Resistant Turfgrasses for Improved Chinch Bug Management on Golf Courses

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Objectives:

1. Evaluate selected cool- and warm-season turfgrasses for resistance to chinch bugs in the *Blissus* complex.
2. Characterize the categories (antibiosis, antixenosis, and tolerance) of chinch bug-resistant turfgrasses.
3. Investigate the underlying biochemical and physiological mechanisms responsible for chinch bug resistance.

Start Date: 2003
Project Duration: three years
Total Funding: $30,000

The overall goal of this research is to identify insect-resistant turfgrasses, and investigate the mechanisms of this resistance. This information is fundamentally important for formulating plant breeding strategies, and subsequently developing chinch bug-resistant germplasm through conventional breeding and biotechnological techniques. In addition, knowledge of specific resistance mechanisms would be valuable for identifying biochemical and physiological markers for use in germplasm enhancement programs, and for characterizing plant defense strategies to insect feeding.

Screening studies were initiated to search for buffalograss, fine fescue, bermudagrass, and zoysiagrass germplasm with resistance to the chinch bug, *Blissus occiduus*. Forty-eight buffalograss genotypes (representing different ploidy levels) from diverse geographical locations were evaluated in replicated studies under greenhouse conditions. Of the genotypes studied, four were highly resistant, 22 were moderately resistant, 19 were moderately susceptible, and three were highly susceptible to chinch bug feeding. There was no significant correlation between chinch bug resistance and ploidy level or chinch bug resistance and pubescence.

Several zoysiagrasses and bermudagrasses also exhibited moderate resistance to *B. occiduus*. The zoysiagrass 'Emerald' and bermudagrass 'Mini Verde' displayed the highest level of resistance, while the zoysiagrasses 'Meyer', 'Zenith', 'DeAnza', and the bermudagrasses 'Jackpot' and 'Tifway 419' were moderately to highly susceptible to *B. occiduus* injury.

Another component of this research is to document the presence of multiple chinch bug (*B. occiduus*, *B. l. hirtus*, and *B. insularis*) resistance in buffalograss, fine fescue, and St. Augustinegrass. Greenhouse screening studies established that *B. occiduus*-resistance and -susceptible buffalograsses were susceptible to all other chinch bug species (*B. l. hirtus* and *B. insularis*) evaluated. All St. Augustinegrass (*B. insularis*-resistant 'Floratam' and -susceptible 'Raleigh' and 'Amerishade') were highly resistant to *B. occiduus*.

All endophyte-free and -enhanced fine fescues were moderately to highly susceptible to *B. l. hirtus*, but moderately to highly resistant to *B. occiduus*. This research clearly demonstrates multiple resistance among turfgrasses to chinch bugs and suggests different feeding mechanisms among the chinch bug complex. Studies are currently underway to identify and characterize chinch bug salivary secretions, and document differences among the chinch bug species.

A final objective of this research is to document the underlying biochemical and physiological mechanisms responsible for chinch bug resistance. Photosynthetic studies have documented the short- and long-term changes in carbon exchange rates in response to chinch bug injury. Gas exchange responses suggest chinch bug feeding negatively impacts carbon exchange rates of susceptible buffalograsses through end-product inhibition, while resistant plants are able to allocate energy for recovery from chinch bug injury.

Previous research by Heng-Moss et al. (2004) documented increased levels of peroxidase activity among resistant buffalograsses in response to chinch bug feeding. Additional studies were carried out to determine if other chinch bug-resistant buffalograsses also exhibit elevated peroxidase activity levels. Three of the four resistant buffalograsses evaluated showed an increase in peroxidase activity in response to chinch bug feeding, indicating up-regulation of peroxidases in response to chinch bug feeding. Peroxidase levels were similar between susceptible infested and control plants.

Studies are currently underway to evaluate peroxidase activity among other warm-season grasses with resistance to *B. occiduus*. A final area of focus includes creating subtractive cDNA libraries which will allow comparison of gene expression between chinch bug-resistant and -susceptible buffalograsses to identify genes contributing to resistance.

The Blissus *Complex:* B. l. leucopterus *(A),* B. l. hirtus *(B),* B. insularis *(C), and* B. occiduus *(D). Studies are currently underway to explore the feeding mechanisms of these chinch bugs on different turfgrass species.*

Summary Points

- Several cool- and warm-seasons turfgrasses with resistance to chinch bugs in the *Blissus* complex have been identified.
- Significant progress towards identifying the biochemical and physiological mechanisms responsible for chinch bug-resistance have been made.
- Knowledge gained from this project will benefit turfgrass sod producers, golf course superintendents, and other turfgrass managers by furnishing turfgrasses with improved resistance to chinch bugs.