COMPARISON OF TWO STINK BUG SCOUTING TECHNIQUES IN COTTON UNDER FIELD CONDITIONS

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Abstract

In 2007 and 2008, field studies were conducted across northeastern North Carolina and southeastern Virginia to evaluate a new external cotton boll scouting technique compared to the traditional boll popping internal technique. In 2007, 10 field sites at or near stink bug threshold were utilized and 15 in 2008. Within each field site, 10 sample areas were selected in 2007 and five in 2008. Sample areas were distributed in a typical scouting pattern and pre-marked with flags. Individual runs for each technique were conducted at each field site. In 2007, sample size for both techniques was 10 quarter-sized bolls per sample area for a total of 100 bolls for each technique. In 2008, the new external boll scouting technique samples consisted of 20 quarter-sized bolls per sample area for a total of 100 bolls. The traditional boll popping internal scouting technique samples consisted of 10 quarter-sized bolls per sample area for a total of 50 bolls. During the external scouting process, bolls were deemed damaged in 2007 if the boll exterior had four or more external stink bug feeding lesions, and bolls were deemed damaged if one or more were present in 2008. Internally evaluated bolls were deemed damaged if a wart and/or stained lint were detected. In 2008, investigators were categorized into one of three expertise levels (low, moderate, and high) based on their scouting experience. Data collected included number of damaged bolls detected by each scouting technique and amount of time required to complete each technique. Results indicated that the new external stink bug scouting technique appears to be as effective as the traditional scouting technique in determining boll damage, and significantly reduced the required sampling time.

Introduction

The stink bug complex, which includes the brown stink bug, *Euschistus servus* (Say), and green stink bug, *Acrosternum hilare* (Say), continues to increase as a common pest of cotton, *Gossypium hirsutum* L., across the Southeastern U.S. cotton belt. The continued adoption of Bt cotton varieties, reduction in broad spectrum insecticide usage, and eradication of the boll weevil, *Anthonomous grandis grandis* Boheman, has lead stink bugs to become more of a prominent pest (Greene and Herzog 1999, Leonard et al. 1999, Roberts 1999). In 2007, stink bugs infested more than 4.8 million acres of which approximately 2 million acres were treated and over 68,000 bales destroyed across the U.S. (Williams 2008). Williams (2008) reported that North Carolina and Virginia accounted for just over half a million acres infested by stink bugs alone.

Current scouting techniques for stink bug damage requires scouts to collect quarter sized bolls, which are then dissected to determine internal damage such as warts and stained lint (Figure 1) (Bacheler 2007), which can be time consuming (Toews 2008). Stink bug feeding can result in external circular, concaved lesions approximately 1/16 inch in diameter, along with other less obvious symptoms (Figure 2). These external stink bug feeding lesions may provide a basis for a new scouting procedure to make damage assessments by visually inspecting the cotton bolls externally. Blinka et al. (2008) showed that a moderately strong, positive correlation existed between external stink bug feeding lesions on cotton bolls and internal damage. These correlations were utilized to develop a new stink bug scouting technique that relies on the external examination of cotton bolls. This new scouting technique could reduce the time required by scouts dissecting bolls and allow them to gain more power from their sampling by collecting and examining more bolls and/or sampling more fields in a given time-period. The objective of this research was to evaluate a new external stink bug scouting technique as compared to dissecting bolls to determine internal damage, along with comparing the time required for each sampling technique in commercial cotton fields.

Figure 1. Stink bug feeding wart (left) and damaged/stained lint (right).

Figure 2. External stink bug feeding sign (lesions).

Materials and Methods

2007 Field Trials

In 2007, 10 field sites with stink bug infestations levels near or above the 20% internal cotton boll damage threshold were selected in northeastern North Carolina and southeastern Virginia. Within each field site, 10 sample areas were pre-marked with flagged polls in a pattern that was consistent with a typical scouting pattern (Figure 3). External and internal boll damage examinations were conducted separately. Investigators began by first recording the start time at the field border, and then proceeded through the sampling route. Investigators entered the field and proceeded to the first marked sampling area, where they pulled 10 quarter-sized bolls (ca. 2.4cm), examined, and recorded the number of bolls with four or more external stink bug feeding lesions. The investigators then proceeded to the next sampling area and repeated the procedure. This process was continued until bolls had been collected and examined from all ten sampling areas for a total of 100 bolls per field. As the investigator exited the field, the ending time was recorded. This procedure was repeated in identical fashion but bolls were pulled, dissected on the spot, and the number of bolls with any internal damage (warts and/or stained lint) was recorded for a total of 100 bolls. Again, the starting and ending times were recorded.

2008 Field Trials

In 2008, 15 field sites with stink bug infestation levels near or above the 20% internal cotton boll damage threshold were selected in northeastern North Carolina and southeastern Virginia. Within each field site, five sampling areas were pre-marked with flagged polls in a pattern that was consistent with a typical scouting pattern (Figure 3). External and internal boll damage examinations were conducted separately. Investigators began by first recording the start time at the field border, and then proceeded through the sampling route. Investigators entered the field and proceeded to the first marked sampling area, where they pulled 20 quarter-sized bolls (ca. 2.4cm), examined, and recorded the number of bolls with one or more external stink bug feeding lesions. The investigators then proceeded to the next sampling area and repeated the procedure. This process was continued until bolls had been collected and examined from all five sampling areas for a total of 100 bolls per field. As the investigator exited the field, the ending time was recorded. This procedure was repeated in identical fashion with the exception that 10 bolls were pulled from all five sampling areas, dissected on the spot, and the number of bolls with any internal damage (warts and/or stained lint) was recorded for a total of 50 bolls. Again, the starting and ending times were recorded.

Additionally, in 2008 we investigated the differences between cotton field scouts at three different expertise levels. The expertise levels consisted of: low, individuals that had never scouted cotton fields before and were not familiar with either the internal or new external scouting techniques; medium, individuals who have spent some time in cotton fields and were familiar with both the internal and new external scouting techniques; high, individuals who scout cotton fields professionally and are familiar with both internal or new external scouting techniques. This addition was done to aid in determining how much experience an individual would require to effectively and efficiently utilize the new external stink bug scouting technique, and to a aid in design of educational materials.

Data from both 2007 and 2008 were subjected to ANOVA using Proc GLM in SAS® for statistical analysis. Since the size of each field may have varied, both the time difference and boll damage difference data for each year were transformed using the following equation: (T1-T2/T2, where T1 = the amount of time required for the internal technique and T2 = the amount of time required for the external technique; and D1-D2/D2 where D1 = the amount of damaged detected by the internal technique and T2 = the amount of damage detected by the external technique), and a *t* test was performed. Experience level data were further analyzed using a slice statement in SAS® to determine differences between each level.

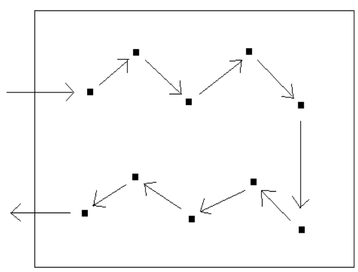

Figure 3. Example of a typical field scouting pattern used in field studies.

Results and Discussion

Results indicated that in both 2007 and 2008, there were no differences in mean percent boll damage detected by either the external or internal boll scouting techniques (Figure 4 and Table 1). Despite the lack of statistical significance, numerical trends suggested that by increasing the external scouting technique sample size from 10 to 20 quarter-sized bolls per sample area, the amount of variation between the two scouting techniques was further reduced. These data demonstrated that using the new external boll scouting technique was just as effective in detecting stink bug damage as the traditional boll popping internal technique. Results also indicated that in both years, utilizing the new external boll scouting technique significantly reduced the amount of time required to sample as compared to the traditional boll popping internal technique (Figure 5 and Table 1). Even though the sample size from 2007 was doubled in 2008, the amount of time required for sampling was still significantly reduced utilizing the new external boll scouting technique.

Examining the experience level data, there were no differences between the low and moderate expertise levels with respect to the overall percent boll damage detected. However both the low and moderate levels did detect significantly higher overall percent boll damage than the high expertise level (Figure 6). Examining each of the individual expertise levels with respect to the percent boll damage detected by the new external boll scouting technique and traditional boll popping internal technique, we observed no statistical differences between the two scouting techniques for either the low or high expertise levels. However, the moderate expertise level detected a significantly higher percent boll damage utilizing the traditional boll popping internal technique (Figure 6). The experience level data also demonstrated that the low expertise level was significantly slower then the moderate and high expertise levels, which were not different from one another (Figure 7). This would be expected as the low expertise level individuals may not be as fluent in a cotton field with either scouting technique as compared to the moderate and high expertise level individuals who have spent more time in cotton fields. Examining each of the individual expertise levels with respect to the amount of time required by the new external boll scouting technique and traditional boll popping internal technique, we observed no statistical differences between the two scouting techniques for either the moderate or high expertise levels (Figure 7). However, the low expertise level required a significantly greater amount of time utilizing the traditional boll popping internal technique. Despite the lack of statistical significance for both the moderate and high expertise levels, numerical trends suggested that utilizing the new external boll scouting technique reduced the amount of time required to sample.

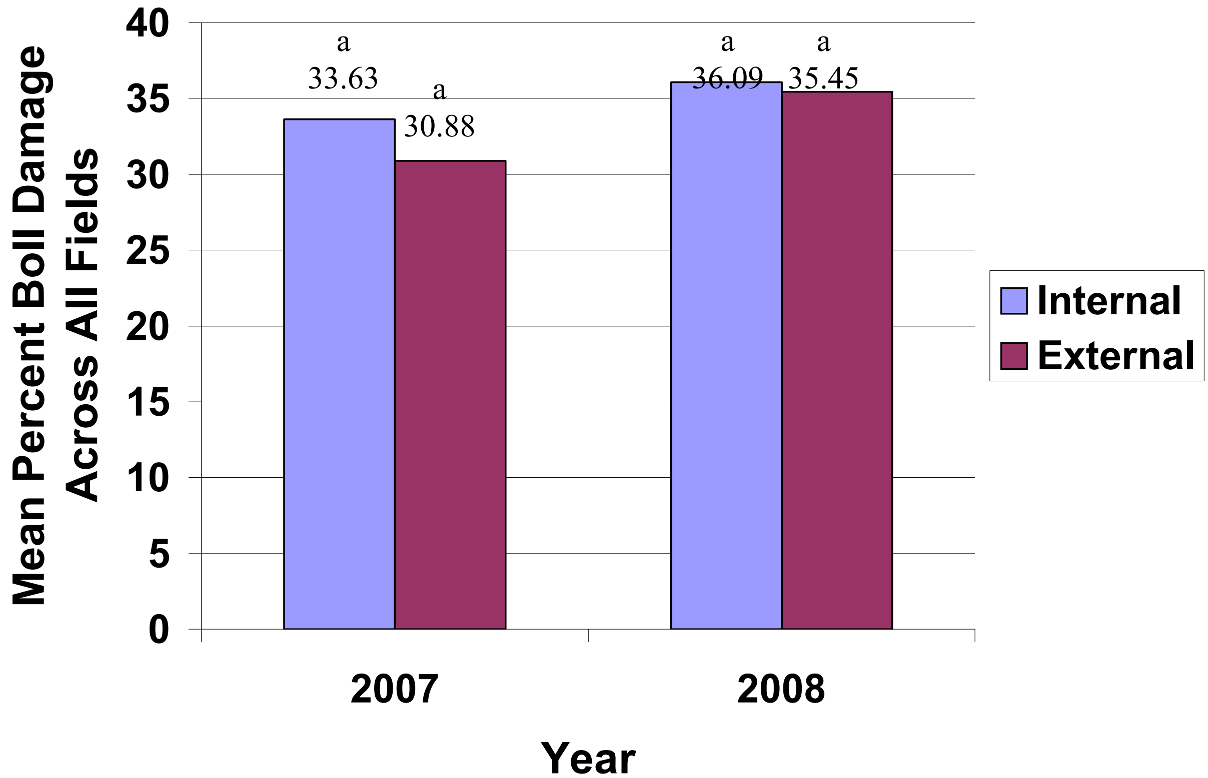

Figure 4. Overall comparison of mean % boll damage levels for each scouting technique. Internal vs. External (p-values for 2007 = 0.1034 [n = 10] & 2008 = 0.3434 [n = 45]).

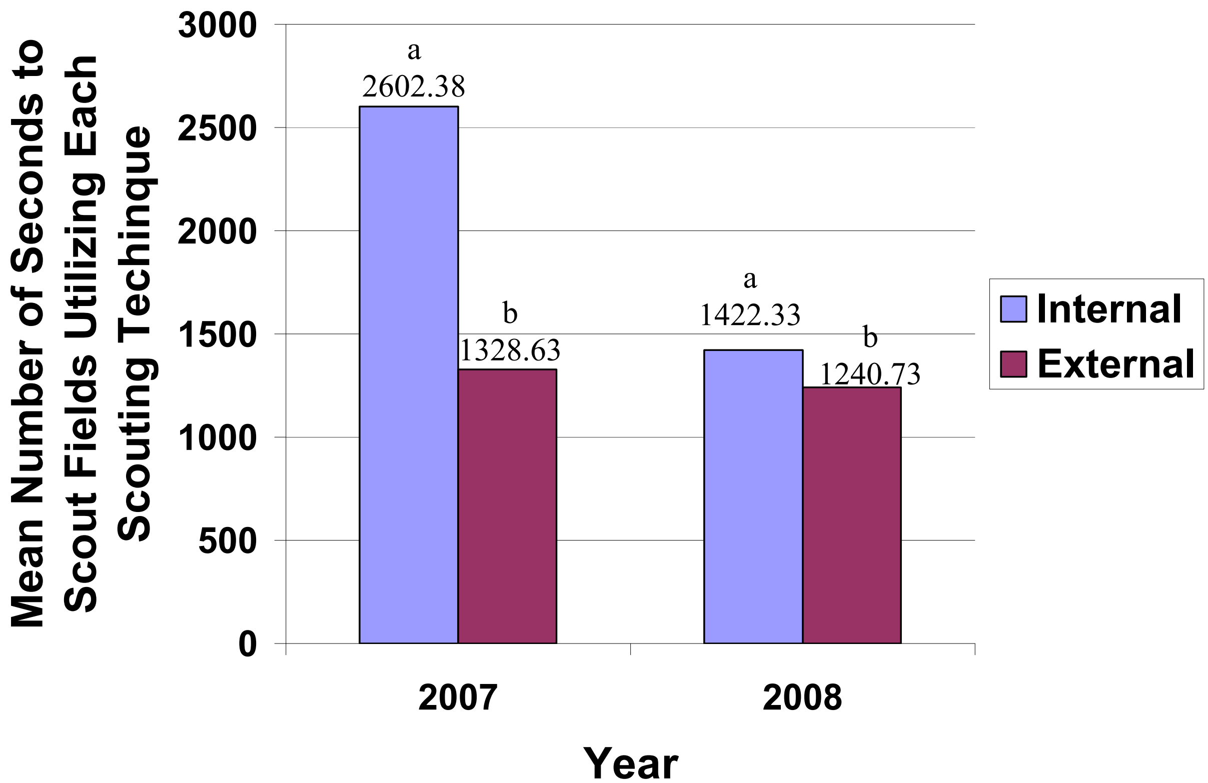

Figure 5. Overall comparison of mean number of seconds for each scouting technique. Internal vs. External (p-values for 2007 = < 0.0001 [n = 10] & 2008 = < 0.0001 [n = 45]).

Table 1. Percent difference of time (T1-T2/T2) and percent boll damage (D1-D2/D2) between scouting techniques based on individual field test runs (*t* test; significant at p-value > 0.05). N=number of field scouting runs.

Year	Variable	Mean	N	p – Value
2007	Boll Damage Difference	0.43	10	0.1067
2008	Boll Damage Difference	0.07	45	0.2524
2007	Time Difference	0.87	10	<0.0001
2008	Time Difference	0.17	45	<0.0001

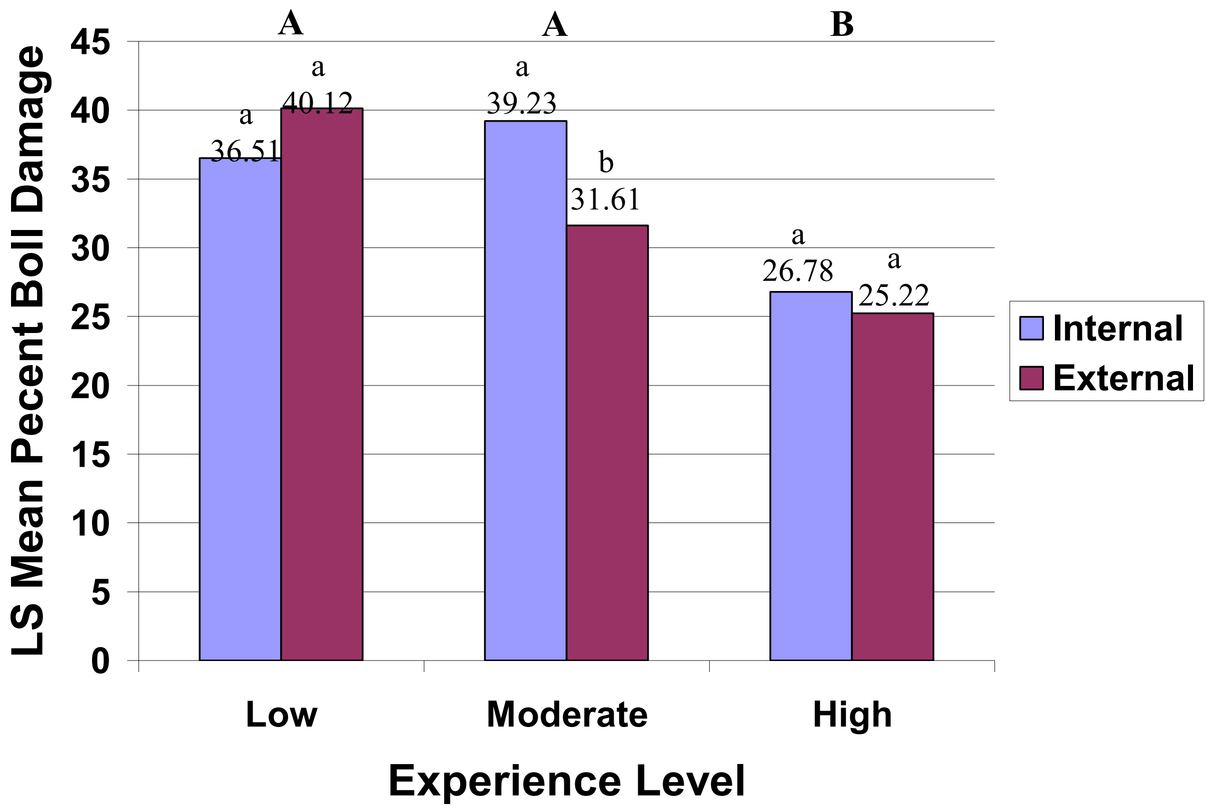

Figure 6. Comparison of LS mean % boll damage levels for each expertise level utilizing each scouting technique. Internal vs. External (Experience level p-value = < 0.0001 [represented by capital letters] and Slice Effect p-values for each experience level: low = 0.1577, moderate = 0.0266, and high = 0.7014 [represented by lower case letters]).

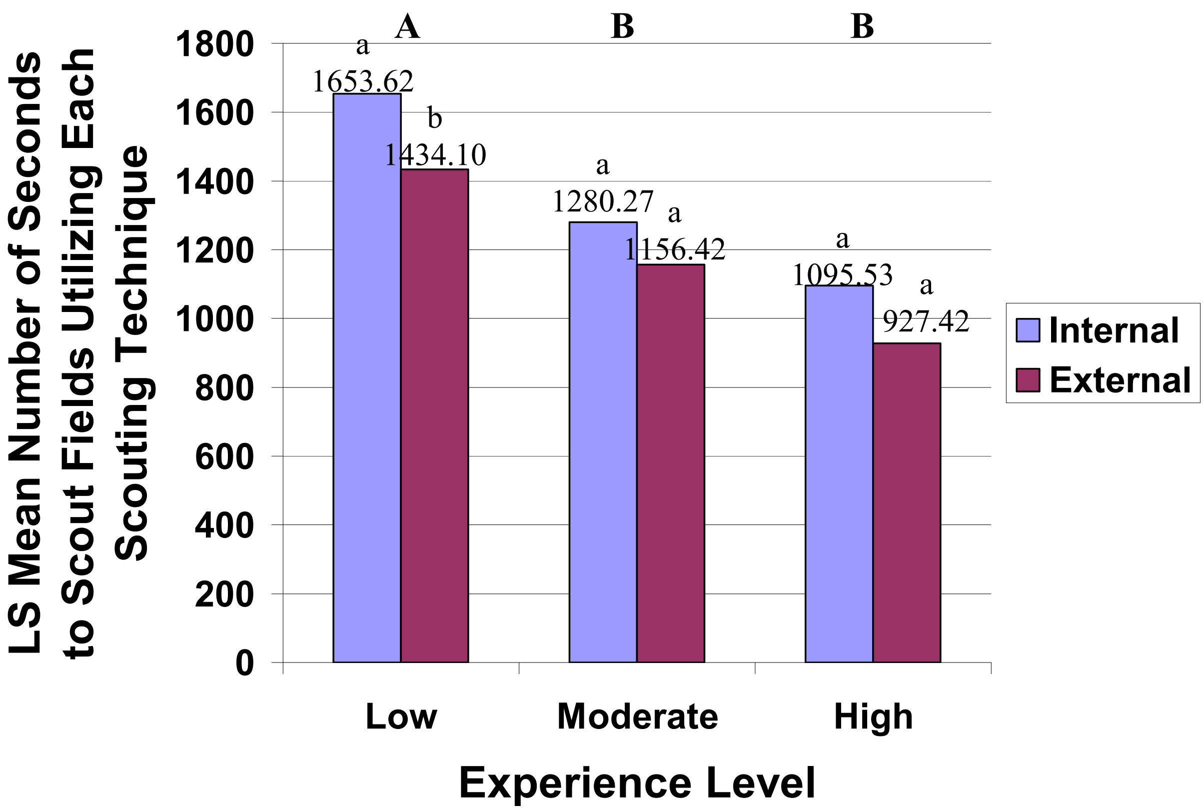

Figure 7. Comparison of LS mean number of seconds for each expertise level utilizing each scouting technique. Internal vs. External (Experience level p-value = < 0.0001 [represented by capital letters] and Slice Effect p-values for each experience level: low = 0.0229, moderate = 0.3273, and high = 0.2691 [represented by lower case letters]).

Conclusions

Overall, the new external stink bug scouting technique appeared to be as effective as the traditional scouting technique in determining boll damage, and significantly reduced the required sampling time. Cotton scouts and consultants may find the new external stink bug scouting technique beneficial in that it may allow them to scout more acres of cotton for stink bugs, increase the sample size, and/or reduce finger and hand fatigue from popping so many bolls as compared to the traditional boll popping internal technique. It is our intention to repeat this experiment for an additional year to validate that these results are repeatable since the sample size was increased from 10 bolls per sample area in 2007 to 20 bolls per sample area in 2008.

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