

**The Lady Beetle *Diomis terminatus* (Coleoptera: Coccinellidae) and the Yellow Sugarcane Aphid *Sipha flava* (Homoptera: Aphididae) in Florida.**

D.G. Hall  
United States Sugar Corporation  
Clewiston, FL

The yellow sugarcane aphid is occasionally an important pest of sugarcane in Florida. In a greenhouse study comparing the growth of young sugarcane plants infested versus not infested by aphids over a 3wk period, the height of infested primary shoots was reduced by 36.2% and infested plants produced fewer leaves and tillers. At the end of the test, 71.7% less dry matter was present per infested plant. The lady beetle *Diomis terminatus* is a common predator of the yellow sugarcane aphid in Florida. Mass-rearing the beetle on yellow sugarcane aphids was investigated. Yellow aphids were relatively easy to raise in a greenhouse during winter and spring 1998-1999 and 1999-2000, but the aphid was difficult to rear in the greenhouse during summer and fall 1999, apparently due to excessive air temperatures. Sorghum-Sudan grass proved a convenient plant host for mass-rearing the aphid. *D. terminatus* was reared in a laboratory in large glass test-tubes on yellow sugarcane aphids. To obtain beetle eggs, aphids were transferred into the tubes along with adult beetles and a small piece of wax paper, onto which adults oviposited. Eggs on wax paper were transferred to new tubes and supplied with aphids for larvae to feed upon. Larvae pupated in the tubes, and adults were harvested. A ratio of about 7 live aphids per *D. terminatus* larva or 10 live aphids per *D. terminatus* adult was maintained in the tubes. Morphological characters for distinguishing male and female beetles were not known. In rearing tubes with 10 beetles per tube, an average of 1.4 eggs per female per night were laid (50% beetles per tube assumed to be female). When mated females were held individually, they laid an average of 3.0 eggs per female per night, with an average total of 41.9 eggs per female. Across all densities of eggs per tube studied, an average of 33.9% eggs developed to the adult stage. Higher percentages of success in rearing larvae to the adult stage were achieved when fewer than around 40 eggs were placed in a tube.

## **RNA Isolation and Photosynthetic Gene Expression in Sugarcane Exposed to Elevated CO<sub>2</sub> and High Temperature**

M.Q. Zhang, M. Gallo-Meagher, J. C.V. Vu, and H. Allen, Jr  
Agronomy Department, University of Florida  
Gainesville, FL

Two simple and effective protocols based on guanidinium isothiocyanate (GTC) and cetyltrimethylammonium bromide (CTAB) have been developed for the isolation of RNA from sugarcane exposed to enriched CO<sub>2</sub> and high temperature. The GTC protocol resulted in high yield of high-quality RNA from sugarcane grown at the ambient temperatures (Ta, °C), but not from tissues exposed to high temperatures (Ta+6, °C) because of their high levels of polysaccharides, polyphenolics or other unidentified compounds. The CTAB protocol was superior to the GTC protocol due to the inclusion of polyvinylpyrrolidone (PVP) and ethylenediamine tetraacetic acid (EDTA) in the RNA extraction buffer. However, the CTAB method is more labor intensive. RNA isolated using suitable protocols was of high quality and produced good hybridization signals in northern blot analysis. Results from northern blot analysis also showed that high temperature significantly inhibited the transcript levels of phosphoenolpyruvate carboxylase (PEPcase) and Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase small unit (rbcS) genes in plants grown both at enriched CO<sub>2</sub> (700 ppm) and at ambient CO<sub>2</sub> (360 ppm); However, their transcripts in plants exposed to high temperature were reduced to a greater extent at ambient CO<sub>2</sub> when compared with the plants at elevated CO<sub>2</sub>. Growth at ambient temperature appeared to reduce the transcript levels for PEPCase, but to increase for rbcS.

## **The Effect of Harvest Method and Plot Size on Sugarcane Yield**

K. P. Bischoff, K. A. Gravois, H. P. Schexnayder and G. L. Hawkins  
Louisiana State University Agricultural Center, Sugar Research Station  
St. Gabriel, LA

For years, the accepted means of collecting sugarcane plot weight data was utilizing the whole stalk or “soldier” type harvester and a tractor mounted weighing device with a load cell. As the Louisiana sugar industry moved toward the combine harvesting system, Louisiana sugarcane researchers began work toward adapting to combine harvesting. This study was initiated in 1999 to compare plot yields obtained with whole stalk and combine harvesting systems and estimated yields. This study not only investigated method of obtaining plot yields, but also the effect plot size may have on the accuracy of yield data.

The two varieties used (LCP86-454 and HoCP85-845) were selected because of their erectness and better than average harvestability. This would provide a best-case scenario for harvesting methods. Plots were set up based on the various sizes of plots used throughout the stages of the Louisiana “L” Variety Improvement Program. Sixteen-foot single row (six foot wide row) plots are used in the second line trial stage through the nursery stages of the program. Two-row twenty-four foot plots are now being used in infield tests, while three-row thirty-two foot plots are the outfield test plot sizes. The test was replicated three times. Stalk counts were made in all plots during the first week of December. In the combine-harvested plots, ten-stalk samples were hand cut and stripped of all leaf material. Each sample was weighed to obtain mean stalk weight and then measured to obtain stalk height. The samples were then milled to obtain Brix and pol values for estimating theoretical sugar per ton of cane. The sixteen and thirty-two foot plots were soldier harvested and weighed with the traditional tractor mounted weigh rig. Ten-stalk samples were taken from the heap row for each soldier-harvested plot. These samples were also weighed, measured, and milled for juice analysis. Four plot sizes (single row sixteen-foot length, single row twenty-foot length, two-row twenty-four foot length, and three-row thirty-two foot length) were combine harvested. The combine harvested plots were weighed with a small self-dumping weigh wagon (three load cells), which was manufactured by Cameco Industries, Inc. Estimated cane yield was obtained as the product of stalk number per acre and mean stalk weight.

The data indicated that cane yields obtained from the whole stalk soldier harvesting method were significantly lower than cane yields obtained from estimated cane yields. The soldier harvesting method also had significantly lower stalk weight and stalk height and significantly higher sugar per ton of cane. This is a result of a low topping height even though the harvester topping height was set at its maximum setting. Cane yields from combine-harvested plots, regardless of plot size, were not significantly different from estimated cane yields. For estimated cane yields, standard errors for cane yield decreased as plot size increased up to the two-row twenty-four foot length, but increased again at the three-row thirty-two foot length. As a result, the Louisiana “L” Variety Improvement Program increased its nursery plot sizes from sixteen feet to twenty feet and changed its infield plot sizes to two-row twenty-four foot length.

## Fertilizer Effects of Older Sugarcane Ratoon Crops in Louisiana

C. LaBorde, K. Gravois, and K. Bischoff  
Sugar Research Station, Louisiana State University Agricultural Center  
St. Gabriel, LA

Louisiana sugarcane (*Saccharum spp.*) farmers are currently undergoing a trend change in the ratoon longevity of their sugarcane crops. For the last several decades in Louisiana, the intensity of ratooning in sugarcane has usually been a plantcane crop plus two ratoon crops. Since its release in 1993, LCP 85-384 has surpassed the expectations of the Louisiana sugar industry, with one of the reasons being its excellent and increased ratooning ability. The main objective of this study was to determine the response of LCP 85-384 to higher than recommended rates of nitrogen in third and fourth ratoon crops. A secondary objective was to determine potassium and phosphorus responses. Fertilizer treatments were evaluated at two locations during 1998-1999: Blackberry Farms near Vacherie, Louisiana and Triple V Farms near Youngsville, Louisiana. The experiment was planted as a Latin square design with six fertilizer treatments. The year by treatment interaction was not significant for either location; therefore, treatment means were averaged across the two years. For the Vacherie location, cane yield was the only yield parameter significantly affected by the treatments. Orthogonal contrasts indicated a significant increase in cane yield between the medium (168 kg ha<sup>-1</sup>) and high (224 kg ha<sup>-1</sup>) nitrogen rate. Potassium significantly increased cane yield between the low (0 kg ha<sup>-1</sup>) and high (134 kg ha<sup>-1</sup>) rate. For the Youngsville location, cane yield was not significantly increased by the higher nitrogen rates. Orthogonal contrasts indicated a significant increase in both sugar yield and cane yield due to potassium between the low (0 kg ha<sup>-1</sup>) and high (134 kg ha<sup>-1</sup>) rate. For fourth ratoon cane on light to medium textured soils of the Mississippi river, the higher nitrogen rate increased cane yield over the medium nitrogen rate. The third ratoon LCP 85-384 cane at Youngsville exhibited no response to higher nitrogen rates. Potassium increased cane yield in both soil types, whereas phosphorus did not produce a significant cane yield response in both soil types.

**EFFECT OF SILICON ON EXPRESSION OF RESISTANCE TO  
SUGARCANE BORER (*DIATRAEA SACCHARALIS*)**

**D.L. Anderson**

University of Florida  
Everglades Research and Education Center  
P.O. Box 8003  
Belle Glade, Florida 33430

and

**Omelio Sosa, Jr.\***

Research Entomologist (retired), USDA-ARS, Canal Point, FL  
Present Address: 2365 Palm Rd.  
West Palm Beach, Florida 33406

The sugarcane borer (*Diatraea saccharalis*) causes damage to sugarcane (*Saccharum* spp.) in Florida and the Western Hemisphere. Association of host plant pest resistance with silicon content in plants has been shown with some insects. Under many soil conditions, calcium silicate slag, a by-product of electric furnace production of elemental phosphorus from apatite ores, is applied in Florida for increasing sugarcane yields. The objective of this study was to determine the effect of calcium silicate application on the resistance of sugarcane to the borer in field studies. Five popular cultivars (CP70-1133, CP72-1210, CP72-2086, CP74-2005, and CP80-1827) were evaluated for yield response and borer resistance to the broadcast application (1/164 ha plots) of calcium silicate slag (0 and 6.7 Mg ha<sup>-1</sup>) using a randomized complete block design and 4 replicates. Across all cultivars, Si application increased cane and sugar plant crop yields by 16.7% and 19.5%, respectively. In cultivars CP72-1210 and CP80-1827, cane yields declined with increasing borer intensity; however, borer intensity did not affect cane yields of the other cultivars. Although nonsignificant at p=0.10, data trends for all five cultivars indicated decreased borer intensity with application of calcium silicate slag.

**ONE DESIGN, TWO PANS  
LARGE FLEXIBILITY OF USE**

**G. Journet and C. Pelletan**  
FCB-Sugar Department  
BP2047, 59015 LILLE, France  
dsucom@fcb-group.com

In 1996, the new CCTW continuous vacuum pan replaced the older CCTR pan. The new continuous vacuum pan shows clearly improved performance. Its design allows installation of mechanical agitation. A variant of the CCTW continuous vacuum pan, the CCTWD double pan, has been developed which allows a great flexibility of use, like, for example, two strikes in the same equipment, or two pans running in parallel, or the ability to make continuous vacuum pans of very small capacity.

The first true continuous vacuum pan used in sugar mills dates back to 1967. It was the FCB prototype installed in the sugar refinery in Nassandres, France. Since then FCB has built and installed 150 continuous vacuum pans (CCTR type) in every strike of beet and cane sugar mills throughout the world.

Since 1996 a new continuous vacuum pan, the CCTW, has replaced the old CCTR models. Thirty-five CCTW pans are already in operation or in the course of installation. This new model marks a significant advance relative to the older one.

## **The Presence of Total Polysaccharides in Sugar Production and Methods for Reducing Their Negative Effects**

J. A. Cuddihy, Jr., M. E. Porro, and J. S. Rauh  
Midland Research Laboratories, Inc.  
Lenexa, Kansas

A tremendous amount of research has been done on the various polysaccharides found in sugar cane and their effects on the processing and recovery of sugar. Polysaccharides found in the production process include those from the plant itself, which may be dependent upon plant variety and weather patterns, and those resulting from deterioration processes due to cane handling methods. While efforts to deter the effects of polysaccharides have been primarily focused on starch and dextran, there are several other polysaccharides contributing to these production inefficiencies and losses. The practice of adding a specific enzyme to address a single polysaccharide often ignores the larger problem. A new methodology is presented for a treatment protocol that addresses the total polysaccharide problem. Also, a detailed discussion is presented on how total polysaccharides contribute to production losses, the economic importance of more closely tracking their presence, and taking appropriate actions to reduce their negative influence.

**Cane Juice Analysis by Near Infrared (NIR) to Determine Grower Payment at  
Sugar Cane Growers Cooperative of Florida**

T. P. Johnson  
Sugar Cane Growers Cooperative of Florida  
Belle Glade, Florida

As applications of NIR analysis are increasing in the grain and food industries, more options are becoming available for analysis of incoming sugar cane in the factories. For the 1999-2000 crop season, Sugar Cane Growers Cooperative of Florida (SCGC), together with Florida Crystals Corporation, has adopted Near Infrared (NIR) spectroscopy as the standard method for cane juice analysis. This paper will include a brief history of cane juice analysis at SCGC as it has evolved from polarization using lead clarification to polarization using NIR spectroscopy. Experiences with data acquisition, equation development, and equation validation, necessary for implementing NIR analysis, will also be discussed.

## **Strategies for the Expansion of Cane Sugar Mills**

P. W. Rein

Audubon Sugar Institute, Louisiana State University  
Baton Rouge, LA

Faced with the need to crush more cane, sugar mills have various options open to them. This paper explores the possible strategies for improving capacity. The first step in each case is to maximize throughput and performance of existing equipment. The best options for expanding each section of the plant, namely extraction, clarification, evaporation, pan house activities and steam and power generation are discussed. Installation of new equipment can be undertaken in a way to simplify plant and reduce operation costs, particularly if adequate forward planning is possible. The trade off between capital costs, on-going maintenance costs and plant performance efficiencies is considered. Future options for making better use of capital assets are mentioned, including power islands for steam and power generation and off-season refining or syrup/molasses processing.

## **A Flexible Coupling for Sugarcane Mills – Its Design Conception and Performance**

L. C. Felicio

Universidade Paulista-Campus Ribeirao Preto

Simioni Metalurgica LTDA

P. O. Box 641, CEP 14160-000, Sertaozinho, SP, Brazil

Traditional mill couplings frequently cause serious problems to the mill driver components. Shaft cracks, flattened points of the shaft square surfaces and bearing deformations causing damages to the gears are the most usual troubles. Measurements of these coupling effects under actual operation condition show a significant bending moment (same magnitude of the torque) applied on the shaft square tips and an oscillatory bending tension having amplitude of 105 MPa.

In order to minimize those problems a new coupling was developed based on a mechanism similar to a crank and arm. The coupling uses four crank-arm arrangements such that a pair of cranks (like a fork) works with a pair of arms (like a “T”) on each shaft. This configuration allows the shafts and the tail-bar to have lateral, axial and angular motions which cause a reduction in axial and bending moment loads.

This work analyzes the effects of the traditional coupling, explains the design conception of the new coupling and discusses its performance based on measured data. The most important results are a 78% reduction in the bending tension (from 105 MPa to 23MPa) and a decrease in bending moment to the level of 25% of the driving torque.

## **NATURAL FREQUENCY OF TORSIONAL VIBRATIONS IN SUGAR MILL DRIVES**

**Saul Herscovici**

Power Engineering and Manufacturing, Ltd.  
Waterloo, Iowa 50704-4055

Natural frequencies of vibration are present in all mechanical drive line systems. This property is derived from the shafts that represent a torsional spring with mass plus the gears, turbine rotor, and rolls, each of which possess mass. Such a mass spring system can be defined mathematically for a roll drive installation from the tip of the turbine all the way to the end of the rolls. The natural frequency of the entire drive system can thus be calculated. It is desirable to have a natural frequency of vibration higher than the operating speed by more than fifteen percent. If the natural frequency of vibration is at or near the operating speed then a vibration damper must be incorporated in the drive system to reduce the "amplitude of vibration" to zero or as close as possible to zero. If the drive system is operated at or near the natural frequency of vibration without damping, then the system will vibrate and possibly fail.

**CANE FACTORY PROCESS MODELING USING  
SUGARS™ FOR WINDOWS®**

**L. Warner Weiss**  
Sugars International LLC  
30 Glenmoor Drive  
Englewood, Colorado 80110 USA  
sugars@sugarsintl.com  
www.sugarsintl.com/sugars

The Sugars™ computer program is used extensively for sugar process modeling and simulation to make improvements to existing factories, or design new factories. The new Windows® version of Sugars features a full graphical interface that uses drag-and-drop techniques to draw the flow diagram and build a model of the process. It is fast, flexible and very user-friendly. Stencils containing shapes of stations are provided with the program and these shapes are used to draw the flow diagram. Connections are made between shapes using a connector tool with automatic line routing and crossovers. Data for each station and flow stream in the model is entered on dialog screens that are displayed by double clicking on the station shape, or flow stream. All of the data for a model is stored in a Microsoft® Access database that can be addressed by other programs. Heat, material and color balances are quickly obtained from simulations of the model to predict the performance results for the process. A revenue screen shows the net process revenues generated by the process to assist with financial decisions. The new Sugars for Windows computer program is a major upgrade to assist cane sugar factory and refinery process engineers and management with decisions for making improvements to their operations.