MONITORING FOR AND MANAGEMENT OF STINK BUGS

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Abstract

Because stink bugs can be difficult to detect in cotton with traditional sampling tools, we examined other methods of monitoring the pest complex for management decisions. *Euschistus servus* (Say) was successfully lured and captured during the season, but potential for successful pheromone trapping of stink bugs remains contingent upon development of lures for other important species. Action thresholds for stink bugs based on internal boll damage caused by their feeding were tested, and treatment at 20% injury to 14-d-old bolls adequately protected yields.

Introduction

Important phytophagous pentatomids in Georgia cotton include the brown stink bug, *Euschistus servus* (Say), the green stink bug, *Acrosternum hilare* (Say), and the southern green stink bug, *Nezara viridula* (L.). These pests are active during most months of the year (Fig. 1), feeding on numerous wild and cultivated host plants (Jones and Sullivan 1982, Todd and Herzog 1980). Damaging populations are usually observed in cotton during the months of July, August, and September. Reduced broad-spectrum insecticide use in cotton (specifically varieties producing proteins from *Bacillus thuringiensis*, i.e. *Bt* cotton) has allowed this secondary pest complex to become a major pest group of the crop (Greene and Turnipseed 1996). Piercing/sucking mouthparts enable stink bugs to inject digestive enzymes and feed on developing seeds within the boll. This process allows entry of microorganisms that also contribute to physiological damage and degradation of fruit (Watkins 1981, Verma 1986), resulting in reduced yield and lint/seed quality.

Monitoring Density

Traditional sampling methods for stink bugs in cotton include the drop cloth, the sweep net, and observational counts. Standardized plant counts used for worm pests are inefficient for stink bugs because of clumped distribution and elusive behavior of bugs in the field. The sweep-net method can be destructive to developing fruit, and it produces variable results that depend on the user's technique, sampling time, plant density, height of canopy, etc. The drop-cloth method is time-consuming, somewhat variable, but reliable if done correctly in a canopy of ideal height. Because numerous researchers have examined these sampling methods in cotton and soybeans, we did not directly compare the techniques in this study. Despite sampling difficulties, a research-based treatment threshold (Greene et al. 1998) of 1 stink bug per 2 m of row using a ground cloth has been adopted by most states in the Southeast.

Trapping Stink Bugs

Because of the difficulties in detecting stink bugs in cotton with traditional methods, a successful pheromone trap could have a significant place in our management strategies for the pest complex. Initial movement of bugs into fields and population changes thereafter might be monitored with trapping techniques. The concept is not new for these insects but is limited by the lack of effective attractants for the group. The spined soldier bug, *Podisus maculiventris* (Say), has been lured and trapped with a synthetic pheromone (Aldrich et al. 1984), but research on additional stink bug pheromones has produced few practical lures. One commercially available compound, methyl 2,4 decadienoate, readily attracts *Euschistus* spp. in some trap designs. The "Florida stink bug trap" has shown potential as an efficient design in pecans (Mizell and Tedders 1995; Mizell et al. 1997; Yonce and Mizell 1997). We investigated the effectiveness of using this trap and lure combination to observe populations of stink bugs around cotton fields.

Examining Bolls and Damage Thresholds

Stink bugs leave evidence of their feeding in and on bolls that is easily recognized and quantified. Symptoms of internal feeding damage are intimately related to yield and fiber quality and can be useful as predictors of damaging populations of stink bugs. Affected bolls reveal damage to lint, seeds, and carpel walls when examined internally for feeding injury. Our previous work has demonstrated that damage symptoms can appear within 24-48 hr after feeding and that bolls aged ca. 14 d from white bloom are an appropriate size for examination (Greene and Herzog 1999). We have also reported that as *N. viridula* and bolls age, damage potential increases and decreases, respectively (Greene et al. 1999). We continued investigations into the effectiveness of treating for stink bugs when percentages of a particular age group of bolls displayed feeding damage exceeding predetermined levels.

Materials and Methods

Monitoring Density

We did not compare the efficiency of observational counts with sweep-net or drop-cloth sampling techniques in these studies. Many factors including plant height, time of day,

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temperature, and row spacing affect sampling efficiency and should help determine the most appropriate method to use. We believe that the drop-cloth method, if used correctly, is generally the most effective way to detect the presence of stink bugs in the crop. However, other methods should be considered if conditions warrant their use.

Trapping Stink Bugs

Traps (ca. 30) described by Mizell and Tedders (1995) were placed in and around three cotton fields near Tifton, GA on 12 July 1999. A lure was placed in the wire-screen top of each trap and consisted of a rubber septum treated with 40 μl of methyl 2,4-decadienoate and replaced every 4-5 d. Traps were examined and emptied at least twice per wk and removed from fields on 18 October 1999.

Examining Bolls and Damage Thresholds

In southwest Georgia, plots of DPL33B at the Coastal Plain Experiment Station in Tift county (16 rows by 50 ft), the Attapulgus Research Center in Decatur county (24 rows by 130 ft), and DPL655B/RR at a producer's farm in Brooks county (48 rows by 150 ft) were arranged in a RCBD with 6-7 treatments and 4 replications. Twenty-five bolls (50-75% full size, ca. 14 d from white bloom) were collected from each plot weekly and examined for internal symptoms of feeding (cell proliferation) by stink bugs. A boll was considered damaged if at least one internal growth was observed. Dicrotophos (Bidrin 8, Amvac, Los Angeles, CA at 0.50 lb [AI]/a) was applied to all plots in a treatment at or exceeding the following levels of damaged bolls: 10, 20, 30, and 50% and at a density of 1 bug per 6 ft of row. Additional treatments included cyfluthrin (Baythroid 2, Bayer, Kansas City, MO at 0.04 lb [AI]/a) or λ-cyhalothrin (KarateZ 2.08, Zeneca, Wilmington, DE at 0.03 lb [AI]/a) applied weekly at Attapulgus and Tifton, respectively, and an untreated control at all sites. Two or four rows from each plot were harvested by machine.

Results and Discussion

Monitoring Density

Relative sampling methods (scouting, sweep net, drop cloth) were not formally compared in this study. Our observations and experiences lead us to believe that observational counts of stink bugs in the field have little quantitative value. However, visual detection of stink bugs should make the observer aware of potential problems with the pests.

Sample area is limited to the top 12-18" of the cotton canopy with the sweep net, providing variable results in detecting numbers of both immatures and adults. Unlike typical early-season plant bugs, stink bugs are mid/late-season pests when plants can be quite tall, so sampling the tops of tall plants can provide inadequate estimates of stink bug density. Adults are likely to be found warming in the sun near plant tops during morning hours, but as temperatures increase during the day, they move down into the canopy to find more favorable conditions. Nymphs are likely to be found hidden in the lower canopy because they are more susceptible than adults to increased predation and desiccation found in open areas. Also, highly mobile adults might seek out the unrestricted areas of the upper canopy from which to take flight and seek mates, whereas flightless nymphs would not need to be "up top" for those reasons. Because of plant height and the importance of detecting reproducing populations of stink bugs, the sweep net might not be the best choice for detecting their numbers in cotton.

In our opinion, the drop cloth provides the best available and practical means of detecting pentatomids in the crop. If done correctly, a portion of the entire canopy can be sampled for stink bugs. Because stink bugs move very quickly, care must be taken not to disturb plants before sampling. Plants from one row should be shaken vigorously over the cloth and dislodged bugs quickly counted.

Trapping Stink Bugs

The "Florida stink bug trap" was the most effective trap in preliminary tests. These traps (ca. 30 placed around and in 3 cotton fields) caught ca. 1700 *Euschistus* spp. in 14 wk, and weekly trap numbers (Fig. 2) appeared to reflect field populations. Although successful in capturing brown stink bugs, the availability of operative lures for other important species such *N. viridula* would have undoubtedly increased capture and monitoring capacity of the traps. Until additional "field-ready" lures are available, we will continue to explore opportunities for monitoring stink bugs in cotton using this trap and lure combination.

Examining Bolls and Damage Thresholds

Because of the difficulties in detecting stink bugs in cotton, we tested the effectiveness of using symptoms of boll injury as a monitoring tool. Insecticide application based on percentages of bolls with internal feeding damage protected cotton, and highest yields were obtained when plots were treated 2 times at the 20% level (20% of 14-d-old bolls displaying internal symptoms of feeding) (Fig. 3). As a result of these continuing studies, alternative monitoring and management recommendations are available for stink bugs in cotton.

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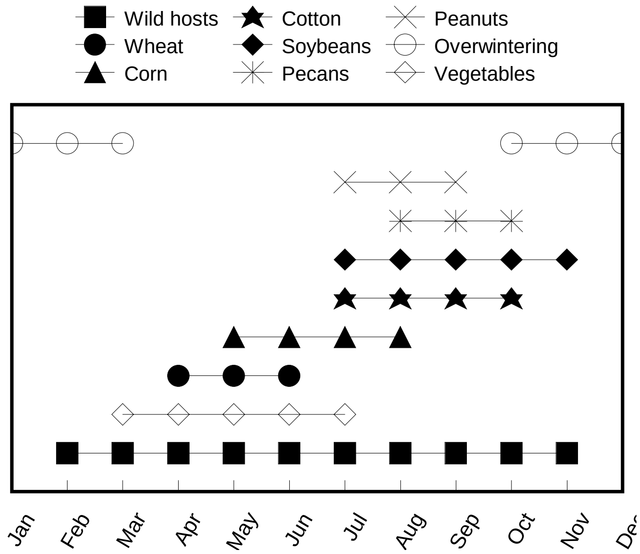

Figure 1. Typical seasonal host sequence of important phytophagous stink bug species in the southeastern U.S.A.

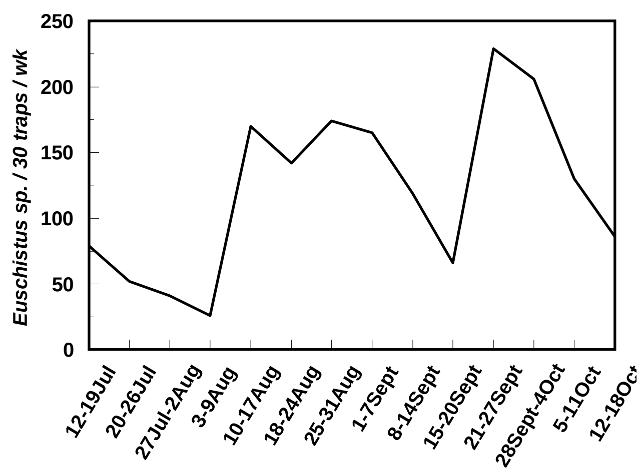

Figure 2. Weekly capture of *Euschistus* spp. in baited traps over 14 wk interval.

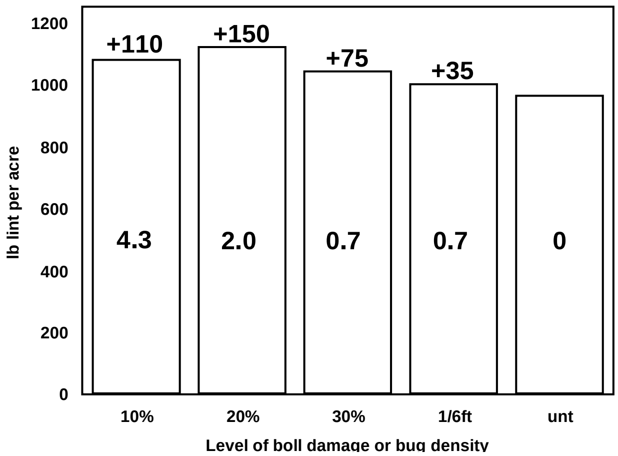

Figure 3. Yield following treatment with dicrotophos (avg. # in bar) at various thresholds (percentage of internal boll damage or density) for stink bugs.