

Component II: Protection of Agricultural and Horticultural Crops

20. Sugarcane (U.S. Value 2006: \$0.9 billion)

Problem Statement: The following weed and insect pests are most responsible for reducing yields in sugarcane:

- Perennial Weeds: Johnsongrass and Bermudagrass
- Annual Weeds: Morningglory and Itchgrass
- Stemborers: Sugarcane Borer and Mexican Rice Borer
- Sugarcane Aphid

Research Needs:

1. Weed Interference from Perennial Weeds Johnsongrass and Bermudagrass

Importance: Johnsongrass and Bermudagrass continue to be the most widespread and economically important perennial weeds of sugarcane. Integrated weed management practices need to be developed that provide season-long control of these perennial weeds that are capable of enduring the four- to five-year crop cycle, where competition from these weeds generally increases each year. Sugarcane is at a competitive disadvantage against these weeds during the critical establishment phase each spring due to the crop's slower spring growth, growth that can be further slowed by the application of glyphosate as a ripener in the previous season. Currently, there are no herbicides labeled for the selective and long-term control of these weeds once they are established and no attempts have been made to date to develop glyphosate-tolerant sugarcane which would afford some opportunity to selectively control and perhaps eliminate these weeds from sugarcane. Aggressive early generation (near wild) sugarcane varieties and related genera of high biomass producing traditional and non-traditional crops are being developed for a bioenergy industry which includes sugarcane. Weed control strategies within these crops, as well as an assessment of the weediness potential of some of these non-traditional crops to sugarcane need to be determined.

Research Gaps: Reducing input costs is needed for the continued economical production of sugarcane which requires a better understanding of the value of cultivation and herbicide application. In addition, further evaluations of herbicides are needed in order to refine application timings throughout the growing season (fallow field, at planting, fall, spring layby) to target specific weed problems. If herbicide resistant sugarcane becomes available, application rates and timing will have to be identified for the control of both Johnsongrass and Bermudagrass. A better understanding of the effects of potential short-season rotational crops that could be planted in place of the traditional fallow season on weed infestation is needed. Development of reduced input weed control programs for energy cane is also needed as well as an assessment of

dedicated energy crops being considered for the South for their potential to become weed problems.

Actions: ARS will:

Damage Assessment, Weed Interference

- Measure Johnsongrass interference in ratoon crops as influenced by residue management, ripener application, and asulam application.
- Measure the impact of Bermudagrass on sugarcane production as influenced by tillage frequency.

Control

- Evaluate fallow plus at-planting plus spring herbicide treatments for the control of Johnsongrass and Bermudagrass in sugarcane/energy cane.
- Develop management practices for the application of glyphosate in glyphosate resistant sugarcane if it becomes available.

2. Evaluation of New Herbicide Chemistry for Annual and Perennial Weed Control in Sugarcane

Importance: Sugarcane growers rely heavily upon multiple and high dosage applications of a small number of herbicides, the majority of which were developed many years ago and utilize only a few modes of action. With this reliance on multiple applications of just a few herbicidal modes of action, the buildup of weed resistance becomes likely. These herbicides applied preemergence and again one or more times post-planting in the same production year must control a broad-spectrum of seedling grass and broadleaf weeds including Bermudagrass, Johnsongrass, itchgrass, morningglory, pigweed, crabgrass, browntop millet, sprawling panicum, yellow and purple nutsedge, etc., that emerge throughout the year. Weeds interfere with sugarcane emergence and establishment after planting and in the spring as plant-cane and ratoon crops emerge following a period of winter dormancy. Vine-type weeds such as morningglory not only compete with sugarcane, but its twining vines can impede harvesting equipment. Once established, Bermudagrass can not be selectively controlled in the sugarcane crop with the herbicides currently registered for use in sugarcane.

Research Gaps: Additional herbicides for weed control in sugarcane continues to be limited by the lack of interest in developing selective herbicides or herbicide resistant crops by chemical manufacturers for the small domestic sugarcane industry. New herbicides need to be developed that are more environmentally friendly, use lower rates, and provide additional modes of action for weed control to help avoid development of herbicide weed resistance. In order for new herbicides to be adopted they must also be cost-effective, have a long residual due to the long growing season, and not delay growth and maturity of sugarcane. Additionally, there is a need to find an herbicide that will selectively control Bermudagrass postemergence in sugarcane. The utility of these herbicides for sugarcane varieties developed for use in the bioenergy industry “energy cane” will also have to be explored.

Actions: ARS will:

Control, Herbicide

- Cooperate with herbicide manufactures in identifying new herbicides with potential utilization in sugarcane to:
 - identify weed spectrum controlled;
 - evaluate crop injury potential; and
 - identify appropriate application timings.
- Develop and/or evaluate technologies to improve the crop safety of herbicides not currently registered for use in sugarcane and work with herbicide manufacturers in developing registrations for herbicides identified with potential utility in sugarcane. (Also See Minor Crops Cross-cutting Issues.)

3. Stemborers

Importance: Stemborers (sugarcane borer and Mexican rice borer) remain the most important pest insects of sugarcane in the continental United States. Biological control of the sugarcane borer is limited in Louisiana by its temperate climate while biological control of the Mexican rice borer is limited by the lack of effective parasites. Plant resistance is an important component for successful pest management of both species, but effective breeding strategies are lacking. Future adoption and planting of energy crops will likely increase area-wide problems with stemborers; however, these same plantings may also provide important refuge sites for overwintering beneficial insects. Transgenic sugarcane and energy crops are likely to have important implications in future stemborer IPM.

Research Gaps: Research suggests that a significant level of cross resistance exists between the two species, and current resistance mechanisms are strongly correlated with resultant lower sucrose yields. New sources of resistance that either are not correlated or less correlated with lower yields are needed. In addition, there is a need to identify potential new biological control agents of borers, determine important aspects of their biology, and evaluate their potential as biological control agents. Research on the potential area-wide impact of wide-spread planting of energy crops is also needed as well as continued research incorporating novel genes conferring resistance to stemborers.

Actions: ARS will:

Control, Host Plant Resistance

- Identify stemborer resistance in *Saccharum* and related species.
- Conduct a recurrent selection program to develop elite breeding canes for incorporating any new sources of identified resistance into new cultivars.

Control, Biological

- Conduct studies to determine important aspects of the biology of *Leptotrachelus dorsalis* (Coleoptera: Carabidae), a native predator of the sugarcane borer.
- Enhance biological control by existing natural enemies through conservation or augmentative control.

Control, Cultural

- Conduct studies to determine the role of silica in enhancing resistance to stemborers.

4. Sugarcane Aphid

Importance: Identified in Louisiana in 1999, this aphid was initially a concern only for its ability to transmit the virus that causes yellow leaf disease (YLS). However, there is also a growing concern that the aphid, when present in sufficient numbers, is able to cause direct yield losses. Currently, YLS is not considered to be important in Louisiana, but concern remains that some varieties may be super-sensitive to the disease and may yet exhibit yield loss.

Research Gaps: Yield data is unavailable either from research done in the United States or elsewhere that relates sugarcane aphid densities to yield loss. In addition, little is known of the affect of plant resistance on the transmission of the virus that causes yellow leaf disease.

Actions: ARS will:

Damage Assessment

- Assess the quantitative relationship between aphid densities and yield loss.

Control, Host plant resistance

- Determine levels of aphid resistance in current and soon to be released sugarcane cultivars.

Monitoring

- Correlate aphid appearance and sugarcane infestation by YLS.
- Correlate aphid numbers to YLS spread and disease titers.

Anticipated Products:

- New recommendations for the control of Johnsongrass and Bermudagrass with existing herbicides.
- New herbicides with different modes of action labeled for use in sugarcane.
- Information on rotational crops such as wheat and sweet sorghum that can be use in the sugarcane production cycle for food and bioenergy.
- Information and recommendations for the use of herbicide- and insect-resistant sugarcane if it becomes available.
- Increased knowledge of beneficial insect biology, ecology, and behavior.
- New sources of borer resistance.
- Identification of plant traits that might be used to develop pest-resistant plants.
- Enhancement of plant traits with the use of soil amendments.
- Information on the relationship of aphid numbers and YLS spread.
- Determine the economic impact of aphid feeding on sugarcane yields.

Potential Benefits (Outcomes):

- Increased knowledge and implementation of weed management practices may lower input costs while increasing production through less weed interference.
- Management strategies for companion crops dedicated to the production of bioenergy.
- Strategies of improved IPM of stemborers
- Reductions in crop losses to insect pests of sugarcane and the plant diseases they transmit.
- Reductions in expenditures to manage insect pests.
- Control tactics that are ecologically sound.

USDA ARS Resources:

- Sugarcane Research Unit, Houma, Louisiana