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OPTIONAL MANAGEMENT TACTICS FOR THE SUCKING BUG COMPLEX IN ADVANCED B.T. COTTON

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Abstract

Sucking bugs (such as tarnished plant bug, *Lygus lineolaris* and Stink bugs: *Acrosternum hilare*, *Euschistus servus, Nezara viridula*) have become a major problem in current B.t. varieties primarily because of reductions in insecticide use against lepidopteran pests that also provided coincidental control of these bugs. Success of the Boll Weevil Eradication Program has resulted in additional reductions in insecticide use for control of boll weevil. As advanced B.t. cottons such as Monsanto's Bollgard II and Dow Agrosciences's Widestrike are grown, few, if any, insecticides will be needed for lepidopteran pests and sucking bugs will become even more important. We cannot expect farmers to pay for these new technologies unless they are confident that sucking bugs can be managed effectively and efficiently. Our current treatment thresholds are based on numbers of insects per meter of row determined using a drop cloth or sweep net, combined with percentage of bolls damaged which is determined by mashing bolls open and examining them for punctures, internal warts, and seed or lint staining. These thresholds are cumbersome, time consuming, and are not fully utilized by most decision makers. Obviously, cotton farmers need more efficient and dynamic thresholds that are responsive to 1) the actual species involved, 2) boll development which outstrips insect development in mid-season, and 3) other factors such as bugs vs. boll rot, hard lock, lint quality. We present data and suggest ways that this sucking bug problem can be managed.

The Rising Cost of Bugs

Overall costs of sucking bugs should consider both sprays applied and crop loss incurred. Cost of applications against stink bugs (Figure 1) throughout the cotton belt (Beltwide Cotton Insect Losses, Mike Williams) increased from none reported in 1995 to over $30 million in 2001. This rapid rise occurred after release of Bollgard varieties in 1996. At the same time, crop losses beltwide from stink bugs (Figure 2), have increased from $13 million to over $50 million. Some of this crop loss was likely caused by the tarnished plant bug feeding on young bolls. Of particular interest is that the Carolinas and Georgia accounted for more than half of these losses in recent years. These states are characterized by: 1) being high users of B.t. varieties, 2) among the first without the boll weevil, and 3) not usually spraying for plant bugs to retain early season squares.

Seasonal Abundance of Sucking Bugs

Numbers of tarnished plant bugs and stink bugs during the 2003 season in S.C. are shown (Figure 3) from two early-planted tests for threshold development (untreated plots combined) and one late-planted test (untreated plots); all Bollgard II cotton. In the early-planted tests on July 24, when initial bolls were almost full-sized, damage to quarter-sized bolls was 39%, stink bugs averaged less than two per four meters of row; whereas *L. lineolaris* averaged nine per four meters. By early September, *L. lineolaris* had declined to almost none, but stink bugs had more that tripled to six per four meters. In the late-planted test, when first bolls were 1/2 to 3/4 grown in mid-August some 38% of bolls exhibited damage. Most of this damage was likely caused by stink bugs (4 per 4 m row) and some by *L. lineolaris* (2 per 4 m row). Again stink bugs increased and plant bugs declined rapidly. In both early- and late-planted tests, damage was high as boll development began, lower as boll production increased faster than bugs developed, and high again in late season with declining boll development.

Current Thresholds

Obviously, our current static thresholds need to be replaced by dynamic thresholds that change from early to late boll development. To accomplish this we need to determine: 1) spatial and temporal distribution of major bug species; 2) actual damage caused by each species; and 3) whether or not, in addition to yield, boll-feeding impacts boll rot, hard lock, and lint quality.

Probably the greatest impediment to effective bug management in cotton is the difficulty in utilizing current treatment thresholds. These thresholds are based on: 1) sampling numbers of different bugs involved using a beat cloth or sweep net; and 2) determination of percent sucking bug damage which involves removing bolls from plants, opening them, and examining interior of bolls for punctures, warts, and seed/lint staining.

Optional Solutions

We suggest application of physical or chemical technology as replacement (s) for current treatment thresholds. For example, ultrasound could be used to field scan bolls rapidly from the outside to determine internal damage from sucking bugs. Of equal or greater promise is the utilization of chemical technology to determine plant volatiles elicited by bug-feeding or utilization of chemical signatures specific to different bugs. Such measurements would be correlated with bug numbers and/or bug damage to determine treatment need. During the 2003 season we utilized "chemical sniffing" technology exhibited in the E-nose (Cyranose 320) to determine whether or not whole bolls were undamaged or damaged by the southern green stink bug, *Nezara viridula*. Although considerable refinement in several areas must be addressed for threshold application, an appropriately calibrated Cyranose 320 gave accurate indication of damage.

In the future, we envision a site-specific sprayer (Figure 4) as a replacement for current conventional sprayers. Sensors in the front would determine boll damage, damage elicited plant volatiles, or presence of insects through their signature chemicals. As thresholds are reached, front sensors would activate the "on" switch in the back and spray would be applied. Finally, a GPS receiver records field locations where spray was applied. This information would be used to determine where the next mechanical insect/damage sampling should be made and would be valuable in determining points of field entry of bugs for research purposes. Also, site-specific treatments using improved thresholds could be combined with use of trap crops for bugs, strip-tillage to enhance natural control, different planting dates to avoid certain bugs, etc.

Acknowledgements

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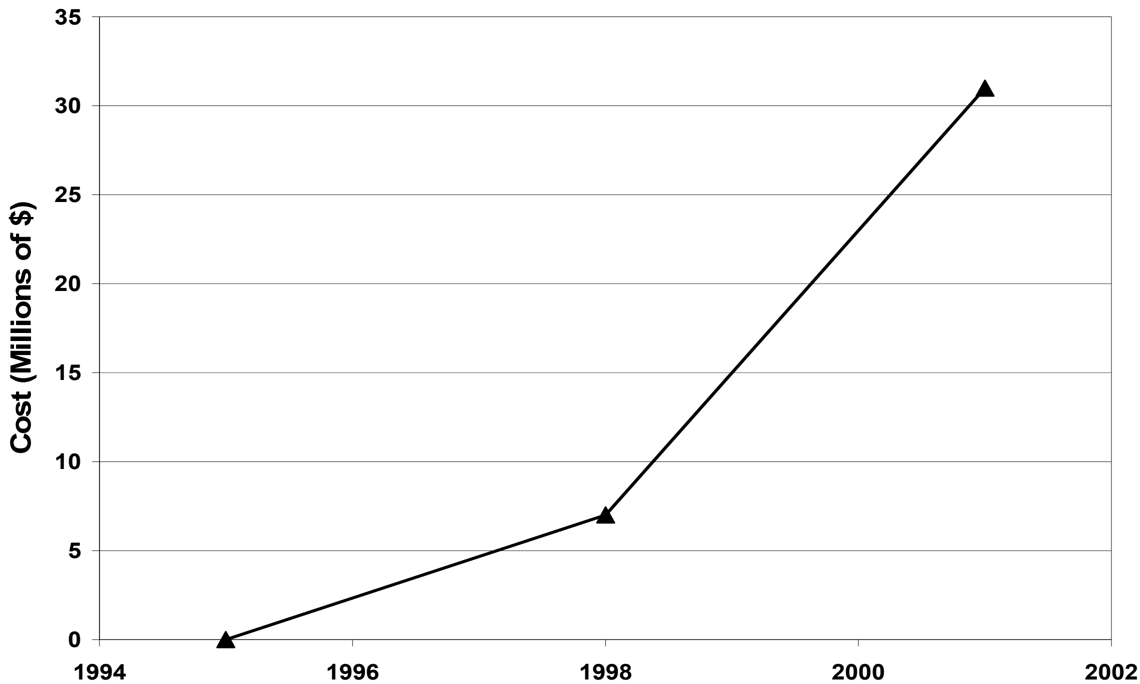

Figure 1. Beltwide insecticide costs for control of stink bugs.

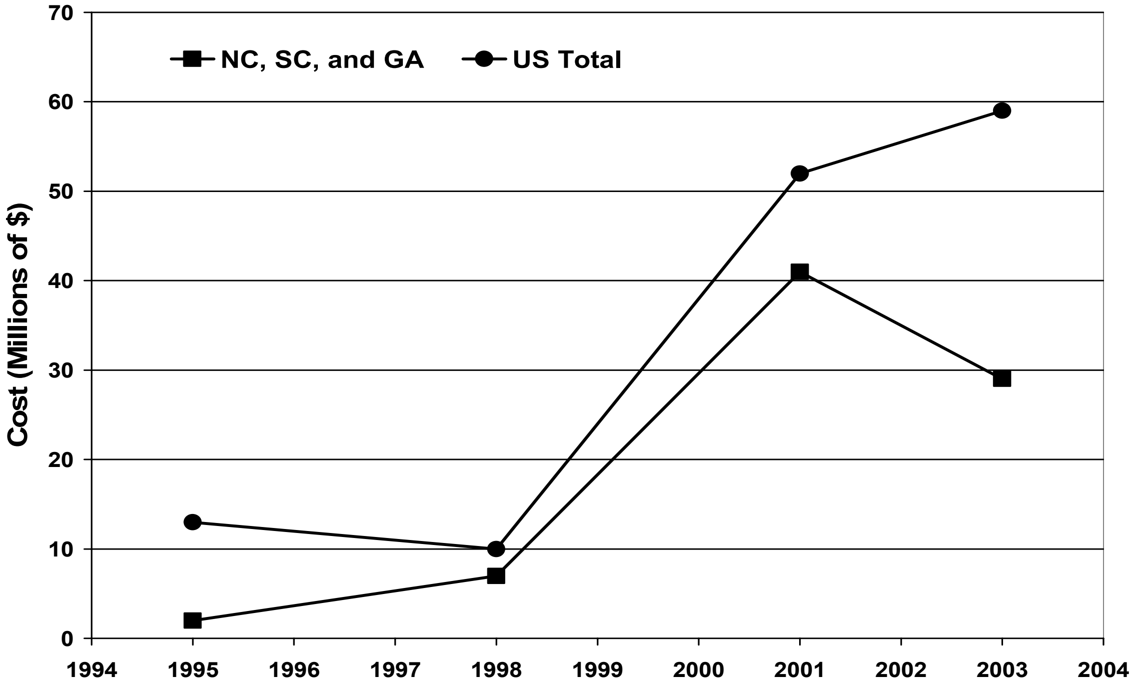

Figure 2. Beltwide crop losses from stink bugs.

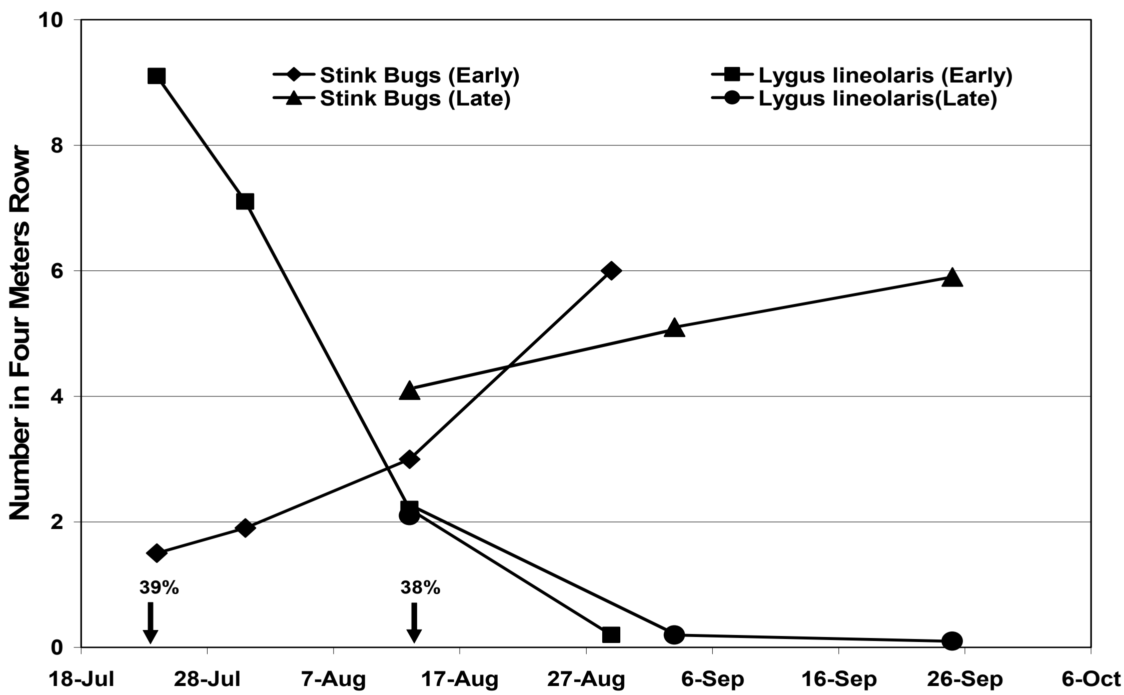

Figure 3. Seasonal abundance of stink bugs and plant bugs from two early-planted and one late-planted threshold tests (untreated plots combined).

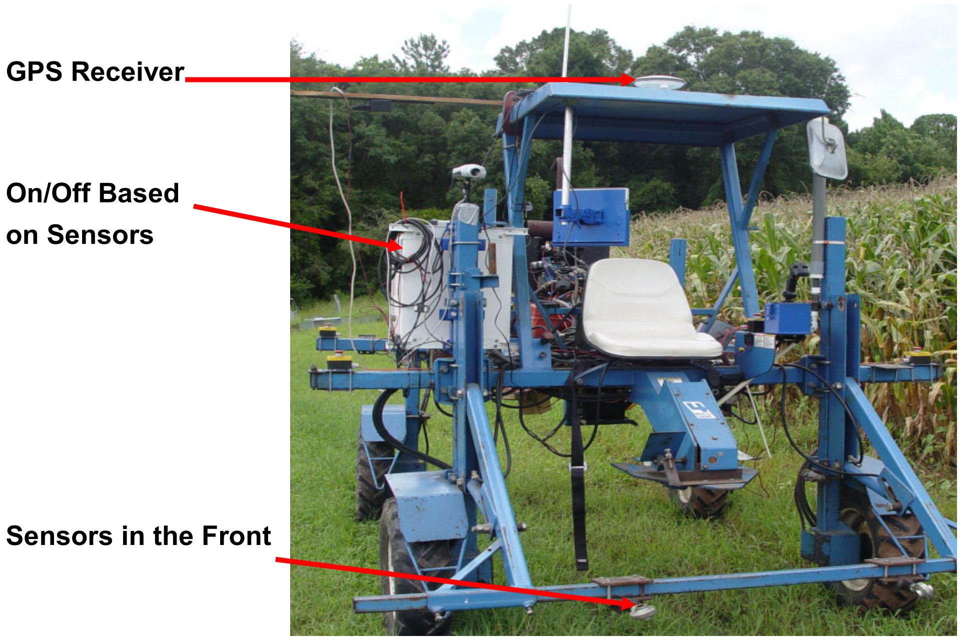

Figure 4. Optional site-specific sprayer.