

## **Hurricanes and Sugar Recovery: Impact of Varieties, Fertility, Ripeners and Weather-Related Phenomena**

**Benjamin L. Legendre**

Audubon Sugar Institute LSU Agricultural Center, St. Gabriel, LA

Prior to the sugarcane harvest season in 2008, Louisiana experienced two hurricanes, Gustav and Ike, which made landfall in South Louisiana on September 1 and 13, respectively, causing extensive damage to the state's sugarcane crop to include lodging, uprooting, broken stalks and frayed leaves. In 2002 and 2005, Louisiana also experienced two hurricanes each year that also caused considerable damage to the sugarcane crop. There was also extensive tidal flooding in Terrebonne, St. Mary, Iberia and Vermilion Parishes as a result of the hurricanes in 2005 and 2008. Following the 2002 hurricanes, there was considerable rainfall throughout the harvest season making for wet field conditions and poor cane quality resulting in an unusually low yield of recoverable sugar per ton of cane of 179 lbs. However, following the 2005 hurricanes, which included Katrina, it was relatively dry during the harvest season resulting in a yield of recoverable sugar per ton of cane of 219 lbs. Following the 2008 hurricanes, it was not known immediately what impact the hurricanes would have on cane quality and the yield of sugar per ton of cane. Given a wet harvest season with lodged cane and harvesting by cane combine one would have anticipated low sugar yields; however, given a dry harvest season, even with the lodged cane and harvesting by cane combine, one would have anticipated relatively good sugar yields. As it turned out, the 2008 harvest season was one of the driest on record and the yield of recoverable sugar per ton of cane was at a near record level for the crop at 224 lbs due to better than average cane quality. Other factors considered in this paper in the near record sugar yields for 2008 include new early maturing, high sucrose varieties, a reduction in the rate of nitrogen fertilizer, continued use of chemical ripeners, above average solar radiation and the delay in the commencement of harvest by the mills due to the late planting caused by the hurricanes. Although the yield of recoverable sugar per ton of cane was above average, the two hurricanes did, undoubtedly, cause a reduction in the yield of tons of cane per acre due to the lodging and physiological shock caused by the high winds, the significant stalk breakage in some varieties, notably Ho 95-988, L 99-233 and HoCP 00-950 and frayed leaves that impacted photosynthesis. The crop was estimated at 35-36 tons per harvested acre prior to the hurricane but ended up at 32-33 tons when all cane was harvested. Even with the lower than anticipated cane yield the overall yield of sugar per acre was also near a record level because of the higher than anticipated yield of sugar per ton of cane.

### **How Brown and Green Sugarcane Leaves Deteriorate and Implications for Processing**

**Gillian Eggleston<sup>1\*</sup>, Maren Klich<sup>1</sup>, April Antoine<sup>1</sup>, Ryan Viator<sup>2</sup> and Jessica Gober<sup>1</sup>**

<sup>1\*</sup> USDA-ARS-SRRC, New Orleans, LA

<sup>2</sup>USDA-ARS Sugarcane Research Laboratory, Houma, LA

How sugarcane leaves deteriorate under dry and wet weather conditions is unknown. The current interest in sugarcane bio-products has made information on the deterioration of sugarcane

trash more important. Brown, dry (BL) and green leaves (GL) were stripped from hand-cut whole-stalks from Louisiana sugarcane variety LCP 85-384 in 2007 and 2008. In 2007, BL and GL were separately laid out, in two sets, on the ground under a screen house to simulate field canopy shade. One set was wetted with de-ionized water (5.1 cm) across 14 days to simulate rain, and the other set was not (control). Juice was extracted from the leaves on days 0 and 14 and analyzed; microbes growing on the leaves were also identified. The 14 day sampling period was repeated three times across the 2007 Louisiana processing season (Oct to Dec) to cover weather variations and cane maturation stages. In 2008, BL and GL were similarly treated as in 2007 but over one 28 day period (17 Nov -15 Dec). Non-deteriorated and deteriorated leaves were also collected from a grower's LCP 85-384 field and analyzed. In 2007, visually the worst deterioration of both BL and GL occurred in the wetted samples, particularly in Dec when humidity was highest. Compared to GL where humidity/rain was critical to bacterial and yeast deterioration, temperature seemed more critical to BL. After deterioration, more soluble impurities (Brix) were extracted from GL than BL. In 2008, the field experiment results were, generally, more extreme than the simulated experiments. Even though the percent extraction of the deteriorated BL was markedly lower than the non-deteriorated BL, the turbidity was dramatically higher. This has marked consequences for the factory as turbidity particles have to be removed at the clarification process. Leaf moisture was always higher in the deteriorated field BL than the non-deteriorated BL most likely because its shredded state creates more surface area to absorb water; this also allowed for more *Leuconostoc* to grow and form dextran. The effect of deteriorated leaves on juice acidity, particle size distributions, color, and microbe colony counts are also discussed.

### **Performance of Juice Heaters and Roberts Evaporators in Louisiana**

**Harold Birkett and Jeanie Stein**

Audubon Sugar Institute LSU Agricultural Center, St. Gabriel, LA

The heat transfer coefficients achieved by both shell and tube and plate heaters were measured at most of the Louisiana factories. Wide variations in the heat transfer coefficients were noted and these variations depended both on heater service and heater type. Operating data was obtained on most of the evaporator station installations operating in Louisiana sugar factories. This data was analyzed using a rigorous heat balance method to calculate heat transfer coefficients achieved by the individual effects, evaporation rates, and the scaling (fouling) rate of the evaporator sets and last effects.

### **Improvements in Clarification and Scaling Problems with Hot Liming**

**Jose F. Alvarez, Alfonso Salido, Tere Johnson, Tirso Carreja**

Sugar Cane Growers Cooperative of Florida

A hot liming system was installed at Sugar Cane Growers Cooperative of Florida for the crop of 2006-07. Two months into the crop of 2006-07 the juice heaters began to scale and lose

heat transfer capacity. Switching back to cold liming alleviated the problem but clarification was much improved with hot liming. The crop of 2007-08 resulted in the same scaling problems, and again hot liming resulted in better juice clarification. For the crop of 2008-09, modifications to the juice heating scheme eliminated the scaling problem but with much improved clarification. Experimental data will be presented illustrating efficiency of proposed concepts.

### **Improved Cooling Crystallization**

**Idalberto Delgado, Alejandro Morales and Stephen Clarke**

Okeelanta Corporation; Florida Crystals

The fundamental principles of crystalline sugar production from cane are well understood but not adequately applied in practice. Cooling crystallization, especially for low grade massecuites, is standard practice but is slow, inefficient and requires massive amounts of equipment. The chemical industry is putting much effort into process intensification and improving efficiency with improved mixing and heat transfer. Pilot scale cooling crystallizers have been built and tested which enhance these factors and, at the pilot plant scale, show much reduced time to achieve better exhaustion. Design basics and test results will be presented for a range of processing streams.

### **Effect of Sugar Crystal Size and Uniformity on C-Centrifugal Performance**

**Keith Miller, Iryna Tishechkina, Vadim Kochergin**

Audubon Sugar Institute, Louisiana State University AgCenter

Sugar losses in final molasses are higher than in any other stage in raw sugar production. Poor operation of C-centrifuges may be responsible for a significant portion of overall sugar loss. Centrifuge performance is affected by the crystal size distribution in C-masseccuite, since small crystals not retained by the centrifugal screen are lost to the final molasses. Additionally, they can fill the void space between larger crystals resulting in incomplete molasses purging. This leads to either increased molasses recycle with C-magma or additional wash water requirements, and, hence, higher molasses purity. The goal of the present study was to evaluate the influence of C-sugar crystal size and uniformity on final molasses purity. Samples of C-masseccuite, C-sugar, Nutsch molasses, and final molasses were obtained throughout the processing season. Crystal size distribution of C-masseccuite and C-sugar as well as the purity difference between the Nutsch and final molasses samples were measured. The median particle size (d50) and coefficient of variation (CV) of the masseccuite were then correlated with the purity rise across the centrifugals. Results show that samples of C-masseccuites with a d50 in the range of 240-280 microns and CV in the range of 40-44% resulted in purity rises of less than three points. Higher purity rises were observed when d50 was below 240 microns. Samples with larger d50 also tended to have lower CV.

### **The Performance of Polyaluminum Coagulants in Raw Sugar Mills**

**Marianne McKee, Ronnie Triche, Mary Ann Godshall, and Charley Richard**

Sugar Processing Research Institute, Inc., New Orleans, LA

At Sugar Processing Research Institute (SPRI), we have evaluated many polyaluminum coagulants (PAC) in the laboratory for their potential use as clarification aids in sugar processing. Based on promising laboratory results which demonstrated the ability of these compounds to remove color, turbidity and polysaccharides, one PAC was evaluated in “real world” world conditions at several raw sugar factories. After conducting the factory trails, this PAC was found to have an effect on pH of the clarifier, and to increase color and turbidity removal in the clarifier. The setup and results of these trials will be presented.

### **Implementation of South African Sugar Technology:**

#### **The World’s Largest Sugar Cane Diffusers**

##### **I. VOIGT Bosch Projects (Pty) Ltd**

Cane diffusion gained popularity in South Africa in the 1970’s and 80’s using European technology. Local research and developments (such as lifting screws) led to South Africa achieving the highest extraction rates in the world and to the development of locally designed diffusers. The largest diffusers in the South African industry were installed at Felixton 2 in 1984, being 12 metres wide and rated (conservatively) at 350 tch. Since then, no significant advances in diffuser technology were made until Bosch Projects introduced the Chainless Diffuser concept in 2006. Of the 9 Chainless diffusers installed in Brazil between 2008 and 2010, two are similar in size to those at Felixton and six are larger. The first of the 12 metre diffusers (at UNP and rated at 500 tch, expandable to 625 tch), was commissioned in September 2008. The diffusers at Brenco, Cosan Jatai and Meridiano are 15 metres in width and rated for 98% extraction at 625 tch and are the largest cane diffusers in the world. The diffuser in Cosan will ultimately process 875 tch. The success of the Chainless Diffuser in Brazil is evidence that South African sugar technology and engineering is still relevant and continues to play a leading role, even in the most competitive sector of a fast-changing world industry. In response to the demands of the market, Bosch Projects is about to initiate a design for diffusers that are 20 metres wide.

#### **CIP Cleaning of the GEA Ecoflex Plate Heat**

##### **Exchangers in the Cane Sugar Industry**

**<sup>1</sup> Miguel Harutiunian, <sup>2</sup> Klaus Niepoth, <sup>2</sup> Karl Mosich**

<sup>1</sup> EDELFLEX S.A., Argentina

<sup>2</sup> GEA Ecoflex GmbH, Germany

In the cane sugar industry an automatic CIP plant is more and more common especially for

plate heat exchangers and plate evaporators. Due to the shorter cleaning periods, the CIP plant increases the production capacity. So the operation down time is shorter. Furthermore, it is an advantage to apply the used detergent for pre-cleaning. This saves chemical cleaning solutions and waste water. Due to the smaller product volume of the plate heat exchangers comparing to shell & tube heat exchangers the automatic CIP plant is much more economic. Without plate heat exchangers and CIP plants an optimal heat scheme with cogeneration is not possible. Only with plate heat exchangers excellent heat economy is possible.