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ASSOCIATION OF BUG-INDUCED BOLL DAMAGE SYMPTOMS WITH HARD LOCK, LINT YIELD AND QUALITY

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Abstract

Internal and external boll damage from stink bug feeding was examined in five Virginia/North Carolina commercial cotton fields in 2005. The number of sunken feeding lesions per quarter-sized boll was recorded in the field. Bolls were removed and dissected at 3 different times (quarter-size, black seed coat, and fully open stages) to investigate the relationship between sunken feeding lesions and internal damage such as warts, damaged seed, or damaged locks. Lint from both black seed coat and fully open stages was classified into five damage categories. Lint from these categories was compiled for each location and graded for lint quality. The average number of sunken lesions per boll ranged from 1.15 to 3.35. The largest lint damage category was no damage and ranged from 1.63 to 3.38 locks per boll. There was an average of 0.42 to 1.93 locks per boll with minor damage and only 0.0 to 0.37 locks per boll with moderate to severe damage. Few locks were destroyed or had hardlock.

Introduction

Boll weevil eradication and the adoption of Bollgard® cotton varieties by many producers are responsible for the current “low insecticide spray environment” that exists in most cotton acreage across the southeastern United States. The hemipteran sucking-bug complex has dramatically responded to this "low-spray environment” and population and damage levels are increasing.

The sucking-bug complex is composed of plant bugs and stink bugs and two to four (or more) species may be abundant in any given cotton field. Sucking bugs are mid-to-late season pests that move into and reproduce in cotton, and feed primarily on developing bolls. Because of the species diversity, the difficulty in sampling bugs, and because bug damage is superficially obscure, persons scouting cotton are challenged to determine accurate bug levels. Bugs may be “phantom-like,” moving into and out of cotton fields and present without damage or vice versa. Bugs may be very spotty in their in-field distribution, occurring on one or more field edge or within some, but not other portions of the field.

In most states, the currently used thresholds for these boll-feeding bugs in cotton have been adapted from Greene et al. (2001) and are estimated at 1 stink bug per 6 row feet, as measured from drop cloth counts, or from 10% to 20% of medium-sized bolls displaying internal bug feeding damage (from in-field boll dissection). Tarnished plant bugs contribute to boll damage thresholds causing similar damage but it is incurred during earlier stages of boll development (Tugwell et al. 1976, Russell et al. 1999, Horn et al. 1999), but may also cause square abortion, and are monitored using sweep net counts, missing square counts, dirty bloom estimates, and/or damaged boll assessment (Bacheler 2004). These monitoring techniques are time consuming and difficult to use when scouting commercial cotton fields. Additionally, thresholds are not precise (e.g., they vary from 10% to 20%) and they are static, not reflecting the changing nature of a cotton field’s susceptibility to boll damage. Often the sampling techniques are poorly defined and are difficult for consultants or scouts to understand from the printed page or when applying knowledge to field situations. Cotton consultants are often confused by what seemingly are conflicting scouting results when using more than one technique. The result is to use more insecticide applications if unsure or to not spray if damage estimates do not seem to reflect yields or quality measures. The clarification of cotton fruit and bug monitoring procedures and the development of dependable treatment thresholds are a high research priority, and primary objectives of this study.

Objectives

1. Correlate external and internal boll damage by stink bug to cotton fiber yield and quality.
2. Determine which boll damage factor(s) are most correlated with lint yield and quality.
3. Use these findings to develop improved stink bug scouting and management policies.

Materials and Methods

A total of 22 cotton fields in southeast Virginia and northeast North Carolina were scouted from squaring (July 7) to boll formation (August 2) for stink bugs and levels of internal boll damage. Insects were monitored using ten 25-sweep net samples and ten 6-foot beat sheet samples on each field visit. After boll formation, a random sample of 100 quarter-sized bolls was removed and inspected for internal damage caused by bug feeding.

Five fields, three in North Carolina and two in Virginia, were determined to have adequate infestation levels of sucking bugs to be included in this study. In each of those fields, an area large enough to accommodate the study was sectioned off using white poles and flagging tape. To minimize further damage by insects, each study area was treated weekly with Assail 30SG at 0.002 lb ai/A plus Capture 2EC at 0.01 lb ai/A. Treatments were applied with a CO2-pressurized backpack sprayer (39 PSI, 10 gallons per acre) using an offset boom with two TX10 hollow cone nozzles, one nozzle over the top of each row.

In each study area, 300 quarter-sized bolls were identified. The node above cotyledon on which the boll was found was recorded, as well as the number of visually apparent external sucking bug feeding punctures (sunken lesions). Bolls were divided into three subsets of 100 bolls each: Same-day=bolls removed on the day the study was initiated; Time-skip 1=bolls removed at maturation (black seed coat); and Time-skip 2=bolls removed when fully opened. The bolls selected for Time-skip 1 and Time-skip 2 samples were identified with a numbered plastic tag and left in the field.

After removal, Same-day bolls were taken to the Virginia Tech Tidewater Agricultural Research and Extension Center where they were dissected to determine levels of internal damage. Observations were focused on two areas: internal carpel walls and seeds. Carpel walls were inspected for the number of puncture marks, small warts, and large warts. Warts were categorized as large if they were 3 mm in diameter or larger. Seeds were teased from the lint and were assigned as undamaged, stained, underdeveloped, or killed (only damaged seeds were counted).

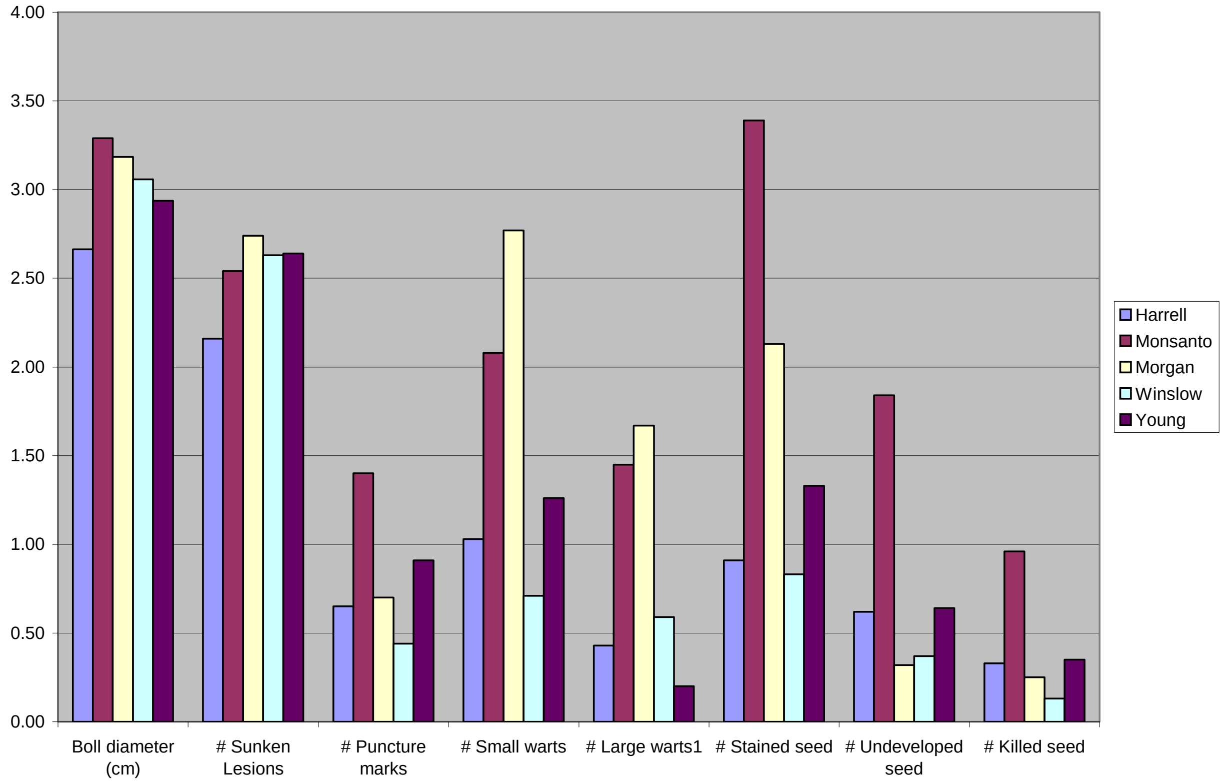
Time-skip 1 bolls were dissected in the laboratory and lint from individual locks was assigned to one of five lint damage categories: 1) no damage; 2) minor damage=1 small stained area; 3) moderate damage=several small stained areas or one large stained area; 4) severe=more than half the lock damaged; and 5) destroyed=completely rotted or hard locked. The lint from each damage category (except the destroyed and hard locked) was grouped for each of the five study sites, weighed, and ginned separately. Time-skip 2 bolls were dissected and lint damage was categorized as described for Time-skip 1 samples. Lint samples are being processed for grade (AFIS and HVIT tests) by Cotton Incorporated in Raleigh, NC.

Results and Discussion

Same-day

There was little variation in the number of external sunken lesions per boll among the fields, ranging from 2.16 to 2.74 (Figure 1). There was greater variation in number of internal puncture marks from an average of 0.44 per boll in Winslow Field to 1.4 in Monsanto Field. The highest averages of both small and large warts were recorded in Morgan Field, while Winslow Field saw the fewest small warts and Young Field had the fewest large warts. More variability was seen in seed damage than carpel wall damage. The average number of stained seeds per boll ranged from 0.83 in Winslow Field to 3.39 in Monsanto Field. Morgan Field saw an average of 0.32 underdeveloped seeds whereas Monsanto Field experienced 1.84 underdeveloped seeds per boll. In killed seeds, again Monsanto Field recorded the highest average of 0.96 seeds per boll and Winslow recorded only 0.13 seeds per boll.

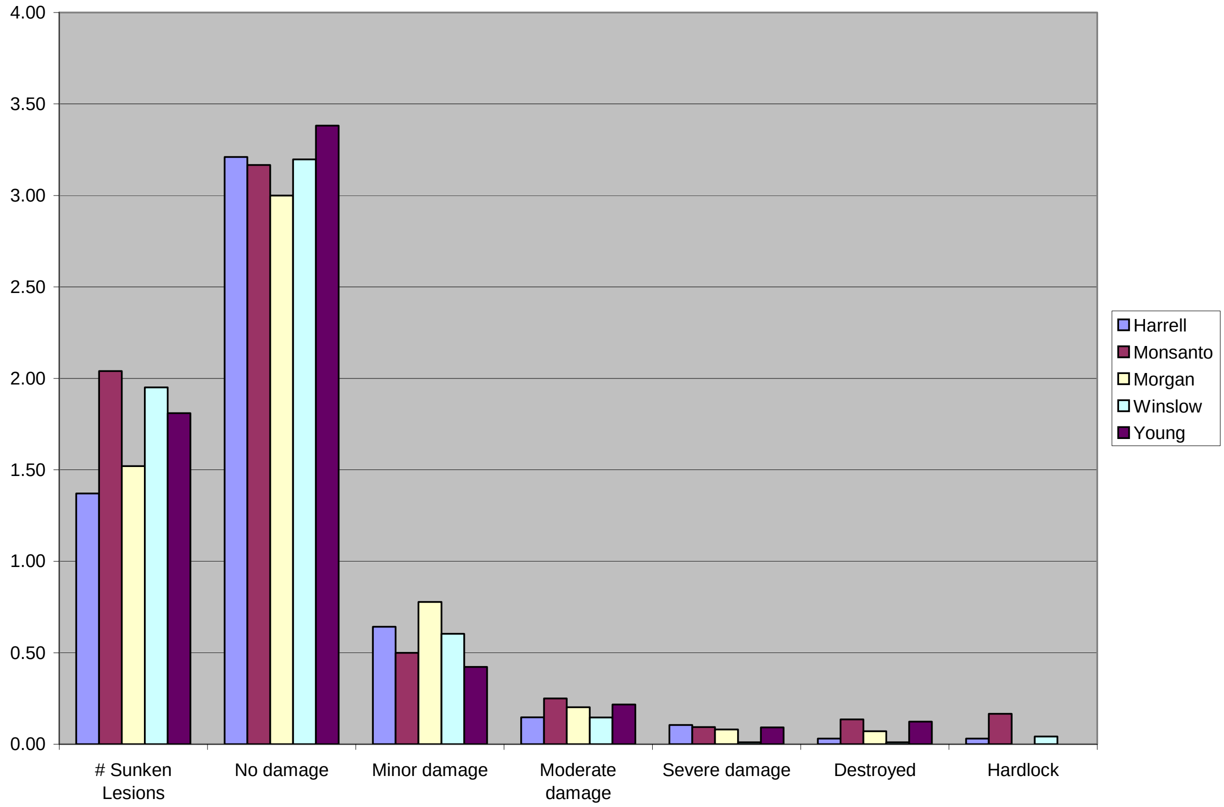
Figure 1. Means of internal bug-induced boll damage rating, for 100-boll sample, same-day.



Time-skip 1

The average number of sunken lesions per boll in Time-skip 1 ranged from 1.37 in the Harrell Field to 2.04 in the Monsanto Field (Figure 2). The largest lint damage category was no damage and ranged from an average of 3.0 to 3.38 locks per boll. Lint damage was light and fairly consistent among the five study fields. An average of 0.42 to 0.78 locks per boll had minor damage and only 0.01 to 0.25 had moderate to severe damage. Few locks were destroyed or had hardlock.

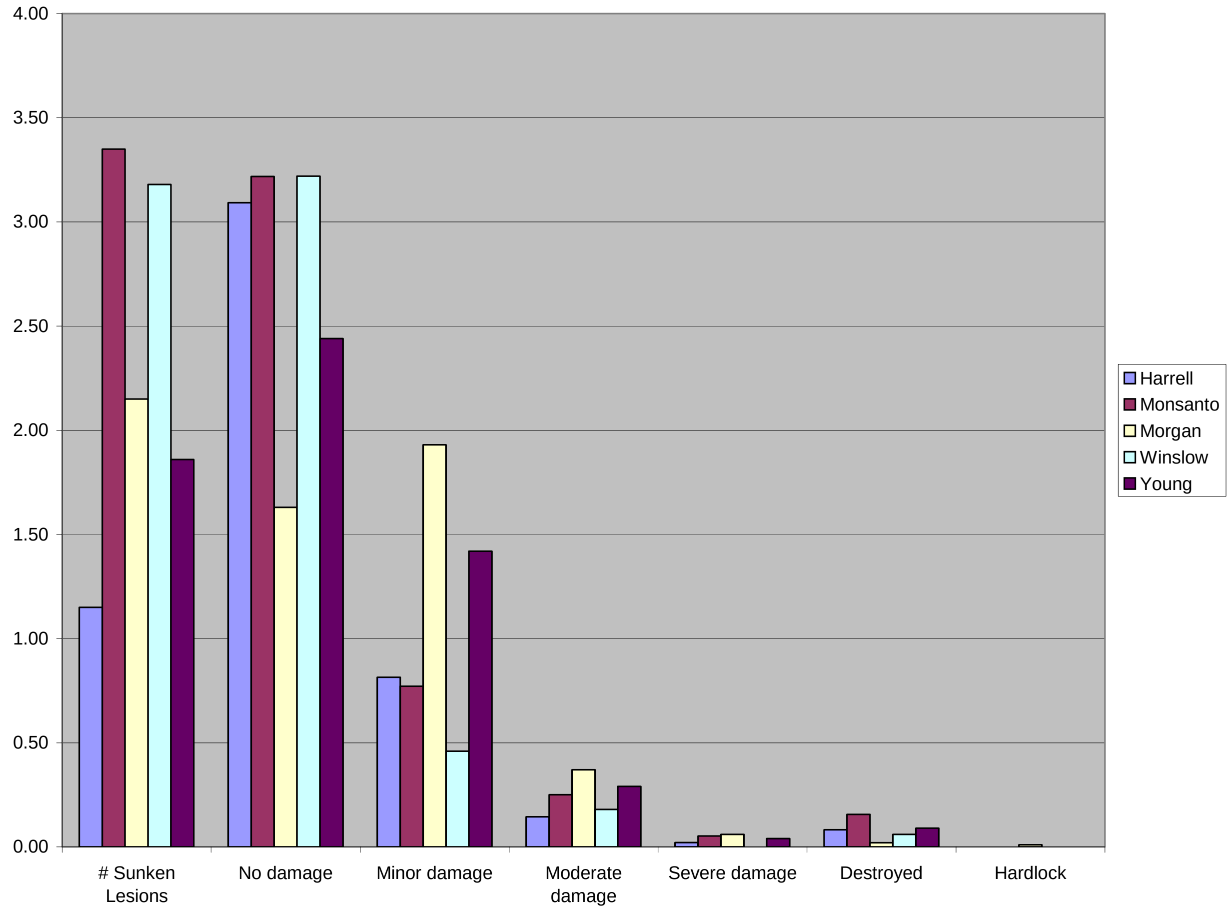
Figure 2. Mean number of locks per boll for lint damage categories based on 100-boll sample, Time-skip 1.



Time-skip 2

The average number of external sunken lesions ranged from 1.15 in the Harrell Field to 3.35 in the Monsanto Field (Figure 3). As in Time-skip 1, the largest lint damage category was no damage and ranged from an average of 1.63 locks per boll in the Morgan Field to 3.22 in the Monsanto Field. There was more minor damage compared to the Time-skip 1 sample with the average number of locks per boll ranging from 0.46 to 1.93. The average number of locks per boll with moderate to severe damage was similar to the Time-skip 1 sample and ranged from 0.0 to 0.37, and few locks were destroyed or had hardlock.

Figure 3. Mean number of locks per boll for lint damage categories based on 100-boll sample, Time-skip 2.



Our data differ from that of Greene et. al. (2001) by suggesting that thresholds may need to be dynamic throughout the growing season. We plan to further investigate this by continuing our research in 2006.

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