducted to fur-
ther determine if planting cotton between
rows of a previous cotton crop could help
reduce damage from reniform nematodes.

Field trials were conducted in 2000 and
2001 at the North Florida Research and
Education Center near Quincy, FL, U.S.A.
on a loamy sand soil (80% sand, 8% silt,
12% clay) infested with reniform nema-
todes. Cotton was grown on the sites the
year before, and the mowed stubble was left
undisturbed over the winter. Cotton culti-
vars DeltaPine 458 BR and Stoneville BXN
47 were planted using strip tillage with chis-
els placed 30 cm deep on 22 June 2000 and
26 June 2001, respectively. Plot rows were
91-cm-wide, 7.62 m long and four rows
wide. The two treatments consisted of plant-
ing cotton either directly in-row over the
old cotton stubble or planting between the
previous cotton rows. Treatments were
alternated and replicated six times. Cotton
was maintained using standard cultural
practices for north Florida. In the 2000
trial, soil samples were collected from cot-
ton rows with the exception of the 136-day
sampling date that included samples from
the cotton rows and between rows. In 2001,
soil samples obtained during the cotton
growing season were collected from both
cotton rows and between rows. Samples for
nematode analysis and plant yield param-
eters were collected from the two center rows
in each plot. When soil samples were taken
concurrently in the cotton row and between
rows, individual cores were taken across
from each other to insure comparable sam-
pling areas. Soil was collected by removing
six cores (2.54 cm diam) to 25 cm deep
from each plot. A 100 cm$^3$ soil sub-sample
from each plot was extracted by the modi-
fied centrifugation-sugar flotation tech-
nique (Jenkins, 1964) and reniform
nematodes counted. Seed cotton was manu-
ally harvested on 6 December 2000 and 5
December 2001, and the weight was multi-
plied by 0.40 to provide a lint yield estimate.

In the 2000 test, reniform nematode
population densities 28 days after planting
were significantly lower ($P \leq 0.05$) in cotton
planted between previous rows than that
planted over the previous stubble (Table 1).
As the season progressed, however, reniform
nematode population densities in-row in
both treatments increased and were roughly
equal 76 days after planting. Samples taken
at 136 days were collected both in-row and
between rows of the two treatments. Reni-
form nematode population densities were
significantly higher in-row in both treat-
ments (mean-1603/100 cm$^3$ soil) compared
to row middle populations (mean-544/100
cm$^3$ soil). Seed cotton yields mirrored early
season nematode population density data.
Yield was significantly higher in cotton
planted between previous cotton rows com-
pared to in-row planting.

In the 2001 test, initial reniform nema-
tode population densities were lower ($P \leq
0.05$) between previous cotton rows than
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those taken in the cotton stubble (Table 2). At both the 81 and 153-day sampling dates, reniform population densities in the row did not differ between the two planting methods. Additionally, nematode population densities between rows middles of both previous year treatments did not differ from each other but were lower than those found in the planted row of either treatment. Due to the initially lower populations of reniform nematodes in rows middles, however, cotton lint yield was significantly higher than in-row plantings.

Many growers have considered compaction in the row middles from tractor tires as a major concern. However, much of the cotton in Florida is strip till planted with an in-row subsoiler that breaks the

<table>
<thead>
<tr>
<th>Planting method</th>
<th>Days after planting</th>
<th>Lint kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28</td>
<td>76</td>
</tr>
<tr>
<td>In-Row</td>
<td>431 a</td>
<td>971 a</td>
</tr>
<tr>
<td>Row Middle</td>
<td>179 b</td>
<td>793 a</td>
</tr>
</tbody>
</table>

Table 1. Comparative reniform nematode population densities in cotton planted in row or between rows of a previous cotton crop, 2000.

<table>
<thead>
<tr>
<th>Planting method</th>
<th>At planting</th>
<th>Days after planting</th>
<th>Lint kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Row</td>
<td>328 a</td>
<td>378 ab</td>
<td></td>
</tr>
<tr>
<td>Row-middle</td>
<td>330 a</td>
<td>624 a</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Population variation of reniform nematodes and lint yield of cotton planted in-row and in row middles of a previous cotton crop, 2001.

1In-row planting indicates that cotton was seeded over the stubble from the previous year; row middle cotton was planted between rows from the previous year.
2Column means followed by the same letter are not significantly different (P ≤ 0.05).
compaction layer. The present research indicates that nematode management may be more of a concern than increased compaction. Our data supports the hypothesis that planting cotton in previous row middles will help avoid a portion of potential yield loss due to reniform nematodes, since population densities of reniform nematodes are lower between rows compared to in-row populations. However, plant growth and therefore root spread are probably important factors in the success of this technique. More detailed tests are needed to determine advantages of planting between previous cotton rows over a wide range of initial population densities of reniform nematodes, soil types and previous cotton yield. Should these results be applicable under a wide range of conditions, nematicide rates could possibly be reduced, or more likely, row middle plantings could increase nematicide performance. Also, shifting to row middle plantings using strip-till technology does not involve additional grower expense so any yield improvement would be profitable for the cotton farmer.

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