INFLUENCE OF ADJACENT CROPS ON COTTON FIBER QUALITY WITH RESPECT TO STINK BUG MOVEMENT

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Abstract

Stink bugs have become serious insect pests in southeastern US cotton production. Research shows that these pests actively move among crops in search of developing seeds. Therefore, understanding when and where stink bugs will move into cotton fields may help growers better manage infestations. To investigate how adjacent crops affect stink bug damage in cotton fields, a second year of data on replicated 4 to 5 acre trials were conducted with unsprayed corn, peanut, and soybean bordering an unsprayed cotton field. The cotton in rows 1, 5, 10, 20, and 50 from each adjacent crop was sampled weekly during weeks 3 through 6 of bloom. At the end of the year, representative plots from distances of 1, 10, 20, and 50 rows from the adjacent crop were harvested, ginned, and classed. Results show that boll damage, fiber color, and lint value were negatively affected when the cotton was immediately adjacent to peanuts and soybeans.

Introduction

The within-farm configuration of resource patches utilized by a particular species is commonly referred to as the farmscape. This concept is different from a landscape in that the latter is a much larger geographic areas composed of a mosaic of local ecosystems. The farmscape, made up of the cultivated and naturally occurring plant hosts, is the appropriate scale for studying mobile insect populations at the local ecosystem level. Stink bugs are best studied in this context because they have a broad host range comprising over 200 known plant species where stink bug feeding and development were observed or implied. Some commonly rotated cultivated hosts of stink bugs in the southeastern US include: corn, grain sorghum, peanut, and soybean. Stink bugs overwinter in non-crop vegetation and then infest a sequence of fruiting non-cultivated hosts until large acreages of cultivated hosts are available. The spatial arrangement of these hosts favors the development of high pest densities and subsequent economic damage to late maturing crops like cotton. Objectives of this study were to 1) assess stink bug induced damage and fiber quality in cotton fields planted adjacent to corn, peanut, and soybean, and 2) determine how far observed damage extended into cotton fields.

Materials and Methods

Four to five acre fields were equally divided into four separate plots at each study site for planting common agronomic crops in Georgia farmscapes. Crops included corn, peanut, and soybean bordering a centrally located cotton field (Fig.1). Three locations each were monitored in 2007 and 2008. Stink bug pressure in 2008 was much greater than 2007. Location of the adjacent crops (cotton was always in one of the two center positions) was randomized to avert any directional bias. Cultivars and planting dates were patterned after typical commercial practices for Georgia producers. Crops were planted on a 36-inch row spacing under conventional tillage and all fields were irrigated. Each crop was grown using Georgia Cooperative Extension recommended agronomic practices, except no broad spectrum (pyrethroid or organophosphate) insecticide applications were made after planting.

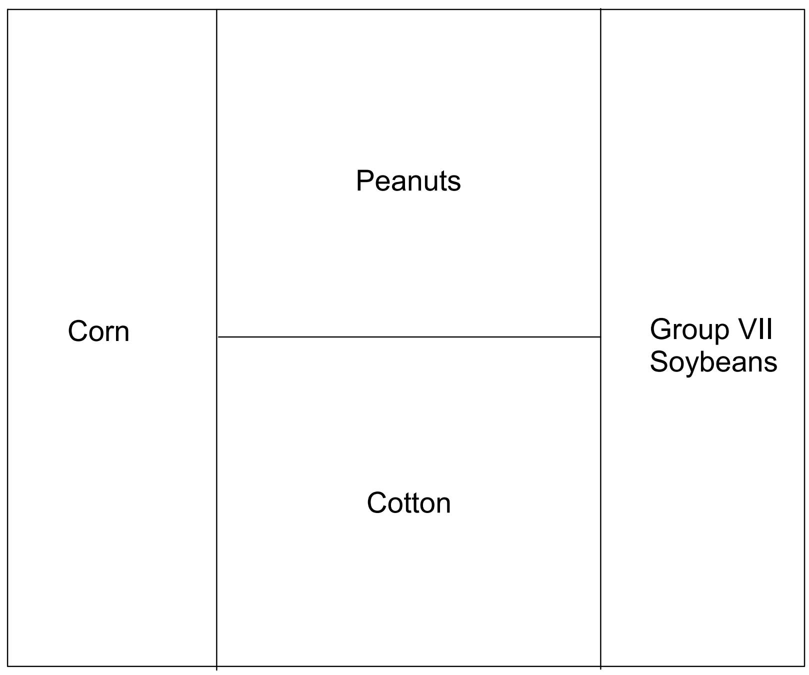

Fig. 1. Generic plot layout including position of corn, peanuts, and soybeans (randomized in each replicate of the experiment) positioned around a central cotton field.

A comprehensive sampling plan including boll damage, seed cotton yield, and fiber quality assessment was conducted in the cotton plots. Assessments of boll damage were completed weekly during weeks 3 through 6 of white flower. Quarter sized soft bolls from rows 1, 5, 10, 20, and 50 were pulled and internally examined for signs of stink bug damage including stained lint, carpal warts, and boll rot. Regardless of the distance from the edge of the field, sampling activities were always confined inside a centered 50 foot zone (parallel to the adjacent border of interest) to avoid bias as a result of sampling in the corners of the field were two adjacent crops came together. At the end of the growing year the cotton was picked, weighed, ginned, and classed. Following defoliation, alleyways were mowed into the plots to facilitate operation of a 2-row cotton picker (spindle picker) modified to collect seed cotton into bags. A total of 100 row feet of cotton were picked into separate bags at each distance from the adjacent crop. A single cotton sample was also picked from the center of each cotton plot (50 rows). Bags were weighed to determine seed cotton yield before being ginning at the UGA Microgin (Tifton, GA), a pilot scale facility that handles research quantities of seed cotton. Representative ginned fiber samples from each plot were then sent to the USDA Classing Office located at Macon, GA.

Lint value was calculated for each replication of each treatment. Value was based on the November 2008 average Georgia cash (spot) price received for base quality (Color 41-Leaf 4, Staple 34) cotton adjusted for fiber quality. Lint yield was multiplied by the price per pound adjusted for the fiber quality. The November average price included LDP (Loan Deficiency Payment) if applicable (USDA-FSA). The November 2008 base price including the average LDP for the month was 54.91 cents per pound.

Results and Discussion

Across years, cotton boll damage differed significantly as a function of adjacent crop and distance from the edge of the cotton plot. Cotton bolls in row 1 adjacent to peanut and soybean both exceeded 60% damage while similar positioned bolls experienced 20% damage adjacent to corn. These data suggest that more stink bugs are moving directly into cotton from peanuts and soybeans. The percent boll damage rapidly decreased with distance into the cotton field regardless of adjacent crop (Fig. 2). This observation suggests that stink bugs likely colonize the edges of cotton fields before moving into the field interior.

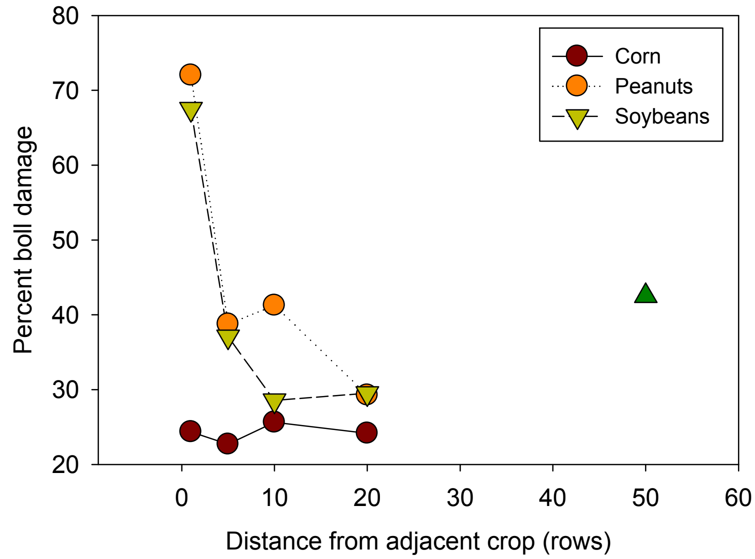

Fig. 2. Average percent boll damage as a function of distance from the field edge and adjacent crop.

The plot of seedcotton yield was a mirror image of boll damage. Edges of the cotton field that were heavily damaged by stink bugs yielded proportionally less seedcotton than regions of the field with less damage (Fig. 3). These data also support the hypothesis that stink bugs first colonize field edges and then move around and colonize the interior portions of the field.

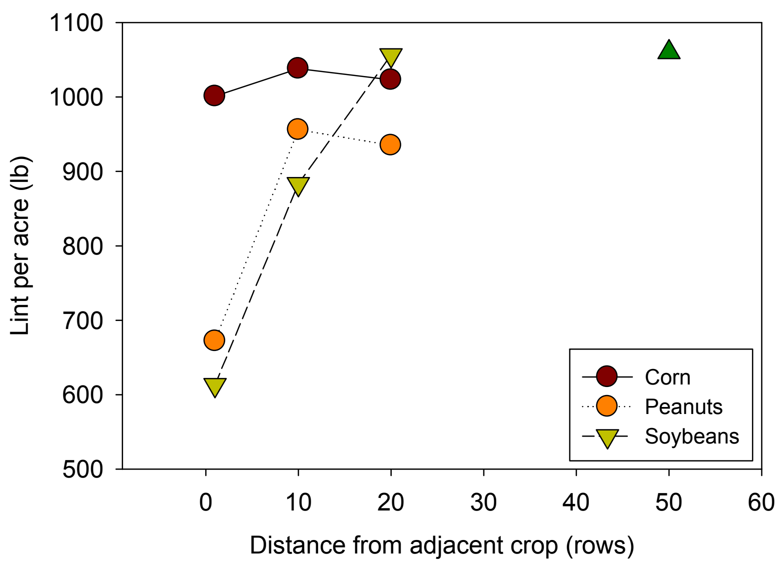

Fig. 3. Seedcotton yield as a function of distance from the field edge and adjacent crop.

Fiber quality of the cotton was impacted by the stink bug infestations near the field edges. Both color Rd (fiber brightness) and color +b (fiber yellowness) showed obvious signs of stink bug damage (Fig. 4). Generally speaking, cotton harvested from the rows immediately adjacent to peanut or soybean were classed one color grade worse than the average cotton in that plot (ex. color grade 52 next to peanut compared to color grade 41 across the rest of the plot).

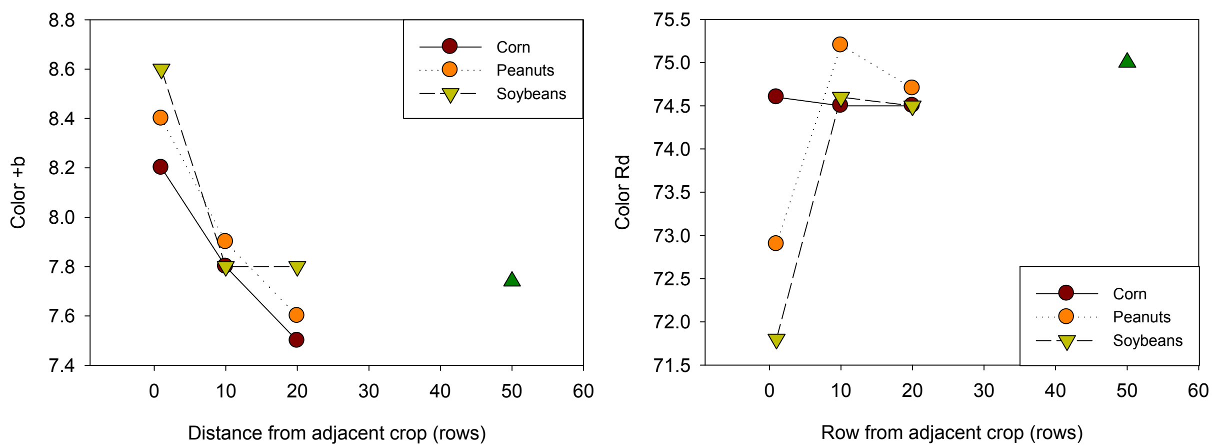

Fig. 4. Changes in color +b (left) and color Rd (right) as a function of distance from the field edge and adjacent crop.

Finally, lint values were calculated to reflect the monetary value of the seedcotton based on yield and fiber quality on a per acre basis. Areas of the field that were heavily damaged by stink bugs produced considerably less lint and lint of lower quality. Therefore, these areas produced lower valued product (Fig. 5). These data suggest that growers need to be much more proactive about managing stink bug populations near peanut and soybean fields.

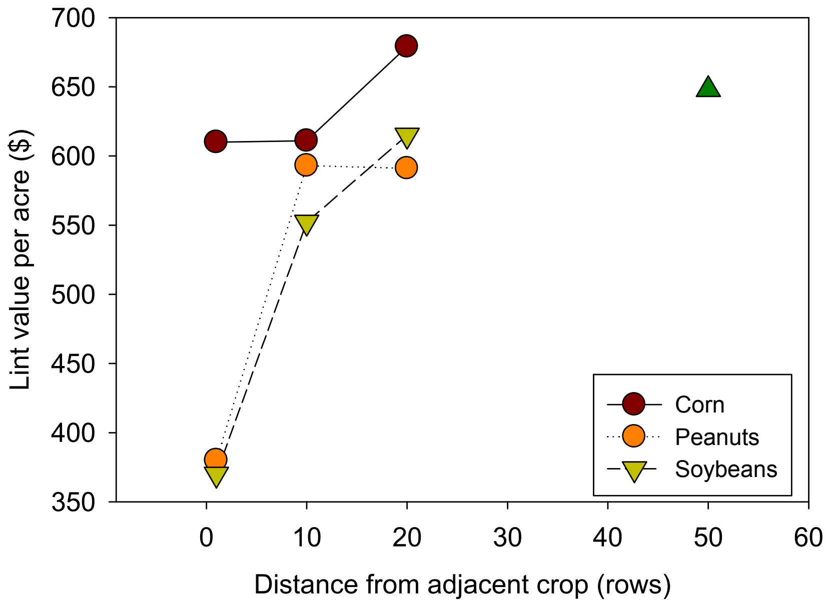

Fig. 5. Mean lint value as a function of distance from the field edge and adjacent crop.

Stink bugs are known to be particularly sensitive to host quality. They are constantly in search of plants that are in the process of setting fruit. This may help explain why corn is a good stink bug host early in the year, but cotton placed adjacent to corn field did not suffer stink bug damage to the same degree that would have been expected. Because the reproductive stages of the two plants are not closely synchronized, the stink bugs likely left the corn in search of new hosts before the cotton was attractive. Obviously, peanuts and soybeans are serving as a stink bug source when located adjacent to cotton fields. The exact distance that stink bugs will travel to find a cotton field is unknown, but it is likely that the population would be diluted in time and space thereby reducing damage.

Acknowledgments

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