Variability of Thrips Abundance Across Soil Electrical Conductivity-Based Management Zones in Cotton With and Without Wheat Cover Crop

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RESEARCH PROBLEM

Soils in eastern Arkansas cotton fields have a diverse mixture of textures associated with the depositional processes of the Mississippi River. In northeast Arkansas, producers also must contend with sand blows: areas where seismic activity has pushed liquefied sand up to the soil surface through cracks and fissures. These spatially variable, soil physiochemical properties influence cotton yield potential. Management challenges with in-field soil variability are exacerbated by land-leveling activities, which may expose subsoil textures to the soil surface.

It has become a common practice for northeast Arkansas producers to plant cereal winter cover crops to protect seedlings from abrasive, windblown sand. There is also producer interest in adoption of site-specific, zone management in spatially variable fields. With zone management, production and protection inputs are gauged to match yield potential. The objectives of this 2012 field study were to determine if cereal winter cover crops affect infestation risks from early-season thrips and to investigate whether thrips distribution patterns were associated with management zones based on different soil textures.

BACKGROUND INFORMATION

Management zones are as defined as sub-regions of a field that have homogeneous combinations of yield-limiting factors, which a specified amount crop input is applicable to improve efficiency of farm inputs (Doerge, 1999). Management zones can be created using a variety of characteristics. For this study, the emphasis was to use soil electrical conductivity (EC) to classify zones. Soil EC has been useful for establishing management zones because it has been shown to be a stable indirect measure of soil physiochemical properties that have prevailing influence on yield (Corwin and Lesch, 2005). Cover crops in northeast Arkansas cotton typically are planted to protect young seedlings from blowing sand. Ad-

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Additional positive benefits include reductions in soil erosion and improved runoff water quality as well as improved crop root health, and enhanced weed management (Dabney et al., 2010). Previous research has shown that cover crops have the potential to increase yield in conservation tillage systems (Bauer and Roof, 2004; Bauer and Busscher, 1996; Raper et al., 2000). In this research project, thrips infestations were monitored in commercial cotton fields grown with and without cereal cover crops. These fields were further divided into soil EC-based management zones. Assessments included in-season crop and insect monitoring as well as yield evaluations.

**RESEARCH DESCRIPTION**

Cooperating producers, David Wildy (Wildly Family Farms, Manila), Gordon Miller (Gordon Miller Farms, Leachville) and Danny Finch (FDA Farms, Caraway) selected the paired research fields on each of their farms in Fall 2011. Soils in project fields had been mapped as a Routon-Dundee-Crevasse Complex, ranging from coarse sand to fine sandy loam. Previous land leveling activities to facilitate furrow irrigation exposed subsoil and clay layers in portions of the fields. Each field was classified into three to four management zones based on soil EC grouped from measurements using a dual depth Veris® 3150 Soil Surveyor (Veris Technologies, Salina, Kan.) made in Fall 2011. Swath width for the sensor varied between farms. In the Wildy field, the Veris cart surveyor was pulled through every row (38 inch row spacing). For the Miller and FDA farms, Veris intervals were at 10 to 12 rows. There were four management zones in the Wildy and FDA fields (coarse sand, sand, sandy loam and clay) and three zones in the Miller fields (sand, sandy loam and clay). For the Wildy fields, category ranges -4 to 0, 0 to 35, 35 to 70, 116 to 460 mS/M were defined for coarse sand, sand, sandy loam and clay management zones, respectively. Similar groupings and ranges were defined for the Miller and FDA fields.

Within management zones in each field, sample points were randomly selected. There were three to four sites per zone per field. All plant and insect monitoring activities through the season occurred within a 12 row (38 ft) radius of the sample point. Standard COTMAN, Squaremap and Bollman sampling protocols were followed for plants within each sample site (Oosterhuis and Bourland, 2008). Other pest insects including tarnished plant bugs were monitored through the season (data not shown). A 10 ft-long section was designated for each sample point for handpicking for yield determination. Yield monitor data were collected from cooperating producers following machine harvests; these data were analyzed by creation of 50 ft by 50 ft harvest shapefiles in ArcGIS (ESRI, Redlands, Calif.). The shapefiles were then centered over the sample sites and data collection occurred throughout the season. The number of sample points that fell inside the harvest shapefile were then adjusted to replicate the same number of passes in each of the shapefiles completed by the cotton picker through all three of the fields. Harvest dates as well as other production details are listed in Table 1.
Thrips abundance was estimated using a whole plant wash method. Ten plants were randomly collected at each site. Sample dates were 17 and 23 May, 20 and 26 days after planting (DAP) for Miller Farm, 16 and 22 DAP for FDA Farm and 7 and 13 DAP for Wildy Farm. Plants were cut at the soil level and immediately placed in sealed plastic bags, positioned in coolers on blue ice and taken back to the laboratory for evaluation. Plants were immersed and “washed vigorously” in a 70% alcohol solution in glass beakers. Special care was taken to thoroughly rinse each bag. The solution was poured through coffee filters to separate thrips from alcohol. Thrips adults and larvae on the filter paper were counted using a dissecting microscope. Variation in average number of larvae and adults was analyzed using analysis of variance between groups (ANOVA) separately for each date and among management zones, tillage treatments and farms.

RESULTS AND DISCUSSION

Infestations of tobacco thrips (*Frankliniella fusca* (Hinds)) and western flower thrips (*Frankliniella occidentalis* (Pergande)) were detected in the first three weeks following crop emergence. Population densities were at low levels in two of three fields and did not exceed the University of Arkansas Cooperative Extension Service action threshold (2-5 thrips/plant with damage present). There was no spatial component for thrips numbers among the soil EC-based management zones for any farm or field (*P* > 0.25). Highest thrips numbers were observed on Miller Farm, where there were significantly fewer thrips associated with cotton grown with the wheat cover crop compared to cotton without wheat (*P* < 0.01) (Fig. 1).

COTMAN crop growth curves for cover crop and conventional fields were similar; however, there were differences in developmental pace and number of main-stem sympodia in plants among management zones (Fig. 2). Overall, days to cutout were significantly different among zones in two of three farms, ranging from 71 to 83 days at the Wildy fields and 81 to 90 days at the Miller fields. Cutout dates ranged from 77 to 86 days after planting at the FDA fields. For handpicked yields, there were no significant differences among fields with and without cover crop (*P* > 0.25). Yields differed among farms (*P* = 0.06), but there were no significant interactions. Yield differences were significant among management zones (*P* = 0.0001) with lowest yields associated with coarse sand and clay management zones, and highest yields from sand and sandy loam zones. Similar findings were observed with machine harvests (Fig. 3).

PRACTICAL APPLICATION

Fewer thrips were observed in cotton with terminated wheat cover crops. This has been noted in our previous research (Teague, unpublished data) as well as from other production regions including the Texas High Plains and the Southeast U.S. (Olson et. al., 2006). Planting of cereal winter cover crops as opposed to a
winter weed fallow is an effective integrated pest management (IPM) tactic resulting in reduced risks of crop damage from thrips induced injury (Toews et al., 2010). Infestations were similar across management zones. Different soil textures affected the rate of development and crop maturity measured as days to cutout.

ACKNOWLEDGMENTS

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LITERATURE CITED

Table 1. Cotton cultivar, dates of planting and harvest for cotton and details for cereal cover crops establishment and termination in six commercial fields monitored in 2012 thrips study.

<table>
<thead>
<tr>
<th>Farm</th>
<th>Cultivar</th>
<th>Date of Planting</th>
<th>Date of harvest</th>
<th>Cover crop, seeding method, dates of planting &amp; burndown</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDA Farm</td>
<td>Stoneville 5458 B2RF</td>
<td>1 May</td>
<td>26 Sept</td>
<td>wheat broadcast – 3 Nov 2011; terminated April 2012</td>
</tr>
<tr>
<td>Gordon Miller Farm</td>
<td>Stoneville 5458 B2RF</td>
<td>27 April</td>
<td>25 Sept</td>
<td>wheat seeded in alternate row middles 1 Nov 2011, terminated May 2012</td>
</tr>
<tr>
<td>Wildy Family Farm</td>
<td>Deltapine 0912 B2RF</td>
<td>10 May</td>
<td>24 Sept</td>
<td>oats broadcast 10 Nov 2011; terminated 3 March 2012</td>
</tr>
</tbody>
</table>

*Fields were located in the Buffalo Island production region in northeast Arkansas in the Little River Ditches Watershed in Craighead and Mississippi Counties.

Fig. 1. Mean (±SEM) numbers of thrips per 10 plants observed on plants collected on cotton planted in conventional and with a wheat cover crop on 17 and 23 May (20 and 26 days after planting (DAP)). Spinetoram (Radiant @1.5 oz/ac) insecticide was applied by the cooperating grower to both fields following sample collection on 17 May.
Fig. 2. COTMAN Growth curves for soil electrical conductivity (EC)-based management zones for each pair of conservation practice fields on the FDA, Wildy and Miller Farms in NE Arkansas 2012. Soil EC classifications ranged from low-EC coarse sand to high-EC clay soil.

Fig. 3. Mean lint yields (±SEM) for management zones from handpicked samples (left) on the three farms, and from 50 × 50 ft area estimates derived from the Miller and Wildy yield monitors (right). Means followed by similar letters do not differ significantly (analysis of variance $P = 0.05$; least significant difference = 0.05).