

**AGRICULTURAL ABSTRACTS
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**Genetic Linkage Map of Sugarcane (*Saccharum* spp.) Based on
SRAP and TRAP Markers**

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A genetic linkage map is being constructed using two fairly new molecular marker techniques, namely Sequence Related Amplified Polymorphism (SRAP) and Target Region Amplification Polymorphism (TRAP). The SRAP is a two-primer PCR amplification technique wherein primers of about 17 to 18 nucleotides long are designed to target Open-Reading Frames (ORFs). The primers consist of 10 to 11 filler sequences at the 5' end followed by either AATT in the forward or CCGG in the reverse primer which are believed to target introns or exons, respectively. The 3' end consists of three selective nucleotides. TRAP markers, on the other hand, employ EST or gene derived nucleotide sequences for the forward primer but the reverse primer is similar to a SRAP primer.

The mapping population consist of 88 individuals from a cross between La Stripe (*S. officinarum*) x SES 147B (*S. spontaneum*). Thus far, 33 SRAP and 12 TRAP primer combinations have resulted in 185 (97 single- and 88 double-dose) and 70 (52 single- and 18 double-dose) polymorphic bands, respectively, which were used for mapping. The map was constructed using the JoinMap software, based on a LOD score of 3.0 to 7.0, a threshold recombination value of 0.4 and the Kosambi mapping function. Of the 255 mapped markers, 117 have grouped into 43 co-segregation groups while the rest remained ungrouped. The genome coverage for these 117 markers is 1311 cM with an average of ~11.0 cM between any two markers. Our long term objective is to saturate the map using additional SRAP and TRAP primer combinations along with EST-derived SSRs and AFLP markers. We are also evaluating the mapping population in field trials with a view of mapping QTLs. These preliminary results show that SRAP and TRAP markers have a potential to be employed in mapping and marker assisted selection in sugarcane breeding programs.

**Target Region Amplification Polymorphism (TRAP) for Assessing Genetic Diversity in
Sugarcane Germplasm Collections**

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Target Region Amplification Polymorphism (TRAP) is a new PCR-based molecular marker technique which uses gene-based information for primer design. A fixed primer of 18 nucleotides designed from an EST or gene of interest is paired with an arbitrary primer, designed with either an AT- or GC-rich motif to anneal with an intron or exon, respectively. The objectives of this study were to evaluate the utility of TRAP markers for assessing genetic diversity and inter-relationships among sugarcane germplasm accessions and to verify if indeed TRAP markers reveal trait-based polymorphism. Thirty genotypes, representing species of *Saccharum*, *Miscanthus* and *Erianthus* were used in the study. The *Saccharum* species included *S. officinarum*, *S. barberi*, *S. sinense*, *S. spontaneum*, *S. robustum*, cultivars, cultivar-derived mutants and interspecific hybrids between *S. officinarum* and *S. spontaneum*. Six fixed primers, designed from sucrose- and cold-tolerance related EST sequences, paired with each of three arbitrary primers, were used to characterize the germplasm. Both the cluster and principle component analysis analyses placed the *Erianthus* and *Miscanthus* genotypes distinctly from each other and from the *Saccharum* species, thus, supporting their taxonomic classification into separate genera. The *S. spontaneum* genotypes clustered into one group while the rest of the sucrose producing *Saccharum* species formed one inter-related cluster with no distinct sub-groups. Sequence analysis of TRAP bands derived from a *S. spontaneum* clone revealed homology with known gene sequences from other grass species including *Sorghum*. A BLASTn search using one of the homologous sequences from *Sorghum* matched with the *S. officinarum* GenBank accession from which the fixed primer was designed. These results support the use of TRAP markers as a potentially useful technique for genetic diversity studies in sugarcane germplasm collections.

Development of High Fiber Cane Varieties for Biofuel Production in the Southern United States

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Interest in the production of biofuels has increased considerably within the last decade due in part to rising energy costs. As this interest has grown, research initiatives are underway to examine the potential for increasing biomass in selected row crops and developing efficient processes for the conversion of biomass to biofuels and electricity and perhaps other saleable products. With sugarcane's superior ability to convert solar energy into biomass (sugar and fiber), the use of sugarcane as a biomass feedstock is of interest to producers as they search for alternative sources of revenue. Fiber content in combination with sugar yield was evaluated for six varieties: HoCP 00-961, L 79-1003, TucCP 77-42, US 00-16, US 01-10, and US 01-12 in field studies located at the Sugarcane Research Laboratory in Houma, LA and at the Diamond W Ranch near Welsh, LA. The variety LCP 85-384 was included as a commercial standard. The varieties L 79-1003, US 00-16, US 01-10 and US 01-12 produced the highest fiber content, ranging from 18.5 to 26.9%. The variety L 79-1003 was the most uniform in fiber content in plant-cane, first-ratoon, and second-ratoon crops, at 25.7, 26.1 and 25.6%, respectively. Although this variety had the highest fiber content in each crop, it typically was one of the lowest

sucrose yielding varieties, 4.4 to 7.6%, along with US 00-16, US 01-10 and US 01-12. The variety that appears to have the greatest potential for biofuel production among the varieties evaluated was HoCP 00-961. Although this variety did not have the highest fiber percentage, its moderate to high fiber yield, 15.4 to 18.6%, in combination with a moderate production of sucrose, 8.3 to 12.6%, suggest that the total yield of both ethanol and electricity would be greater with this variety.

Characterization of Sugarcane Populations for Disease Reactions for Use in Molecular Marker Research

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Molecular markers associated with resistance have been used for genotypic selection of individuals in a number of crops and may offer a means of detecting resistance in sugarcane. To initiate research and to associate molecular markers with resistance, several sugarcane populations were characterized for their reaction to yellow leaf, rust and ratoon stunt pathogens. The objective was to find populations with individuals that had extremes in disease reaction for yellow leaf, brown rust and ratoon stunt. Yellow leaf and rust data were taken from clones based on their natural infection. Ratoon stunt data were obtained from inoculated tests based on the number of Colonized Vascular Bundles. The mid-rib tissue immunoassay was used to detect *Sugarcane Yellow Leaf Virus* (SCYLV) in the phloem cells. Sixty-eight progeny of a cross of Green German x Ind 81-146 had been naturally exposed to SCYLV at Canal Point for 15 years, during a period where almost all other clones at Canal Point became infected within a period of 4-5 years. Thirty-nine clones of this population remained free of SCYLV for over the last three years. However, almost all other clones at Canal Point became infected within a period of 4-5 years. Rust data were taken from individuals from two families: 1) Green German x Ind 81-146 with 23 resistant progeny with no sporulating pustules and 165 susceptible progeny with varying amounts of sporulating pustules and 2) CP 94-1200 x CP 92-1167 with 33 resistant and 72 susceptible progeny. Progeny of six families were evaluated for their ratoon stunt reaction: Green German x Ind 81-146; Green German x SES 208; Green German x Coimbatore; CP 80-1827 selfed; SS 57-3 x Yacheng #12 and CP 94-1200 x CP 92-1167. All families exhibited extremes in disease reaction of individuals to ratoon stunt except that of Green German x Ind 81-146 population where all individuals were susceptible. Disease reaction data for the different populations and preliminary marker data will also be presented.

Assessment of Sugarcane Families in South Texas

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An experiment was conducted in 2004 at the Texas Agricultural Experiment Station Weslaco Center, to assess the yield performance (cane yield and Brix) of 81 families. Statistical

design utilized was the randomized incomplete blocks, in two replicates, and two common treatments in each block. Plots were harvested with a weighing wagon and Brix readings were taken on the juice of a random sample from each plot. Another trial had been planted on 2003 with 60 crosses, for cane yield assessment only. Both trials were harvested on the plant cane stage, leaving the first ratoon crop for the selection of individual plants, within each family. Utilization of family assessment in 2003 allowed the increase of selection rate from 5 to 10 %, and the identification of “proven crosses” for sowing from remnant seed in 2005. Results from the 2004 trial will be used for within-family selection on the first ratoon stage, to be conducted on the fall of 2005.

Genetic analysis showed that good biparental combinations could not be predicted based on the general breeding value of each parent, suggesting that the nonadditive genetic component of variance was more important than the additive one. A strategy, using genomic information, for the prediction of superior biparental combinations will be proposed.

Sugarcane (*Saccharum spp.*) Response to the Herbicide Flumioxazin

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The herbicide flumioxazin (Valor[®]) recently received a supplemental registration for weed control in sugarcane. Flumioxazin inhibits protoporphyrinogen oxidase, which results in the formation of oxygen radicals which cause cell membrane degradation and ultimately death in susceptible plants. Only one other herbicide that is registered for use in sugarcane, sulfentrazone, is similar in its mode of action. Experiments were initiated in October, 2000 and September 2001, to determine potential for injury and yield reduction from flumioxazin applications in plant-cane and successive first-ratoon crops of three of the most common sugarcane varieties (‘LCP 85-384’, ‘HoCP 85-845’, and ‘HoCP 91-555’) currently grown in Louisiana. In plant-cane, flumioxazin was applied preemergence (PRE) at 0.28 and 0.42 kg ai/ha immediately following planting, postemergence (POST) at 0.28 kg/ha approximately 6 weeks after planting (FPOST), in March (0.28 kg/ha) as an early-spring POST (ESPOST) application, and in May (0.28 kg/ha) following layby cultivation as a postemergence-directed spray (PDS), along with sequential applications at FSPOST followed by PDS (each at 0.28 kg/ha). In first-ratoon sugarcane, flumioxazin was applied ESPOST (0.28 and 0.42 kg/ha), as a late-spring POST (LSPOST) application in April (0.28 kg/ha), as a PDS at layby (0.28 kg/ha), and as sequential applications at LSPOST (0.28 and 0.42 kg/ha) each followed by a PDS application (0.28 kg/ha). Sugarcane injury due to flumioxazin applications consisted primarily of necrosis of treated leaves and stunted growth, and was most pronounced (25 to 30%) when applied as a LSPOST application. Injury also occurred when flumioxazin was applied as an ESPOST or as a PDS treatment at layby. Stalk height (recorded in August of each year) reductions of 15 to 28 cm occurred when flumioxazin was applied in sequential applications in both plant- and first-ratoon sugarcane. LSPOST applications of flumioxazin reduced sugarcane yields by 7 to 11%, and sequential applications reduced yields by 7 to 37% in plant-cane and by 10-19% in first-ratoon sugarcane. PRE and ESPOST treatments were generally similar to sugarcane receiving no flumioxazin application. PDS applications reduced yield in 4 of 6 year by variety observations in

plant-cane, but did not significantly reduce yield in the first-ratoon crop. In plant-cane, 'LCP 85-384' appeared to be least tolerant of flumioxazin applications as yield was reduced by all three springtime applications in 2001 and at all six application timings in 2002, while 'HoCP91-555' appeared to be most tolerant of flumioxazin, as yield was reduced by all springtime applications in 2001, but only by sequential applications in 2002. In first-ratoon sugarcane, all varieties responded similarly. To avoid risk of yield loss, flumioxazin should not be applied as an over-top POST application in actively growing sugarcane, and care should be taken to minimize spray contact with sugarcane leaves when applied as a PDS at or after layby cultivation.

The Effect of Planting Date and Planting Method on Louisiana Sugarcane Varieties

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Sugarcane in Louisiana is propagated from either whole-stalks or billets in late summer through early fall. Research was conducted to determine if yields of sugarcane varieties currently grown in Louisiana are affected by planting date and/or planting method. Billet planting was compared to whole-stalk planting at three planting dates (August 15, September 15, and October 15) with three varieties (LCP 85-384, HoCP 85-845, and HoCP 91-555) in 2002 and 2003. Yields of sugar per ton of cane, cane per acre, and sugar per acre were compared in the plant-cane and first-ratoon crops. Yields in plant-cane from billet planting were inconsistent when compared to whole-stalk planting. The August planting date had higher yields of cane (40.0 to 43.1 t/A) and sugar (11,000 to 11,800 lbs/A) than the September and October plantings (30.0 to 36.1 t/A and 7,200 to 9,900 lbs/A) when varieties and planting methods were combined and averaged for each planting date. Varieties did not differ in response to planting method. In 2003, the first-stubble crop also benefited from an early planting as yields in the August-planted cane were 2.5 t/A and 600 lbs/A higher than in the September and October-planted cane. Billet planting did not affect yields of the first-ratoon crop. Data suggests that farmers should plant as much as possible in August to obtain maximum yields. Also, farmers should be aware that by planting billets, they may get inconsistent yields compared to planting whole-stalks.

Identification of Microsatellite Markers Associated with Yield-Traits in Sugarcane

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Identification of molecular markers associated with quantitative trait loci (QTL) offers the potential to increase the overall efficiency of sugarcane breeding programs. Co-dominant segregation of 12 microsatellite (SSR) loci was evaluated in the F₁ progeny population obtained from an interspecific cross between *Saccharum officinarum* (cv. Green German) and *S. spontaneum* (cv. IND 81-146). The objectives of this study were to follow the inheritance of

these alleles in 162 full-sib families through a linkage analysis and to explore the putative association between the markers and six phenotypic traits (Brix, pol, sucrose content, stalk diameter, stalk height, and stalk weight) measured at two locations and for two crop-years. A total of 107 polymorphic markers were used for linkage analysis in this interspecific cross. Polymorphic profiles generated by single-dose markers that segregated in a Mendelian fashion were subjected to multiple interval mapping. Twice as many markers were specific to the *officinarum* as to the *spontaneum* parent. The segregation patterns of these markers to different linkage groups and their association with sugarcane yield-component traits will be discussed in the context of this two-location/two-crop year study. The linkage/QTL map developed in this study will be useful for identification of markers linked to genes that control QTL of economic importance in sugarcane and for marker-assisted selection. It also serves as a first step in producing a saturated map of the *Saccharum* genome with more molecular markers used in different pedigrees.

Alternatives to Tillage/Herbicide Programs in Fallowed Sugarcane Fields

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When sugarcane plant populations are reduced to the point that replanting is warranted, sugarcane fields are fallowed to address problems with drainage and perennial weeds such as bermudagrass [*Cynodon dactylon* (L.) Pers.] and johnsongrass [*Sorghum halapense* (L.) Pers.]. Failure to effectively control perennial weeds in fallow can have an economic impact on both the plant cane and ratoon crop. A study was conducted at St. Gabriel, LA, in a fallowed sugarcane field, to compare conventional tillage/herbicide programs with that of a no-till program where Roundup UltraMAX was used to kill sugarcane stubble and weeds. Another study conducted in Henderson, LA, evaluated only conventional programs. At both locations, standard herbicide programs at planting and throughout the first production year were used to allow for direct comparison of the effectiveness of the fallow treatments.

At St. Gabriel, LA, weed control and sugarcane and sugar yield for the first production year were each equivalent for the conventional and no-till fallow treatments. Therefore, effectiveness of the fallow weed control programs were based on economics where net returns (NR) were compared to the standard tillage only program (NR=\$0.00/A). Based on inputs and sugar yield, the most economical fallow program was the combination of four tillage operations and one glyphosate application (NR=\$8.23/A). Since weed control and crop yield were not negatively affected when tillage was eliminated, the no-till fallow program was economically competitive (NR=\$-1.71/A) when compared with a tillage only fallow program.

At Henderson, LA, the tillage alone program provided little control of bermudagrass 86 and 247 days after planting (DAP) (45 and 73% ground cover, respectively). In contrast, bermudagrass control when tillage and Roundup UltraMAX were used was excellent (no more

than 5% ground cover). Sugarcane shoot emergence 36 and 247 DAP was not negatively affected regardless of the conventional fallow program used, but by August of the first production year, sugarcane height and stalk population were less when only tillage was used in fallow. When bermudagrass was not controlled in fallow, sugarcane and sugar yields were reduced approximately 40% compared with the other conventional programs. Even though the tillage alone program was the lowest cost input program (\$34.00/A), due to the significant sugar yield reduction net returns were as much as \$291/A more for the other programs.

Other experiments evaluated control of LCP 85-384 sugarcane with various rates of glyphosate and with various glyphosate formulations. Maximum control 45 days after treatment (DAT) was achieved when Roundup UltraMAX was applied at 1.0 lb ai/A to 6 to 12 inch tall sugarcane (94%). When application was delayed until sugarcane was 18 to 24 inches tall, 2.0 lb/A was needed to obtain 95% control. Sugarcane was controlled 88 to 94% 38 DAT when Roundup WeatherMAX, Roundup OriginalMAX, Roundup UltraMAX, Mirage, or Honcho Plus was applied at 2.0 lb/A to 8 to 10 inch sugarcane. In a no-till system less expensive glyphosate formulations and lower rates could be used to decrease input cost without sacrificing sugarcane destruction.

Establishment and Management of Sugarcane on Organic-Amended vs. Non-Amended Mineral Soils

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Low organic matter (OM) and associated poor soil condition limit sugarcane production and sustenance of ratoon yields on sandy soils. Organic amendments can improve sugarcane production by improving water and nutrient holding capacities. Data are presented on the establishment phase of an ongoing study on the effect of long-term application of organic amendments on sugarcane production on Immokalee fine sand (sandy, siliceous, hyperthermic Arenic Alaquods) at Immokalee (26° 27' N; 81° 26' W), south Florida. The site was used yearly for fall and spring vegetable production from 1993 to 2003, and sorghum x sudangrass (*Sorghum bicolor* L. 'Sx17') as cover crop in 2004. The organic-amended plots received 7 to 180 Mg/ha/year of composted municipal solid waste (biosolids), yard trimmings, and/or cow manure, depending on availability. The non-amended plots received no amendments.

On 13 January 2005, two sugarcane (interspecific hybrids of *Saccharum* spp.) cultivars, CP 78-1628 and CP 80-1743 (sub-sub plot) were planted at 1.5 m row spacing, and randomly assigned to four N-rates (subplots). Organic amendment (with or without) constituted the whole plot and were randomly assigned to four blocks. At planting, P, K, Mg, and micronutrients were applied in the furrows at recommended rates. Water table was maintained with perimeter ditch irrigation and shallow field ditches (20-cm deep) constructed between each soil amendment whole plots.

Data were collected before plots received N fertilizer. Average soil OM contents at 0-15 and 15-30-cm depths were 24.0 and 11.0 g/kg soil on amended and 9.0 and 6.8 g/kg soil on non-amended soil, respectively. Higher soil water matrix potential was recorded in amended soil than in non-organic-amended soil in the morning (07:00 h) and afternoon (15:00 h) and at both 15- and 30-cm depths. At 10 weeks after planting, CP 78-1628 (17,579 shoots/ha) had a significantly greater ($P < 0.0001$) shoot count than CP 80-1743 (8,436 shoots/ha), and organic-amended soil (20,371 shoots/ha) had greater shoot count than non-amended soil (9,714 shoots/ha). There was no soil amendment x cultivar interaction on stand count. There was significantly greater weed incidence on amended than non-amended soil, with weed (mainly nutsedge [*Cyperus* spp.]) ground cover, reaching 62.5% on amended plot vs. 6.5% on non-amended plots. Therefore, agronomic management programs that utilize organic amendments to improve OM of sandy soils in south Florida will need to address potential problems associated with achieving proper soil moisture for seed piece germination and establishment, and weed control.

Sugarcane Response to Water Table, Periodic Flood, and Foliar Nitrogen on Organic Soil

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Sugarcane (*Saccharum* spp.) is exposed to periodic floods and high water tables in the Everglades Agricultural Area (EAA) of Florida. Learning sugarcane responses to these conditions will help sustain and improve yields. This study evaluated the effects of three constant water-table depths, periodic floods, and foliar N fertilization on cane and sugar yields of two sugarcane cultivars. In 2001 and 2002, two foliar N and four water treatments were applied to the plant- and first-ratoon crops of 'CP 72-2086' and 'CP 80-1827' in lysimeters filled with Pahokee muck soil. Constant target water-table depths were 23, 37, and 51 cm. A fourth treatment was flooded for 2 days in each of eight 14-day cycles per year, and otherwise drained to a target depth of 44 cm. No consistent effects of foliar N were identified. Over cultivars and crop years, for every cm increase in water-table depth, theoretical recoverable sucrose (TRS) decreased by 0.13 g kg^{-1} , and cane and sucrose yields increased by 0.16 and 0.02 kg m^{-2} , respectively. However, water-table did not affect CP 80-1827 in either crop year or CP 72-2086 in the plant crop. Cane and sugar yields of CP 72-2086 increased by 0.38 and 0.04 kg m^{-2} , respectively, with each cm increase in water-table depth in the first-ratoon crop. Repeated 2-day floods often increased yields of both cultivars. After heavy rains, allowing floods to remain for 2 days may improve yields and reduce P discharge to the Everglades.

A Look at Sugarcane Variety Protection Options

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The LSU AgCenter, along with other sugarcane breeding institutions, has initiated efforts to protect sugarcane varieties. As one looks at the history of sugarcane variety releases in the U.S., the predominant means of release was to do so publicly. A notice of release was sent out and subsequently the variety release was publicized through a crop registration manuscript in *Crop Science*. The new variety would be entered into the National Plant Germplasm System of the USDA-ARS and maintained at the National Germplasm Repository in Miami, Florida. New sugarcane varieties could be freely accessed upon public release through the USDA-ARS germplasm system.

There are many reasons that institutions are beginning to protect newly developed sugarcane varieties. The advent of transgenic varieties in many crops has triggered the use of increased variety protection in the public sector. Also, public sugarcane breeding programs are deriving more of their funding through private sugarcane grower and milling funds derived by various check-off collections. The advantages and disadvantages of sugarcane variety protection will be discussed.

No-Till Sugarcane: Agronomic and Economic Implications

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In Louisiana, tillage is used extensively to control weeds, eliminate ruts caused by harvest, destroy residue from the previous crop, and incorporate fertilizer. Sugarcane growers strongly feel that tillage also stimulates sugarcane regrowth in the spring by warming the seedbeds. The effect of tillage and weed control programs on 'LCP 85-384' sugarcane (*Saccharum* spp. hybrids) growth and yield and on economics was evaluated over two growing seasons. Residue remaining from harvest of the previous crop was not a factor affecting sugarcane regrowth. When row shoulders and middles were not tilled in March soil temperature in the sugarcane drill early in the growing season was equal to that where March tillage was performed. Weeds were effectively controlled with a March application of hexazinone at 0.53 lb ai/A plus diuron at 1.88 lb ai/A. Sugarcane and sugar yield were each equivalent for the full season tillage (off-bar tillage in March plus layby tillage in May) and the no-till programs.

Elimination of a single tillage operation reduced cost \$6.59/A and herbicide applied on a band rather than broadcast reduced cost \$12.34/A. For the no-till program with herbicide banded in March compared with full season tillage, net return was increased \$13.18/A. In a subsequent study conducted at five locations sugar yield was increased 8.6% and net return was increased \$61.79/A when sugarcane was not tilled in March. Sugar yield was increased 8.0% and net return was increased \$58.23/A when layby tillage in May was eliminated.

Crop residue deposited on the soil surface as a consequence of using chopper harvesters can affect regrowth of the ratoon crop following the winter dormant period and efficiency of spring tillage. Mechanical removal of crop residue using a Sunco Trash Tiger[®] three weeks after harvest of LCP 85-384 with a chopper harvester was compared with burning. Tillage efficiency in March was not reduced when the residue was mechanically removed from the row top and placed in the row middle. Sugar yield was reduced an average of 7.9% when sugarcane residue was not removed compared with mechanical removal or burning in December. Research was also conducted to compare mechanical removal of sugarcane residue with the Trash Tiger[®] in January, February, or March. Allowing crop residue to remain on the soil surface until March reduced both early season sugarcane height and shoot population when compared with December residue removal. Sugar yield was equivalent when crop residue was removed in December by burning or mechanically and averaged 7,740 lb/A. Delaying mechanical removal of residue until February or March decreased sugar yields an average of around 13% compared with December burn or mechanical removal.

Effect of *Sugarcane Yellow Leaf Virus* on Sugarcane Yield and Juice Quality of LCP 85-384 and Ho 95-988

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Sugarcane yellow leaf virus (SCYLV) was first detected in Louisiana in 1996 and has since been repeatedly detected in the leading commercial cultivar, LCP 85-384. A field experiment was conducted from 2001 to 2003 to determine the effect of SCYLV infection on yield and juice quality of LCP 85-384. The experiment was repeated from 2003 to 2004 and expanded to include cultivar Ho 95-988 as well as LCP 85-384. The experiments were harvested green with a chopper harvester and billet samples were collected for juice and cane analysis by the pre-breaker, core press method. Prior to harvest, whole-stalk samples with green leaves attached were hand cut from each experimental plot. The whole stalks were divided into four sections (the lower six internodes of the stalk, the upper mature internodes of the stalk, the immature portion of the upper stalk that included the growing point, and the green leaves) for detailed juice analysis. Neither sugar nor cane yields differed between the SCYLV-infected and non-infected plots in plant-cane or first-ratoon crops of either cultivar. In the second-ratoon crop of LCP 85-384, sugar and cane were reduced by approximately 10% in the SCYLV-infected plots. Increased starch accumulation was found in the growing point and the green leaf sections of the SCYLV-infected stalks of both varieties as compared to the non-infected tissues. The mean starch concentrations in LCP 85-384 increased from 940 to 1160 ppm (23%) and from 2700 to 4050 ppm (50%) in the growing point section and the green leaves, respectively. In Ho 95-988, the mean starch concentration increased from 1100 to 1540 ppm (40%) and from 940 to

1490 ppm (57%) in the growing point section and the green leaves, respectively. The majority of green leaves and immature sections of stalks is normally removed when cane is harvested with chopper harvesters; however, these tissues may not be removed if the harvester is not being operated at full extractor fan efficiency, when the cane is lodged, or when harvesting under rainy conditions. Although SCYLV-infected sugarcane plants in Louisiana rarely show the typical external symptoms of midrib yellowing and dying tops associated with SCYLV infection, elevated levels of starch in the cane delivered to the mill could reduce processing efficiency.

Some Insect and Mite Pests New to Florida Sugarcane

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The number of insect and mite species attacking sugarcane in Florida has increased over time. Five new pest species were discovered during the 31-year period 1964 to 1995, one species indigenous to Florida with no previous association with sugarcane and four invasive species entirely new to the Everglades Agricultural Area where sugarcane is grown. Reported for the first time here are six new pest species that were discovered attacking Florida sugarcane during the eight-year period 1995 to 2003: the desert corn flea beetle *Chaetocnema ectypa* Horn (Coleoptera: Chrysomelidae); a leafmining buprestid beetle, *Aphanisticus cochinchinae seminulum* Obenberger (Coleoptera: Buprestidae); an armored scale, *Duplacionaspis divergens* (Green) (Hemiptera: Diaspididae); a spider mite, *Oligonychus grypus* Bakers and Pritchard (Acarina: Tertranychidae); the Diaprepes root weevil *Diaprepes abbreviatus* (L.) (Coleoptera: Curculionidae); and the pink sugarcane mealybug, *Saccharicoccus sacchari* (Cockerell) (Hemiptera: Psuedococcidae).

Discrimination of Sugarcane Varieties with Hyperspectral Reflectance Measurements and Plant Pigment Analysis

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High resolution, hyperspectral leaf reflectance and pigment measurements was evaluated as a potential tool to aid in the identification and delineation of commercial sugarcane varieties (interspecific hybrids of *Saccharum* spp.), noble canes (*Saccharum officinarum* L.) and wild canes (*Saccharum spontaneum* L.). Seven varieties of sugarcane were selected from the USDA-ARS-SRRC, Sugarcane Research Unit (SRU) breeding program for reflectance analysis, including: five commercial cultivars, one noble cane, and one wild cane. Hyperspectral reflectance data at 0.4-nm intervals were collected from the third youngest fully open leaf from nine replicates using a dual input fiber optic spectrometer under natural light conditions from ~ 1200 to 1600-h. After reflectance measurements were completed the same leaf was sampled for plant pigment analysis by boring a 0.5 cm disc from ca. 10 cm from the leaf tip. The discs were extracted with 100% acetone and analyzed by HPLC. Reflectance data were condensed into 5, 10 or 20-nm intervals and then with plant pigment data were subjected to analysis of variance and multivariate mean separation techniques. Differences in reflectance were observed for each variety, with the seven cultivars having ~3-fold difference in reflectance values. Reflectance measurements at 560 and 700 nm and reciprocal reflectance at 700 and 710 nm provided the best discrimination (76%) with single wavelengths, while vegetation indices based on multiple wavelengths improved the varietal discrimination to 81%. Multivariate analysis of leaf reflectance and plant pigment data using canonical discrimination and discriminant analysis resulted in a 100% correct classification for plant pigment data and an 89% correct classification for reflectance data. Finally, there were no false negative *S. spontaneum* species classifications and only one false positive classification when variety Ho 95-988 was classified as the *S. spontaneum* MPTH 97-216.

Red Morningglory in Sugarcane: Biology and Management

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Field studies were conducted to evaluate red morningglory (*Ipomoea coccinea* L.) emergence and growth in response to shade and tillage. Both studies were conducted over two years from May through September. In the shade study, shade boxes were used to provide 0, 30, 50, 70, or 90% shade environments. Red morningglory seedlings emerged throughout the growing season even under 90% shade. Vine length, number of leaves, leaf area, and biomass of red morningglory under 90% shade was equal to that of plants exposed to full sunlight. In the tillage study, red morningglory emergence was recorded throughout the growing season in plots that were tilled monthly and in plots that were undisturbed. In July, red morningglory emergence was equal whether or not soil was tilled. Although red morningglory emergence decreased as the season progressed significant emergence occurred in both the tilled and non-tilled plots. Results clearly show that red morningglory would be capable of emerging in sugarcane throughout the growing season even when significant shading occurs. Findings emphasize the need to develop weed control programs that promote maximum residual control from soil-applied herbicides.

The level of residual activity of several herbicides was determined based on red morningglory emergence 5, 7, 9, and 11 weeks after soil treatment (WAT). After each rating Liberty (glufosinate) which has only postemergence activity was applied to eliminate weed competition as a variable. Soil type for this study was a silt loam. Red morningglory control 5 WAT was at least 90% with Spartan (sulfentrazone) at 4, 5, 6, 7, and 8 oz/A; atrazine at 3 and 4 qt/A; Dupont K4 (hexazinone plus diuron) at 3 and 4 lb/A; Sencor (metribuzin) at 3 lb/A; and Valor (flumioxazin) at 4, 6, and 8 oz/A. By 7 WAT, only Spartan at 4, 5, 6, 7, and 8 oz/A controlled red morningglory at least 90%. None of the other herbicide treatments controlled red morningglory 7 WAT more than 71%. At 9 WAT, all rates of Spartan except 3 oz/A controlled red morningglory at least 75% and Spartan at 3 oz/A and Dupont K4 at 2, 3, and 4 lb/A were the only other treatments that controlled red morningglory at least 50%. By 11 WAT, Spartan at all rates except 3 oz/A controlled red morningglory 71 to 76%, but all other treatments provided less than 50% control.

Results clearly show that red morningglory control failures with atrazine are directly related to lack of long-term residual activity. The shift in Louisiana to earlier herbicide application at layby (early to mid-May as opposed to late May and early June) has only exacerbated the problem. For most effective red morningglory control at layby, herbicide application should be delayed as long as possible. The long residual activity with Spartan makes it an excellent choice as a layby herbicide. Research is underway to evaluate morningglory control in sugarcane when herbicides with preemergence and postemergence activity are applied as directed treatments in late June and early July when sugarcane is jointing.

**Response of the Mexican Rice Borer (Lepidoptera: Crambidae)
to Drought Stressed Sugarcane**

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A field study was conducted in Texas to evaluate the effect of several management strategies, including irrigation, on Mexican rice borer, *Eoreuma loftini* (Dyar), infestations in sugarcane. Applying irrigation water reduced *E. loftini* injury in both tested cultivars (LCP 85-384 and HoCP 85-845) by two-fold, and was necessary to achieve adequate control. Drought stress increased levels of several free amino acids in sugarcane leaves, some that are essential for insect growth and development, which may have exacerbated *E. loftini* infestations. To better understand insect-crop dynamics in Texas and Louisiana, *E. loftini* oviposition preference studies were conducted in the greenhouse. Oviposition on sugarcane occurred exclusively on dry leaves, dry tips of leaves or dry leaf sheaths, and was enhanced by drought stress. Preference for stressed sugarcane provided a mechanism which would at least partially explain the breakdown of resistance observed in the field. The number of dry leaves per plant and leaf free amino levels assisted in explaining variability in oviposition using regression models.

Yield, Residue Degradation, and Soil Quality Response among Different Harvest Residue Management Practice Inputs.

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Alternatives to burning harvest residue are being investigated because of the problems generated by the smoke associated with burning and also because of the possibility of utilizing the residue to improve soil quality and water quality. Eight management treatments were initiated in Nov., 2001, on the plant cane harvest residue of LCP85-384 to evaluate effects on yield, residue degradation, and soil quality. The treatments were: post-harvest burn, residue remained undisturbed, residue swept to furrows, residue treated *in situ* with 9.4 l/ha molasses, residue treated *in situ* with 67kg N/ha as urea-ammonium nitrate (UAN), residue treated *in situ* with 67kg N/ha as stabilized urea (Super U), residue soil incorporated/covered *in situ* , and residue removed without burning. These treatments were maintained through three ratoon crops, ending in Oct., 2004. Effects on yield and yield components were generally not consistently different among treatments. Moreover, adjuvant treatments (UAN, Super U, and molasses) did not appear to accelerate residue decomposition during winter and early spring. This experiment was conducted on a fine-textured soil. Soil data taken in March, 2004 indicated soil quality was only slightly affected by treatment. The effects on soil chemistry were minimal. Organic matter content was unchanged. Bases and therefore base saturation was statistically different among treatments, but probably not enough to be of biological importance. Soil physical properties also changed slightly among treatments, but only incorporating residue or treating it with 67kg N/ha as UAN during winter months resulted in statistically lower bulk density. Soil strength and percent water stable aggregates were little changed and were in the acceptable quality range for all treatments. Soil respiration measurements were not different when directly compared. When normalized to a constant temperature (25° C) and /or % water filled pore space (60%) results were generally higher under the residue blanket. This indicated that although the blanket offers increased substrate for degradation, it also has a bigger insulating effect and water trapping/holding characteristic that slowed the degradation process from achieving its potential. Volumetric moisture content and % water free pore space varied with time due to residue treatment and rainfall. In conclusion, results of 3 years of continued residue management treatments on a fine-textured soil had minimal effects on soil quality. These data would indicate that keeping the harvest residue intact does little to improve the soil quality within one crop cycle on this type of soil.

Ripening Sugarcane For Early Factory Starts

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In recent years, the Louisiana sugar industry has expanded its area planted to sugarcane to approximately 500,000 acres. Along with this expansion, came the release of a new, high yielding sugarcane variety, LCP 85-384, in 1993 which produced as much as 30 percent more cane per acre than the varieties it replaced. Another change occurred when the industry switched from the whole-stalk or “soldier” to the combine harvesting system which meant that more total biomass had to be processed by the mills especially when recumbent cane was harvested. Although milling capacity was increased at most mills, the harvest season was extended to 100 days or more which meant that the starting date for the harvest season was advanced into September. Then with the current Farm Bill, mills that did not meet their allotment during the normal crop were forced to begin the next crop in September prior to the start of the Federal fiscal year in order to market all sugar allocated to them.

In 1980, glyphosate was labeled as a chemical ripener to enhance the yield of sugar per ton of cane especially in cane that was harvested early in the season. However, at that time, the average startup date for the mills was the first or second week of October; now that date is about September 20. In the past, it was a general recommendation that glyphosate be applied 35-49 days prior to the harvest; however, it was known that this product generally reduced cane yield while increasing sugar yield. With the earlier startup dates necessitated an earlier application of glyphosate in August which is still during the grand growth phase of the crop, further impacting the yield of cane tonnage. In 2004, glyphosate (Polado-L®, RoundUp WeatherMax® or Touchdown iQ®) was applied at three equivalent rates on two dates, August 18 and September 14. The results showed that glyphosate can be applied on or about mid-August without loss of sugar per acre if the crop is harvested within 28 days of harvest. However, if the harvest is delayed beyond 42 days, the increase in yield of sugar per ton is generally offset by the reduction in tons of cane per acre. For cane harvested later in the harvest season, these studies showed a significant increase in sugar per acre when compared to harvesting earlier in the season. These studies also showed that a significant increase in sugar per acre can be obtained with longer treatment-to-harvest intervals when glyphosate is applied in mid-September and presumably later. The results of these studies show conclusively that ripening of sugarcane for early factory starts is attainable without sacrificing the yield of sugar per acre.

A Comparison of Growth and Sugar Accumulation in Sugarcane Genotypes Adapted to Hawaii or Louisiana

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Louisiana sugarcane breeders are using Hawaiian (HI) genotypes to increase the genetic base of new cultivars. Cultivars developed in Hawaii have high tonnage potential, but are adapted to two-year crop cycles. We were interested in the growth and sugar accumulation of HI genotypes when grown in the short Louisiana season. We sampled stalks of four HI genotypes (US 02-101, US 02-102, US 02-103, and US 02-104) and two Louisiana (LA) cultivars, HoCP 85-845 and LCP 85-384, grown in Schriever, Louisiana. Samples were taken during the grand growth and ripening stages in the plant and first ratoon crops. We determined stalk length and

internode number, and then sampled internodes 2, 5, 8 and 11 from the top, from which sugars were extracted. Stalk length was the same in all genotypes except US 02-104, which had longer stalks due to a greater number of above-ground internodes. Internodes of the LA genotypes generally had a higher total sugar concentration than the HI genotypes. The differences in sucrose accumulation were even greater. Internodes of LA genotypes accumulated more sucrose than the HI genotypes, especially during ripening. Only US 02-103 approached the two LA genotypes in sucrose concentration. LA genotypes also had a higher sucrose: total sugar ratio than HI genotypes. The four HI genotypes evaluated in this experiment had reduced sugar accumulation compared to the LA cultivars. While introduction of HI germplasm into the Louisiana breeding program may broaden the genetic base of sugarcane genotypes, it may do so at the cost of sugar accumulation.

The Use of FTIR to Monitor Trash Decomposition in the Sugar Cane Industry

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The majority of sugarcane in Louisiana is harvested green with a chopper harvester. The blanket of trash when left in place can provide several benefits that include weed suppression and a barrier to the loss of soil, fertilizer, and pesticides from the field. Unfortunately, the trash blanket also slows the growth of the new crop and subsequently reduces its sugar yield by 500 to 1000 lbs/ac. Studies done in Australia and Hawaii on the rate of microbial decomposition of field cane trash indicate that nearly all the trash can be removed in one year by microbes already existing in the soil. Since dry trash is approximately 36% cellulose, 21% hemicellulose, and 16% lignin, it can be removed in a shorter time to preserve sugar yields by enhancing existing soil microbes with a selection of microbes that decompose these leaf components efficiently. Fourier transform infrared spectroscopy, FTIR, is an analytical tool that can be used to identify, quantify, or signify changes in sugarcane leave composition owing to microbial decomposition. To investigate decomposition efficiency of microbes, sugarcane leaves were inoculated with different microbes and studied via attenuated total reflection (ATR)-FTIR. Changes in the different spectra due to alterations in the leaf composition are presented.

Potential of Sugarcane for Restoring Everglades Soils

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Soils in the Everglades Agricultural Area of south Florida are subsiding due to decomposition by aerobic microorganisms. Growing plants that can add organic matter back to the soil is a means to replenish soil that was lost. Sawgrass (*Cladium jamaicense* Crantz) is the native plant from which built the organic soils of the Everglades accreted over a 5,000-yr period, but it grows slowly and doesn't compete well with plants growing in the region. An experiment was conducted to compare dry matter production and root growth of sugarcane (*Saccharum* spp.)

with St. Augustine grass [*Stenotaphrum secundatum* (Walt.)] and sawgrass to determine the potential of sugarcane for restoring Everglades soils. Plants were grown outside in 10 gal containers containing Pahokee muck soil (Euic, hyperthermic Lithic Haplosaprist). Water-tables were maintained at 6 and 12 inches from the soil surface. After 11 months, plants were harvested and dry matter and root yields were compared. In both high and low water-table treatments, sugarcane produced as much or more root dry matter as the entire sawgrass plant dry matter. Averaged across water-table depths, sugarcane produced 9 and 20 times more shoot and root dry matter, respectively, than sawgrass. St. Augustinegrass produced about the same amount of shoot and root dry matter as sawgrass in both water tables. Averaged across water-table depths, sugarcane produced 13 times more root length than sawgrass, indicating it had a greater potential for absorbing nutrients. As with dry matter yield, St. Augustinegrass produced similar quantities of root length as sawgrass. Based on dry matter production, sugarcane appeared to have greater potential than sawgrass and St. Augustinegrass for accreting Everglades peat soil, while reducing nutrient levels in ground water.

Application of High-Throughput DNA Marker Technology in Sugarcane Breeding: Phase II – PCR Amplification and Capillary Electrophoresis

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Each year, only a small portion of the seedlings (approximately 120,000 seedlings from 300 commercial and basic crosses) are transplanted to the field at the SRU's Ardoyne Farm due to space limitations in the greenhouse and field. We are continuing to explore the utilization of high-throughput (HT) DNA marker technology in an effort to maximize the number of hybrid seedlings being transplanted to the greenhouse and field. The HT-DNA extraction method described at this meeting in 2004 and currently being used at our lab, allows the preparation of DNA templates from 600 seedlings per day per technician using 96-well DNA sample microplates and as such is no longer a limiting step. Our goal in further developing this process was to be able to assess cross quality (percentage of seedlings with DNA fragments from both parents) using 22 randomly picked seedlings from each cross. In order to process a minimum of 6,600 HT-DNA samples beginning in early February, we automated the PCR reaction preparation step by using a robot station that set up four 384-well PCR reaction plates in 30 minutes for sixteen 96-well HT-DNA sample plates (1,536 samples in total). PCR amplification reactions were then conducted on a thermal cycler equipped with four 384-well heating blocks for durations not to exceed two hours. Using the same robot system, we automated the capillary electrophoresis sample plate preparation for the same number of samples in 30 minutes by mixing 1 μ l of amplified DNA products with 9 μ l HiDye formamide solution containing the Rox™ 500 size standards. Amplified DNA fragments were separated through capillary electrophoresis on ABI3730 Genetic Analyzer for duration of about 22 hours. The separation process was recorded automatically into run files that could be analyzed by the ABI software GeneMapper. Based on the single marker-PCR and single marker capillary electrophoresis just described, we were able to process 6,624 HT DNA samples from sixty-nine 96-well sample

plates with two microsatellite markers in 8 days. The breeders were able to obtain microsatellite genotyping data for 1,646 individuals from the *Saccharum spontaneum* cytoplasm project where spont clones were used as the female parents and for 2,304 individuals representing 93 commercial crosses before beginning the transplanting season on April 11, 2005. The output of ABI3730 Genetic Analyzer can be maximized to 9,216 HT-DNA samples per day if up to six PCR amplified microsatellite DNA products with three fluorescence labels were pool-plexed and separated through a single capillary electrophoresis run.

Sensor to Indicate Plant Density and Skips in Sugarcane

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A sensor was developed to detect skips and/or plant density in sugar cane stands. The sensor consisted of two cross beam optical sensors mounted on poles below a cultivation tractor, a control box, and a GPS. Signals were recorded with either a PDA or laptop computer. Three different programs were available: either 3-foot (1 m) skips, percent plants (based on plant material being present every 1 foot (0.3 m) of distance), or stalk counting. The sensor operated over tractor speeds from 2 to 7 MPH (3.2 to 11.2 KMH) and output from the sensor was easy to import into current GIS and site specific farming software for mapping. 3-foot (1 m) skips were estimated with 100% accuracy in the lab and 85% correctness in the field. Counting accuracies were 97.9 % with a mean distance estimate of 1.5 inches. The percent plants routines was 97.5 % in the laboratory test. Mapping was done with percent plants routine and presented.

Evaluation of Trinexapac-Ethyl for Use as a Ripener in Florida Sugarcane

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Trinexapac-methyl is currently labeled for use as a growth regulator in perennial ryegrass seed production and turfgrass. Preliminary studies have indicated that trinexapac has potential for use as a ripening agent in sugarcane. Currently, glyphosate is the only compound labeled for use as a ripener in Florida sugarcane. In Florida, glyphosate can only be used in the final harvest of sugarcane because of stand and growth reductions in subsequent ratoons. Trinexapac is reported to have potential for safe use in each year of the crop. Plots were established in 2004 at the Okeelanta Corporation and the University of Florida Everglades Research and Education Center (EREC) to evaluate and compare trinexapac to glyphosate for use as a sugarcane ripener. Plots were established at Okeelanta in a field of CP89-2143 plant cane and in a field of CP72-2086 plant cane at the EREC. Several rates of trinexapac and glyphosate were applied using a 20 ft overhead spray boom calibrated to deliver 5 gallons per acre and simulate aerial application.

Ten stalk samples were collected immediately following treatment application and at 2, 4, 6, 8, and 10 weeks after treatment (WAT). Harvest samples were ground, crushed, and the juice was analyzed for Brix and apparent sucrose and theoretical yields were calculated. Stalk counts following harvest are being conducted to evaluate the effect of ripener treatment on stalk emergence in the subsequent ratoon crop.

At Okeelanta, Brix and apparent sucrose were not significantly affected by treatment, except at the 6 WAT sampling. Although not significantly different, the glyphosate treatments tended to result in higher Brix and apparent sucrose 2 and 4 WAT. By 6 WAT, Brix and apparent sucrose were similar with the low rate of trinexapac and the glyphosate treatments. Theoretical yield was not significantly affected by treatment, and the overall response to treatment followed a trend similar to that for Brix and apparent sucrose.

At the EREC, Brix, apparent sucrose, and theoretical yield were not significantly affected by treatment. The data tended to be highly variable, thus making trends difficult to distinguish. Trinexapac treatments typically ranked higher than the untreated control, but were often lower than the glyphosate treatments.

Preliminary results suggest that in some situations trinexapac can perform similarly to glyphosate, but response to glyphosate tends to be more consistent. Complete results including data on regrowth in the ratoon crop will be presented at the meetings.

Molecular Assessment of the Fidelity of Sugarcane Crosses with High-Throughput Microsatellite Genotyping

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With the recent advent of high-throughput microsatellite genotyping in sugarcane, breeders now have an effective means to assess the fidelity of sugarcane crosses. Cross fidelity was defined as the proportion of progeny within each cross that inherited microsatellite DNA fingerprints from both parents. A total of 76 crosses were assessed, of which 48 had most or all of the following pollen constraints imposed on the designated parents at the time of crossing, namely 1) tassel trimming of designated females, 2) hot-water emasculation of designated females, 3) inclusion of only two parents per cubicle, and 4) use of fully enclosed cubicles (all four sides); while 28 crosses had none. For each cross, 20 randomly sampled seedlings, along with the two parents and positive and negative controls were fingerprinted. Six microsatellite markers were employed in this study; however, within each cross, only two microsatellite markers that best differentiated the parents were used. Among the 48 crosses where pollen constraints were in effect, most had a fidelity rate above 80%. Among the 28 crosses where pollen constraints were not in effect, fidelity ranged from 0 to 95% and the average being below 50%. The results of this study highlight the importance of imposing as many pollen constraints on the female parents as is practical.

Evaluation of Resistance to Sugarcane Red Rot in Basic Germplasm and Early Generation Crosses in Louisiana

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The susceptibility of current cultivars to red rot disease of planted seed-cane, caused by *Colletotrichum falcatum*, indicates a need to identify and incorporate sources of resistance in commercial breeding programs. The objective of this study was to evaluate the sugarcane basic germplasm collection maintained by the Sugarcane Research Unit and two *S. spontaneum* hybrid progeny populations for genetic diversity of host plant resistance to red rot. The experiment was conducted with detached, inoculated stalks. Eighty basic clones representing species of *Saccharum*, one clone of *Miscanthus* and two clones from *Erianthus* were screened. Among the *Saccharum* species, *S. officinarum*(8), *S. robustum*(10), *S. barberi*(15), *S. sinense*(11), *S. spontaneum*(32), and interspecific hybrids (4) were evaluated using a commercial *Saccharum* interspecific hybrid, LCP85-384, as the susceptible control. Also included in this evaluation were F1 hybrids (119) between *S. officinarum* (La Striped, classified as highly susceptible) and *S. spontaneum* (SES147, classified as resistant) and F2 hybrids (178) between two interspecific F1 hybrids of SES 234 (female parent) and LCP85-384. Expression of resistance in these clones and single F1 and F2 progeny populations was assessed as the number of nodes passed (the ability of the infection to move through the node) and the number of and extent of internode rotting. A 1 to 9 rot index, based on the number of nodes passed and rot severity, was developed with 1 representing no rotting and 9 representing all internodes rotted. For our purpose, a clone with a rating of 3 or less was considered resistant. New sources of resistance were found among *Erianthus* (2), *S. barberi* (5), *S. robustum* (2), *S. sinense* (1), *S. spontaneum* (4) and the interspecific hybrids (2). Inheritance of resistance to red rot was evaluated using the interspecific F1 hybrids between La Striped and SES147 and the F2 progeny between two interspecific F1 hybrids of SES234 and LCP85-384. The resistance ratings of the *S. spontaneum* cytoplasm parents of the F2 population were 4 and 2, and the susceptible control cultivar LCP85-384 was 9. The *S. spontaneum* cytoplasmic F2 progeny produced a higher frequency of resistance 47 of 178 than the F1 hybrids 4 of 119. *S. spontaneum* hybrids were identified as potential sources of resistance to red rot. The results from the progeny populations suggest that the utilization of identified resistance sources in crossing could increase the frequency of red rot resistance in the cultivar selection population.

Variable-Rate Nitrogen Management of Sugarcane

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Site-specific management of sugarcane has lagged behind other commodities because of the unavailability of commercial yield monitors. Measures of spatially variable soil attributes associated with sugar cane yield have been both inconvenient and limited. The principal objective of this study was to determine the response of plant cane to the application of variable rates of fertilizer nitrogen. An ancillary objective was to investigate the relationship of yield to measured soil attributes. Four N rates (0, 90, 179 or 269 kg/ha⁻¹) were superimposed in a randomized block design on a 10-hectare field on which apparent soil electrical conductivity (EC_a) and soil nutrient levels were measured. The soil (Vertic Haplaquolls) had a silty clay loam surface layer and a clayey subsoil. Absent a workable yield monitor, plot weights were measured using a field wagon equipped with electronic load cells. The growing season was characterized by moisture extremes, with excessive rainfall occurring in the spring, followed by a moisture deficit during the grand growth stage of summer. A multi-source regression was fit to the plot data. The three applied N rates were statistically equivalent and significantly higher in sugar per acre than the 0 kg/ha⁻¹ rate. Blocks (approximate surrogate for clay content), N application rates, average EC_a of the plots, soil sodium and the interaction of average EC_a and soil sodium were all significant in a model that explained 92 percent of the variability in sugar per hectare. This significant interaction is consistent with visual displays of EC_a and soil sodium for the experimental region and consistent with our understanding of the typical effect of these variables on yield. This model will be used in the upcoming growing season as a prescription for a variable N rate investigation. As is typical of seasons with exceedingly uneven moisture regimes, sugarcane underperformed on areas of the field with higher clay content (% clay ranged from 20.8 to 60.8 within the experimental area). Management options useful for mitigation of this dilemma are limited. The results suggest that the ability to predict the response of sugar cane yield on clay soil to nitrogen fertilizer is undermined by the inability to predict growing season climate. The data also suggest, as others have observed with different crops, that EC_a alone cannot be used to predict variation in sugarcane yield. Collateral observations and information must be included in the development of fertilizer prescriptions.

Autotoxic and Allelopathic Activity of Post-Harvest Residue

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Soon after the adoption of green-cane harvesting in Louisiana, USDA-ARS research indicated that a 10-20% (4.5-13.5 t/ha) yield loss was associated with non-removal of post-harvest residue from the row top. Autotoxicity from the decaying residue may be one of the potential causes for this yield reduction. The objective of this experiment was to determine possible autotoxic or allelopathic activity of sugarcane post-harvest residue. Potential allelochemicals were extracted from the residue using distilled water at 25°C with a 1:28 residue to water weight ratio. This extract was diluted with distilled water to obtain final concentrations that were 0, 0.1, 10, 25, and 100% of the original extract solution. Oat, rye, and tomato seeds along with bud-chipped cane eyes were germinated at 26°C on filter paper in Petri dishes moistened with 5 ml of the various concentrations. Percent germination was recorded after seven days. To determine activity on plant growth, eye pieces of LCP85-384 were germinated in

tissue paper soaked with distilled water and then transplanted into 15 cm pots where they were maintained at field capacity using the various cane extracts for two months. The 100% extract significantly reduced the germination of oats, rye, and sugarcane by 31, 33, and 50%, respectively. During the first two weeks of the pot experiment, leaf development was also hindered by the extracts. After this two week duration, extracts did not significantly affect cane growth in terms of height, leaf development, fresh weight, or dry weight. This preliminary data suggests that sugarcane post-harvest residue has both autotoxic and allelopathic activity.

Irrigation and Nitrogen Application Effects on Sugarcane Production in the Lower Rio Grande Valley of Texas

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Water for agricultural production is becoming increasingly limited in semiarid South Texas. Optimum irrigation scheduling based on knowledge of crop water use is necessary in order to maintain production while conserving water. Methods of N application also have to be modified when more efficient irrigation practices are adopted compared to conventional furrow irrigation. A 4-year study was conducted to evaluate sugarcane growth and yield at different irrigation levels based on different crop coefficient curves applied to Penman-Monteith reference evapotranspiration. Broadcast, thru-the-drip and stool-splitter methods of N application were also compared, along with different rates of N application. Optimum irrigation levels varied annually, with no differences being found in the first two years while optimum yields were obtained at lower irrigation levels in the later years. Substantial reductions in crop irrigation applications were obtained when using drip compared to furrow irrigation. Sugarcane yields showed a somewhat diminished response to N application than expected. Both thru-the-drip and broadcast applications gave best results, while the stool-splitter resulted in slightly lower yields.