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.

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Project Duration: four years
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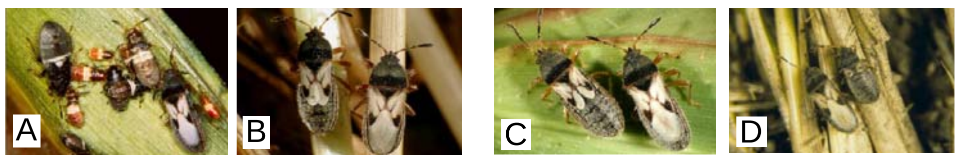
The overall goal of this research is to identify chinch bug-resistant turfgrasses, investigate the mechanisms of this resistance, and identify target genes conferring resistance. Knowledge of specific resistance mechanisms would be valuable for identifying biochemical and physiological markers for use in germplasm enhancement programs and for characterizing plant defense strategies to insect feeding.

We continue to evaluate selected warm-season turfgrasses for resistance to chinch bugs. Of the ninety buffalograss genotypes evaluated in greenhouse and field studies, four were categorized as highly resistant (‘Prestige’, NE 184, NE 196, and NE PX 3-5-1) and 22 as moderately resistant. Of the resistant buffalograsses studied, ‘Prestige’ exhibited the highest level of resistance even though it often became heavily infested with chinch bugs.

Subsequent choice and no-choice studies characterized ‘Prestige’ as tolerant. Greenhouse screening studies are currently underway to document levels of susceptibility among buffalograss lines derived from crosses between ‘Prestige’ (tetraploid female) and two moderately resistant tetraploid males (NE 46 and NE 98). This research also evaluated additional warm-season turfgrasses (zoysiagrass and bermudagrass) for resistance to *B. occiduus*. A wide range of susceptibilities to chinch bug feeding was documented among the zoysiagrasses and bermudagrasses evaluated. The grasses with the greatest potential for resistance to *B. occiduus* are the zoysiagrass ‘Emerald’ and the bermudagrass ‘Mini Verde’.

A second component of this research investigated the underlying biochemical and physiological mechanisms responsible for chinch bug resistance. The impact of chinch bug feeding on the physiological responses of resistant and susceptible buffalograss was evaluated using measurements of carbon exchange rate, light and carbon assimilation (A-Ci) curves, chlorophyll fluorescence, and non-structural carbohydrates at specific time intervals. These studies demonstrated that resistant plants can generate energy for recovery from chinch bug feeding.



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.*

Susceptible plants appeared unable to maintain compensatory photosynthesis and, as a consequence, suffered substantially more tissue damage from chinch bug feeding. Results of this research demonstrate that short- and long-term changes in photosynthetic compensation could be used to differentiate chinch bug-resistant and -susceptible genotypes.

Our research also focused on characterizing protein changes in resistant and susceptible turfgrasses challenged by chinch bugs and explored the value of these changes as protein-mediated markers to screen for insect-resistant turfgrasses. These studies documented a loss of catalase activity in susceptible buffalograsses in response to chinch bug feeding, while resistant buffalograsses showed an increase in peroxidase activity.

These findings suggest that an initial plant defense response to chinch bug feeding may be to elevate the levels of specific oxidative enzymes, such as peroxidase, to help detoxify peroxides that accumulate as a results of plant stress.

A third objective of this research was to identify target genes conferring resistance to *B. occiduus* through the development of cDNA subtractive libraries for resistant and susceptible buffalograsses. These subtractive libraries will allow comparison of gene expression between resistant and susceptible buffalograsses, and will serve to identify genes contributing to the resistance.

Thirty-two transcripts were differentially expressed between resistant and susceptible buffalograsses in response to chinch bug feeding. These differentially expressed genes were classified into the following categories: photosynthesis, signal transduction, and defenses against stress and pathogens.

Thirteen undefined cDNAs were also identified (good database match, no function assigned). Studies are currently underway to characterize the genes differentially expressed and to identify potential markers for screening buffalograss germplasm for chinch bug resistance.

Summary Points

- Several cool- and warm-seasons turfgrasses with resistance to chinch bugs in the *Blissus* complex have been identified.
- Commercial production of ‘Prestige’ provides consumers with a high quality buffalograss with improved chinch bug resistance.
- Progress towards identifying the biochemical and physiological mechanisms responsible for chinch bug-resistance has been made.
- Development of subtractive cDNA libraries will provide the foundation for understanding the biological pathways that contribute to chinch bug resistance and facilitate the development of elite turfgrasses with resistance to chinch bugs.