SUGARCANE RESEARCH

ANNUAL PROGRESS REPORT

2004

This report is from 2004 only and should be regarded as preliminary. Complete research is reported in appropriate Louisiana Agricultural Experiment Station and Louisiana Cooperative Extension Service publications and/or other professional publications.

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FOREWORD

Research on sugarcane in the Louisiana Agricultural Experiment Station is an integral part of the LSU Agricultural Center's research-extension effort to provide the knowledge and technology base for efficient production and processing of sugarcane. Sugarcane research projects are led by scientists in the St. Gabriel Research Station, Audubon Sugar Institute and the departments of Agricultural Economics and Agribusiness, Agronomy and Environmental Management, Biological and Agricultural Engineering, Entomology, and Plant Pathology and Crop Physiology.

Members of the Louisiana Agricultural Experiment Station maintain close working relations with colleagues in respective departments of the College of Agriculture and other colleges of the LSU Baton Rouge campus, the Louisiana Cooperative Extension Service, the Agricultural Research Service and Natural Resources Conservation Service of the USDA, the American Sugar Cane League, and the Louisiana Department of Agriculture and Forestry.

A major portion of the resources for production research is linked to the St. Gabriel Research Station located at St. Gabriel, Louisiana. Processing research is linked to the Audubon Sugar Institute located on the LSU campus at Baton Rouge, La. The Iberia Research Station helped to accomplish specific sugarcane research objectives in 2004.

Important parts of the 2004 research effort were conducted on cooperating farms and in cooperating factories. These activities are important and must be continued. The cooperation of individual growers in conducting field research projects and financial support from the American Sugar Cane League are gratefully acknowledged.

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AN OVERVIEW OF 2004 ACTIVITIES IN THE LSU AGCENTER SUGARCANE VARIETY DEVELOPMENT PROGRAM

Kenneth Gravois
St. Gabriel Research Station

The primary objective of the LSU AgCenter Sugarcane Variety Development Program is to contribute to the profitability of the Louisiana sugarcane industry by developing improved sugarcane varieties.

Sugarcane variety development in the LSU AgCenter is carried out by a team of scientists (Table 1). The LSU AgCenter sugarcane breeding team and the United States Department of Agriculture (USDA) sugarcane breeding team work independently yet cooperatively to produce "L" and "HoCP or Ho" varieties, respectively. The best varieties from the two programs are brought together for evaluation at the nursery, infield, and outfield test locations. Outfield testing is conducted by personnel of the LSU AgCenter, the USDA, and the American Sugar Cane League. Seed increase is carried out by the American Sugar Cane League and begins when varieties are introduced to the outfield testing stage. The cooperative efforts of sugarcane breeding are done in accordance with the provisions of the "Three-way Agreement of 1978." After yield data for one crop cycle (plant-cane, first stubble, and second stubble) are collected in the outfield testing stage, those varieties that show promise are released for commercial production.

Table 1. Members of the LSU AgCenter Sugarcane Variety Development Team in 2004.

Team Member	**Budgetary Unit**	**Responsibility**
Kenneth Gravois	St. Gabriel Research Station	Program Leader
Keith Bischoff	St. Gabriel Research Station	Selection
Collins Kimbeng	Agronomy	Molecular Breeding
Gene Reagan	Entomology	Insect Resistance
Jeff Hoy	Plant Pathology & Crop Physiology	Disease Resistance
Jim Griffin	Agronomy	Herbicide Tolerance
Sonny Viator	Iberia Research Station	Variety Testing
Terry Bacon	St. Gabriel Research Station	Variety Testing
Gert Hawkins	St. Gabriel Research Station	Sucrose Laboratory
Chris LaBorde	St. Gabriel Research Station	Photoperiod and Crossing
Mike Duet	St. Gabriel Research Station	Outfield Testing
Todd Robert	St. Gabriel Research Station	Variety Testing
Joel Hebert	St. Gabriel Research Station	Farm Manager

A total of 92,598 seedlings from 211 crosses from the 2003 crossing series were planted in the field in the spring of 2004. A total of 89,104 seedlings survived transplanting. In addition, 4,215 seedlings were planted in a cross appraisal trial. The majority of the seedlings were from crosses of commercial varieties and elite experimental varieties. Selection will be carried out in 2005 when the seedlings are in the first stubble crop.

Photoperiod treatments to induce flowering began on May 31 and continued until September 10. Flowering in 2004 was excellent, with 404 crosses being made. Germination tests were conducted in December and January. Seed production for 2004 was more than adequate based on germination test results, with 346,886 true seed produced during 2004.

In the fall of 2004, individual selection was practiced on 50,951 first stubble seedlings that represented the 2002 crossing series. Family selection (top 79.6% in 2004) was utilized based on information from the cross appraisal study. Of the 40,577 clones, 2,742 were selected and planted to establish the first-line trials.

Established procedures were used to advance superior clones of the 2001 crossing series from first-line trials to second-line trials (773 clones) and of the 2000 crossing series from second-line trials to increase trials (313 clones). After preliminary ratings for cane yield and plant type in August, clones with acceptable ratings were further evaluated for lodging, borer damage, diseases, pith/tube, and Brix/sugar per ton.

The best 38 experimental varieties from the 1999 crossing series were assigned permanent variety designations in the fall of 2003. Newly assigned varieties were entered in replicated nursery trials at three locations (St. Gabriel Research Station, USDA Ardoyne Farm, and Iberia Research Station). "L", "HoCP, or Ho" varieties of the 2004 series were exchanged in the fall of 2004 to plant cooperative infield and off-station nursery tests the following year.

Experimental varieties were replanted in infield and off-station nursery tests (14 varieties of the 2003 series), introduced to the outfield tests (four varieties of the 2002 series), and planted in outfield tests (two varieties of the 1999 series; one variety of the 2000 series; two varieties of the 2001 series). Breeding personnel assisted Dr. Jeff Hoy and Dr. Gene Reagan in entering experimental varieties in the sugarcane smut and sugarcane borer resistance trials, respectively.

The decision regarding the further testing and seed increase of candidate varieties was determined at the Variety Advancement Committee meeting. The 2004 meeting was held on August 13, 2004, at the American Sugar Cane League office in Thibodaux.

The distribution of "L" and "LCP" experimental clones through stages of testing in 2004 is presented in Table 2. The practice of planting nursery and infield trials at multiple locations allows efficient identification of superior varieties in each assignment series.

Progress in the LSU AgCenter Sugarcane Variety Development Program would not be possible without the financial support of state funds from the LSU AgCenter and the Louisiana sugar industry through the American Sugar Cane League.

Table 2. Number of "L" varieties by assignment series at the most advanced stage of testing in 2004.

Series	Stage of Testing	Number of experimental varieties
L 1999	Outfield – Replanted and harvested as plant-cane and first stubble	2
	Off-station nurseries – third stubble harvested	
L 2000	Outfield – Replanted and harvested as plant-cane	1
	On-station nurseries – third stubble harvested	
	Off-station nurseries – second stubble harvested	
L 2001	Outfield – Planted	2
	On-station nurseries – second stubble harvested	
	Off-station nurseries – first stubble harvested	
L 2002	Outfield – Introduced	4
	On-station nurseries – first stubble harvested	
	Off-station nurseries plant-cane harvested	
L 2003	On-station nurseries plant-cane harvested	14
	Off-station nurseries planted	
L 2004	Assignment – On-station nurseries planted	38

In 2004, rust continued to be seen in high levels in LCP85-384 throughout the growing season. Pith and leaf scald in experimental varieties were extremely high compared to other years, likely due to extremely dry conditions in late summer and early fall portions of the growing season.

St. Gabriel 2004 Weather Overview:

Records indicate that 2004 was a "wet and warm" year for St. Gabriel, with annual rainfall topping 65" (111% of normal) and temperatures for the year averaging more than 1º above the long-term mean. But a closer look at the weather of 2004 shows some significant swings in monthly and season patterns during the year, highlighted by an exceptionally wet late spring followed by an unusually dry mid and late summer.

2004 opened with a dry January, but February rains topped 10" at St. Gabriel, making for the wettest February since 1988. Drier weather returned during March, resulting in near-normal rainfall for the first quarter of 2004. Although there were a number of days with early morning freezes in January, as well as a pair of light freezes in February, records indicate no significant Arctic Outbreaks for the winter season, and only three dates when lows dipped below 28ºF.

April was slightly wetter than normal, but an unusually wet pattern became established through May and June: two-month rainfall at St. Gabriel topped 22" (215% of normal), proving to be the wettest two-month period for the research station since 2001 (mainly because of T.S. *Allison*) and the wettest May-June combination for that location since 1991.

After the wet weather of late spring, the climate shifted into a much drier cycle for most of the summer. Monthly rainfall at St. Gabriel was less than 50% of normal for July, August and September, averaging just 36% of normal for the three-month period. At the same time,

temperatures were frequently above the norm during these months, suggesting higher-than-average PET rates for the summer as a whole.

From a Louisiana perspective, the tropics turned active during September, as all eyes were on Hurricane *Ivan* as 'he' neared the southeastern coastal parishes (Sep 14-15). A turn to the northeast and east -- with landfall along the Alabama coast -- meant little in the way of weather-related impacts for east-central Louisiana, but the storm's size and strength as it approached the Bayou State prompted many to modify work schedules or briefly halt operations altogether.

An early October tropical system -- T.S. *Matthew* -- combined with a weak cold front to become a much bigger rainmaker for southeast Louisiana compared to September's *Ivan*. The October storm system dumped nearly 7" of rain at St. Gabriel over a three-day period, the wettest single storm event of the year. October was also noteworthy because of the unusually warm weather that developed across the Gulf Coast region during the latter half of the month. Afternoon highs at St. Gabriel reached between 86º and 90º during each of the last 13 days of October, pushing the monthly average temperature to nearly 7º above the norm and resulting in the warmest October for St. Gabriel in at least 40 years!

November also proved warmer- and wetter-than-normal, but the departures were not especially significant. 2004 closed with a cool-and-dry December, marked by a run of very chilly weather for much of the holiday period. In addition to light to moderate freezes on each morning from the 23rd through the 28th, the holiday week included rare sightings of snowflakes in parts of south Louisiana on Christmas Eve and Christmas Day.

Jay Grymes
LSU AgCenter
Extension Climatologist

Table 3. 2004 rainfall (inches) reported by date at the St. Gabriel Research Station, St. Gabriel, Louisiana.

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1:	0.00	0.00	0.00	0.00	2.74	0.25	0.03	0.00	0.00	0.00	0.87	0.41	: 1
2:	0.00	0.00	0.00	0.00	1.05	0.30	0.00	0.11	0.00	0.00	0.00	0.00	: 2
3:	0.00	0.41	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00	1.10	0.00	: 3
4:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.30	: 4
5:	0.40	0.94	0.00	0.00	0.00	0.00	0.07	0.00	0.20	0.53	0.00	0.00	: 5
6:	0.46	1.64	0.50	0.00	0.00	1.15	0.00	0.08	0.00	0.00	0.00	0.13	: 6
7:	0.00	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	: 7
8:	0.00	0.00	0.00	0.00	0.00	0.06	0.20	0.00	0.00	0.90	0.00	0.00	: 8
9:	1.07	0.00	0.00	0.00	0.00	T	0.76	0.00	0.00	4.70	0.00	0.21	: 9
10:	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.10	1.00	0.00	0.00	:10
11:	0.00	2.00	0.00	0.25	0.39	0.00	0.90	0.00	0.00	0.00	0.00	0.00	:11
12:	0.00	1.00	0.00	0.12	0.28	0.00	0.00	0.00	0.00	0.00	0.04	0.00	:12
13:	0.00	0.00	0.00	0.00	3.87	0.00	0.00	0.00	0.08	0.00	0.00	0.00	:13
14:	0.00	0.35	0.00	0.00	0.67	0.24	0.00	0.00	0.00	0.00	0.00	0.00	:14
15:	0.00	0.00	1.45	0.00	0.90	0.20	0.00	0.00	0.00	0.26	0.00	0.00	:15
16:	0.00	0.00	0.14	0.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	:16
17:	0.00	0.00	0.00	0.00	1.30	1.60	0.00	0.00	0.00	0.00	0.00	0.00	:17
18:	0.24	0.10	0.00	0.00	T	0.00	0.50	0.00	0.00	0.00	0.00	0.00	:18
19:	0.00	0.00	0.00	0.00	T	0.00	0.20	0.00	0.00	0.14	0.39	0.00	:19
20:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	:20
21:	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.20E	0.00	0.00	0.00	0.00	:21
22:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16	0.20	:22
23:	0.00	0.15	0.00	0.00	0.02	0.00	0.00	0.00	0.14	0.00	0.00	0.00	:23
24:	0.00	2.28	0.00	0.00	0.00	0.30	0.00	0.00	0.09	0.00	0.82	0.00	:24
25:	0.00	1.45	0.00	0.49	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	:25
26:	0.10	T	0.00	2.20	0.00	2.10	0.00	0.20	0.00	0.00	0.00	0.00	:26
27:	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	1.20	0.00	:27
28:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	:28
29:	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	:29
30:	0.91	---	0.18	1.43	0.00	0.20	0.00	0.50E	0.00	0.00	0.19	0.00	:30
31:	0.08	---	0.00	---	0.00	---	0.00	0.00	---	0.00	---	0.00	:31
Sum:	3.26	10.37	2.27	5.63	13.32	9.53	2.66	1.29E	1.51	7.53	6.77	1.59	
Nrm:	5.58	5.17	4.89	4.35	4.56	6.06	5.49	5.08	4.52	4.09	4.43	5.14	
DFN:	-2.32	+5.20	-2.62	+1.28	+8.76	+3.47	-2.83	-3.79	-3.01	+3.44	+2.34	-3.55	
Pct:	58%	201%	46%	129%	292%	157%	48%	25%	33%	184%	153%	31%	

Annual Total: 65.73" Annual DFN: +6.37 (111% of Normal)

T - indicates a trace of rain (less than 0.01") E - estimated daily/monthly value
Data compiled by Jame Grymes, LSU AgCenter Extension Climatologist

Table 4. 2004 daily maximum/minimum temperatures (F°) reported by date at the St. Gabriel Research Station, St. Gabriel, Louisiana.

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1:	70|40	60|41	74|55	73|39	69|62	91|72	90|75	95|76	90|70	89|62	84|71	78|38	: 1
2:	77|56	61|50	78|60	79|52	81|59	86|68	87|75	97|75	90|69	89|66	86|70	54|39	: 2
3:	75|60	65|35	81|67	77|52	67|48	89|68	89|73	95|73	92|72	91|68	86|66	60|37	: 3
4:	78|63	58|37	80|67	80|48	75|46	85|70	91|69	94|74	92|72	90|67	76|50	59|38	: 4
5:	77|54	72|41	79|68	80|51	80|55	89|70	94|74	95|76	92|73	91|68	67|47	62|49	: 5
6:	55|35	75|45	78|58	74|48	82|55	88|70	92|74	96|73	91|72	84|68	69|41	73|62	: 6
7:	50|28	54|33	82|50	81|53	85|57	89|69	90|74	88|65	92|73	87|69	72|47	78|57	: 7
8:	51|29	51|30	79|48	83|62	85|60	91|72	93|72	89|65	90|68	77|71	78|49	74|48	: 8
9:	54|43	46|34	70|45	78|57	88|62	90|73	89|71	91|75	88|70	75|70	79|46	75|48	: 9
10:	50|34	71|44	75|41	84|55	87|64	91|72	84|69	93|73	93|72	75|70	73|52	78|51	:10
11:	51|29	58|53	68|37	85|62	87|68	91|73	91|70	91|72	95|70	75|69	76|55	68|39	:11
12:	57|33	59|45	70|43	73|55	84|67	93|73	93|76	94|72	93|74	81|62	79|50	58|37	:12
13:	66|34	48|42	76|50	62|45	77|65	94|72	94|73	82|59	88|72	78|55	60|51	70|46	:13
14:	71|44	49|43	73|51	66|39	86|66	94|72	94|75	82|57	90|73	81|56	58|51	62|35	:14
15:	72|45	49|39	74|59	71|40	84|67	84|73	92|76	82|60	88|73	69|46	68|56	48|27	:15
16:	66|50	52|32	70|60	77|44	81|68	92|75	97|78	85|61	87|74	76|46	71|58	53|30	:16
17:	68|49	57|33	74|45	79|49	82|72	91|75	96|78	88|60	91|69	83|60	74|57	64|41	:17
18:	71|50	58|33	77|55	82|53	84|67	92|75	89|73	90|64	96|69	85|70	75|60	61|34	:18
19:	68|41	63|35	80|55	83|55	84|67	93|75	91|71	92|69	94|62	86|69	72|64	63|35	:19
20:	50|26	67|42	80|54	83|60	86|65	92|71	88|69	92|76	87|64	88|69	77|58	59|27	:20
21:	51|29	74|49	81|55	80|61	88|67	92|74	91|73	88|72	87|63	90|72	71|61	60|32	:21
22:	59|30	69|45	74|44	84|63	88|67	90|72	92|76	92|75	84|65	90|72	77|65	75|45	:22
23:	62|30	72|52	66|44	88|69	86|67	90|72	94|75	93|74	88|69	89|68	77|68	77|32	:23
24:	68|38	58|51	72|49	8|69	89|71	88|72	95|74	94|74	81|70	88|69	82|63	36|27	:24
25:	69|50	58|53	75|52	88|66	89|70	85|72	96|78	94|75	84|70	86|67	70|44	35|27	:25
26:	73|43	60|42	77|54	84|65	89|68	75|68	95|73	93|75	88|68	89|64	58|38	38|26	:26
27:	75|32	48|43	79|53	77|52	89|71	79|69	88|72	95|75	88|65	87|65	67|42	54|29	:27
28:	46|23	63|36	81|60	79|49	88|69	91|71	88|69	94|72	85|58	88|62	74|41	64|30	:28
29:	55|26	63|44	79|59	80|59	90|70	91|71	92|73	95|72	85|57	87|61	65|46	66|34	:29
30:	57|35	-----	81|47	81|65	91|76	91|73	95|75	93|72	86|59	88|63	76|55	74|42	:30
31:	58|40	-----	79|43	-----	92|79	-----	94|75	90|67	-----	88|65	-----	73|52	:31
Monthly Averages --													
MaxT:	62.9	59.9	76.2	79.3	84.3	89.2	91.7	91.4	89.2	84.5	73.2	62.9	
MinT:	39.3	41.4	52.5	54.6	65.0	71.7	73.5	70.3	68.5	64.8	54.1	38.5	
Mean:	51.1	50.7	64.4	67.0	74.7	80.5	82.6	80.9	78.9	74.7	63.7	50.7	
DFN:	+1.0	-2.6	+4.1	+0.5	+0.4	+0.9	+0.9	-0.6	+1.2	+6.7	+4.2	-1.9	

Annual Average Temperature: 68.3F (+1.2F)

Temperature data recorded at LSU-Ben Hur Farm.
Data compiled by Jame Grymes, LSU AgCenter Extension Climatologist

2004 PHOTOPERIOD AND CROSSING IN THE LSU AGCENTER SUGARCANE VARIETY DEVELOPMENT PROGRAM

Chris LaBorde, Kenneth Gravois, and Keith Bischoff
St. Gabriel Research Station

The LSU AgCenter's Sugarcane Variety Development Program is a complex program that covers thirteen years to develop new commercial sugarcane varieties for the sugarcane industry. The first stage of the program is the photoperiod induction and crossing stage. For subsequent stages to be successful, success must first be achieved at both photoperiod induction and crossing. The objective of crossing is to produce not only a large number of seed, but viable "true" seed/fuzz from the most desirable crosses. Desirable crosses are quantified by program success of past parents and crosses. The seed from these crosses will then be advanced to the seedling stage of the program.

Cuttings of potential parent varieties used for the 2004 crossing season were planted in the fall of 2003. After establishing the plants from the cuttings, the plants were fertilized biweekly with a 200 ppm solution of Peter's 20-20-20. In late January 2004, the cuttings were then transferred to can culture. In April, the cans were moved from the greenhouse to the photoperiod rail carts. Soluble fertilizer applications were continued on a biweekly basis. Fertilization was discontinued in early- to mid-May to condition the plants for floral induction. Three additional applications of dry granular fertilizer (8-24-24, one Tbs/can) were applied to the cans during July, August, and September. A reduced nitrogen ratio makes a higher C:N ratio, which is more desirable for the ease of flowering.

Natural lighting and eight light-tight chambers (six traditional photoperiod bays and two temporary photoperiod bays) were used for photoperiod treatments. To prevent overwhelming the crossing facilities, two flowering peaks were planned for September 23 and October 8 although these two flowering peaks can be advanced or delayed because of certain climatic factors. Records of varietal flowering, past photoperiod response, and pollen production were used to determine the most appropriate photoperiod treatment for each variety. The first photoperiod treatments began on May 30. All photoperiod treatments (time from artificial sunrise to natural sunset) were initiated with a minimum of 34 consecutive days of 12 ½ hours of constant day length. After the initial constant photoperiod days, day length was shortened by one minute per day. Treatments differed by the number of days with constant day length and the date on which the decline of photoperiod was initiated. All photoperiod treatments were discontinued on September 10, 2004, when natural day length was 12 ½ hours and decreasing.

Photoperiod treatments require pulling the carts out of the photoperiod bays at their appropriate time each morning to receive full sunlight. On certain days when the weather was severe, the carts were pushed back into the photoperiod chambers to protect the parental varieties from wind damage. While in the photoperiod chambers, artificial lighting was used. In addition to artificial lighting, the doors were partially opened to allow natural light to enter the chambers.

Flowering percentage of total stalks was average on the photoperiod carts in 2004 (Tables 1-2). Total flowering percentage for the eight bays was 51%, which was based on total 1,905 stalks. As in 2003, total stalk number was exceedingly high due to a replicated research project where the crossing greenhouse was converted into two temporary photoperiod bays (7 & 8). The conversion of the crossing greenhouse consisted of Dura Skrim 8 (two sheets of high strength polyethylene film laminated together with a third layer of molten polyethylene) material draped over cables (creating a box-type enclosure) that were connected to the interior of the crossing greenhouse. This created an additional 90 pots (10 gallon). All of the breeding clones for the research project consisted of proven parents such as HoCP 85-845, LCP 85-384, and LCP 86-454. For the research project, these three varieties were used predominantly in polycrosses due to their pollen abundance to quantify seed production. This resulted in a higher than usual number of polycrosses made in 2004 (Table 3). These varieties were used for both research and seed production purposes. In 2004 as in previous years, seedlings were produced from hybridization techniques that used sugarcane yield components, borer resistance, and diseases resistance as some of the criteria to determine which breeding stocks were most compatible.

The flowering season in 2004 began during the second week of September. The normal time frame for first flowering can be as early as the last week of August or as late as the second week of September. There can be a slight deviation on when the first flower does appear due to temperature during the photoperiod induction phase, varietal characteristics, and the photoperiod treatments. Crossing began on September 8 and ended on November 12, 2004. The end date was earlier than usual due to a minor adjustment in one of the later photoperiodic treatments (Bay 1). A total of 964 tassels of 95 varieties were used to produce 404 crosses producing 346,881 viable seed with 229,243 seed produced from biparental crosses (Table 3). The germination rate is one of two components that measure the success of this stage in the crossing program. The other component is photoperiod induction. Close attention was made once again in maintaining high relative humidity within the crossing greenhouse; high relative humidity has been proven in past studies to increase seed set. High relative humidity is maintained with the use of a misting system that has been installed inside of the crossing greenhouse. The majority of crosses made were during to the two flowering peaks that were planned; 83% of the crosses were made by October 15, 2004. High temperatures in September can result in poor seed set as was the case in 2004. Temperatures in excess of 100 degrees have adverse effects on pollen viability. Although outside temperatures may be in the 90 degree range, greenhouse temperatures can be anywhere from 10 to 30 degrees hotter. To manage high temperatures the crossing greenhouse is white-washed at the beginning of the crossing season (late August). Along with the shading effect of the white-washed greenhouse, the misting system also has a cooling effect on the greenhouse environment.

Table 1. Summary of the 2004 photoperiod treatments for the LSU AgCenter's sugarcane variety development program.

Bay	Cart	Treatment Start Date	Days of Constant Photoperiod	Date Photoperiod Decline Started	Days of Declining Photoperiod Peak 1	Days of Declining Photoperiod Peak 2	Mean Flowering Date	Total Stalks	Percent Flowered
1	A	16-Jun	44	30-Jul	72	87	292±14	90	82
1	B	16-Jun	44	30-Jul	72	87	291±11	89	73
1	C	16-Jun	44	30-Jul	72	87	292±13	83	70
2	A	16-Jun	34	20-Jul	72	87	291±15	102	55
2	B	16-Jun	34	21-Jul	72	87	283±13	86	45
2	C	16-Jun	34	22-Jul	72	87	288±17	79	54
3	A	30-May	37	6-Jul	87	102	277±19	85	49
3	B	30-May	37	6-Jul	87	102	274±10	97	42
3	C	30-May	37	6-Jul	87	102	276±15	77	60
4	A	30-May	37	6-Jul	87	102	273±12	94	57
4	B	30-May	37	6-Jul	87	102	275±14	95	40
4	C	30-May	37	6-Jul	87	102	278±14	86	31
5	A	4-Jun	36	10-Jul	82	97	284±15	89	26
5	B	4-Jun	36	10-Jul	82	97	301±19	86	17
5	C	4-Jun	36	10-Jul	82	97	281±6	76	25
6	A	30-May	41	10-Jul	82	97	287±14	84	37
6	B	30-May	41	10-Jul	82	97	284±17	78	40
6	C	30-May	41	10-Jul	82	97	286±14	79	53
7	B	4-Jun	36	10-Jul	82	97	274±7	91	91
7	C	4-Jun	36	10-Jul	82	97	268±10	71	38
8	A	4-Jun	36	10-Jul	82	97	278±14	85	58
8	B	4-Jun	36	10-Jul	82	97	278±14	66	59
8	C	4-Jun	36	10-Jul	82	97	270±19	49	59

Table 2. Summary of can, variety, and flower information on bays 1-8 subjected to photoperiod treatments.

Varieties used in crossing	Cans with stalks	Cans with tassels	Total stalks	Total tassels	Mean stalks per can	Mean tassels per can†	Mean pollen rating‡	Mean days to flower§
--Number--								
95	414	316	1905	964	4.60±1.13	3.05±1.44	4.13±1.56	80.06±15.45

† Based upon cans with tassels.
‡ Rating of 1 to 4 being male and 5 to 9 being female.
§ Days from decline date to flowering.

Table 3. Summary of 2004 crossing and seed production.

Type of Cross	Crosses	Sum of Seed Production	Mean Seed Production Per Cross	Mean Seed Production Per Female Tassel	Mean Germination Per Gram Seed
--Number--					
Biparental	310	229,243	740±870	724±867	96±91
Polycross	56	94,718	1691±2325	783±1158	112±114
Self	38	22,920	603±1101	603±1101	67±100
Total	404	346,881	859±1242	721±934	95±95

Table 4. Varietal flowering summary in 2004 in the photoperiod bays.

Variety	Days of Constant Photoperiod	First Flower Date	Mean Days to Flower	Pollen Rating	Total Stalk Number	Total Flowers	Percent Flowering Stalks
CP65-357	41± 2	266	83±3	6	13	6	46
CP73-351	41	285	93	7	1	1	100
CP77-310	44	271	59	4	8	1	13
CP79-318	36±1	266	89±6	5±1	6	5	83
CP79-348	37	257	73±4	6	14	2	14
CP83-644	38	.	.	.	25	.	.
HO01-564	40±1	268	92±7	6±1	10	8	80
HO89-889	39±1	.	.	.	10	.	.
HO91-572	40±1	252	63±1	5±1	8	7	88
HO95-988	37±1	264	83±2	5	50	27	54
HOCP00-927	38±1	.	.	.	14	.	.
HOCP00-930	39±2	261	71±3	6±1	19	8	42
HOCP00-933	41±3	287	83±4	5±1	11	3	27
HOCP00-950	37±1	268	79±2	7	17	9	53
HOCP01-517	37	268	87±5	4±1	9	3	33
HOCP01-523	37	271	86±3	6	14	3	21
HOCP01-529	40±2	278	81±4	5±1	11	5	45
HOCP01-541	39±1	266	83±4	7	15	10	67
HOCP01-544	41	271	79	5	7	1	14
HOCP01-551	37±1	.	.	.	12	.	.
HOCP01-553	40±1	271	87±3	3±1	10	5	50
HOCP01-558	40±2	275	67±1	6	9	9	100
HOCP01-561	36±1	285	94±2	5	15	8	53
HOCP02-618	36	278	86	3	6	6	100
HOCP02-620	36	273	84±3	3	5	5	100
HOCP02-623	36	278	90±4	3	6	2	33
HOCP85-845	36	264	84±1	3	180	94	52
HOCP88-739	41	280	88	7	9	1	11
HOCP89-831	37	278	90	7	4	2	50
HOCP89-846	38±1	264	74±2	4	21	20	95
HOCP91-551	41	.	.	.	3	.	.
HOCP91-552	40±1	257	63±2	3	21	20	95
HOCP91-555	41	294	105±3	6±1	27	2	7
HOCP92-618	37	273	92±2	5±1	22	11	50
HOCP92-624	40±1	257	66±2	6	34	30	88
HOCP92-648	39±1	261	79±5	7	15	10	67
HOCP93-746	44	.	.	.	6	.	.
HOCP95-951	37	257	81±4	5±1	9	5	56
HOCP96-509	37	271	94±3	6	13	7	54
HOCP96-540	36	264	82±1	3	92	79	86
HOCP96-549	44	280	75±4	5±1	5	5	100
HOCP96-561	36	266	86±3	5±1	9	6	67
HOCP97-606	37	285	97	7	13	1	8
HOCP97-609	38±1	273	77±3	4±1	17	9	53
HOCP99-815	41	285	93	7	4	1	25
HOCP99-866	44	289	91±14	5±1	9	2	22
L00-264	34	.	.	.	5	.	.

Table 4. Continued.

Variety	Days of Constant Photoperiod	First Flower Date	Mean Days to Flower	Pollen Rating	Total Stalk Number	Total Flowers	Percent Flowering Stalks
L00-266	41	273	92±11	2±1	31	2	6
L01-281	37	264	81±3	3	7	3	43
L01-283	38±1	278	102±6	5±1	15	7	47
L01-292	41	.	.	.	5	.	.
L01-299	39±1	259	75±2	4	31	24	77
L02-316	37	268	85±2	4±1	23	13	57
L02-320	39±1	266	86±7	5±1	8	8	100
L02-323	38±1	.	.	.	13	.	.
L02-324	37±1	.	.	.	8	.	.
L02-325	39±1	271	83±2	5±1	11	5	45
L02-326	38±1	.	.	.	7	.	.
L02-336	37	278	99±5	5±1	15	5	33
L02-342	41	280	97±5	6±1	8	3	38
L02-353	43±1	261	70±1	5±1	9	8	89
L73-351	40±1	.	.	.	9	.	.
L89-113	37	292	104	7	7	1	14
L91-255	44	314	102	3	20	2	10
L91-281	44	271	61	4	11	10	91
L92-312	41	266	75±1	5±2	3	2	67
L92-321	36	.	.	.	4	.	.
L94-424	41	.	.	.	5	.	.
L94-426	36	268	86±3	5	30	16	53
L94-428	37	264	82±3	5	18	8	44
L94-432	40±1	278	101±8	4±1	8	4	50
L94-433	36	299	109±2	5±1	10	2	20
L96-092	39±1	.	.	.	16	.	.
L97-128	38±1	257	75±1	6	55	45	82
L97-137	41	261	86±15	4±1	17	3	18
L98-197	37±1	271	89±3	4±1	14	6	43
L98-207	40±1	264	74±3	4±1	22	8	36
L98-209	38±1	264	80±2	4	41	29	71
L99-226	38±1	264	84±3	4	54	21	39
L99-233	38±1	257	69±2	4	31	17	55
LCP81-010	39±1	264	80±3	5	26	18	69
LCP82-089	38±1	266	85±3	3	14	9	64
LCP85-384	37	261	82±1	3	241	152	63
LCP86-454	36	252	68±5	3	118	52	44
N27	37	292	104	3	6	1	17
TUCCP77-042	36	278	96±4	4	18	13	72
US01-039	40±1	.	.	.	8	.	.
US01-040	41±4	278	90	3	7	2	29
US02-095	44	.	.	.	5	.	.
US79-010	39±2	257	70±4	6±1	11	7	64
US80-004	36	268	81±2	3±1	13	6	46
US93-015	35±1	264	95±10	3	16	3	19
US96-002	37	252	85±21	5±1	4	3	75
US99-002	44	271	64±4	5±1	5	4	80

Table 5. Crosses and seed made in 2004 sorted by cross number.

Cross	Female	Male	Seed
XL04-001	HO91-572	04P1	322
XL04-002	US96-002	04P1	1280
XL04-003	LCP86-454	04P1	384
XL04-004	L97-128	HOCP91-552	94
XL04-005	L99-233	HOCP91-552	428
XL04-006	HOCP91-552	HOCP91-552	5997
XL04-007	CP79-348	HOCP92-624	165
XL04-008	HO91-572	HOCP92-624	123
XL04-009	HOCP95-951	HOCP92-624	77
XL04-010	US79-010	HOCP92-624	21
XL04-011	HOCP92-624	HOCP92-624	65
XL04-012	L99-233	LCP86-454	25
XL04-013	L97-128	LCP86-454	0
XL04-014	LCP86-454	LCP86-454	0
XL04-015	L97-128	L99-233	136
XL04-016	HOCP92-624	L99-233	753
XL04-017	L99-233	L99-233	262
XL04-018	LCP86-454	L97-128	144
XL04-019	L01-299	L97-128	7
XL04-020	HOCP92-624	L99-233	602
XL04-021	HOCP92-648	L99-233	627
XL04-022	L97-128	L99-233	661
XL04-023	L97-137	L02-353	91
XL04-024	HOCP00-930	L02-353	1906
XL04-025	L02-353	L02-353	23
XL04-026	L01-299	L02-353	214
XL04-027	L97-128	L02-353	24
XL04-028	HOCP91-552	04P2	406
XL04-029	L02-353	04P2	21
XL04-030	LCP86-454	04P2	1099
XL04-031	HOCP89-846	HOCP89-846	198
XL04-032	CP79-348	HOCP89-846	63
XL04-033	HO95-988	HOCP89-846	385
XL04-034	HOCP92-624	HOCP89-846	1416
XL04-035	HOCP92-648	HOCP89-846	240
XL04-036	L94-428	HOCP89-846	0
XL04-037	LCP81-010	HOCP89-846	690
XL04-038	L97-128	HOCP89-846	1399
XL04-039	L98-209	HOCP89-846	242
XL04-040	HOCP00-930	HOCP89-846	702
XL04-041	HOCP85-845	LCP85-384	1536
XL04-042	HOCP92-624	LCP85-384	1279
XL04-043	L97-128	LCP85-384	1045
XL04-044	LCP85-384	LCP85-384	54
XL04-045	HOCP92-624	L02-353	686
XL04-046	L97-128	L02-353	100
XL04-047	L02-353	L02-353	141
XL04-048	HOCP92-624	L99-233	2339
XL04-049	L97-128	L99-233	717
XL04-050	HOCP95-951	L99-233	743
XL04-051	L99-233	L99-233	439
XL04-052	LCP81-010	L98-207	3463
XL04-053	L98-207	L98-207	244
XL04-054	L97-128	L01-299	565
XL04-055	L01-299	L01-299	42
XL04-056	HOCP96-540	04P3	5325
XL04-057	L01-281	04P3	2394
XL04-058	LCP86-454	04P3	31
XL04-059	US93-015	04P3	141
XL04-060	L99-226	04P3	366
XL04-061	L01-299	04P3	597
XL04-062	CP65-357	LCP85-384	186
XL04-063	CP79-318	LCP85-384	2267
XL04-064	HO95-988	LCP85-384	215
XL04-065	HOCP89-846	LCP85-384	21
XL04-066	L99-226	LCP85-384	685
XL04-067	HOCP89-846	HO95-988	555
XL04-068	L92-312	HO95-988	0
XL04-069	HOCP01-541	HO95-988	0
XL04-070	HO95-988	HO95-988	96
XL04-071	L02-320	HOCP85-845	109
XL04-072	L99-226	HOCP85-845	1150
XL04-073	HOCP92-624	L98-209	1531
XL04-074	LCP85-384	04P4	2889
XL04-075	LCP82-089	04P4	0
XL04-076	L98-209	04P4	452
XL04-077	L01-299	04P4	0
XL04-078	L02-320	L94-428	94
XL04-079	L97-128	L94-428	115
XL04-080	HOCP92-624	L94-428	511
XL04-081	L99-226	HOCP96-540	70
XL04-082	L02-320	HOCP96-540	75
XL04-083	HOCP92-624	HOCP96-540	1481
XL04-084	L99-226	HOCP96-561	93
XL04-085	HOCP92-624	HOCP96-561	1094
XL04-086	L98-209	L99-233	76
XL04-087	L99-226	L99-233	140
XL04-088	L97-128	L99-233	338
XL04-089	L97-137	L99-233	2643
XL04-090	HOCP92-624	L01-299	189
XL04-091	HO95-988	LCP85-384	360
XL04-092	L02-320	LCP85-384	358
XL04-093	HOCP00-950	LCP85-384	91
XL04-094	L97-128	LCP85-384	318
XL04-095	US80-004	LCP85-384	0
XL04-096	HOCP85-845	HOCP89-846	0

Table 5. Continued

Cross	Female	Male	Seed
XL04-097	HOCP92-624	HOCP89-846	91
XL04-098	L94-426	HOCP89-846	114
XL04-099	HO95-988	L92-312	349
XL04-100	HOCP92-624	L92-312	956
XL04-101	L94-426	L92-312	0
XL04-102	L92-312	L92-312	84
XL04-103	L02-316	L94-428	83
XL04-104	HO95-988	L98-207	686
XL04-105	HOCP92-624	L98-207	3061
XL04-106	HOCP01-517	L98-207	3278
XL04-107	HO95-988	L99-233	0
XL04-108	HOCP00-930	L99-233	1235
XL04-109	HOCP96-540	L99-233	6776
XL04-110	LCP81-010	L99-233	2901
XL04-111	HO01-564	L99-233	209
XL04-112	HOCP92-624	HOCP91-552	1237
XL04-113	HOCP96-540	HOCP91-552	4768
XL04-114	HO01-564	HOCP91-552	268
XL04-115	L02-316	HOCP91-552	615
XL04-116	LCP81-010	L99-226	833
XL04-117	HO01-564	L99-226	986
XL04-118	L97-128	L99-226	411
XL04-119	L99-226	L99-226	246
XL04-120	HO01-564	L01-299	0
XL04-121	HOCP85-845	LCP82-089	0
XL04-122	L02-320	L98-209	156
XL04-123	LCP86-454	04P5	0
XL04-124	LCP85-384	04P5	574
XL04-125	HOCP96-540	04P5	2808
XL04-126	L01-299	04P5	34
XL04-127	L98-207	04P6	49
XL04-128	HOCP85-845	04P6	1358
XL04-129	LCP85-384	04P6	2848
XL04-130	LCP86-454	04P6	3296
XL04-131	LCP85-384	04P7	2622
XL04-132	HOCP85-845	04P7	5042
XL04-133	HOCP96-540	04P7	9588
XL04-134	LCP86-454	04P7	1314
XL04-135	HOCP00-950	LCP82-089	277
XL04-136	HOCP92-624	LCP82-089	1063
XL04-137	LCP82-089	LCP82-089	393
XL04-138	L02-316	L02-316	222
XL04-139	CP65-357	L02-316	550
XL04-140	HOCP92-624	L02-316	1293
XL04-141	LCP81-010	L02-316	2830
XL04-142	L94-426	L02-316	50
XL04-143	L94-428	L02-316	119
XL04-144	HOCP01-523	L02-316	740
XL04-145	HOCP01-544	L02-316	0
XL04-146	CP65-357	L99-233	881
XL04-147	L94-426	L99-233	703
XL04-148	L94-428	L99-233	126
XL04-149	HOCP01-553	L99-233	1101
XL04-150	HOCP01-544	L99-233	1730
XL04-151	L97-128	L91-281	10
XL04-152	HOCP92-624	L91-281	62
XL04-153	L91-281	L91-281	22
XL04-154	HO95-988	HOCP91-552	1636
XL04-155	HOCP00-950	HOCP91-552	0
XL04-156	L01-299	HOCP91-552	260
XL04-157	L02-325	HOCP91-552	1328
XL04-158	HOCP91-552	HOCP91-552	3095
XL04-159	L98-197	L99-226	3361
XL04-160	HOCP92-624	L99-226	2059
XL04-161	HOCP01-523	LCP85-384	1641
XL04-162	HOCP92-624	LCP85-384	3507
XL04-163	HOCP96-509	CP77-310	406
XL04-164	US80-004	CP77-310	0
XL04-165	US99-002	CP77-310	3571
XL04-166	CP77-310	CP77-310	732
XL04-167	L97-128	HOCP95-951	691
XL04-168	HOCP85-845	04P8	11615
XL04-169	LCP85-384	04P8	5385
XL04-170	HOCP85-845	04P9	2812
XL04-171	LCP85-384	04P9	3567
XL04-172	LCP86-454	04P9	993
XL04-173	CP79-318	L02-316	1017
XL04-174	HOCP96-509	L02-316	402
XL04-175	HOCP96-561	L02-316	201
XL04-176	L01-299	L02-316	51
XL04-177	L94-426	L02-316	13
XL04-178	L94-426	L02-316	160
XL04-179	US79-010	L02-316	280
XL04-180	LCP81-010	L02-316	2335
XL04-181	HO01-564	HOCP91-552	482
XL04-182	HOCP00-930	HOCP91-552	3478
XL04-183	HOCP92-624	HOCP91-552	1536
XL04-184	HOCP00-950	LCP82-089	7
XL04-185	US79-010	LCP82-089	167
XL04-186	HOCP00-930	L00-266	3595
XL04-187	HOCP92-624	L00-266	1508
XL04-188	HOCP92-648	L00-266	2118
XL04-189	L00-266	L00-266	429
XL04-190	HOCP92-618	HO95-988	674
XL04-191	L02-325	HO95-988	818
XL04-192	L98-209	HO95-988	306

Table 5. Continued

Cross	Female	Male	Seed
XL04-193	LCP81-010	HO95-988	1718
XL04-194	US79-010	HO95-988	347
XL04-195	L94-426	HO95-988	857
XL04-196	L02-316	HO95-988	601
XL04-197	HOCP97-609	HO95-988	325
XL04-198	HOCP92-618	HO95-988	825
XL04-199	HOCP85-845	LCP82-089	708
XL04-200	HOCP01-558	LCP82-089	296
XL04-201	LCP81-010	LCP82-089	1313
XL04-202	HOCP89-846	HOCP85-845	1004
XL04-203	L91-281	HOCP85-845	906
XL04-204	L97-128	HOCP85-845	442
XL04-205	L98-207	HOCP85-845	911
XL04-206	HOCP85-845	HOCP85-845	1117
XL04-207	HO95-988	LCP85-384	150
XL04-208	L02-320	LCP85-384	526
XL04-209	HOCP92-618	LCP85-384	539
XL04-210	HOCP92-648	LCP85-384	930
XL04-211	LCP81-010	LCP85-384	1387
XL04-212	HOCP92-624	L99-226	735
XL04-213	HOCP96-561	L99-226	500
XL04-214	L91-281	L99-226	938
XL04-215	HOCP95-951	L02-325	763
XL04-216	HOCP96-540	L02-325	4520
XL04-217	L91-281	L02-325	819
XL04-218	L02-325	L02-325	1852
XL04-219	HOCP92-624	L97-128	452
XL04-220	LCP81-010	L97-128	395
XL04-221	HOCP01-558	L97-128	238
XL04-222	L01-299	L97-128	226
XL04-223	L97-128	L97-128	309
XL04-224	HOCP89-831	TUCCP77-042	116
XL04-225	HOCP00-930	TUCCP77-042	590
XL04-226	HOCP01-588	TUCCP77-042	408
XL04-227	L01-299	TUCCP77-042	50
XL04-228	TUCCP77-042	TUCCP77-042	13
XL04-229	HOCP92-618	HOCP92-618	410
XL04-230	HOCP01-558	HOCP92-618	2110
XL04-231	L02-353	HOCP92-618	653
XL04-232	HOCP01-541	HOCP92-618	467
XL04-233	HOCP97-609	HOCP92-618	309
XL04-234	L02-325	HOCP92-618	761
XL04-235	L02-353	HOCP91-552	455
XL04-236	HOCP00-930	HOCP91-552	632
XL04-237	HOCP97-609	HOCP91-552	478
XL04-238	HOCP01-558	L02-316	295
XL04-239	L94-432	L02-316	440
XL04-240	HOCP00-930	HO95-988	927
XL04-241	HOCP85-384	HO95-988	461
XL04-242	HOCP89-846	HO95-988	679
XL04-243	HO95-988	HO95-988	1129
XL04-244	HOCP00-950	LCP85-384	256
XL04-245	L94-426	LCP85-384	43
XL04-246	LCP81-010	LCP85-384	843
XL04-247	HOCP89-831	LCP85-384	312
XL04-248	HOCP96-561	LCP85-384	239
XL04-249	US79-010	LCP85-384	914
XL04-250	LCP85-384	LCP85-384	254
XL04-251	HOCP89-846	HOCP85-845	2354
XL04-252	HOCP92-624	HOCP85-845	752
XL04-253	L99-233	HOCP85-845	719
XL04-254	HOCP85-845	HOCP85-845	1369
XL04-255	LCP82-089	HOCP85-845	2546
XL04-256	HO95-988	L02-316	137
XL04-257	HOCP88-739	L02-316	98
XL04-258	HOCP92-648	L02-316	966
XL04-259	L02-316	L02-316	118
XL04-260	HOCP89-846	LCP81-010	767
XL04-261	HOCP01-541	LCP81-010	131
XL04-262	L01-299	LCP81-010	225
XL04-263	L02-325	LCP81-010	867
XL04-264	L97-128	LCP81-010	756
XL04-265	LCP81-010	LCP81-010	1677
XL04-266	HOCP89-846	HOCP85-845	331
XL04-267	L97-128	HOCP85-845	159
XL04-268	HOCP89-846	HOCP97-609	897
XL04-269	HOCP92-618	HOCP97-609	320
XL04-270	HOCP01-558	HOCP97-609	396
XL04-271	HOCP97-609	HOCP97-609	279
XL04-272	L94-428	LCP85-384	1853
XL04-273	HOCP92-618	LCP85-384	1592
XL04-274	HOCP97-609	LCP85-384	1846
XL04-275	L01-299	LCP85-384	1279
XL04-276	HOCP01-523	L98-209	1911
XL04-277	L02-342	L98-209	938
XL04-278	L97-128	L98-209	431
XL04-279	HOCP95-951	04P10	2327
XL04-280	HOCP96-549	04P10	3777
XL04-281	L97-128	04P10	472
XL04-282	HOCP85-845	04P11	1832
XL04-283	LCP86-454	04P11	674
XL04-284	LCP85-384	04P11	1378
XL04-285	LCP85-384	04P12	2363
XL04-286	LCP86-454	04P12	0
XL04-287	HOCP85-845	04P12	5758
XL04-288	CP65-357	L98-207	1248

Table 5. Continued

Cross	Female	Male	Seed
XL04-289	CP73-351	L98-207	1462
XL04-290	HO95-988	L98-207	1181
XL04-291	L99-226	HOCP89-846	1272
XL04-292	L97-128	HOCP89-846	38
XL04-293	HO95-988	HOCP89-846	315
XL04-294	HOCP85-845	HOCP89-846	1316
XL04-295	HOCP00-950	HOCP89-846	726
XL04-296	HOCP92-618	HOCP89-846	905
XL04-297	HOCP92-648	HOCP89-846	652
XL04-298	L94-426	HOCP89-846	325
XL04-299	L94-428	HOCP89-846	658
XL04-300	HO95-988	L98-209	14
XL04-301	HOCP00-950	L98-209	751
XL04-302	HOCP01-558	L98-209	301
XL04-303	L97-128	L98-209	226
XL04-304	L02-353	L98-209	415
XL04-305	L02-353	LCP85-384	376
XL04-306	HO95-988	LCP85-384	624
XL04-307	HOCP00-950	LCP85-384	1425
XL04-308	L94-426	LCP85-384	588
XL04-309	L97-128	LCP85-384	121
XL04-310	L99-233	LCP85-384	405
XL04-311	HOCP96-509	LCP85-384	804
XL04-312	L97-128	HOCP96-540	83
XL04-313	TUCCP77-042	HOCP96-540	784
XL04-314	CB79-318	LCP85-384	1199
XL04-315	US99-002	LCP85-384	454
XL04-316	L97-128	HOCP91-552	167
XL04-317	HoCP85-845	HOCP91-552	1198
XL04-318	HoCP97-609	HOCP91-552	197
XL04-319	L01-283	LCP81-010	544
XL04-320	HOCP96-540	04P13	954
XL04-321	HOCP85-845	04P13	1157
XL04-322	L98-209	04P13	192
XL04-323	LCP85-385	04P14	1135
XL04-324	LCP86-454	04P14	1069
XL04-325	HOCP85-845	04P14	0
XL04-326	HOCP01-529	L02-316	172
XL04-327	HOCP89-846	L02-316	738
XL04-328	TUCCP77-042	LCP85-384	121
XL04-329	HO95-988	LCP85-384	433
XL04-330	HOCP96-549	HOCP01-517	422
XL04-331	L01-283	HOCP01-517	136
XL04-332	L97-128	HOCP01-517	85
XL04-333	HOCP01-517	HOCP01-517	628
XL04-334	HOCP01-561	HOCP85-845	128
XL04-335	L02-336	HOCP85-845	39
XL04-336	L97-128	HOCP85-845	250

Cross	Female	Male	Seed
XL04-337	L89-113	LCP85-384	308
XL04-338	L01-299	LCP85-384	111
XL04-339	L99-226	LCP85-384	684
XL04-340	N27	LCP85-384	1386
XL04-341	CP79-318	LCP85-384	2170
XL04-342	HOCP01-541	HO95-988	198
XL04-343	L97-128	HO95-988	40
XL04-344	L99-226	HO95-988	43
XL04-345	HO95-988	HO95-988	0
XL04-346	L02-342	HOCP92-618	422
XL04-347	HOCP85-845	HOCP92-618	621
XL04-348	L97-128	HOCP92-618	95
XL04-349	HOCP91-555	L98-209	483
XL04-350	HOCP00-950	L98-209	159
XL04-351	L98-209	L98-209	20
XL04-352	HOCP92-648	L00-266	195
XL04-353	HOCP96-509	L00-266	342
XL04-354	HOCP96-561	L00-266	163
XL04-355	L00-266	L00-266	334
XL04-356	HOCP96-540	04P15	336
XL04-357	L94-426	04P15	177
XL04-358	L98-197	04P15	296
XL04-359	L99-226	04P15	318
XL04-360	TUCCP77-042	04P15	70
XL04-361	L02-342	HO95-988	396
XL04-362	LCP81-010	HO95-988	418
XL04-363	HOCP01-529	04P16	191
XL04-364	HOCP01-561	04P16	156
XL04-365	HOCP92-624	04P16	864
XL04-366	HOCP97-609	04P16	229
XL04-367	L94-432	04P16	1003
XL04-368	L98-209	04P16	68
XL04-369	LCP82-089	04P16	1838
XL04-370	TUCCP77-042	04P16	321
XL04-371	US79-010	04P16	658
XL04-372	HO95-988	HOCP91-552	1023
XL04-373	HOCP92-648	HOCP91-552	640
XL04-374	HOCP92-618	HOCP91-552	232
XL04-375	HOCP92-648	LCP85-384	512
XL04-376	HOCP91-555	LCP85-384	873
XL04-377	HO01-564	TUCCP77-042	1308
XL04-378	HOCP01-561	TUCCP77-042	185
XL04-379	L02-320	TUCCP77-042	169
XL04-380	L02-336	TUCCP77-042	277
XL04-381	L94-433	TUCCP77-042	341
XL04-382	HOCP00-933	L99-226	0
XL04-383	HOCP01-561	L99-226	172
XL04-384	HOCP01-529	L99-226	605

Table 5. Continued

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL04-385	L99-226	L99-226	345	XL04-395	TUCCP77-042	L99-226	417
XL04-386	CP65-357	LCP85-384	166	XL04-396	L97-128	L99-226	1645
XL04-387	L99-226	LCP85-384	545	XL04-397	HOCP92-648	L97-137	955
XL04-388	HOCP96-549	TUCCP77-042	252	XL04-398	HOCP01-561	L97-137	560
XL04-389	TUCCP77-042	TUCCP77-042	195	XL04-399	US99-004	L97-137	2667
XL04-390	LCP81-010	L98-209	348	XL04-400	L94-432	L91-255	504
XL04-391	HOCP01-529	L98-209	390	XL04-401	L97-128	L91-255	926
XL04-392	HOCP85-845	HO95-988	572	XL04-402	L91-255	L91-255	272
XL04-393	CP65-357	HO95-988	351	XL04-403	L97-128	L02-320	367
XL04-394	HOCP01-561	L99-226	1221	XL04-404	L02-320	L02-320	87

SELECTIONS, ADVANCEMENTS, AND ASSIGNMENTS OF THE LSU AGCENTER'S SUGARCANE VARIETY DEVELOPMENT PROGRAM FOR 2004

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SUMMARY

In the selection phase of the LSU AgCenter's Sugarcane Variety Development Program, superior clones are advanced through the single stool, first line, second line, and increase stages of the breeding program. In the first stubble crop of the second-line trials, those clones with acceptable breeding or commercial value are assigned a permanent variety number. A total of 92,598 seedlings from 211 crosses were planted in the field in the spring of 2004. The majority of these seedlings are progeny of crosses among commercial and elite experimental varieties. In the fall of 2004, family selection was practiced on the 50,951 stubble seedlings surviving the winter. This selection resulted in the planting of 2,742 8-foot first-line trial plots. At the same time, superior clones were also selected and advanced through subsequent stages (773 to second line trials, 313 to the increase stage). Assignments of permanent "L04" numbers were given to the 38 best clones of the 1999 crossing series.

PROCEDURES

In the selection stage of the LSU AgCenter's Sugarcane Variety Development Program, single stools are established from seed generated in the crossing stage. After evaluating and selecting the families for cane yield potential in the cross appraisal studies, clones with desirable phenotypes are selected and advanced through single stool, first line, second line, and increase stages. In the first stubble crop of the second-line trials, clones judged to have breeding or commercial value are assigned a permanent variety number and advanced to the nursery stage of testing.

RESULTS AND DISCUSSION

A total of 92,598 seedlings from 211 crosses of the 2003 crossing series were planted to the field in the spring of 2004 (Table 1). Many of these seedlings were progeny of crosses among commercial and superior experimental varieties. In the fall of 2004, individual selection was practiced on the 40,577 stubble single stools of the 2002 crossing series that survived the winter. The 2,742 clones selected and advanced from the single stools were planted in 8-foot first-line trial plots. Dates of planting and harvesting of all plots in the selection phase of the program can be found in Table 2.

Nearly 3,000 first-line trial plots of the 2001 crossing series were rated for cane yield and pest resistance in August of 2004 (Table 3). After screening for cane yield rating, acceptable clones were further evaluated for pest resistance (diseases and borer injury) stalk quality, and Brix (Table 3). This second stage of advancement was concluded with the planting of 773 clones in single row 16-foot second line trials plots.

Stalk counts were made on the 699 plant-cane second line trial plots of the 2000 crossing series in August 2004. Based on these counts and sucrose lab data collected in 2003, 313 clones were planted in two single row 16-foot plots representing the increase stage of the program (Table 4). One replication was planted in light soil and the other in heavy soil. These clones will be candidates for assignment in 2005. Of the 152 candidates from the plant-cane crop of the heavy soil increase plots, the best 38 clones from the 1999 crossing series were assigned permanent AL04" numbers (Table 5). These newly assigned AL04" varieties were then planted in replicated nursery trials at three on station locations (St. Gabriel Research Station, Iberia Research Station, USDA-ARS Ardoyne Farm).

The advancement summary of clones from crosses made in 1999 through 2002 is shown in Table 6. Crosses are sorted by female parent in ascending order, with the percentile ranking given for each cross in each stage of the program. The results of the 2002 crossing series cross appraisal in 2004 are presented in Table 7.

Table 1. Summary of selections, advancements and assignments made during 2004 by the Louisiana, "L," Sugarcane Variety Development Program's personnel.

	Crosses				Advanced to			
Crossing series	Progeny test	Selection program	Plants surviving transplanting	Over-wintered plants	1st line	2nd line	Increase	On-station Nurseries (L02 Assignments)
			---------- number of clones ----------					
X99		312	74263	46783	3371	0*	152	38
X00	76	211	98371	75973	4158	699	313	
X01	218	247	93019	46325	2902	773		
X02	200	192	72061	50951	2742			
X03	134	211	92598					

* These plots were not planted because of extremely wet conditions in 2002, therefore the "L04" assignments were made in the plant-cane heavy soil increase plots.

Table 2. Dates of seedling and line trials planted or harvested in 2004.

Crossing Series	Test	Crop	Date Planted	Date Harvested
X03	Seedlings	Planted	4/14 – 4/19/04	
X03	Progeny Test	Planted	4/20/04	
X02	Seedlings	First Stubble	4/4 -4/15/03	
X02	Progeny Test	First Stubble	4/14/03	
X02	First Line Trials	Planted	9/10/04	
X01	First Line Trials	Plant-cane	9/11 – 9/17/03	
X00	First Line Trials	First Stubble	9/5 - 9/1/02	11/5 – 11/9/04
X01	Second Line Trials	Planted	9/22/04	
X00	Second Line Trials	Plant-cane	10/1/03	12/2/04
X98	Second Line Trials	Second Stubble	9/26/01	10/20/04
X00	Light Soil Increase	Planted	9/28/04	
X99	Light Soil Increase	Plant-cane	10/2/03	11/22/04
X98	Light Soil Increase	First Stubble	10/17/02	10/22/04
X97	Light Soil Increase	Second Stubble	10/2/01	10/13/04
X00	Heavy Soil Increase	Planted	9/28/04	
X99	Heavy Soil Increase	Plant-cane	10/2/03	10/7/04
X97	Heavy Soil Increase	Second Stubble	10/2/01	10/13/04

Table 3. Numbers of experimental clones dropped for identified faults in the 2001 crossing series first-line trials.

Trait	Fault Frequency	Fault Percent
------------------------ 2902 clones enter first round of evaluation -----------------------------		
Initial Selection (Rating)	1662	57.3
----------------------- 1252 clones enter second round of evaluation ----------------------------		
Rust	1	0.1
Borers	14	0.5
Lodged	69	2.4
Pith / Tube	131	4.5
Short	18	0.6
Diameter	12	0.4
Smut	10	0.3
Other	5	0.2
-- 1922 clones dropped ---------------------------------------		
-----------------------------980 clones enter third round of evaluation ---------------------------		
Brix	207	7.1
Clones advanced	773	26.6

Table 4. Number of experimental clones dropped for identified faults in the 2000 crossing series of the plant-cane second line trial prior to advancement to the increase stage.

Trait	Fault Frequency	Fault Percent
--------------------------- 699 clones enter first round of evaluation ----------------------------		
Stalk count <75 per plot	266	38.1
Lodged	27	3.9
Pith / Tube	35	5.0
Diameter	14	2.0
Smut	2	0.3
Rust	3	0.4
Borers	2	0.3
Short	32	4.6
Other	5	0.7
--- 386 clones dropped --------------------------------------		
Clones advanced to Increase stage	313	44.8

Table 5. Mean yield data of the 2004 "L" assignments made in plant-cane heavy soil increase plots.

Variety	Female	Male	Sugar Per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
			Lbs/A	Tons/A	Lbs/Ton	Lbs	Stalks/A
LCP1985-384	CP77-310	CP77-407	5740	29.5	195	2.12	25561
HOCP1991-555	CP83-644	LCP82-094	5032	26.3	191	2.35	21175
HOCP1996-540	LCP86-454	LCP85-384	6052	28.5	212	2.42	21629
L2004-400	TUCCP77-042	LCP85-384	6730	32.0	211	2.52	25410
L2004-401	L91-255	LCP85-384	5151	21.4	241	1.57	27225
L2004-402	HOCP97-609	LCP86-454	4506	22.1	204	1.98	22385
L2004-403	CP78-357	L94-432	4629	26.1	177	2.34	22385
L2004-404	CP88-702	HOCP92-618	5274	25.9	203	2.35	22083
L2004-405	HOCP96-509	L95-482	5031	26.2	192	2.19	23898
L2004-406	HOCP92-624	L91-255	6003	32.2	186	2.32	27830
L2004-407	HOCP94-806	HOCP85-845	5464	28.7	190	2.24	25713
L2004-408	LCP86-454	LCP85-384	6709	30.7	218	1.88	32670
L2004-409	CP89-879	L94-426	5825	25.4	230	1.65	30855
L2004-410	HOCP92-648	LCP85-384	6132	24.9	246	1.6	31158
L2004-411	HOCP97-670	L94-432	5747	27.8	207	1.88	29645
L2004-413	US90-018	L94-428	3765	27.7	136	2.08	26620
L2004-414	HO96-565	LCP85-384	4490	26.1	172	1.92	27225
L2004-415	CP89-879	L94-428	4662	26.6	175	2.12	25108
L2004-416	CP65-357	LCP85-384	4885	24.6	198	2.2	22385
L2004-417	HOCP92-624	LCP81-010	4203	19.0	221	1.83	20873
L2004-418	HOCP92-648	LCP85-384	6031	24.8	244	1.71	29040
L2004-419	LCP86-454	LCP85-384	4985	27.2	183	1.9	28738
L2004-420	LCP86-454	LCP85-384	6907	37.6	183	2.71	27830
L2004-421	HOCP92-648	US90-018	5257	34.8	151	2.3	30250
L2004-422	L89-113	HOCP92-618	3567	26.8	133	2.19	24503
L2004-423	L98-207	LCP81-010	6846	36.7	186	2.73	26923
L2004-424	L94-432	L98-209	6627	28.5	233	2.24	25410
L2004-425	L94-432	LCP85-384	6891	33.8	204	2.48	27225
L2004-426	L96-026	HO95-988	5277	25.1	210	2.1	23898
L2004-427	HOCP92-648	LCP85-384	5051	25.5	198	1.74	29343
L2004-428	HOCP92-648	LCP85-384	5214	23.8	219	1.69	28133
L2004-429	HO89-889	LCP85-384	4239	20.1	211	1.82	22083
L2004-430	CP83-644	L96-040	6774	34.9	194	2.08	33578
L2004-431	HOCP94-806	HOCP97-621	6191	29.6	209	2.25	26318
L2004-432	L98-207	L94-432	5839	29.1	201	1.75	33275
L2004-433	HOCP92-624	HO89-889	6424	27.6	233	2.07	26620
L2004-434	HOCP97-609	HOCP85-845	6530	34.0	192	2.44	27830
L2004-435	HOCP92-624	L95-482	7007	30.8	227	2.43	25410
L2004-436	CP83-644	L96-063	4796	18.4	261	1.9	19360
L2004-437	L97-128	HO95-988	6462	29.5	219	1.79	32973
L2004-438	LCP86-454	LCP85-384	4818	27.7	174	2.24	24805

Table 6. Advancement summary of crosses in the 1999 through 2002 crossing series.

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
1999 Crossing Series										
CP65-357	L95-482	407	16	50	.	.	1	71	0	43
CP65-357	LCP85-384	94	20	99	.	.	3	99	0	43
CP65-357	LCP85-384	190	24	95	.	.	3	97	1	97
CP70-321	LCP82-089	176	3	31	.	.	0	33	0	43
CP72-370	HO95-988	469	24	62	.	.	0	33	0	43
CP77-405	HOCP92-618	185	0	12	.	.	0	33	0	43
CP77-405	HOCP95-931	178	0	12	.	.	0	33	0	43
CP77-405	HOCP97-621	393	17	56	.	.	0	33	0	43
CP77-405	L90-191	197	0	12	.	.	0	33	0	43
CP77-405	L94-426	207	1	25	.	.	0	33	0	43
CP77-405	L94-428	377	0	12	.	.	0	33	0	43
CP77-405	L94-428	354	0	12	.	.	0	33	0	43
CP77-405	L96-040	377	0	12	.	.	0	33	0	43
CP77-405	LCP85-384	176	0	12	.	.	0	33	0	43
CP77-405	US90-018	182	0	12	.	.	0	33	0	43
CP78-357	HOCP92-618	207	23	92	.	.	0	33	0	43
CP78-357	L94-432	1106	75	73	.	.	4	79	1	86
CP78-357	L96-030	214	21	90	.	.	1	82	0	43
CP78-357	US90-018	188	6	41	.	.	0	33	0	43
CP79-318	HO95-988	375	0	12	.	.	0	33	0	43
CP79-318	HOCP94-806	232	2	26	.	.	0	33	0	43
CP79-318	HOCP95-931	162	0	12	.	.	0	33	0	43
CP79-318	L97-137	544	20	47	.	.	0	33	0	43
CP79-318	LCP81-010	214	0	12	.	.	0	33	0	43
CP79-318	LCP85-384	698	32	58	.	.	2	75	0	43
CP79-318	LCP85-384	407	17	55	.	.	0	33	0	43
CP79-318	LCP85-384	161	28	98	.	.	1	89	0	43
CP79-348	HOCP92-618	211	0	12	.	.	0	33	0	43
CP79-348	L94-426	1079	18	31	.	.	1	66	0	43
CP82-550	LCP81-010	84	3	45	.	.	0	33	0	43
CP83-644	HOCP97-621	93	2	35	.	.	0	33	0	43
CP83-644	L91-255	194	14	75	.	.	0	33	0	43
CP83-644	L91-255	399	27	73	.	.	0	33	0	43
CP83-644	L96-030	64	12	98	.	.	0	33	0	43
CP83-644	L96-040	140	11	80	.	.	1	91	1	99
CP83-644	L96-063	435	33	77	.	.	3	90	1	90
CP83-644	L98-207	141	7	60	.	.	0	33	0	43
CP83-644	LCP81-010	384	16	55	.	.	0	33	0	43
CP83-644	LCP82-089	347	23	71	.	.	0	33	0	43
CP83-644	LCP85-384	398	0	12	.	.	0	33	0	43
CP88-702	HOCP92-618	179	6	43	.	.	2	94	1	97
CP88-702	L94-428	243	7	39	.	.	0	33	0	43
CP88-702	LCP86-454	86	2	36	.	.	0	33	0	43
CP89-879	HOCP92-618	213	9	55	.	.	1	83	0	43
CP89-879	L91-255	347	24	74	.	.	0	33	0	43
CP89-879	L94-426	212	6	38	.	.	1	83	1	96

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
CP89-879	L94-428	413	51	94	.	.	3	91	1	92
CP89-879	L94-428	148	0	12	.	.	0	33	0	43
CP89-879	L96-030	221	18	81	.	.	1	81	0	43
CP89-879	LCP81-010	237	12	62	.	.	0	33	0	43
CP89-879	LCP81-010	210	4	32	.	.	0	33	0	43
HO89-889	LCP85-384	730	42	67	.	.	1	67	1	87
HO95-985	CP77-405	232	18	79	.	.	0	33	0	43
HO95-985	HOCP85-845	163	9	65	.	.	1	89	0	43
HO95-985	HOCP95-931	190	3	31	.	.	0	33	0	43
HO95-985	L91-255	376	29	78	.	.	1	72	0	43
HO95-985	L94-426	200	15	76	.	.	0	33	0	43
HO95-985	L94-428	190	10	63	.	.	0	33	0	43
HO95-985	L98-209	236	12	62	.	.	2	91	0	43
HO95-985	LCP85-384	168	27	97	.	.	2	95	0	43
HO95-988	LCP82-089	181	0	12	.	.	0	33	0	43
HO96-565	HOCP92-618	206	14	73	.	.	1	86	0	43
HO96-565	LCP85-384	152	21	96	.	.	1	89	1	98
HOCP85-845	99P3	194	0	12	.	.	0	33	0	43
HOCP85-845	L97-137	209	18	83	.	.	0	33	0	43
HOCP89-846	L94-428	374	20	63	.	.	1	73	0	43
HOCP92-618	LCP85-384	218	9	53	.	.	0	33	0	43
HOCP92-624	99P4	170	7	53	.	.	0	33	0	43
HOCP92-624	HO89-889	431	53	94	.	.	6	96	1	91
HOCP92-624	HOCP85-845	238	15	69	.	.	0	33	0	43
HOCP92-624	HOCP92-618	83	3	45	.	.	0	33	0	43
HOCP92-624	HOCP95-931	206	0	12	.	.	0	33	0	43
HOCP92-624	L75-056	453	0	12	.	.	0	33	0	43
HOCP92-624	L91-255	366	35	89	.	.	2	87	1	93
HOCP92-624	L94-426	185	12	70	.	.	0	33	0	43
HOCP92-624	L94-428	168	9	64	.	.	0	33	0	43
HOCP92-624	L95-482	433	16	47	.	.	1	70	1	91
HOCP92-624	L97-137	407	23	66	.	.	0	33	0	43
HOCP92-624	LCP81-010	789	17	35	.	.	1	67	1	87
HOCP92-624	LCP85-384	86	7	81	.	.	2	98	0	43
HOCP92-624	LCP86-454	634	48	77	.	.	0	33	0	43
HOCP92-648	HOCP95-931	233	37	97	.	.	1	80	0	43
HOCP92-648	HOCP96-509	362	0	12	.	.	0	33	0	43
HOCP92-648	L91-255	204	7	43	.	.	0	33	0	43
HOCP92-648	L96-063	359	27	76	.	.	0	33	0	43
HOCP92-648	LCP85-384	625	64	91	.	.	9	97	3	97
HOCP92-648	LCP85-384	627	29	58	.	.	2	78	1	89
HOCP92-648	US90-018	219	9	53	.	.	2	92	1	95
HOCP94-806	HOCP85-845	453	34	76	.	.	1	69	1	89
HOCP94-806	HOCP92-618	389	34	84	.	.	1	71	0	43
HOCP94-806	HOCP97-621	91	1	27	.	.	0	33	0	43
HOCP94-806	HOCP97-621	420	36	83	.	.	4	93	1	92
HOCP95-931	L75-056	638	35	65	.	.	3	83	0	43

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
HOCP96-509	HO89-889	170	7	53	.	.	0	33	0	43
HOCP96-509	HOCP92-618	227	5	35	.	.	0	33	0	43
HOCP96-509	L75-056	460	56	93	.	.	5	94	0	43
HOCP96-509	L94-428	204	8	50	.	.	0	33	0	43
HOCP96-509	L94-432	352	10	38	.	.	1	75	0	43
HOCP96-509	L95-482	151	14	87	.	.	1	90	1	99
HOCP96-509	L97-117	523	44	82	.	.	1	68	0	43
HOCP96-509	LCP85-384	351	7	33	.	.	0	33	0	43
HOCP96-518	LCP85-384	306	0	12	.	.	0	33	0	43
HOCP96-519	L94-428	213	1	25	.	.	0	33	0	43
HOCP96-519	LCP86-454	239	0	12	.	.	0	33	0	43
HOCP96-522	HO95-988	392	19	59	.	.	0	33	0	43
HOCP96-522	HOCP92-618	83	0	12	.	.	0	33	0	43
HOCP96-522	L91-255	76	7	86	.	.	1	96	0	43
HOCP96-522	L95-482	332	5	30	.	.	1	77	0	43
HOCP96-522	L96-026	215	0	12	.	.	0	33	0	43
HOCP96-522	L98-209	155	9	67	.	.	0	33	0	43
HOCP96-522	LCP82-089	325	14	56	.	.	1	78	0	43
HOCP96-522	LCP85-384	219	21	89	.	.	0	33	0	43
HOCP96-522	LCP85-384	1031	71	74	.	.	0	33	0	43
HOCP96-522	US96-001	203	32	97	.	.	0	33	0	43
HOCP96-525	L94-428	394	0	12	.	.	0	33	0	43
HOCP96-525	L94-432	344	0	12	.	.	0	33	0	43
HOCP96-525	LCP85-384	460	0	12	.	.	0	33	0	43
HOCP97-609	HOCP85-845	224	19	82	.	.	4	97	1	95
HOCP97-609	HOCP97-621	431	40	87	.	.	0	33	0	43
HOCP97-609	L94-426	140	0	12	.	.	0	33	0	43
HOCP97-609	LCP86-454	211	15	75	.	.	1	84	1	96
HOCP97-620	LCP81-030	355	28	80	.	.	0	33	0	43
HOCP97-621	HOCP85-845	389	0	12	.	.	0	33	0	43
HOCP97-621	LCP85-384	1086	40	47	.	.	2	67	0	43
HOCP97-641	HOCP94-806	234	11	58	.	.	0	33	0	43
HOCP97-646	L75-056	361	7	32	.	.	1	74	0	43
HOCP97-646	L95-482	170	2	28	.	.	0	33	0	43
HOCP97-670	L94-432	229	13	66	.	.	0	33	0	43
HOCP97-670	L94-432	173	19	91	.	.	1	88	1	98
HOCP97-697	L94-426	194	7	45	.	.	0	33	0	43
L75-056	L98-207	243	19	79	.	.	0	33	0	43
L89-113	HO95-988	388	26	72	.	.	4	94	0	43
L89-113	HOCP85-845	178	6	43	.	.	0	33	0	43
L89-113	HOCP92-618	435	17	50	.	.	1	69	1	90
L89-113	L91-255	399	0	12	.	.	0	33	0	43
L89-113	L94-428	462	0	12	.	.	0	33	0	43
L89-113	L94-428	423	17	51	.	.	0	33	0	43
L89-113	L94-432	366	0	12	.	.	0	33	0	43
L89-113	LCP82-089	197	4	33	.	.	0	33	0	43
L90-191	HOCP94-806	85	3	44	.	.	2	98	0	43

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
L90-191	LCP82-089	222	0	12	.	.	0	33	0	43
L91-255	HO89-889	375	6	31	.	.	0	33	0	43
L91-255	HOCP95-931	167	5	40	.	.	0	33	0	43
L91-255	L94-428	195	3	30	.	.	0	33	0	43
L91-255	LCP82-089	413	0	12	.	.	0	33	0	43
L91-255	LCP82-089	359	28	79	.	.	1	74	0	43
L91-255	LCP85-384	646	79	93	.	.	6	93	1	88
L91-255	US90-018	207	5	37	.	.	0	33	0	43
L94-426	HOCP85-845	175	5	39	.	.	0	33	0	43
L94-426	LCP82-089	224	3	28	.	.	0	33	0	43
L94-426	LCP85-384	225	17	77	.	.	1	81	0	43
L94-428	LCP86-454	150	0	12	.	.	0	33	0	43
L94-432	CP78-357	326	28	83	.	.	1	77	0	43
L94-432	HO95-988	176	0	12	.	.	0	33	0	43
L94-432	HOCP85-845	183	7	48	.	.	1	87	0	43
L94-432	HOCP92-618	407	0	12	.	.	0	33	0	43
L94-432	HOCP97-621	323	14	56	.	.	1	78	0	43
L94-432	HOCP97-670	221	0	12	.	.	0	33	0	43
L94-432	L91-255	203	8	50	.	.	0	33	0	43
L94-432	L98-209	342	23	72	.	.	1	76	1	94
L94-432	LCP85-384	690	64	87	.	.	6	92	1	88
L94-432	US93-015	189	7	47	.	.	0	33	0	43
L95-482	LCP82-089	542	13	37	.	.	0	33	0	43
L96-026	CP83-644	158	0	12	.	.	0	33	0	43
L96-026	HO95-988	504	33	70	.	.	1	68	1	89
L96-026	HOCP85-845	198	0	12	.	.	0	33	0	43
L96-026	HOCP85-845	302	12	51	.	.	1	79	0	43
L96-026	HOCP97-670	421	28	72	.	.	2	84	0	43
L96-026	L91-255	340	11	41	.	.	0	33	0	43
L96-026	LCP81-010	237	0	12	.	.	0	33	0	43
L96-026	LCP82-089	190	0	12	.	.	0	33	0	43
L96-030	HO95-988	193	18	87	.	.	0	33	0	43
L96-030	HOCP96-525	208	9	56	.	.	0	33	0	43
L96-040	HOCP95-931	404	0	12	.	.	0	33	0	43
L96-040	L94-426	206	7	43	.	.	1	86	0	43
L96-092	HOCP96-525	160	0	12	.	.	0	33	0	43
L97-113	HOCP85-845	167	24	96	.	.	2	95	0	43
L97-113	L91-255	188	0	12	.	.	0	33	0	43
L97-113	LCP81-010	205	16	79	.	.	1	86	0	43
L97-113	US96-005	425	5	28	.	.	0	33	0	43
L97-117	L94-432	197	0	12	.	.	0	33	0	43
L97-121	L94-428	231	3	28	.	.	1	81	0	43
L97-121	L94-432	158	18	92	.	.	0	33	0	43
L97-121	US90-018	227	9	51	.	.	0	33	0	43
L97-128	HO95-988	420	37	85	.	.	1	70	1	92
L97-128	L91-255	473	0	12	.	.	0	33	0	43
L97-128	LCP85-384	859	0	12	.	.	0	33	0	43

Table 6. Continued

Female	Male	Survive	1st Line		2nd Line		Increase		Assignment	
			No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l
L97-137	US96-001	194	6	41	.	.	0	33	0	43
L97-142	HO95-988	390	0	12	.	.	0	33	0	43
L97-142	HO95-988	215	0	12	.	.	0	33	0	43
L97-142	LCP82-089	195	0	12	.	.	0	33	0	43
L97-143	L94-428	166	6	45	.	.	0	33	0	43
L97-147	L94-432	165	15	85	.	.	0	33	0	43
L98-191	HOCP97-621	87	10	93	.	.	0	33	0	43
L98-207	HOCP85-845	200	6	40	.	.	0	33	0	43
L98-207	HOCP92-618	329	17	63	.	.	0	33	0	43
L98-207	L94-428	372	0	12	.	.	0	33	0	43
L98-207	L94-432	816	41	60	.	.	2	70	1	86
L98-207	LCP81-010	379	24	69	.	.	1	72	1	93
LCP81-010	HOCP95-931	208	0	12	.	.	0	33	0	43
LCP81-010	HOCP97-621	402	8	33	.	.	0	33	0	43
LCP81-010	L91-255	417	24	67	.	.	2	85	0	43
LCP81-010	L94-432	1029	0	12	.	.	0	33	0	43
LCP81-010	LCP81-030	208	0	12	.	.	0	33	0	43
LCP81-010	LCP85-384	1113	110	91	.	.	0	33	0	43
LCP81-010	LCP85-384	1564	64	53	.	.	1	66	0	43
LCP81-030	L94-432	112	0	12	.	.	0	33	0	43
LCP82-089	HOCP97-621	182	11	68	.	.	0	33	0	43
LCP85-384	99P3	387	37	89	.	.	1	72	0	43
LCP86-454	99P4	238	7	39	.	.	0	33	0	43
LCP86-454	HO95-988	599	13	35	.	.	0	33	0	43
LCP86-454	L96-040	146	0	12	.	.	0	33	0	43
LCP86-454	LCP85-384	207	19	86	.	.	1	85	0	43
LCP86-454	LCP85-384	1098	103	88	.	.	4	80	4	94
LHO83-153	LCP82-089	192	10	63	.	.	0	33	0	43
LHO83-153	LCP85-384	189	18	89	.	.	0	33	0	43
TUCCP77-042	LCP85-384	6	6	99	.	.	6	99	0	43
US79-010	HOCP85-845	348	20	66	.	.	1	75	0	43
US79-010	HOCP92-618	219	14	70	.	.	0	33	0	43
US79-010	L94-426	206	0	12	.	.	0	33	0	43
US79-010	LCP85-384	186	9	59	.	.	0	33	0	43
US79-010	LCP86-454	439	56	95	.	.	2	82	0	43
US80-004	HOCP92-618	71	1	29	.	.	0	33	0	43
US80-004	L94-428	188	7	47	.	.	0	33	0	43
US90-018	HOCP85-845	409	2	25	.	.	0	33	0	43
US90-018	L94-428	364	13	45	.	.	1	73	1	94
US90-018	L94-428	515	12	36	.	.	0	33	0	43
US90-021	LCP81-010	179	11	68	.	.	1	88	0	43
US90-021	LCP81-030	206	0	12	.	.	0	33	0	43
US93-016	L94-426	192	9	58	.	.	0	33	0	43
US93-016	L94-428	267	0	12	.	.	0	33	0	43
US93-016	L94-428	205	10	60	.	.	0	33	0	43
US93-016	LCP85-384	101	2	33	.	.	0	33	0	43
US93-016	LCP85-384	181	2	27	.	.	0	33	0	43

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
US96-001	US90-018	340	30	85	.	.	1	76	0	43
US96-005	L94-428	379	15	51	.	.	0	33	0	43
2000 Crossing Series										
CP65-357	L91-255	429	30	79	2	55	0	21	.	.
CP65-357	LCP85-384	984	40	53	6	58	4	65	.	.
CP77-405	L96-040	249	8	42	1	38	0	21	.	.
CP77-405	L98-197	242	16	77	3	80	2	87	.	.
CP77-405	L98-209	483	7	18	1	31	1	49	.	.
CP77-405	LCP85-384	940	20	29	3	35	3	60	.	.
CP78-317	L98-209	496	14	37	2	38	0	21	.	.
CP78-317	L99-229	245	22	91	3	77	1	66	.	.
CP78-317	LCP85-384	493	21	55	1	29	0	21	.	.
CP79-318	HOCP92-618	251	8	42	0	13	0	21	.	.
CP79-318	L96-040	243	16	77	0	13	0	21	.	.
CP79-318	L98-207	254	10	50	1	37	0	21	.	.
CP79-318	L98-209	249	5	27	3	75	1	63	.	.
CP79-318	L99-233	962	18	25	5	56	2	50	.	.
CP79-318	LCP85-384	727	9	18	0	13	0	21	.	.
CP83-644	HOCP97-609	251	10	51	4	89	1	62	.	.
CP89-846	LCP85-384	249	12	61	4	90	2	86	.	.
HO91-572	L94-428	250	2	16	0	13	0	21	.	.
HO91-572	LCP85-384	688	41	72	4	57	0	21	.	.
HO91-572	LCP87-492	244	0	6	0	13	0	21	.	.
HO95-988	HOCP85-845	241	11	59	1	41	0	21	.	.
HO95-988	HOCP96-561	249	5	27	0	13	0	21	.	.
HO95-988	L90-191	227	14	74	1	51	1	76	.	.
HO95-988	L94-433	426	27	75	9	93	7	97	.	.
HO95-988	L96-040	480	0	6	0	13	0	21	.	.
HO95-988	L98-207	733	31	54	4	56	4	79	.	.
HO95-988	L98-209	247	6	31	1	38	1	64	.	.
HO95-988	LCP85-384	1047	77	82	9	70	3	58	.	.
HOCP85-845	HOCP92-624	241	15	74	5	92	2	88	.	.
HOCP85-845	HOCP96-540	507	21	53	1	29	0	21	.	.
HOCP85-845	L89-113	254	1	14	0	13	0	21	.	.
HOCP85-845	L91-255	220	5	30	0	13	0	21	.	.
HOCP85-845	L98-209	470	0	6	0	13	0	21	.	.
HOCP85-845	LCP85-384	2348	129	68	11	55	5	54	.	.
HOCP91-522	US80-004	194	14	81	2	73	0	21	.	.
HOCP91-552	L90-191	182	3	21	0	13	0	21	.	.
HOCP91-552	L91-255	476	34	80	5	74	3	83	.	.
HOCP91-552	L94-432	211	9	55	1	55	1	78	.	.
HOCP91-552	L99-233	912	26	39	3	36	1	44	.	.
HOCP92-618	HOCP96-540	697	63	91	9	82	0	21	.	.
HOCP92-618	L99-233	245	3	18	0	13	0	21	.	.

Table 6. Continued

Female	Male	Survive	1st Line		2nd Line		Increase		Assignment	
			No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l	No.	Rank Pcnt'l
HOCP92-624	HOCP85-845	477	16	45	2	45	1	52	.	.
HOCP92-624	HOCP92-618	251	17	79	2	64	2	85	.	.
HOCP92-624	HOCP96-522	241	9	47	3	80	1	68	.	.
HOCP92-624	HOCP96-540	977	82	88	10	73	6	81	.	.
HOCP92-624	HOCP96-561	473	2	14	0	13	0	21	.	.
HOCP92-624	HOCP97-601	249	11	56	2	64	1	63	.	.
HOCP92-624	HOCP97-609	498	46	92	16	96	6	94	.	.
HOCP92-624	HOCP97-621	486	14	39	3	59	1	48	.	.
HOCP92-624	L89-113	735	44	72	5	61	0	21	.	.
HOCP92-624	L91-255	1185	106	90	26	94	15	96	.	.
HOCP92-624	L91-281	239	29	98	2	67	1	70	.	.
HOCP92-624	L98-197	483	40	87	7	85	4	87	.	.
HOCP92-624	L98-209	236	8	45	2	69	2	91	.	.
HOCP92-624	L99-226	239	8	43	2	67	2	89	.	.
HOCP92-624	LCP85-384	2371	110	59	20	67	8	61	.	.
HOCP92-624	LCP85-384	715	32	57	3	45	1	45	.	.
HOCP92-624	LCP86-454	665	26	50	4	57	2	59	.	.
HOCP92-624	US80-004	252	7	37	1	38	1	61	.	.
HOCP92-648	HOCP85-845	243	6	33	4	90	2	86	.	.
HOCP92-648	HOCP92-624	228	8	46	3	84	3	97	.	.
HOCP92-648	L91-281	246	23	92	3	77	0	21	.	.
HOCP92-648	L93-363	238	7	39	2	67	2	90	.	.
HOCP92-648	L96-040	230	15	76	2	71	1	75	.	.
HOCP92-648	L98-209	238	2	16	0	13	0	21	.	.
HOCP92-648	LCP85-384	700	34	62	5	62	4	80	.	.
HOCP94-867	L99-226	227	36	99	3	84	1	76	.	.
HOCP95-950	LCP85-384	482	10	29	2	41	1	49	.	.
HOCP95-951	HOCP96-540	247	0	6	0	13	0	21	.	.
HOCP95-951	LCP85-384	732	24	43	5	61	3	67	.	.
HOCP96-522	CP78-317	501	20	51	1	29	0	21	.	.
HOCP96-522	HOCP96-561	453	38	88	6	84	1	55	.	.
HOCP96-522	L91-255	498	28	70	3	57	3	80	.	.
HOCP96-522	L94-432	223	9	51	2	72	2	92	.	.
HOCP96-522	LCP85-384	973	78	86	8	64	3	59	.	.
HOCP96-522	LCP85-384	615	0	6	0	13	0	21	.	.
HOCP96-540	HOCP85-845	222	10	57	0	13	0	21	.	.
HOCP96-540	HOCP91-552	232	26	95	6	95	3	96	.	.
HOCP96-540	HOCP92-624	245	0	6	0	13	0	21	.	.
HOCP96-540	L91-281	398	0	6	0	13	0	21	.	.
HOCP96-540	L92-312	248	0	6	0	13	0	21	.	.
HOCP96-540	L94-433	243	0	6	0	13	0	21	.	.
HOCP96-540	L99-229	219	0	6	0	13	0	21	.	.
HOCP96-540	US96-001	216	0	6	0	13	0	21	.	.
HOCP96-561	HOCP92-624	244	21	89	9	97	3	95	.	.
HOCP96-561	L99-229	251	19	84	4	89	2	85	.	.
HOCP96-561	L99-233	776	26	45	6	63	1	44	.	.
HOCP97-601	HOCP92-618	245	11	57	3	77	1	66	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
HOCP97-606	LCP85-384	486	9	25	2	41	1	48	.	.
HOCP97-609	HOCP85-845	229	6	34	3	83	2	92	.	.
HOCP97-609	HOCP92-624	469	0	6	0	13	0	21	.	.
HOCP97-609	HOCP97-621	215	13	72	1	55	1	77	.	.
HOCP97-609	L91-255	483	19	50	4	65	3	82	.	.
HOCP97-609	LCP81-010	235	1	14	0	13	0	21	.	.
HOCP97-609	LCP85-384	227	9	51	1	51	0	21	.	.
HOCP97-621	HOCP96-540	249	0	6	0	13	0	21	.	.
HOCP97-621	LCP85-384	946	26	36	7	62	3	60	.	.
HOCP97-645	L98-197	234	12	65	5	94	2	91	.	.
HOCP97-645	L99-226	469	37	85	1	31	0	21	.	.
HOCP98-743	L98-209	675	0	6	0	13	0	21	.	.
HOCP98-743	L99-226	236	0	6	0	13	0	21	.	.
HOCP98-776	HOCP97-621	240	16	78	1	45	1	69	.	.
HOCP98-776	L91-281	250	4	21	0	13	0	21	.	.
HOCP98-776	LCP81-010	711	15	29	2	34	0	21	.	.
L89-113	L96-040	230	32	99	13	99	6	99	.	.
L89-113	LCP85-384	482	32	77	10	92	6	95	.	.
L90-191	LCP85-384	239	18	83	2	67	1	70	.	.
L90-191	US96-001	236	0	6	0	13	0	21	.	.
L91-255	HOCP85-845	481	12	33	1	31	0	21	.	.
L91-255	L96-040	447	0	6	0	13	0	21	.	.
L91-255	LCP85-384	710	36	65	2	34	2	57	.	.
L91-281	L91-255	242	18	82	1	41	0	21	.	.
L91-281	L96-040	247	4	21	0	13	0	21	.	.
L91-281	L98-197	476	17	47	3	60	1	52	.	.
L91-281	L98-209	461	35	84	5	75	3	84	.	.
L91-281	L99-237	238	23	93	5	92	0	21	.	.
L91-281	LCP85-384	1205	60	63	5	41	3	56	.	.
L93-363	HOCP92-618	239	0	6	0	13	0	21	.	.
L93-363	L96-040	477	24	63	4	67	3	83	.	.
L93-363	LCP85-384	243	7	39	3	78	1	67	.	.
L93-399	HOCP85-845	489	24	62	6	78	0	21	.	.
L93-399	HOCP91-552	237	12	65	3	81	2	90	.	.
L93-399	L99-226	233	6	34	1	49	0	21	.	.
L94-426	L96-040	248	7	37	3	76	1	64	.	.
L94-426	L98-209	249	11	56	0	13	0	21	.	.
L94-426	L99-224	234	13	70	1	49	0	21	.	.
L94-426	L99-233	234	9	48	0	13	0	21	.	.
L94-426	LCP85-384	947	25	34	3	35	1	43	.	.
L94-426	LCP86-454	237	19	86	5	93	1	72	.	.
L94-428	HOCP97-601	472	16	45	2	45	1	53	.	.
L94-428	L91-281	241	32	98	10	98	7	99	.	.
L94-428	L94-433	234	18	85	1	49	0	21	.	.
L94-428	L99-226	226	12	67	1	51	0	21	.	.
L94-428	LCP81-010	675	16	31	0	13	0	21	.	.
L94-428	LCP85-384	712	39	68	1	28	1	45	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
L94-432	HOCP85-845	244	5	27	1	41	0	21	.	.
L96-040	HOCP98-776	471	0	6	0	13	0	21	.	.
L96-040	LCP81-010	242	15	74	3	80	1	68	.	.
L96-040	LCP85-384	1193	36	41	4	37	2	48	.	.
L97-128	HOCP85-845	237	2	16	0	13	0	21	.	.
L97-128	HOCP92-618	237	15	75	0	13	0	21	.	.
L97-128	L91-281	993	119	97	13	83	6	81	.	.
L97-128	L93-363	479	52	94	18	98	4	89	.	.
L97-128	L99-229	471	53	96	6	81	2	73	.	.
L97-128	L99-233	199	22	95	3	87	2	93	.	.
L97-128	LCP81-010	699	33	60	3	49	1	47	.	.
L97-128	LCP87-492	468	40	89	4	69	1	55	.	.
L97-128	US80-004	236	12	65	0	13	0	21	.	.
L97-128	US96-001	476	32	78	3	60	1	52	.	.
L98-158	L99-233	225	11	62	1	51	0	21	.	.
L98-197	HOCP96-522	204	0	6	0	13	0	21	.	.
L98-197	US99-002	225	0	6	0	13	0	21	.	.
L98-198	HOCP97-621	445	26	71	5	75	1	56	.	.
L98-198	US79-010	474	35	82	2	45	1	53	.	.
L98-207	CP79-318	702	11	21	2	34	2	58	.	.
L98-207	L92-312	250	25	93	4	89	1	62	.	.
L98-209	L94-428	238	0	6	0	13	0	21	.	.
L98-209	L99-233	476	9	25	3	60	1	52	.	.
L98-209	LCP85-384	461	0	6	0	13	0	21	.	.
L99-224	L99-226	240	14	71	2	65	0	21	.	.
L99-224	L99-233	234	8	45	2	69	1	74	.	.
L99-226	HOCP96-522	231	23	93	2	71	1	74	.	.
L99-226	L99-233	711	14	27	3	45	1	46	.	.
L99-226	LCP85-384	688	0	6	0	13	0	21	.	.
L99-229	LCP81-010	240	11	59	1	45	0	21	.	.
L99-229	LCP85-384	474	19	51	7	87	2	72	.	.
L99-233	LCP85-384	838	52	74	25	95	16	98	.	.
LCP81-010	CP78-317	458	1	13	0	13	0	21	.	.
LCP81-010	HOCP85-845	439	8	24	1	33	0	21	.	.
LCP81-010	HOCP96-561	186	7	48	0	13	0	21	.	.
LCP81-010	HOCP97-609	475	11	30	7	86	2	71	.	.
LCP81-010	HOCP97-621	229	4	23	1	51	1	75	.	.
LCP81-010	L92-312	243	13	67	3	78	2	86	.	.
LCP81-010	L94-428	239	13	67	1	45	1	70	.	.
LCP81-010	L96-040	239	6	33	0	13	0	21	.	.
LCP81-010	L98-207	705	12	23	1	28	1	46	.	.
LCP81-010	L99-233	817	13	21	1	27	0	21	.	.
LCP81-010	LCP85-384	1687	122	81	26	88	9	79	.	.
LCP81-010	US96-001	236	7	41	0	13	0	21	.	.
LCP81-010	US99-002	221	11	63	0	13	0	21	.	.
LCP81-030	HOCP85-845	249	7	37	1	38	1	63	.	.
LCP85-384	CP79-318	243	0	6	0	13	0	21	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
LCP85-384	HOCP92-624	236	0	6	0	13	0	21	.	.
LCP85-384	HOCP96-540	720	53	82	22	96	13	98	.	.
LCP85-384	L93-363	224	18	86	2	72	1	76	.	.
LCP85-384	L94-433	712	21	39	3	45	2	57	.	.
LCP85-384	L99-226	757	0	6	0	13	0	21	.	.
LCP85-384	LCP86-454	943	18	25	1	27	1	43	.	.
LCP86-454	L99-226	710	26	47	5	62	0	21	.	.
LCP86-454	L99-234	252	6	31	0	13	0	21	.	.
LCP86-454	LCP85-384	1861	157	88	27	85	14	84	.	.
LCP87-492	HOCP97-609	241	29	97	12	99	2	88	.	.
LCP87-492	L89-113	219	6	36	0	13	0	21	.	.
LCP87-492	L91-281	487	25	65	5	73	3	82	.	.
LCP87-492	L94-432	224	0	6	0	13	0	21	.	.
LCP87-492	L98-209	481	8	23	1	31	1	50	.	.
LCP87-492	L99-233	446	41	92	16	97	5	94	.	.
TUCCP77-042	LCP85-384	716	82	96	12	91	7	93	.	.
US79-010	HOCP96-540	237	13	68	3	81	1	72	.	.
US79-010	L98-209	236	13	68	1	45	1	73	.	.
US79-010	LCP85-384	700	19	36	3	49	1	47	.	.
US79-010	LCP87-492	246	4	21	1	41	1	65	.	.
US80-004	LCP85-384	664	7	17	3	53	3	77	.	.
US92-010	L91-281	201	9	57	3	87	1	78	.	.
US96-001	LCP85-384	948	15	21	2	31	0	21	.	.
US96-002	L94-432	221	3	18	1	53	0	21	.	.
US96-002	LCP85-384	468	19	53	1	31	1	55	.	.
<u>2001 Crossing Series</u>										
CP65-357	L92-312	240	10	61	3	72	.	.	.	.
CP77-405	L98-207	187	0	21	0	23	.	.	.	.
CP77-405	LCP85-384	394	0	21	0	23	.	.	.	.
CP78-317	HOCP91-552	191	0	21	0	23	.	.	.	.
CP79-318	L98-209	229	0	21	0	23	.	.	.	.
CP79-318	L98-209	225	0	21	0	23	.	.	.	.
CP83-644	HOCP96-540	430	15	57	9	86	.	.	.	.
CP83-644	HOCP96-561	210	7	55	1	51	.	.	.	.
CP83-644	HOCP97-621	218	0	21	0	23	.	.	.	.
CP83-644	HOCP98-778	212	0	21	0	23	.	.	.	.
CP83-644	L98-209	402	24	78	8	85	.	.	.	.
CP83-644	L99-226	398	0	21	0	23	.	.	.	.
CP83-644	L99-238	175	0	21	0	23	.	.	.	.
CP89-846	HOCP97-621	229	0	21	0	23	.	.	.	.
CP89-846	L98-209	385	0	21	0	23	.	.	.	.
HO89-889	HOCP85-845	219	11	68	1	50	.	.	.	.
HO89-889	HOCP96-561	69	0	21	0	23	.	.	.	.
HO89-889	L99-233	235	0	21	0	23	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
HO95-988	HOCP96-540	930	45	65	11	70	.	.	.	.
HO95-988	HOCP96-561	237	12	69	3	73	.	.	.	.
HO95-988	HOCP97-609	419	17	60	7	79	.	.	.	.
HO95-988	L89-113	452	19	61	7	76	.	.	.	.
HO95-988	L98-207	625	65	95	28	98	.	.	.	.
HO95-988	L99-226	464	0	21	0	23	.	.	.	.
HO95-988	L99-238	197	11	75	3	75	.	.	.	.
HO95-988	LCP85-384	432	49	96	20	98	.	.	.	.
HO95-988	TUCCP77-042	424	9	47	4	65	.	.	.	.
HOCP85-845	HO95-988	197	10	69	4	85	.	.	.	.
HOCP85-845	HOCP96-540	955	31	53	6	56	.	.	.	.
HOCP85-845	HOCP97-609	228	12	72	4	81	.	.	.	.
HOCP85-845	L96-092	215	0	21	0	23	.	.	.	.
HOCP85-845	L98-207	1325	41	52	16	71	.	.	.	.
HOCP85-845	L99-233	208	11	72	2	65	.	.	.	.
HOCP85-845	LCP85-384	656	39	77	6	63	.	.	.	.
HOCP88-739	LCP85-384	208	15	85	8	95	.	.	.	.
HOCP89-846	HOCP98-741	167	17	94	1	55	.	.	.	.
HOCP89-846	LCP85-384	203	2	44	1	52	.	.	.	.
HOCP89-846	LCP85-384	178	4	48	0	23	.	.	.	.
HOCP89-846	LCP85-384	198	7	57	3	75	.	.	.	.
HOCP89-846	TUCCP77-042	201	15	86	4	85	.	.	.	.
HOCP90-941	L97-137	226	7	52	4	81	.	.	.	.
HOCP90-941	LCP85-384	223	0	21	0	23	.	.	.	.
HOCP91-552	01P1	456	15	55	1	46	.	.	.	.
HOCP91-552	HOCP96-540	543	12	48	4	58	.	.	.	.
HOCP91-552	HOCP97-609	90	0	21	0	23	.	.	.	.
HOCP91-555	HOCP00-955	200	0	21	0	23	.	.	.	.
HOCP91-555	HOCP96-509	210	10	65	0	23	.	.	.	.
HOCP91-555	HOCP96-540	198	0	21	0	23	.	.	.	.
HOCP91-555	HOCP96-540	723	22	50	4	54	.	.	.	.
HOCP91-555	HOCP98-776	149	9	78	1	57	.	.	.	.
HOCP91-555	L99-226	429	38	91	6	74	.	.	.	.
HOCP91-555	LCP85-384	203	0	21	0	23	.	.	.	.
HOCP91-555	LCP86-454	195	0	21	0	23	.	.	.	.
HOCP92-618	HOCP96-540	709	32	63	13	82	.	.	.	.
HOCP92-618	LCP85-384	429	0	21	0	23	.	.	.	.
HOCP92-618	TUCCP77-042	430	0	21	0	23	.	.	.	.
HOCP92-624	HOCP00-961	232	19	88	2	61	.	.	.	.
HOCP92-624	HOCP91-552	219	0	21	2	63	.	.	.	.
HOCP92-624	HOCP96-540	242	12	68	2	60	.	.	.	.
HOCP92-624	HOCP96-561	373	24	81	3	59	.	.	.	.
HOCP92-624	L00-257	442	21	65	7	78	.	.	.	.
HOCP92-624	L89-113	231	14	79	5	87	.	.	.	.
HOCP92-624	L94-426	181	0	21	0	23	.	.	.	.
HOCP92-624	L94-428	218	4	46	2	64	.	.	.	.
HOCP92-624	L98-207	560	18	53	9	78	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
HOCP92-624	L98-209	468	35	86	1	46	.	.	.	.
HOCP92-624	L99-226	232	0	21	0	23	.	.	.	.
HOCP92-624	L99-233	401	37	92	13	94	.	.	.	.
HOCP92-624	LCP85-384	144	12	89	3	86	.	.	.	.
HOCP92-648	HOCP96-540	369	18	66	7	83	.	.	.	.
HOCP92-648	HOCP96-561	210	12	76	1	51	.	.	.	.
HOCP92-648	HOCP97-609	222	0	21	0	23	.	.	.	.
HOCP92-648	HOCP97-621	196	0	21	0	23	.	.	.	.
HOCP92-648	L99-226	345	0	21	0	23	.	.	.	.
HOCP92-648	L99-226	175	6	56	0	23	.	.	.	.
HOCP92-648	L99-234	238	0	21	0	23	.	.	.	.
HOCP92-648	LCP85-384	455	60	98	13	92	.	.	.	.
HOCP92-648	LCP85-384	198	20	94	8	97	.	.	.	.
HOCP94-806	HOCP97-621	72	0	21	0	23	.	.	.	.
HOCP94-806	L99-226	245	0	21	0	23	.	.	.	.
HOCP94-806	L99-233	236	14	77	4	79	.	.	.	.
HOCP95-951	CP79-348	420	54	98	18	97	.	.	.	.
HOCP95-951	HOCP96-540	422	22	70	10	88	.	.	.	.
HOCP95-951	HOCP96-540	232	10	62	6	91	.	.	.	.
HOCP95-951	L97-137	465	33	84	8	80	.	.	.	.
HOCP95-951	LCP82-089	450	28	79	7	77	.	.	.	.
HOCP96-509	HOCP96-561	368	25	82	3	59	.	.	.	.
HOCP96-509	L92-312	243	0	21	0	23	.	.	.	.
HOCP96-509	L99-226	226	0	21	0	23	.	.	.	.
HOCP96-509	LCP85-384	184	17	92	6	95	.	.	.	.
HOCP96-522	HOCP89-846	225	12	72	3	73	.	.	.	.
HOCP96-522	HOCP96-561	184	6	55	2	67	.	.	.	.
HOCP96-522	L91-255	207	11	72	1	51	.	.	.	.
HOCP96-522	L98-209	410	20	66	3	58	.	.	.	.
HOCP96-522	LCP85-384	203	7	56	1	52	.	.	.	.
HOCP96-540	HOCP89-846	623	0	21	0	23	.	.	.	.
HOCP96-540	HOCP96-561	237	0	21	0	23	.	.	.	.
HOCP96-540	L89-113	190	0	21	0	23	.	.	.	.
HOCP96-540	L91-255	371	0	21	0	23	.	.	.	.
HOCP96-540	L99-226	449	0	21	0	23	.	.	.	.
HOCP96-540	LCP85-384	392	0	21	0	23	.	.	.	.
HOCP96-561	HOCP85-845	452	14	52	5	68	.	.	.	.
HOCP97-606	L96-092	237	7	50	3	73	.	.	.	.
HOCP97-609	HO91-572	207	0	21	0	23	.	.	.	.
HOCP97-609	HOCP97-621	167	0	21	0	23	.	.	.	.
HOCP97-609	HOCP98-741	231	0	21	0	23	.	.	.	.
HOCP97-609	L89-113	250	0	21	0	23	.	.	.	.
HOCP97-609	L99-226	417	0	21	0	23	.	.	.	.
HOCP97-609	L99-233	142	4	50	2	74	.	.	.	.
HOCP97-609	LCP82-089	448	31	82	8	82	.	.	.	.
HOCP97-621	L98-207	452	0	21	0	23	.	.	.	.
HOCP98-741	HOCP92-618	236	0	21	0	23	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
HOCP98-741	L94-432	239	0	21	0	23	.	.	.	.
HOCP98-741	LCP85-384	413	43	95	8	84	.	.	.	.
HOCP98-776	CP79-348	210	2	44	0	23	.	.	.	.
HOCP98-776	HOCP96-540	177	0	21	0	23	.	.	.	.
HOCP98-776	L91-255	203	9	63	6	93	.	.	.	.
HOCP98-776	L99-226	236	0	21	0	23	.	.	.	.
HOCP98-776	L99-233	218	6	50	1	50	.	.	.	.
HOCP98-778	CP79-318	219	0	21	0	23	.	.	.	.
HOCP98-778	HOCP97-621	93	0	21	0	23	.	.	.	.
HOCP98-781	HOCP96-540	442	38	90	5	69	.	.	.	.
HOCP99-825	L91-281	217	0	21	0	23	.	.	.	.
HOCP99-833	L98-209	180	13	85	2	68	.	.	.	.
L00-249	L94-432	236	0	21	0	23	.	.	.	.
L00-254	HOCP97-609	430	0	21	0	23	.	.	.	.
L00-254	L98-209	244	0	21	0	23	.	.	.	.
L00-254	LCP85-384	416	0	21	0	23	.	.	.	.
L00-260	HOCP97-621	232	0	21	0	23	.	.	.	.
L00-260	L99-233	400	0	21	0	23	.	.	.	.
L00-264	L94-432	145	0	21	0	23	.	.	.	.
L00-264	LCP85-384	226	7	52	2	62	.	.	.	.
L00-264	LCP85-384	202	7	57	0	23	.	.	.	.
L00-268	HOCP96-540	971	63	81	25	91	.	.	.	.
L00-271	HOCP96-540	194	11	76	1	53	.	.	.	.
L00-273	LCP82-089	198	0	21	0	23	.	.	.	.
L91-255	HOCP96-509	141	0	21	0	23	.	.	.	.
L91-255	L98-207	427	0	21	0	23	.	.	.	.
L91-255	LCP85-384	386	18	64	1	47	.	.	.	.
L91-281	HOCP96-561	442	53	97	12	92	.	.	.	.
L91-281	L97-137	246	12	66	4	79	.	.	.	.
L91-281	L99-234	218	12	74	5	88	.	.	.	.
L91-281	LCP85-384	226	0	21	0	23	.	.	.	.
L93-386	HOCP96-540	363	0	21	0	23	.	.	.	.
L93-391	L98-209	215	0	21	0	23	.	.	.	.
L93-391	L99-226	206	0	21	0	23	.	.	.	.
L93-391	LCP85-384	97	0	21	0	23	.	.	.	.
L93-399	HOCP85-845	176	0	21	0	23	.	.	.	.
L93-399	HOCP85-845	326	12	58	0	23	.	.	.	.
L93-399	LCP85-384	171	0	21	0	23	.	.	.	.
L94-426	HOCP97-621	174	0	21	0	23	.	.	.	.
L94-426	L99-233	185	7	59	1	54	.	.	.	.
L94-426	LCP85-384	224	11	66	1	50	.	.	.	.
L94-426	LCP85-384	184	22	97	9	99	.	.	.	.
L94-426	LHO92-314	234	0	21	0	23	.	.	.	.
L94-428	HOCP96-540	354	32	91	11	94	.	.	.	.
L94-428	MISC	178	8	63	2	69	.	.	.	.
L94-432	HOCP96-540	209	36	99	4	83	.	.	.	.
L94-432	L89-113	208	0	21	0	23	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
L94-432	L91-281	195	0	21	0	23	.	.	.	.
L94-432	L98-207	337	0	21	0	23	.	.	.	.
L94-432	LCP85-384	194	0	21	0	23	.	.	.	.
L94-432	TUCCP77-042	383	13	56	3	58	.	.	.	.
L96-040	HOCP92-618	228	22	93	9	96	.	.	.	.
L96-040	HOCP96-540	227	13	76	1	49	.	.	.	.
L96-040	L99-233	211	0	21	0	23	.	.	.	.
L96-040	L99-233	393	26	82	6	76	.	.	.	.
L97-128	HOCP85-845	224	14	80	2	63	.	.	.	.
L97-128	L91-281	174	15	90	1	55	.	.	.	.
L97-128	L99-233	228	25	96	12	99	.	.	.	.
L97-128	LCP82-089	416	29	83	10	89	.	.	.	.
L97-128	LHO92-314	205	0	21	0	23	.	.	.	.
L97-128	TUCCP77-042	191	32	99	8	97	.	.	.	.
L97-137	HOCP94-806	219	13	77	4	82	.	.	.	.
L97-137	L94-428	406	20	66	7	80	.	.	.	.
L98-197	HOCP00-961	227	0	21	0	23	.	.	.	.
L98-207	01P5	473	2	43	0	23	.	.	.	.
L98-207	CP79-318	388	0	21	0	23	.	.	.	.
L98-207	HOCP85-845	736	45	79	18	90	.	.	.	.
L98-209	01P4	416	38	92	4	65	.	.	.	.
L98-209	HOCP97-621	474	17	58	3	56	.	.	.	.
L98-209	HOCP98-741	205	0	21	0	23	.	.	.	.
L98-209	L92-312	182	0	21	0	23	.	.	.	.
L98-209	LHO92-314	457	18	59	3	56	.	.	.	.
L98-209	TUCCP77-042	427	24	75	9	87	.	.	.	.
L99-214	HOCP97-621	235	0	21	0	23	.	.	.	.
L99-214	L99-233	207	17	88	4	84	.	.	.	.
L99-221	HOCP96-540	433	0	21	0	23	.	.	.	.
L99-226	01P4	676	12	46	2	47	.	.	.	.
L99-226	HOCP92-618	436	0	21	0	23	.	.	.	.
L99-226	HOCP96-540	757	0	21	0	23	.	.	.	.
L99-226	L89-113	204	0	21	0	23	.	.	.	.
L99-226	L99-233	754	5	43	3	48	.	.	.	.
L99-226	LCP82-089	464	19	60	4	61	.	.	.	.
L99-226	LCP85-384	843	42	68	10	70	.	.	.	.
L99-226	TUCCP77-042	621	11	46	2	48	.	.	.	.
L99-231	HOCP85-845	195	3	45	1	53	.	.	.	.
L99-231	HOCP97-621	194	0	21	0	23	.	.	.	.
L99-231	L92-312	147	0	21	0	23	.	.	.	.
L99-233	HOCP97-621	173	0	21	0	23	.	.	.	.
L99-233	L94-428	205	16	87	5	90	.	.	.	.
L99-234	HOCP96-540	216	0	21	0	23	.	.	.	.
L99-234	L98-207	365	0	21	0	23	.	.	.	.
L99-238	L94-432	220	0	21	0	23	.	.	.	.
LCP81-010	L89-113	208	0	21	0	23	.	.	.	.
LCP81-010	L91-281	209	11	72	5	89	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
LCP81-010	L92-312	143	0	21	0	23	.	.	.	.
LCP81-010	L92-312	124	0	21	0	23	.	.	.	.
LCP81-010	L94-428	460	6	45	2	49	.	.	.	.
LCP81-010	L98-207	617	39	80	15	89	.	.	.	.
LCP81-010	L98-207	1095	35	53	12	68	.	.	.	.
LCP81-010	L98-209	605	24	60	5	60	.	.	.	.
LCP81-010	L99-233	898	28	52	12	74	.	.	.	.
LCP81-010	LCP82-089	384	0	21	0	23	.	.	.	.
LCP81-010	LCP85-384	844	85	94	25	93	.	.	.	.
LCP81-010	LCP85-384	937	17	46	4	49	.	.	.	.
LCP82-089	LCP85-384	381	20	70	1	47	.	.	.	.
LCP83-137	HOCP96-561	404	34	89	9	87	.	.	.	.
LCP85-313	HOCP96-509	342	24	83	10	92	.	.	.	.
LCP85-313	HOCP97-609	415	29	83	3	57	.	.	.	.
LCP85-384	01P4	597	0	21	0	23	.	.	.	.
LCP85-384	HOCP89-846	240	19	87	3	72	.	.	.	.
LCP85-384	HOCP92-618	230	0	21	0	23	.	.	.	.
LCP85-384	HOCP97-621	471	53	96	5	67	.	.	.	.
LCP85-384	L91-281	378	0	21	0	23	.	.	.	.
LCP85-384	L99-233	609	13	47	6	66	.	.	.	.
LCP86-454	L99-233	591	32	74	6	66	.	.	.	.
LCP86-454	LCP85-384	636	45	84	10	77	.	.	.	.
LCP86-454	LCP85-384	1475	64	62	18	71	.	.	.	.
LCP86-454	TUCCP77-042	335	0	21	0	23	.	.	.	.
LHO83-153	L99-233	180	14	87	7	96	.	.	.	.
LHO83-153	LCP85-384	213	5	49	2	65	.	.	.	.
LHO92-314	L99-226	207	0	21	0	23	.	.	.	.
LHO92-314	LCP85-384	229	0	21	0	23	.	.	.	.
TUCCP77-042	L98-209	162	14	90	5	94	.	.	.	.
TUCCP77-042	L99-238	232	12	70	2	61	.	.	.	.
TUCCP77-042	LCP85-384	476	25	72	7	75	.	.	.	.
US96-002	LCP85-384	229	22	93	2	62	.	.	.	.
2002 Crossing Series										
CP70-321	LCP85-384	185	2	28	.	.	.	.	.	.
CP77-405	HOCP96-540	454	0	12	.	.	.	.	.	.
CP77-405	L99-233	172	3	31	.	.	.	.	.	.
CP77-405	LCP85-384	234	8	48	.	.	.	.	.	.
CP78-317	L92-312	80	9	95	.	.	.	.	.	.
CP79-318	L91-255	243	10	55	.	.	.	.	.	.
CP79-318	L92-312	222	7	45	.	.	.	.	.	.
CP79-348	HOCP92-618	239	16	77	.	.	.	.	.	.
CP79-348	L98-207	703	89	96	.	.	.	.	.	.
CP83-644	02P9	196	4	33	.	.	.	.	.	.
CP83-644	L99-233	465	19	55	.	.	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
CP89-831	HOCP89-846	485	22	62	.	.	.	.	.	.
HO01-566	02P9	481	17	49	.	.	.	.	.	.
HO89-889	HOCP89-846	714	18	37	.	.	.	.	.	.
HO95-988	02P13	239	0	12	.	.	.	.	.	.
HO95-988	HOCP93-767	443	10	35	.	.	.	.	.	.
HO95-988	HOCP96-540	236	0	12	.	.	.	.	.	.
HO95-988	L00-266	249	23	88	.	.	.	.	.	.
HO95-988	L94-432	58	4	80	.	.	.	.	.	.
HO95-988	L98-207	664	41	74	.	.	.	.	.	.
HO95-988	LCP82-089	404	40	93	.	.	.	.	.	.
HO95-988	LCP85-384	464	45	90	.	.	.	.	.	.
HO95-988	LCP85-384	1203	118	91	.	.	.	.	.	.
HOCP00-905	02P3	245	26	94	.	.	.	.	.	.
HOCP00-905	02P4	477	42	87	.	.	.	.	.	.
HOCP00-920	HOCP92-618	138	3	34	.	.	.	.	.	.
HOCP00-920	L99-226	411	0	12	.	.	.	.	.	.
HOCP01-517	02P10	164	5	42	.	.	.	.	.	.
HOCP85-845	02P11	1831	6	24	.	.	.	.	.	.
HOCP85-845	02P15	226	10	61	.	.	.	.	.	.
HOCP85-845	02P3	336	14	58	.	.	.	.	.	.
HOCP85-845	HOCP89-846	234	4	31	.	.	.	.	.	.
HOCP85-845	L98-207	1343	51	52	.	.	.	.	.	.
HOCP91-552	HOCP97-609	466	0	12	.	.	.	.	.	.
HOCP91-552	L98-209	851	26	43	.	.	.	.	.	.
HOCP92-624	02P10	233	2	27	.	.	.	.	.	.
HOCP92-624	02P16	216	17	83	.	.	.	.	.	.
HOCP92-624	HOCP98-741	202	15	81	.	.	.	.	.	.
HOCP92-624	L00-259	1435	140	91	.	.	.	.	.	.
HOCP92-624	L00-266	711	35	65	.	.	.	.	.	.
HOCP92-624	L91-255	868	76	87	.	.	.	.	.	.
HOCP92-624	L98-209	1149	59	67	.	.	.	.	.	.
HOCP92-624	L99-226	1171	46	53	.	.	.	.	.	.
HOCP92-624	LCP85-384	1396	81	73	.	.	.	.	.	.
HOCP92-624	US01-040	230	41	98	.	.	.	.	.	.
HOCP93-746	L91-255	217	5	35	.	.	.	.	.	.
HOCP93-746	L99-233	463	20	59	.	.	.	.	.	.
HOCP93-749	L00-247	131	2	29	.	.	.	.	.	.
HOCP93-749	L00-266	481	0	12	.	.	.	.	.	.
HOCP93-749	LCP85-384	68	0	12	.	.	.	.	.	.
HOCP93-749	LCP85-384	239	9	52	.	.	.	.	.	.
HOCP93-767	HOCP97-609	213	0	12	.	.	.	.	.	.
HOCP93-767	L99-226	234	33	97	.	.	.	.	.	.
HOCP94-806	HOCP91-552	212	11	68	.	.	.	.	.	.
HOCP94-806	HOCP93-767	240	11	63	.	.	.	.	.	.
HOCP94-806	HOCP96-540	209	12	72	.	.	.	.	.	.
HOCP95-951	02P2	670	56	86	.	.	.	.	.	.
HOCP96-509	L98-207	1205	76	75	.	.	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
HOCP96-561	HOCP00-905	118	0	12	.	.	.	.	.	.
HOCP96-561	L99-226	466	16	48	.	.	.	.	.	.
HOCP98-741	HOCP85-845	249	7	40	.	.	.	.	.	.
HOCP98-741	L00-249	236	16	78	.	.	.	.	.	.
HOCP98-741	L00-268	214	22	94	.	.	.	.	.	.
HOCP98-741	L91-255	236	10	58	.	.	.	.	.	.
HOCP98-741	L94-432	225	7	43	.	.	.	.	.	.
HOCP98-741	L98-207	178	0	12	.	.	.	.	.	.
HOCP98-741	L98-209	151	0	12	.	.	.	.	.	.
HOCP98-741	L99-226	244	23	89	.	.	.	.	.	.
HOCP98-781	HOCP85-845	423	3	25	.	.	.	.	.	.
HOCP98-781	LCP85-384	684	38	70	.	.	.	.	.	.
HOCP99-866	L01-291	473	0	12	.	.	.	.	.	.
L00-247	02P4	230	13	72	.	.	.	.	.	.
L00-247	HOCP97-609	35	0	12	.	.	.	.	.	.
L00-247	L98-209	80	0	12	.	.	.	.	.	.
L00-247	L99-226	204	4	33	.	.	.	.	.	.
L00-264	L94-432	232	21	88	.	.	.	.	.	.
L00-266	LCP86-454	413	0	12	.	.	.	.	.	.
L00-268	HOCP92-618	435	21	63	.	.	.	.	.	.
L00-268	HOCP96-540	1070	0	12	.	.	.	.	.	.
L00-268	L92-321	217	0	12	.	.	.	.	.	.
L00-270	02P2	426	19	62	.	.	.	.	.	.
L00-270	HOCP96-540	521	3	25	.	.	.	.	.	.
L00-270	HOCP97-609	793	0	12	.	.	.	.	.	.
L00-270	L00-247	228	10	61	.	.	.	.	.	.
L00-270	L99-226	1089	0	12	.	.	.	.	.	.
L01-315	HOCP96-540	465	23	65	.	.	.	.	.	.
L01-315	HOCP96-561	232	4	31	.	.	.	.	.	.
L01-315	HOCP98-741	487	20	55	.	.	.	.	.	.
L01-315	HOCP99-825	78	2	38	.	.	.	.	.	.
L01-315	L94-428	188	0	12	.	.	.	.	.	.
L01-315	LCP86-454	240	8	46	.	.	.	.	.	.
L01-315	US01-040	244	0	12	.	.	.	.	.	.
L89-113	LCP85-384	250	20	84	.	.	.	.	.	.
L91-255	HOCP00-905	82	2	36	.	.	.	.	.	.
L91-281	L99-226	761	45	73	.	.	.	.	.	.
L92-312	02P2	442	0	12	.	.	.	.	.	.
L92-312	US80-004	101	0	12	.	.	.	.	.	.
L93-363	L00-259	579	15	38	.	.	.	.	.	.
L93-363	L91-255	208	31	98	.	.	.	.	.	.
L93-363	L99-226	144	12	85	.	.	.	.	.	.
L93-365	L99-233	242	7	41	.	.	.	.	.	.
L93-365	LCP85-384	236	8	48	.	.	.	.	.	.
L93-399	L98-209	229	8	49	.	.	.	.	.	.
L93-399	L98-209	394	17	59	.	.	.	.	.	.
L94-426	HOCP96-540	122	0	12	.	.	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
L94-426	HOCP97-609	225	15	77	.	.	.	.	.	.
L94-426	L98-207	117	2	31	.	.	.	.	.	.
L94-428	02P12	214	2	27	.	.	.	.	.	.
L94-428	HOCP96-540	482	31	76	.	.	.	.	.	.
L94-428	HOCP97-609	41	0	12	.	.	.	.	.	.
L94-428	L00-259	442	21	63	.	.	.	.	.	.
L94-428	L98-207	943	48	67	.	.	.	.	.	.
L94-433	HOCP92-618	174	11	75	.	.	.	.	.	.
L94-433	L94-428	189	0	12	.	.	.	.	.	.
L94-433	L99-226	1280	41	45	.	.	.	.	.	.
L96-040	HOCP97-609	490	0	12	.	.	.	.	.	.
L96-040	L00-268	240	8	46	.	.	.	.	.	.
L96-040	L99-226	664	0	12	.	.	.	.	.	.
L96-092	LCP85-384	463	13	40	.	.	.	.	.	.
L97-128	HOCP91-951	186	5	39	.	.	.	.	.	.
L97-128	HOCP96-540	246	18	80	.	.	.	.	.	.
L97-128	L94-428	146	6	55	.	.	.	.	.	.
L97-128	L98-207	133	7	69	.	.	.	.	.	.
L97-128	L99-233	87	6	80	.	.	.	.	.	.
L97-128	LCP85-384	69	0	12	.	.	.	.	.	.
L98-197	HOCP99-866	226	0	12	.	.	.	.	.	.
L98-207	02P10	1009	96	89	.	.	.	.	.	.
L98-207	02P7	244	0	12	.	.	.	.	.	.
L98-207	02P9	920	0	12	.	.	.	.	.	.
L98-207	L92-321	225	17	82	.	.	.	.	.	.
L98-207	L99-226	461	17	51	.	.	.	.	.	.
L98-209	HOCP97-609	213	0	12	.	.	.	.	.	.
L98-209	L01-299	326	0	12	.	.	.	.	.	.
L99-233	02P18	232	10	59	.	.	.	.	.	.
L99-233	HOCP98-741	216	0	12	.	.	.	.	.	.
L99-233	L99-226	248	9	50	.	.	.	.	.	.
LCP81-010	HOCP96-540	673	54	84	.	.	.	.	.	.
LCP81-010	L92-312	462	14	42	.	.	.	.	.	.
LCP81-010	L99-233	162	11	78	.	.	.	.	.	.
LCP81-010	LCP85-384	226	12	69	.	.	.	.	.	.
LCP81-10	02P19	223	9	54	.	.	.	.	.	.
LCP82-089	02P3	445	0	12	.	.	.	.	.	.
LCP82-089	02P4	410	0	12	.	.	.	.	.	.
LCP85-313	HOCP92-618	137	2	29	.	.	.	.	.	.
LCP85-313	HOCP97-609	159	9	72	.	.	.	.	.	.
LCP85-313	L98-209	623	31	66	.	.	.	.	.	.
LCP85-313	LCP82-089	109	4	51	.	.	.	.	.	.
LCP85-384	02P11	1105	22	33	.	.	.	.	.	.
LCP85-384	02P17	145	14	90	.	.	.	.	.	.
LCP85-384	02P3	200	0	12	.	.	.	.	.	.
LCP85-384	02P4	244	18	81	.	.	.	.	.	.
LCP85-384	HOCP01-517	444	49	95	.	.	.	.	.	.

Table 6. Continued

Female	Male	Survive	1st Line No.	1st Line Rank Pcnt'l	2nd Line No.	2nd Line Rank Pcnt'l	Increase No.	Increase Rank Pcnt'l	Assignment No.	Assignment Rank Pcnt'l
LCP86-454	02P11	1033	0	12	.	.	.	.	.	.
LCP86-454	02P14	233	12	68	.	.	.	.	.	.
LCP86-454	L98-207	374	3	26	.	.	.	.	.	.
LCP86-454	LCP85-384	1366	34	37	.	.	.	.	.	.
LH083-153	HOCP92-618	92	0	12	.	.	.	.	.	.
N-27	HOCP96-540	383	38	93	.	.	.	.	.	.
N-27	L94-428	185	6	45	.	.	.	.	.	.
N-27	L98-209	657	18	39	.	.	.	.	.	.
N-27	LCP85-384	252	16	75	.	.	.	.	.	.
TUCCP77-042	LCP85-384	476	24	66	.	.	.	.	.	.
US79-010	HOCP96-540	131	17	97	.	.	.	.	.	.
US79-010	L01-299	216	17	83	.	.	.	.	.	.
US79-010	L98-207	245	10	55	.	.	.	.	.	.
US79-010	LCP85-384	102	19	99	.	.	.	.	.	.
US96-002	L01-299	185	2	28	.	.	.	.	.	.

Table 7. Plant weight and rank summary statistics from the 2002 crossing series first stubble cross appraisal test at the St. Gabriel Research Station in 2004.

Female	Male	Plant Weight Kg/Plant	Plant Weight Pcnt'l
HOCP98-741	L98-209	8.46	99
HOCP88-739	LCP85-384	8.36	98
N-27	HOCP96-540	8.22	97
L97-128	L99-233	7.99	96
L97-128	L91-255	7.96	95
LCP81-010	L98-207	7.57	94
LCP81-010	HOCP99-825	7.34	93
L01-315	HOCP98-741	7.07	92
HOCP98-741	L98-207	7.07	91
LCP83-137	L99-226	7.04	90
LCP86-454	02P6	7.03	89
US79-010	LCP85-384	6.98	88
US79-010	HOCP96-540	6.95	87
HOCP00-905	02P3	6.95	86
LCP81-010	HOCP96-561	6.94	85
N-27	LCP85-384	6.85	84
LCP81-010	HOCP92-618	6.83	83
L97-128	L99-233	6.71	82
HOCP93-767	L99-226	6.63	81
HOCP91-555	L99-226	6.60	80
LCP85-313	LCP86-454	6.55	79
L93-365	LCP85-384	6.51	78
LCP81-010	L99-233	6.37	77
L01-306	LCP85-384	6.32	76

Female	Male	Plant Weight Kg/Plant	Plant Weight Pcnt'l
L94-433	02P8	6.31	75
LCP85-384	02P4	6.27	74
LCP83-137	LCP86-454	6.25	73
HOCP94-806	HOCP93-767	6.20	72
L91-281	HOCP96-561	6.19	71
HOCP88-739	L98-209	6.18	70
L98-207	02P10	6.14	69
L00-264	L94-428	6.13	68
LCP83-137	L94-428	6.11	67
HOCP92-624	HOCP98-741	6.04	66
L94-426	L00-268	6.03	65
L94-426	HOCP97-609	5.99	64
US79-010	LCP85-384	5.96	63
L94-428	L98-207	5.95	62
L01-315	HOCP96-561	5.93	61
HOCP99-866	LCP85-384	5.88	60
HOCP97-645	L91-255	5.76	59
HOCP93-749	L00-268	5.76	58
CP77-405	L98-207	5.71	57
L00-270	L99-226	5.70	56
L98-197	HOCP99-866	5.68	55
HOCP93-767	HOCP97-609	5.65	54
L01-315	HOCP99-825	5.64	53
L00-264	HOCP96-561	5.61	52

Table 7. Continued

Female	Male	Plant Weight	
		Kg/Plant	Pcnt'l
L91-255	HOCP00-905	5.59	51
HOCP99-866	L98-209	5.53	50
L00-247	HOCP97-609	5.49	49
L00-270	02P2	5.46	48
L94-426	L00-259	5.44	47
HOCP95-951	US80-004	5.42	46
N-27	L98-209	5.42	45
L00-247	HOCP92-618	5.38	44
HOCP92-624	L00-266	5.36	43
L94-426	L91-255	5.35	42
HOCP00-920	HOCP92-618	5.35	41
HOCP95-951	HOCP99-825	5.33	40
HOCP93-749	LCP85-384	5.28	39
L93-399	L98-209	5.22	38
L91-281	L99-226	5.12	37
HOCP00-920	L99-226	5.09	36
HOCP92-624	L99-226	5.08	35
HOCP91-555	HOCP96-540	5.05	34
HOCP91-552	HOCP97-609	4.99	33
HOCP00-920	L99-226	4.97	32
HOCP96-561	HOCP00-905	4.97	31
HOCP92-648	L00-259	4.96	30
L00-266	LCP86-454	4.90	29
HOCP00-905	02P4	4.79	28
L98-209	L00-259	4.78	27

Female	Male	Plant Weight	
		Kg/Plant	Pcnt'l
L94-433	HOCP96-509	4.73	26
L00-264	HOCP92-618	4.67	25
LCP85-384	HOCP01-517	4.58	24
CP79-348	US01-040	4.56	23
HOCP98-741	HOCP85-845	4.50	22
L00-247	02P4	4.39	21
LCP85-313	L94-432	4.36	20
HOCP91-552	L98-209	4.34	19
CP77-405	L91-255	4.32	18
LCP86-454	L98-207	4.23	17
HOCP99-866	L01-291	4.22	16
L00-270	L00-247	4.15	15
L00-270	HOCP96-540	4.15	14
L98-209	L01-299	4.11	13
HO91-572	LCP85-384	4.07	12
L01-315	LCP86-454	4.05	11
CP70-321	L00-268	3.87	10
US96-002	L01-299	3.86	9
HOCP85-845	02P11	3.84	8
L96-040	L99-226	3.79	7
L98-207	02P9	3.71	6
L00-270	HOCP97-609	3.68	5
L98-207	L94-428	3.63	4
L98-209	HOCP97-609	3.39	3
CP79-348	HOCP96-561	3.13	2
L98-207	L92-321	2.87	1

2004 LOUISIANA SUGARCANE VARIETY DEVELOPMENT PROGRAM NURSERY AND INFIELD VARIETY TRIALS

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Five years after the initial hybridization of parents, clones that have met or exceeded criteria for desired characteristics at previous selection stages are assigned permanent numbers by each of the Louisiana Sugarcane Variety Development Programs. The LSU program assigns variety designations of "L," and the USDA program assigns variety designations of "Ho" and "HoCP." These varieties are planted in replicated nursery and infield tests at locations across the southern Louisiana sugarcane-growing areas.

One objective of the nursery and infield stages is to identify and select varieties that will perform well across the range of environments a commercial variety will encounter in Louisiana. Nursery tests are initially planted at three on-station locations (USDA-ARS - Ardoyne Farm, Iberia Research Station, and St. Gabriel Research Station) during the year of assignment, and four to five additional and different off-station locations are planted the year after assignment. The three off-station nurseries, Newton Cane, Inc. (Bunkie), D & N Farm (Cecelia), and Landry Farms (Paincourtville), along with the two infield trial locations at Blackberry Farms (Vacherie) and Sugarland Acres, Inc. (Youngsville), were planted with both the LSU and USDA varieties. The locations, soil types, dates of planting and dates of harvest are listed in Table 1.

The on-station nursery trials were planted in single row (6-foot centers), 16-foot-long plots with 4-foot alleys. The off-station nurseries were planted in single row, 20-foot plots with 5-foot alleys. The infield tests were planted in two-row, 25-foot plots with 5-foot alleys. The experimental design for both nursery and infield tests was a randomized complete block with two replications per location. Five commercial check varieties, LCP85-384, HoCP91-555, Ho95-988, HoCP96-540, and L97-128, were planted in all off-station nursery tests for comparison. Four commercial check varieties, LCP85-384, Ho95-988, HoCP96-540, and L97-128, were planted in all on-station nursery tests for comparison.

Millable stalk counts for both nursery and infield tests were made in late July and August. A combine harvester/weigh wagon system was used to cut and weigh plots for the infield tests. During the harvest season, 10-stalk samples were harvested by hand and stripped of leaves for the nursery tests. A 15-stalk sample was taken for the infield tests and sent to the USDA Ardoyne Farm and analyzed for fiber content using the pre-breaker press. Samples were weighed and milled at the sucrose laboratory in St. Gabriel to obtain a juice sample for analysis. Brix and pol readings were used to estimate theoretical recoverable sugar per ton as estimated by the Winter-Carp formula as reported by Gravois and Milligan (1992). Cane yield for the nursery

tests was estimated as the product of stalk weight and stalk number. Cane yield for the infield tests was determined from the plot weights and reduced 14 percent to account for extraneous trash. Sugar per acre was calculated as the product of sugar per ton and cane yield.

The 2004 sugarcane crop experienced less-than-ideal growing conditions. Late winter and spring were excessively wet, making early-season cultivation and herbicide application difficult. Fields began to dry in early July, and some portions of the industry did not receive appreciable rainfall until Tropical Storm Mathew arrived in early October. The planting season was extremely dry as a result of the extended drought conditions. The initial harvest was dry with excellent maturity. The crop lodged after the winds and heavy rains of Tropical Storm Mathew passed. Cane tonnage was lower than anticipated, with slightly above-average sucrose recovery at the factories. All experimental locations were harvested before the first freeze. Recommended cultural practices were followed at all test locations.

LCP85-384 has been the leading variety in Louisiana since 1998. Approximately 91% of Louisiana's harvested sugarcane acreage was in LCP85-384 for 2004. For comparison, LC85-384 is highlighted in the tables. To adjust for missing data, the statistical analysis calculated least square means (SAS 9 Proc Mixed). Mean separation used least square means probability differences where P=0.05. Varieties that are significantly higher or lower than LCP85-384 are denoted by a plus (+) or minus (-), respectively, next to the value for each trait.

References:
Gravois, K.A. and S.B. Milligan. 1992. Genetic relationships between fiber and sugarcane yield components. Crop Sci. 32: 62-66.

Table 1. 2004 Location, soil texture, and planting and harvest dates for the nursery and infield tests.

					Harvest Date	Varieties	
Series	Location†	Stage	Soil Texture	Planting Date	2004	No. Planted	No. Harvested
1999	Blackberry Farms	Infield	Commerce silt loam	08/17/00	10/05/04	39	2
1999	Newton Cane, Inc.	Nursery	Moreland silt loam	08/24/00	09/30/04	39	2
1999	D & N Farm	Nursery	Baldwin silty clay	08/18/00	10/11/04	16	2
1999	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/23/00	11/29/04	39	2
1999	Landry Farms	Nursery	Commerce silt loam	08/21/00	09/27/04	39	2
2000	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/12/00	10/19/04	33	1
2000	Iberia Research Station	Nursery	Baldwin silty clay	10/13/00	10/11/04	33	1
2000	Blackberry Farms	Infield	Commerce silt loam	08/21/01	10/05/04	48	2
2000	Newton Cane, Inc.	Nursery	Moreland silt loam	08/24/01	09/30/04	48	2
2000	Landry Farms	Nursery	Commerce silt loam	09/18/01	09/27/04	48	2
2001	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/18/01	10/19/04	37	2
2001	Iberia Research Station	Nursery	Baldwin silty clay	10/22/01	10/11/04	37	2
2001	St. Gabriel Research Station	Nursery	Sharky clay	10/09/01	10/12/04	37	2
2001	Blackberry Farms	Infield	Commerce silt loam	08/27/02	12/06/04	38	7
2001	Newton Cane, Inc.	Nursery	Moreland silt loam	08/21/02	10/15/04	38	7
2001	D & N Farm	Nursery	Baldwin silty clay	08/22/02	11/08/04	12	2
2001	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/09/02	10/25/04	38	7
2001	Landry Farms	Nursery	Commerce silt loam	08/29/02	11/10/04	38	7
2002	St. Gabriel Research Station	Nursery	Sharkey clay	11/01/02	11/10/04	38	4
2002	Blackberry Farms	Infield	Commerce silt loam	08/20/03	12/06/04	41	19
2002	Newton Cane, Inc.	Nursery	Moreland silt loam	08/15/03	11/12/04	41	19
2002	D & N Farm	Nursery	Baldwin silty clay	08/26/03	11/23/04	14	4
2002	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/19/03	11/29/04	41	19
2002	Landry Farms	Nursery	Commerce silt loam	08/21/03	11/10/04	41	19
2003	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/16/03	11/30/04	35	14
2003	Iberia Research Station	Nursery	Baldwin silty clay	10/21/03	11/29/04	35	14
2003	St. Gabriel Research Station	Nursery	Sharkey clay	10/09/03	11/22/04	35	14
2003	Blackberry Farms	Infield	Commerce silt loam	08/17/04		40	
2003	Newton Cane, Inc.	Nursery	Moreland silt loam	08/31/04		40	
2003	D & N Farm	Nursery	Baldwin silty clay	08/26/04		14	
2003	Sugarland Acres, Inc.	Infield	Coteau silt loam	08/19/04		40	
2003	Landry Farms	Nursery	Commerce silt loam	08/18/04		40	
2004	Ardoyne Farm-U.S.D.A	Nursery	Commerce silt loam	10/19/04		37	
2004	Iberia Research Station	Nursery	Baldwin silty clay	10/27/04		37	
2004	St. Gabriel Research Station	Nursery	Sharkey clay	10/18/04		37	

† Ardoyne-U.S.D.A. Ardoyne Farm (Chacahoula), Blackberry Farms (Vacherie), Iberia Research Station (Jeanerette), Newton Cane, Inc. (Bunkie), St. Gabriel Research Station (St. Gabriel), D & N Farm (Cecelia), Sugarland Acres Inc. (Youngsville), Landry Farms (Paincourtville).

Table 2. 2004 Infield third-stubble means of the 1999 "HoCP" and "L" assignment series in light soil at Blackberry Farms, Vacherie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
CP70-321	2344	9.3	250	1.20	15658	14.2
LCP85-384	4884	19.8	256	1.14	32149	13.4
HoCP85-845	6251	23.2	270	1.39	33726	14.7 +
L99-226	6849	26.0	265	1.79 +	29462	12.7
L99-233	8720	32.6	268	1.20	54962	14.7 +

Table 3. 2004 Nursery third-stubble means of the 1999 "HoCP" and "L" assignment series in light soil Newton Cane, Inc., Bunkie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	5593	26.5	211 +	1.65	31944 -
LCP85-384	9261	49.7	187	1.49	66792
HoCP85-845	7006	33.3	209 +	1.58	41927 -
L99-226	13359	57.3	234 +	2.50 +	46101
L99-233	10254	58.7	175	1.67	70059

Table 4. 2004 Nursery third-stubble means of the 1999 "L" assignment series in heavy soil at D & N Farm, Cecilia, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	5697	23.1	247	1.92 +	24321
LCP85-384	6251	23.2	266	1.20	38841
HoCP85-845	10122	41.3 +	245	1.94 +	42471
L99-226	14838 +	51.1 +	291	2.09 +	48824
L99-233	12164 +	45.7 +	267	1.36	67155 +

Table 5. 2004 Infield third-stubble means of the 1999 “HoCP” and “L” assignment series in light soil at Sugarland Acres, Inc., Youngsville, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
CP70-321	4922	19.7	251	1.83	21787	13.3
LCP85-384	6620	24.5	270	1.29	38270	11.3
HoCP85-845	8455	31.6 +	267	1.45	43736	14.7
L99-226	9710 +	35.7 +	272	1.95	36602	11.7
L99-233	7438	31.1	240	1.35	47448	12.3

Table 6. 2004 Nursery third-stubble means of the 1999 “HoCP” and “L” assignment series in heavy soil at Landry Farms, Paincourtville, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	3135	11.4 -	276	1.28	17969 -
LCP85-384	6587	27.3	240	1.09	49368
HoCP85-845	9993	39.0	256	1.62	48098
L99-226	8256	32.4	256	1.76	37934
L99-233	11074 +	44.1 +	251	1.29	68789 +

Table 7. 2004 Infield second-stubble means of the 2000 “HoCP” and “L” assignment series in light soil at Blackberry Farms, Vacherie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	8004	28.8	279	1.52	37848
HoCP85-845	7970	27.8	288	1.65	34057
HoCP91-555	8047	29.0	278	1.40	41443
L00-266	7805	29.9	261	1.35	44353
HoCP00-950	10135	32.7	310 +	1.71	38414

Table 8. 2004 Nursery second-stubble means of the 2000 "HoCP" and "L" assignment series in light soil at Newton Cane, Inc., Bunkie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	8759	38.9	225	1.34	58262
HoCP85-845	6669	27.5 -	244	1.48	37389 -
HoCP91-555	7366	29.9	247	1.27	47009
L00-266	13656 +	59.3 +	230	1.70	69878
HoCP00-950	9349	37.9	246	1.62	46827

Table 9. 2004 Nursery second-stubble means of the 2000 "HoCP" and "L" assignment series in heavy soil at Landry Farms, Paincourtville, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7058	32.0	222	1.19	54450
HoCP85-845	7166	26.1	274 +	1.59	32307
HoCP91-555	8883	31.2	286 +	1.32	47735
L00-266	9776	40.5	242	1.28	63525
HoCP00-950	10497	36.1	291 +	1.65	44468

Table 10. 2004 Nursery third-stubble means of the 2000 "L" assignment series in light soil at U.S.D.A- Ardoyne Farm, Chacahoula, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	10128	40.3	251	1.91	42199 -
LCP85-384	10352	41.1	252	1.52	53996
HoCP85-845	10625	44.3	240 -	2.03	43787 -
L00-266	8030	35.0	230 -	1.55	44921 -

Table 11. 2004 Nursery third-stubble means of the 2000 “L” assignment series in heavy soil at Iberia Research Station, Jeanerette, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	5533	20.8	266	1.40	29721
LCP85-384	8144	34.5	236	1.33	51728
HoCP85-845	6182	25.0	246	1.32	37434
L00-266	7047	28.6	246	1.05	54223

Table 12. 2004 Infield first-stubble means of the 2001 “HoCP” and “L” assignment series in light soil at Blackberry Farms, Vacherie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	8438	29.9	283	1.31	45912	11.6
HoCP85-845	8657	32.2	270	1.99 +	32372	15.1 +
HoCP91-555	8207	29.3	280	1.67	36644	14.4 +
L01-283	10033	32.8	306	1.68	39640	13.0
L01-299	11278 +	40.0 +	282	2.05 +	39098	15.2 +
HoCP01-517	10918 +	35.8 +	305	2.68 +	26860	12.8
HoCP01-523	10072	34.6	292	2.09 +	33126	14.3 +
HoCP01-551	8984	32.3	279	2.25 +	29024	14.8 +
HoCP01-561	10385 +	35.2 +	295	2.42 +	29186	12.1
HoCP01-564	8955	29.9	299	1.87 +	32269	12.5

Table 13. 2004 Nursery first-stubble means of the 2001 “HoCP” and “L” assignment series in light soil at Newton Cane, Inc., Bunkie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	8988	36.7	245	1.42	51728
HoCP85-845	10239	42.0	243	2.00 +	41927
HoCP91-555	8561	32.8	261	1.59	41564
L01-283	14033 +	53.8 +	260	1.86	57899
L01-299	12433 +	49.0 +	254	1.78	55176
HoCP01-517	11962 +	43.5 +	275	2.51 +	35574 -
HoCP01-523	11017 +	43.8 +	251	1.70	51728
HoCP01-551	5272 -	21.2 -	249	2.05 +	20510 -
HoCP01-561	11375 +	42.7	266	1.98 +	43560
HoCP01-564	7813	32.1	244	1.58	40838

Table 14. 2004 Nursery first-stubble means of the 2001 “L” assignment series in heavy soil at D& N Farm, Cecilia, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	11694	38.8	301	1.53	51002
HoCP85-845	8081	31.6	256 -	1.78	34848 -
HoCP91-555	9324	34.2	273 -	1.68	40838
L01-283	10724	36.8	291	1.70	43379
L01-299	13305	42.6	312	1.85	46283

Table 15. 2004 Infield first-stubble means of the 2001 “HoCP” and “L” assignment series in light soil at Sugarland Acres, Inc., Youngsville, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	10474	36.5	287	1.72	42260	11.6
HoCP85-845	11510	37.6	307	2.00	37601	12.8
HoCP91-555	9800	32.6	301	1.79	36637	12.4
L01-283	13191	43.2	305	2.01	43149	12.0
L01-299	16103 +	52.6 +	306	2.04	51699 +	12.1
HoCP01-517	12540	41.4	303	2.46 +	33742 -	10.6
HoCP01-523	11461	39.9	287	1.89	42284	11.7
HoCP01-551	10856	36.4	298	2.28 +	32306 -	12.9
HoCP01-561	11830	36.0	328	2.11 +	34372	10.7
HoCP01-564	11333	34.1	332	1.81	37862	11.1

Table 16. 2004 Nursery first-stubble means of the 2001 “HoCP” and “L” assignment series in light soil at Landry Farms, Paincourtville, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	13936	52.5	264	1.94	54087
HoCP85-845	9891	37.3	266	1.90	39204 -
HoCP91-555	16786	63.9	263	1.96	65159 +
L01-283	16330	58.1	281	1.83	63344
L01-299	13287	49.7	267	1.81	54995
HoCP01-517	14203	50.4	282	2.37	42471 -
HoCP01-523	8564 -	33.8 -	255	1.75	38659 -
HoCP01-551	10994	42.8	257	1.99	43197 -
HoCP01-561	10163	39.4	259	2.25	35029 -
HoCP01-564	11688	46.3	253	1.62	57172

Table 17. 2004 Nursery second-stubble means of the 2001 "L" assignment series in light soil at U.S.D.A- Ardoyne Farm, Chacahoula, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	12601	51.2	244	1.71	58988
HoCP85-845	10020	40.6	247	1.88	43333
HoCP91-555	14213	53.5	267	1.85	57626
L01-283	16442	62.9	262	1.88	66928
L01-299	16097	68.8	235	2.18	62844

Table 18. 2004 Nursery second-stubble means of the 2001 "L" assignment series in heavy soil at Iberia Research Station, Jeanerette, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7479	31.5	238	1.39	45375
HoCP85-845	7008	29.3	239	1.59 +	36981
HoCP91-555	7633	28.7	266	1.29	44241
L01-283	10719	41.7 +	258	1.65 +	50593
L01-299	11160	44.1 +	252	1.75 +	50366

Table 19. 2004 Nursery second-stubble means of the 2001 "L" assignment series in light soil at St. Gabriel Research Station, St. Gabriel, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7445	31.7	235	1.18	53996
HoCP85-845	7529	31.7	238	1.34	47871
HoCP91-555	7693	31.4	244	1.30	47871
L01-283	8449	33.2	256	1.29	52181
L01-299	10354	42.2	243	1.31	64433

Table 20. 2004 Infield plant-cane means of the 2002 "HoCP" and "L" assignment series in light soil at Blackberry Farms, Vacherie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	7894	28.6	277	1.61	35600	12.1
HoCP91-555	9408	33.7	280	1.67	40478	13.9 +
HoCP96-540	9614	35.8	269	2.22 +	32390	13.5
L02-316	9666	35.1	276	1.51	46751	13.6
L02-324	9039	33.4	271	1.69	39635	14.1 +
L02-325	9331	33.1	283	1.78	37116	14.6 +
L02-342	9147	33.0	279	1.79	37287	11.4
HoCP02-610	9515	36.8	259 -	2.23 +	33089	13.6
HoCP02-612	9791	36.1	272	1.94 +	37187	11.1
HoCP02-618	9798	37.2	264	1.66	45245	13.2
HoCP02-620	9186	36.4	253 -	1.44	52041	13.3
HoCP02-622	8774	34.0	258 -	1.67	40890	12.8
HoCP02-623	9916	36.1	275	1.86	39214	13.9 +
HoCP02-624	8073	31.1	260 -	1.21 -	52752	12.0
HoCP02-625	7066	27.7	257 -	1.39	39865	12.0
HoCP02-632	9538	34.4	278	1.61	42630	12.2
HoCP02-634	8487	31.5	269	1.83	34600	12.3
HoCP02-636	9067	35.9	253 -	1.92 +	37475	13.4
HoCP02-639	7810	27.9	280	1.46	38972	13.3
HoCP02-640	9010	33.5	269	1.99 +	33668	10.9
HoCP02-652	8642	33.9	255 -	1.62	41870	10.9
Ho02-653	8542	31.8	268	2.10 +	30454	14.3 +

Table 21. 2004 Nursery plant-cane means of the 2002 "HoCP" and "L" assignment series in heavy soil at Newton Cane, Inc., Bunkie, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	10868	47.6	229	2.05	46646
HoCP91-555	9467	38.1	248	1.78	42653
HoCP96-540	10807	41.6	260	2.23	37026 -
L02-316	11079	48.4	236	1.98	48279
L02-324	10861	45.2	238	2.08	43379
L02-325	10024	40.2	246	1.62	49187
L02-342	8339	35.4	236	1.83	38841
HoCP02-610	12862	53.2	241	2.56	41927
HoCP02-612	9821	47.8	204	2.66 +	36119 -
HoCP02-618	9954	43.9	226	1.92	45557
HoCP02-620	10473	43.4	242	1.65	52454
HoCP02-622	7407	33.4	222	1.70	39386
HoCP02-623	10033	39.8	252	1.85	43197
HoCP02-624	7564	35.3	214	1.45 -	49368
HoCP02-625	8607	39.7	216	1.81	43741
HoCP02-632	7547	31.3	242	1.75	35756 -
HoCP02-634	10069	48.6	207	2.38	40838
HoCP02-636	8933	41.5	217	2.12	39749
HoCP02-639	8129	33.4	243	1.45 -	46645
HoCP02-640	10538	42.3	250	2.19	38297
HoCP02-652	11341	47.9	236	1.94	49550
Ho02-653	7541	31.0	243	1.86	33396 -

Table 22. 2004 Nursery plant-cane means of the 2002 "L" assignment series in heavy soil at D & N Farm, Cecilia, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	8923	32.6	271	1.94	33940
HoCP91-555	7965	32.3	247	2.28	28314
HoCP96-540	8185	29.8	272	2.93 +	20328
L02-316	6879	26.6	257	1.92	27225
L02-324	9432	39.3	242	2.47 +	31581
L02-325	8623	33.4	259	2.44 +	27406
L02-342	11377	40.8	278	2.47 +	33577

Table 23. 2004 Infield plant-cane means of the 2002 "HoCP" and "L" assignment series in light soil at Sugarland Acres, Inc., Youngsville, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	9766	35.4	276	1.56	45511	13.5
HoCP91-555	9752	37.3	262	2.03 +	36751 -	13.4
HoCP96-540	11231	40.7	276	2.13 +	38376	12.7
L02-316	9275	34.5	269	1.49	46356	12.7
L02-324	8406	33.8	249 -	1.83	37272 -	13.2
L02-325	11518	44.3 +	260	1.86	47971	13.8
L02-342	8606	32.7	264	1.74	37627 -	11.2 -
HoCP02-610	9745	38.0	257	2.11 +	36121 -	14.5
HoCP02-612	7675	30.1	253 -	2.41 +	24954 -	10.9 -
HoCP02-618	9902	39.5	251 -	1.54	51906	12.7
HoCP02-620	10051	38.2	263	1.47	51988	12.9
HoCP02-622	9407	36.1	261	1.81	40055	12.1
HoCP02-623	12329 +	45.3 +	272	2.04 +	44522	13.6
HoCP02-624	9773	38.6	253 -	1.49	51825	12.1
HoCP02-625	9207	36.7	251 -	1.70	43226	12.3
HoCP02-632	9012	33.0	273	1.66	39728	11.5 -
HoCP02-634	10345	40.0	259	1.96 +	40661	13.5
HoCP02-636	8274	35.8	231 -	1.73	41395	12.7
HoCP02-639	7835	31.8	246 -	1.70	37603 -	12.9
HoCP02-640	10767	40.2	267	2.02 +	39907	10.3 -
HoCP02-652	8932	34.7	258	1.65	42110	12.3
Ho02-653	8924	34.6	259	1.86	37507 -	15.2

Table 24. 2004 Nursery plant-cane means of the 2002 “HoCP” and “L” assignment series in light soil at Landry Farms, Paincourtville, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	9687	37.6	258	1.22	61710
HoCP91-555	9970	41.8	239	1.56 +	53543
HoCP96-540	13913 +	55.3 +	252	2.33 +	47553 -
L02-316	9069	36.0	252	1.30	55539
L02-324	8900	34.9	255	1.72 +	40112 -
L02-325	13063 +	53.2 +	246	1.96 +	54450
L02-342	10231	40.2	255	1.67 +	48279 -
HoCP02-610	11392	50.7 +	225 -	2.26 +	44831 -
HoCP02-612	8442	36.1	234 -	2.30 +	31581 -
HoCP02-618	10947	42.9	254	1.51	56447
HoCP02-620	7194	29.3	246	1.11	52635
HoCP02-622	9158	38.2	239	1.69 +	45194 -
HoCP02-623	13212 +	50.8 +	260	1.78 +	57354
HoCP02-624	10493	45.0	232 -	1.36	66066
HoCP02-625	9723	43.3	225 -	1.40	61892
HoCP02-632	9507	37.7	250	1.37	54995
HoCP02-634	8219	39.6	208 -	1.71 +	46464 -
HoCP02-636	11131	48.2	232 -	1.70 +	57173
HoCP02-639	8883	34.9	255	1.25	56084
HoCP02-640	10351	40.3	257	1.92 +	41745 -
HoCP02-652	9135	38.0	240	1.39	54632
Ho02-653	10761	45.6	236 -	2.26 +	40475 -

Table 25. 2004 Nursery first-stubble means of the 2002 "L" assignment series in light soil at St. Gabriel Research Station, St. Gabriel, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	13117	50.7	259	2.09	48324
HoCP85-845	7245 -	28.1 -	258	1.71	32670
HoCP91-555	11226	42.1	267 +	1.97	42879
L02-316	10880	40.9	266 +	1.82	44921
L02-324	13083	50.0	261	2.34	42879
L02-325	12672	47.7	265 +	2.08	46283
L02-342	12689	46.8	271 +	2.10	44694

Table 26. 2004 Infield plant-cane means of the 2003 "L" assignment series in light soil at U.S.D.A-Ardoyne Farm, Chacahoula, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	8858	34.6	256	2.23	31082	13.2
HoCP91-555	9968	36.4	273 +	2.25	32443	13.9
HoCP96-540	11348	42.5	266	2.95 +	28586	12.2
L03-364	14046 +	54.1 +	261	2.81 +	38342	13.7
L03-365	7510	29.0	259	2.74 +	21099	14.4
L03-371	12759	45.7	279 +	2.58	35166	12.0
L03-374	13908 +	55.5 +	250	3.02 +	36754	11.5 -
L03-378	16832 +	62.3 +	270	2.67	46509 +	12.8
L03-381	9083	34.6	262	2.31	29721	10.1 -
L03-386	4390	18.1	243	2.26	16108 -	12.5
L03-387	9034	36.4	250	2.58	28133	11.3 -
L03-390	12770	49.4	259	2.35	41972	14.9 +
L03-391	9396	36.0	260	2.43	29494	14.8 +
L03-392	11401	41.3	276 +	2.25	36754	12.4
L03-393	8309	31.7	262	2.55	24956	13.9
L03-396	10859	39.0	280 +	2.27	34485	14.1
L03-397	11919	44.2	268	2.05	42652 +	13.9

Table 27. 2004 Nursery plant-cane means of the 2003 "L" assignment series in heavy soil at Iberia Research Station, Jeanerette, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	7674	33.5	230	1.85	36073	11.4
HoCP91-555	8226	36.7	224	2.28	32216	12.6
HoCP96-540	7655	35.3	217	2.24	31536	11.3
L03-364	8327	38.3	217	2.49 +	30855	12.5
L03-365	11047	49.2	224	3.06 +	32216	12.6
L03-371	10704	43.1	249	2.37 +	36527	10.6
L03-374	7513	29.3	255	2.48 +	22914	10.6
L03-378	9540	40.3	236	2.27	35619	11.9
L03-381	6704	28.6	233	2.29	20419	9.7
L03-386	6642	33.6	197	2.04	33124	11.3
L03-387	7316	32.9	221	2.10	33578	11.4
L03-390	9128	40.5	225	2.12	38115	13.5 +
L03-391	6345	25.8	245	1.86	27452	11.9
L03-392	7062	29.3	241	1.88	30174	10.9
L03-393	3810	15.5	242	2.07	14974	12.2
L03-396	11984	48.2	251	2.30	42426	12.8
L03-397	7124	30.8	230	1.81	34939	14.7 +

Table 28. 2004 Nursery plant-cane means of the 2003 "L" assignment series in light soil at St. Gabriel Research Station, St. Gabriel, Louisiana.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	10039	42.1	238	2.12	39703
HoCP91-555	10530	49.7	214	2.56	38796
HoCP96-540	8956	37.1	241	2.29	32443 -
L03-364	7917	37.9	209	2.19	35166
L03-365	7698	31.6	243	2.43	26091 -
L03-371	11368	44.7	254	2.51	35846
L03-374	11807	49.1	241	2.86 +	34258
L03-378	9956	40.0	247	2.28	34939
L03-381	9348	38.5	242	2.48	30855 -
L03-386	8631	36.1	242	2.01	35846
L03-387	5750 -	28.1	206	1.93	29040 -
L03-390	8467	39.8	214	2.05	38796
L03-391	8897	36.2	246	2.26	31989 -
L03-392	9949	41.6	240	2.31	36073
L03-393	12216	52.0	235	2.72 +	38342
L03-396	9459	38.6	246	2.06	37661
L03-397	9496	40.3	235	1.74	46509

Table 29. 2004 Infield and Nursery third-stubble means of the 1999 "HoCP" and "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
CP70-321	4338 -	18.0 -	247	1.58 +	22336 -	13.7
LCP85-384	6729	28.9	244	1.24	45629	12.3
HoCP85-845	8366	33.7	249	1.59 +	41992	14.7
L99-226	10603 +	40.5 +	263	2.02 +	39784	12.2
L99-233	9930 +	42.4 +	240	1.37	61683 +	13.5

Table 30. 2004 Infield and Nursery second-stubble means of the 2000 "HoCP" and "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7941	33.2	242	1.35	50187
HoCP85-845	7268	27.1	268 +	1.57	34584 -
HoCP91-555	8099	30.0	270 +	1.33	45395
L00-266	10413	43.2	244	1.44	59252
HoCP00-950	9994	35.6	282 +	1.66	43236

Table 31. 2004 Nursery third-stubble means of the 2000 "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	7831	30.6	258	1.65	35960
LCP85-384	9248	37.8	244	1.42	52862
HoCP85-845	8403	34.7	243	1.67	40611
L00-266	7538	31.8	238	1.30	49572

Table 32. 2004 Infield and Nursery first-stubble means of the 2001 "HoCP" and "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	10706	38.9	276	1.58	48998	11.6
HoCP85-845	9676	36.1	268	1.94 +	37190 -	13.9 +
HoCP91-555	10535	38.6	275	1.74	44168	13.4 +
L01-283	12862	45.0	289	1.81 +	49482	12.5
L01-299	13281 +	46.8	284	1.90 +	49450	13.7 +
HoCP01-517	12270	42.0	293	2.49 +	34138 -	11.7
HoCP01-523	10143	37.2	273	1.85 +	40926	13.0
HoCP01-551	8890	32.3	272	2.13 +	30736 -	13.8 +
HoCP01-561	10803	37.5	289	2.18 +	35013 -	11.4
HoCP01-564	9811	34.8	284	1.71	41512	11.8

Table 33. 2004 Nursery second-stubble means of the 2001 "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	9175	38.1	239	1.43	52786
HoCP85-845	8186	33.9	241	1.60	42728 -
HoCP91-555	9846	37.9	259 +	1.48	49912
L01-283	11870	45.9	258 +	1.60	56567
L01-299	12537 +	51.7 +	243	1.74	59214

Table 34. 2004 Infield and Nursery plant-cane means of the 2002 "HoCP" and "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	9428	36.3	262	1.67	44682	12.8
HoCP91-555	9312	36.6	255	1.86	40348	13.7
HoCP96-540	10750	40.7	266	2.37 +	35135 -	13.1
L02-316	9193	36.1	258	1.64	44830	13.1
L02-324	9327	37.3	251	1.96 +	38396 -	13.6
L02-325	10512	40.8	259	1.93 +	43226	14.2 +
L02-342	9540	36.4	262	1.90 +	39122 -	11.3 -
HoCP02-610	10738	43.8	246 -	2.39 +	36129 -	14.1 +
HoCP02-612	8791	36.7	241 -	2.43 +	29598 -	11.0 -
HoCP02-618	10010	40.0	249 -	1.76	46926	13.0
HoCP02-620	9085	35.9	251	1.52	49417	13.1
HoCP02-622	8546	34.5	246 -	1.82	38518 -	12.5
HoCP02-623	11232 +	42.1	265	1.98 +	43209	13.7
HoCP02-624	8835	36.7	240 -	1.48	52140 +	12.0
HoCP02-625	8510	36.0	237 -	1.68	44318	12.2
HoCP02-632	8760	33.2	261	1.70	40414	11.8
HoCP02-634	9139	39.1	236 -	2.07 +	37778 -	12.9
HoCP02-636	9210	39.5	233 -	1.97 +	41085	13.0
HoCP02-639	8023	31.2	256	1.57	41963	13.1
HoCP02-640	10025	38.2	261	2.13 +	35542 -	10.6 -
HoCP02-652	9372	37.8	248 -	1.76	44177	11.6
Ho02-653	8801	34.9	252	2.12 +	32595 -	14.8 +

Table 35. 2004 Nursery first-stubble means of the 2002 "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	13117	50.7	259	2.09	48324
HoCP85-845	7244.5	28.1	258	1.71	32670
HoCP91-555	11226	42.1	267	1.97	42879
L02-316	10880	40.9	266	1.82	44921
L02-324	13083	50.0	261	2.34	42879
L02-325	12672	47.7	265	2.08	46283
L02-342	12689	46.8	271	2.10	44694

Table 36. 2004 Nursery plant-cane means of the 2003 "L" assignment series across locations.

Variety	Sugar per Acre	Cane Yield	Sugar Per Ton	Stalk Weight	Stalk Number	Fiber
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)	(%)
LCP85-384	8857	36.7	241	2.07	35619	12.3
HoCP91-555	9575	40.9	237	2.36	34485	13.2
HoCP96-540	9320	38.3	242	2.49 +	30855	11.7
L03-364	10097	43.5	229	2.49 +	34788	13.1
L03-365	8752	36.6	242	2.74 +	26469 -	13.5 +
L03-371	11610	44.5	261 +	2.49 +	35846	11.3 -
L03-374	11355	46.1	246	2.82 +	31309	11.0 -
L03-378	12109	47.5	251	2.40	39023	12.3
L03-381	8441	34.3	245	2.36	26998	9.8 -
L03-386	6554	29.3	227	2.10	28359	11.9
L03-387	7243	32.2	225	2.20	30250	11.1 -
L03-390	10122	43.2	233	2.17	39628	14.2 +
L03-391	8213	32.7	250	2.18	29645	13.3 +
L03-392	9471	37.4	252	2.15	34334	11.6
L03-393	8112	33.1	246	2.44 +	26091 -	13.0
L03-396	10767	42.0	259 +	2.21	38191	13.5 +
L03-397	9658	39.1	245	1.86	41367	13.9 +

2004 LOUISIANA "HoCP" NURSERY and INFIELD VARIETY TRIALS

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Three years after selection from single stools in the seedling stages, experimental varieties that are advanced for further testing are assigned permanent 'HoCP' or 'Ho' numbers. It is at this stage when these newly assigned varieties are routinely planted to replicated tests for the first time. These tests are planted at three locations (Ardoyne Farm in Chacahoula, Iberia Research Station in Jeanerette, and St. Gabriel Research Station in St. Gabriel). The year after assignment, varieties advanced for further testing are planted in two nursery trials and two infield tests. These trials are conducted on commercial farms representing distinct regions of the Sugarcane Belt. When possible, varieties are replanted in an infield test on heavy soil at Ardoyne Farm two years after assignment.

USDA nursery test plots that are planted during the year of assignment consist of two replications with 16-foot, single row plots. There is a 4-foot alleyway between plots. A minimum of three commercial varieties (LCP 85-384, HoCP 85-845, HoCP 91-555, or HoCP 96-540) are planted in each test for comparison purposes. Beginning in 2003, varieties from the USDA's Recurrent Selection for Borers (RSB) program were included in nursery trials. This should give breeders more agronomic data on these varieties and aid in deciding what crosses should be made with these resistant clones.

Nursery tests plots are generally rated for agronomic traits in the spring and summer each year. Stalk counts representing mature millable stalks are made in July or August. A 10-stalk sample is hand-cut from each plot during the harvest season. Samples from USDA nurseries are taken to the Juice and Milling Quality Laboratory at Ardoyne Farm, where they are weighed and processed for sucrose analysis. Brix and pol are then used to estimate the yield of theoretical recoverable sugar (TRS) per ton of cane. Results from these analyses, along with mature millable stalk counts and mean stalk weight, are used to calculate yield of sugar per acre, yield of cane per acre, and number of stalks per acre. Varieties with acceptable yields (both tonnage and sugar per ton) and disease and insect resistance are advanced for further testing.

An infield variety test is routinely replanted at Ardoyne Farm two years after assignment. Varieties in this test are introduced to outfield locations and primary stations in the same year. Because of circumstances out of our control, these infield tests were not planted in 2002 and 2003. Fortunately, the 2002 HoCP & L series were planted on heavy soil at Ardoyne Farm in 2004. Infield tests were planted in a randomized complete block design with two replications, and include a minimum of three commercial varieties (LCP 85-384, HoCP 85-845, HoCP 91-555, or HoCP 96-540) for use as checks. With the change from soldier harvester to combine harvester, plot size in infield tests have been changed from three rows (18 feet) by 16 feet to two rows (12 feet) by 24 feet. Two samples (10 stalks for sucrose analysis and five stalks for fiber analysis) are hand-cut from each plot just prior to harvesting and sent to the sucrose lab at Ardoyne Farm for processing. Plots are weighed with a tractor-pulled hydraulic weigh wagon.

Plot weights and sucrose analysis are used to estimate sugar per acre, tons of cane per acre, sugar per ton of cane, mean stalk weight, and number of stalks per acre. An estimate of fiber percentage is also obtained.

Planting and harvest dates of USDA infield and nursery tests can be found in Table 1. Results from the 2nd stubble 1999 series infield test can be found in Table 2. Results from individual nursery tests as well as analyses combined by series over locations can be found in Tables 3 to 11. Statistical analyses were conducted for each test and for each series using PROC MIXED procedures in SAS (version 9.1). For purposes of comparison, LCP 85-384 is highlighted in each table. Yield estimates which are significantly higher or lower (P=0.05) than estimates for LCP 85-384 are noted with a '+' or '-'respectively.

Table 1. 2004 Planting and harvest dates of AHoCP@ nursery & infield tests.

					Harvest Dates		
Series	Location[2/]	Soil Texture [3/]	Test type	Planting Date	2002	2003	2004
1999	AFH	Sc	Infield	9/27/01	11/26	10/8	11/2
2001	AFL	Csl	Nursery	10/18/01	12/06	11/10	10/04
2001	IRS	Bsc	Nursery	10/23/01	12/11	11/12	10/27
2001	STG	Csl	Nursery	10/19/01	12/13	10/24	10/21
2002	AFL	Csl	Nursery	11/8/02		11/24	11/05
2003	AFL	Csl	Nursery	10/20/03			12/06
2003	IRS	Bsc	Nursery	10/21/03			11/19
2003	STG	Csl	Nursery	10/17/03			12/13
2002	AFH	Sc	Infield	8/24/04			
2004	AFL	Csl	Nursery	10/20/04			
2004	IRS	Bsc	Nursery	10/27/04			
2004	STG	Csl	Nursery	10/21/04			

[2/] AFH = Ardoyne Farm heavy soil, AFL = Ardoyne Farm Light soil in Chacahoula, IRS = Iberia Research Station in Jeanerette, STG = St. Gabriel Research Station in St. Gabriel.
[3/] Bsc = Baldwin silty clay, Csl = Commerce silt loam, Sc = Sharkey clay

Table 2. Means of the 1999 Ho series second-stubble infield variety test on heavy soil at Ardoyne Farm in Chacahoula, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre	Variety
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)	
LCP 85-384	6996	26.2	267	1.39	37653	12.3
HoCP 85-845	9265 +	31.4	295 +	1.86	34611	14.1
HoCP 91-555	7707	29.6	261	1.61	36703	12.5
L 99-226	8810 +	30.5	289 +	2.16 +	28624	12.7
L 99-233	10420 +	38.1 +	274	1.36	56161 +	12.6

Table 3. Means of the 2001 HoCP and Ho series second-stubble nursery variety trial on a Commerce silt loam soil at Ardoyne Farm in Chacahoula, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	10447	44.1	237	1.49	59214
HoCP 85-845	11256	44.9	251	1.81	49686
HoCP 91-555	10318	43.6	238	1.40	62391
HoCP 01-517	10144	38.2	265 +	2.00	38115
HoCP 01-523	10249	43.1	239	1.59	53996
HoCP 01-551	11637	44.5	261 +	1.93	46283
HoCP 01-561	12145	48.6	250	2.04	47644
Ho 01-564	12968	52.7	246	1.81	58988

Table 4. Means of the 2001 HoCP and Ho series second-stubble nursery variety trial on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	10747	35.2	298	1.49	42199
HoCP 85-845	7315	27.9	262 -	1.49	37434
HoCP 91-555	9754	34.6	282	1.26	54904 +
HoCP 01-517	15912	54.7	290	2.51 +	43333
HoCP 01-523	11471	40.2	287	1.83	43787
HoCP 01-551	11747	41.0	286	2.19 +	37434
HoCP 01-561	7720	26.3	295	1.80	29267
Ho 01-564	12235	40.4	303	1.53	52862

Table 5. Means of the 2001 HoCP and Ho series second-stubble nursery variety trial on a Commerce silt loam soil at St. Gabriel Research Station in St. Gabriel, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	11809	41.1	285	1.44	55131
HoCP 85-845	8835	33.6	264	1.47	45829
HoCP 91-555	11908	42.2	282	1.62	51954
HoCP 01-517	14333	47.4	303	2.53	37434
HoCP 01-523	11811	45.8	259	1.86	48551
HoCP 01-551	12481	43.9	286	1.79	49005
HoCP 01-561	13201	50.2	267	2.26	44241
Ho 01-564	12164	43.7	279	1.60	54450

Table 6. Combined means of the 2001 HoCP and Ho series second-stubble nursery variety trials in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	11052	41.1	273	1.47	54178
HoCP 85-845	9135	35.5	259	1.59	44316 -
HoCP 91-555	10660	40.1	267	1.43	56416
HoCP 01-517	13463	46.8	286	2.34 +	39628 -
HoCP 01-523	11177	43.0	261	1.76	48778
HoCP 01-551	11955	43.1	277	1.97 +	44241 -
HoCP 01-561	11022	41.7	271	2.03 +	40384 -
Ho 01-564	12455	45.6	276	1.65	55433

Table 7. Means of the 2002 HoCP and Ho series first-stubble nursery variety trial on a Commerce silt loam soil at Ardoyne Farm in Chacahoula, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	12050	47.7	249	1.71	55811
HoCP 85-845	11024	39.7	278 +	2.15 +	36981 -
HoCP 91-555	15658	56.5	277 +	2.14 +	53089
HoCP 02-610	12928	50.4	256	2.43 +	41518 -
HoCP 02-612	13713	56.5	243	2.35 +	48098
HoCP 02-618	11940	44.4	268	1.51	59214
HoCP 02-620	18110	66.0	274 +	2.11	62391
HoCP 02-622	11676	46.7	250	1.89	49459
HoCP 02-623	13860	50.0	278 +	2.00	50139
HoCP 02-624	13199	60.6	218 -	1.97	61710
HoCP 02-625	12689	50.0	254	1.88	53316
HoCP 02-632	11973	46.7	257	1.85	50593
HoCP 02-634	12569	48.5	257	2.00	48551
HoCP 02-636	11042	51.7	214 -	1.88	55131
HoCP 02-639	11100	44.3	252	1.55	57173
HoCP 02-640	15835	56.8	279 +	2.14 +	53089
HoCP 02-652	12446	49.6	249	2.02	50139
Ho 02-653	11732	47.3	248	2.21 +	42879 -

Table 8. Means of the the 2003 HoCP and Ho series plant-cane nursery variety trial on a Commerce silt loam soil at Ardoyne Farm in Chacahoula, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	11652	39.5	296	1.88	41745
HoCP 91-555	15140	49.8	305	2.24	44468
HoCP 96-540	14046	51.3	274	2.72 +	37661
HoCP 03-703	13456	44.9	300	2.69 +	33351
HoCP 03-704	14576	51.2	284	2.32	45148
HoCP 03-708	14156	46.5	305	2.18	42653
HoCP 03-711	10193	34.4	297	1.98	34712
HoCP 03-713	11027	38.6	287	2.07	36981
HoCP 03-714	9681	36.4	266 -	1.69	42879
HoCP 03-716	12267	44.5	277	2.34	38569
HoCP 03-717	12862	46.4	277	2.68 +	34712
HoCP 03-718	9547	32.5	294	1.55	42199
HoCP 03-719	14975	53.1 +	282	2.56 +	42426
HoCP 03-720	11697	44.0	267 -	2.04	43106
HoCP 03-721	13587	50.7	267 -	2.39	42426
HoCP 03-725	11427	42.9	266 -	2.75 +	31309 -
HoCP 03-726	8662	30.4	286	2.14	28359 -
HoCP 03-727	10437	39.0	267 -	2.04	38342
HoCP 03-730	12516	43.6	287	2.02	43333
HoCP 03-731	12958	46.7	279	2.65 +	34939
HoCP 03-735	12547	43.9	286	1.87	47190
HoCP 03-736	9409	33.2	284	1.77	37661
HoCP 03-738	9003	33.0	272 -	1.56	42879
HoCP 03-739	10145	45.1	225 -	2.80 +	32216 -
HoCP 03-743	12828	42.5	302	2.11	40384
HoCP 03-744	13013	51.6	254 -	2.59 +	39930
HoCP 03-749	13523	45.9	295	2.34	39249
HoCP 03-757	14182	47.9	296	2.23	43106
Ho 03-759	13270	46.5	284	2.22	41745
US 90-18	8502	28.9	295	1.81	31989 -
US 01-40	8485	36.5	232 -	2.00	36527
US 02-95	12081	42.7	283	2.27	37661
US 02-96	7516 -	33.6	225 -	2.21	30401 -
US 02-97	6688 -	23.7 -	278	2.34	20873 -
US 02-98	7268 -	26.5 -	274	2.09	25410 -
US 02-99	8140	30.5	266 -	2.52 +	24276 -

Table 9. Means of the 2003 HoCP and Ho series plant-cane nursery variety trial on a Baldwin silty clay soil at Iberia Research Station in Jeanerette, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	7876	31.0	257	2.14	28813
HoCP 91-555	11181 +	42.2 +	265	2.23	37888
HoCP 96-540	7633	31.1	246	2.29	27225
HoCP 03-703	7886	30.5	258	2.07	29494
HoCP 03-704	8529	34.4	249	2.09	33124
HoCP 03-708	6904	25.6	274	2.06	24729
HoCP 03-711	5780	23.7	241	2.34	19738
HoCP 03-713	6486	25.3	257	1.81	28133
HoCP 03-714	6680	28.0	239	2.17	25864
HoCP 03-716	8340	32.4	257	2.35	27679
HoCP 03-717	7372	31.3	236	2.32	26998
HoCP 03-718	6052	24.1	251	1.59 -	30401
HoCP 03-719	7283	30.0	243	2.62 +	22914
HoCP 03-720	7147	27.6	258	1.97	27906
HoCP 03-721	3125 -	13.3 -	240	2.02	13386 -
HoCP 03-725	5280 -	21.6	244	2.58 +	16789 -
HoCP 03-726	6905	26.8	258	2.20	24503
HoCP 03-727	5876	27.7	212 -	1.83	30174
HoCP 03-730	6542	27.7	234	1.65 -	34031
HoCP 03-731	4961 -	22.4	225 -	2.22	20192
HoCP 03-735	6759	27.2	249	1.72 -	31763
HoCP 03-736	4828 -	20.1 -	240	1.59 -	25864
HoCP 03-738	5206 -	22.7	231 -	1.58 -	28586
HoCP 03-739	5462	24.2	226 -	3.01 +	16108 -
HoCP 03-743	7529	30.9	244	1.85	33578
HoCP 03-744	6258	32.0	196 -	2.40	26771
HoCP 03-749	4472 -	18.1 -	249	1.83	19738
HoCP 03-757	10818 +	40.5	267	2.03	39930 +
Ho 03-759	7150	28.7	250	2.06	28133
US 90-18	4710 -	18.2 -	260	1.79	20192
US 01-40	7841	41.3	190 -	2.36	35166
US 02-95	5961	24.2	247	2.63 +	18377
US 02-96	3999 -	21.2	190 -	2.30	18377
US 02-97	3168 -	13.9 -	227 -	2.00	14066 -
US 02-98	3409 -	15.6 -	219 -	1.94	16789 -
US 02-99	3052 -	14.1 -	216 -	2.18	12932 -

Table 10. Means of the 2003 HoCP and Ho series plant-cane nursery variety trial on a Commerce silt loam soil at St. Gabriel Research Station in St. Gabriel, Louisiana, in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	10011	42.5	236	2.08	40838
HoCP 91-555	9547	39.0	247	2.30	33578
HoCP 96-540	10141	48.7	208	2.74 +	35393
HoCP 03-703	8721	44.8	194 -	2.77 +	32443
HoCP 03-704	12086	52.3	232	2.07	50139 +
HoCP 03-708	9456	38.0	249	1.89	40611
HoCP 03-711	10862	48.7	223	2.26	43106
HoCP 03-713	9068	41.6	219	2.27	36527
HoCP 03-714	7253	37.4	194 -	1.65 -	45602
HoCP 03-716	8660	40.4	216	2.56 +	31536 -
HoCP 03-717	7430	34.3	217	1.89	36527
HoCP 03-718	9273	37.5	248	1.84	40611
HoCP 03-719	8830	40.3	220	2.42	33351
HoCP 03-720	8383	40.7	206	2.04	39930
HoCP 03-721	7253	40.3	182 -	2.29	35393
HoCP 03-725	8807	42.3	208	2.72 +	31082 -
HoCP 03-726	8357	35.2	237	2.65 +	26544 -
HoCP 03-727	7557	37.4	202	2.03	36981
HoCP 03-730	7854	38.2	206	1.89	41064
HoCP 03-731	7407	38.5	191 -	2.21	35166
HoCP 03-735	8688	40.0	218	1.79	44468
HoCP 03-736	8505	42.0	203	1.85	45602
HoCP 03-738	7850	35.8	219	1.47 -	48778
HoCP 03-739	5646 -	32.2	185 -	2.30	27679 -
HoCP 03-743	10832	46.5	233	2.40	38796
HoCP 03-744	8581	45.8	188 -	2.48	36981
HoCP 03-749	7601	33.4	221	1.97	33124
HoCP 03-757	10462	49.2	214	2.36	41972
Ho 03-759	5998 -	28.0 -	215	1.90	29494 -
US 90-18	7938	33.6	237	2.04	33124
US 01-40	5847 -	42.4	137 -	2.50	34031
US 02-95	8630	39.2	221	2.50	31309 -
US 02-96	7910	44.9	176 -	2.53 +	35393
US 02-97	3218 -	19.2 -	168 -	2.01	19058 -
US 02-98	3896 -	23.7 -	163 -	1.75	27225 -
US 02-99	7998	40.1	199	2.33	34485

Table 11. Combined means of the 2003 HoCP and Ho series plant-cane nursery variety trials in 2004.

Variety	Sugar/ acre	Tons/ acre	Sugar/ ton	Weight/ stalk	Stalks/ acre
	(lbs.)	(tons)	(lbs.)	(lbs.)	(no.)
LCP 85-384	9846	37.6	263	2.03	37132
HoCP 91-555	11956	43.7	272	2.26	38644
HoCP 96-540	10607	43.7	243 -	2.58 +	33426
HoCP 03-703	10021	40.1	251	2.51 +	31763
HoCP 03-704	11731	45.9	255	2.16	42804
HoCP 03-708	10172	36.7	276	2.04	35998
HoCP 03-711	8561	33.0	260	2.18	30401
HoCP 03-713	8860	35.2	254	2.05	33880
HoCP 03-714	7872	34.0	233 -	1.83	38115
HoCP 03-716	9756	39.1	250	2.42 +	32594
HoCP 03-717	9221	37.4	243 -	2.29	32746
HoCP 03-718	8290	31.4	264	1.66 -	37737
HoCP 03-719	10362	41.1	248	2.53 +	32897
HoCP 03-720	9076	37.5	243 -	2.02	36981
HoCP 03-721	7988	34.8	229 -	2.23	30401 -
HoCP 03-725	8505	35.6	239 -	2.68 +	26393 -
HoCP 03-726	7975	30.8	260	2.33	26469 -
HoCP 03-727	7957	34.7	227 -	1.97	35166
HoCP 03-730	8971	36.5	242 -	1.85	39476
HoCP 03-731	8442	35.9	232 -	2.36 +	30099 -
HoCP 03-735	9331	37.0	251	1.79	41140
HoCP 03-736	7580 -	31.8	242 -	1.73	36376
HoCP 03-738	7353 -	30.5	241 -	1.53 -	40081
HoCP 03-739	7084 -	33.8	212 -	2.70 +	25334 -
HoCP 03-743	10396	40.0	259	2.12	37586
HoCP 03-744	9284	43.1	212 -	2.49 +	34561
HoCP 03-749	8532	32.5	255	2.04	30704
HoCP 03-757	11821	45.9	259	2.21	41669
Ho 03-759	8806	34.4	249	2.06	33124
US 90-18	7050 -	26.9 -	264	1.88	28435 -
US 01-40	7391 -	40.1	186 -	2.29	35241
US 02-95	8891	35.3	250	2.47 +	29116 -
US 02-96	6475 -	33.2	197 -	2.34	28057 -
US 02-97	4350 -	18.0 -	234 -	2.12	17167 -
US 02-98	4857 -	22.0 -	218 -	1.93	23141 -
US 02-99	6397 -	28.2 -	227 -	2.34	23898 -

2004 LOUISIANA SUGARCANE VARIETY DEVELOPMENT PROGRAM OUTFIELD VARIETY TRIALS[1]

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The outfield variety trials are the final stage of testing experimental varieties for their potential commercial production in Louisiana. Results from these trials are used in both variety advancement and crossing decisions. The outfield variety trials are cooperatively conducted at 10 commercial locations throughout the Louisiana Sugarcane Belt by the LSU AgCenter, the USDA-ARS, and the American Sugar Cane League.

To be considered for release, an experimental variety must equal or exceed the performance of commercial varieties with regard to yield and harvestability across locations, crops, and years. Accurate varietal evaluation requires overall yield performance information in addition to performance under adverse harvest conditions. The objective of this report is to provide overall and specific location yield data by crop for the 2004 outfield tests. Included are multi-year yield analyses for appropriate test varieties (tables 3-31).

The experimental design used at each outfield location was a randomized complete block design with three replications per location. To reflect industry practices, all locations were harvested with a combine harvester. Third-stubble plots were three rows wide (6-foot rows) and 32 feet long with a 5-foot alley between plots. Plant-cane, first stubble, second stubble test plots were harvested on plots that were two rows wide and 50 feet long with a 5-foot alley between plots. All tests planted in 2004 had two-row plots that were 50 feet long with a 5-foot alley. Tests were harvested with combine harvesters and weighed with an electronic weigh wagon with load cells mounted on each axle and hitch. A 15-stalk, whole-stalk sample, not stripped of leaves, was taken from each plot and sent to the USDA-ARS sucrose lab. Samples were hand cut for all tests. The samples were weighed, milled, and the juice analyzed for Brix and pol. Pounds of theoretical recoverable sugar per ton of cane are reported.

Cane yield for each plot was estimated by plot weight, less 14% to adjust for leaf-trash weight and 10% for harvester efficiency. Stalk number was calculated by dividing adjusted cane yield by stalk weight. Adjustments made to cane yield resulted in lower estimated stalk numbers than those achieved by growers.

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[1]Data were obtained through a cooperative effort of personnel from the LSU AgCenter, USDA-ARS, Sugarcane Research Unit, and the American Sugar Cane League in accordance to the provisions of the "Three-way Agreement of 1978." The Testing program would not be possible without the full cooperation of the growers at each outfield location.

Interpreting one year of yield data can be misleading because varieties may differ in relative performance from year to year. Across location means can likewise be misleading since a variety, experimental or commercial, may not perform consistently at all locations. Multi-year and multi–location testing solves these problems by averaging the inconsistent performances.

LCP85-384 has been the leading variety in Louisiana since 1998 with about 91% of the sugarcane acreage in 2004 grown to this variety. For comparison, LCP85-384 is highlighted in the tables. To adjust for missing data, the SAS analysis calculated least square means (v 9.0, Proc Mixed). Mean separation used least square mean probability differences (P=0.05). Varieties that are significantly higher or lower than LCP85-384 are denoted by a plus (+) or minus (-), respectively, next to the value for each trait.

Twenty experimental varieties were introduced to the outfield locations for seed increase in 2004 (Table 1). Twelve experimental and five commercial varieties were planted at 10 outfield locations. Twenty-nine tests were harvested in 2004 including nine plant-cane, eight first-stubble, nine second-stubble, and three third-stubble crops (Table 2).

Variety yields are reported by crop and trait with overall means and individual location data in the same table (Table 3-22) and in summary tables by crop (Tables 23-26). Tables 27-31 provide combined analysis of plant-cane, first stubble, second stubble, and third stubble crops averaged over several years that is used to evaluate commercial and experimental varieties.

Experimental varieties L99-226 and L99-233 continued to perform well in outfield testing in 2004 based on both plant-cane and first stubble data. Experimental varieties L00-266 and HoCP00-950 were included in plant-cane tests in 2004, with experimental variety HoCP00-950 performing extremely well. L00-266 had the lowest yields of any experimental variety in the plant-cane tests. L99-226 and L99-233 will be eligible for release in 2006

Table 1. Commercial and experimental varieties planted in the outfield testing stage in 2004.

Commercial Varieties	Experimental Varieties		Experimental Varieties Introduced to the Outfield		
LCP85-384	L99-226	HOCP01-517	CP89-2143	HOCP02-612	HOCP02-632
HOCP91-555	L99-233	HOCP01-523	L02-316	HOCP02-618	HOCP02-634
HOCP95-988	L00-266	HOCP01-551	L02-324	HOCP02-620	HOCP02-636
HOCP96-540	HOCP00-950	HOCP01-558	L02-325	HOCP02-622	HOCP02-639
L97-128	L01-283	HOCP01-561	L02-342	HOCP02-623	HOCP02-640
	L01-299	HO01-564	HOCP02-610	HOCP02-624	HOCP02-652
				HOCP02-625	HO02-653

Table 2. Harvest and planting dates for all outfield locations harvested in 2004.

Location	Parish	Plant-cane			First-stubble		Second-stubble		Third-stubble	
		2004 Date Planted	2004 Harvest Date	2003 Plant Date	2004 Harvest Date	2002 Plant Date	2004 Harvest Date	2001 Plant Date	2004 Harvest Date	2000 Plant Date
A. Landry	Iberville	09/09	12/15	09/17		***		***		***
Allain	St. Mary	09/01		09/12*		***	10/27	09/19	10/27	09/27
Alma	Pointe Coupee	09/20	12/02	09/11	12/02	09/04	10/21	09/14		08/30
Bon Secour	St. James	09/08	12/14	09/05	12/14	09/03	11/08	09/08	11/08	08/24
Georgia	Lafourche	09/07	11/23	09/18	11/23	09/21	11/23	09/15		09/19
Glenwood	Assumption	09/10	11/18	08/27	11/04	08/29	11/04	09/25		08/23
K. Self	Pointe Coupee	9/22*	**	***		***		***		***
Lanaux	St. John	08/25	11/09	09/03	11/09	09/11	10/20	09/05	10/20	09/06
Levert-St. John	St. Martin	08/26	11/15	08/26	10/25	09/11	10/25	09/19		09/01
Magnolia	Terrebonne	09/10	10/29	10/09	10/29	08/16	10/29	10/04		10/04
R. Hebert	Iberia	09/13	11/19	09/12	11/19	09/18	11/19	09/27		09/05

* Introductions only; ** No test harvested at this location; *** No test planted.

Table 3. Plant-cane sugar per acre for four commercial and four experimental varieties at nine outfield locations in 2004.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/A)					
LCP85-384	8539	4903	7587	7373	7995	7957	5491	8043	6914	7200
HOCP91-555	9690	7050 +	8727	9865 +	9075	8723	7877 +	9171	7110	8588+
HOCP96-540	10737+	5963 +	10348+	10539+	8491	10619+	6787 +	10431+	7083	9000+
L97-128	10903+	5345	9532 +	9412 +	9620 +	9296	6571	9563	6510	8528+
L99-226	10329	7530 +	9635 +	11184+	9373	10853+	7982 +	11230+	7722	9538+
L99-233	9419	5241	9771 +	10462+	10230+	10256+	6857 +	11068+	6021	8814+
L00-266	7717	4625	9171 +	9119	6788	9039	6519	8903	6281	7573
HOCP00-950	8719	7751 +	10015+	11309+	8905	11295+	8421 +	10320+	8678 +	9490+

Table 4. Plant-cane yield for four commercial and four experimental varieties at nine outfield locations in 2004.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(tons/A)					
LCP85-384	30.2	17.9	24.3	28.9	30.1	30.5	19.7	30.5	27.6	26.6
HOCP91-555	32.5	25.7+	28.5	33.4	29.7	32.6	27.2+	31.5	27.5	29.8+
HOCP96-540	37.3+	23.9+	30.7+	37.7+	30.2	42.6+	24.3+	35.7	25.7	32.0+
L97-128	35.0	18.9	30.5+	31.7	31.2	33.5	21.7	32.0	23.0	28.6
L99-226	37.0+	26.4+	29.0+	36.1+	32.8	39.4+	27.7+	36.0	27.7	32.5+
L99-233	33.8	19.9	32.2+	36.0+	35.6	37.1+	23.9+	37.6	22.6-	31.0+
L00-266	27.7	18.5	29.1+	32.5	25.1	35.3	22.5	32.3	24.6	27.5
HOCP00-950	29.4	25.2+	30.1+	37.1+	27.6	39.6+	28.2+	33.2	28.6	31.0+

Table 5. Plant-cane sugar per ton for four commercial and four experimental varieties at nine outfield locations in 2004.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/ton)					
LCP85-384	283	274	312	255	266	260	278	264	251	272
HOCP91-555	298	274	305	295+	306+	268	289	291+	258	287+
HOCP96-540	285	250-	337+	279	281	250	280	293+	274	281
L97-128	311	283	312	297+	309+	277	302+	298+	284+	297+
L99-226	279	285	332+	310+	286	275	288	312+	281+	294+
L99-233	277	264	304	290+	288	277	288	295+	266	283+
L00-266	279	251-	315	279	271	256	290	277	255	275
HOCP00-950	298	307+	333+	305+	323+	285+	299	311+	303+	307+

Table 6. Plant-cane stalk weight for four commercial and four experimental varieties at nine outfield locations in 2004.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs)					
LCP85-384	1.75	1.73	2.03	1.78	2.13	1.85	1.94	1.75	1.75	1.86
HOCP91-555	2.21+	2.12	1.87	1.83	2.24	2.39+	2.14	1.85	2.15+	2.09+
HOCP96-540	2.26+	2.34+	2.34	2.66+	2.16	2.63+	2.71+	2.45+	2.55+	2.46+
L97-128	2.38+	2.09	2.44	2.43+	2.67+	2.86+	2.06	2.34+	2.26+	2.39+
L99-226	2.98+	2.34+	2.92+	3.01+	2.93+	3.42+	2.41	2.75+	2.94+	2.86+
L99-233	1.79	1.64	1.75	1.98	1.99	2.24+	2.04	1.75	2.01	1.91
L00-266	1.85	1.81	1.76	1.88	2.02	1.99	2.36	1.77	2.06	1.95
HOCP00-950	2.08+	2.15+	2.25	2.08	2.07	2.25+	2.12	2.11+	2.09	2.13+

Table 7. Plant-cane stalk number for four commercial and four experimental varieties at nine outfield locations in 2004.

	Heavy		Light							
Variety	Landry	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(stalks/A)					
LCP85-384	34635	20755	24189	32568	28608	33484	21178	35306	31810	29170
HOCP91-555	29871	24363	31406 +	36865	26726	27284-	25521	34622	26342	29222
HOCP96-540	33082	20560	26421	29096	28524	32619	18093	29172	20391 -	26440
L97-128	29689	18056	25099	26188	23490	23568-	21247	27384	20285 -	23889-
L99-226	24982-	22753	20123	24251	22460	23246-	23851	26113-	18980 -	22973-
L99-233	38128	25003	36877 +	37379	36080+	33116	23346	43746	22923 -	32955+
L00-266	29719	20579	33597 +	35236	25208	35488	19989	36302	23918 -	28776
HOCP00-950	28207-	23502	26705	36256	26661	35506	26705	31485	27875	29211

Table 8. First-stubble sugar per acre for five commercial and two experimental varieties at eight outfield locations in 2004.

	Heavy	Light							
Variety	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/A)				
LCP85-384	3369	5423	9353	6597	6512	7718	7468	6213	6588
HOCP85-845	4688	4917	8297 -	6389	7804	5851 -	10618+	6967	6941
HOCP91-555	3317	5604	10621+	7203	8785 +	8189	10006+	6802	7598 +
HOCP96-540	4102	6499	10640+	6471	7913	6943	9775 +	8223 +	7571 +
L97-128	5132+	5766	8998	7082	8606 +	7008	10438+	6867	7487 +
L99-226	4862	5736	11278+	7630	9140 +	8487	11927+	8106 +	8396 +
L99-233	5057+	6020	10415+	7811 +	8834 +	8498	9729 +	6564	7866 +

Table 9. First-stubble cane yield for five commercial and two experimental varieties at eight outfield locations in 2004.

	Heavy	Light							
Variety	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(tons/A)				
LCP85-384	11.2	20.6	31.4	23.4	25.3	29.0	28.0	21.9	23.9
HOCP85-845	15.2	19.6	29.4	23.2	28.6	23.4-	41.2+	26.3	25.8
HOCP91-555	10.7	23.1	34.5+	24.4	29.8+	28.8	34.4+	24.1	26.3+
HOCP96-540	13.5	25.4	35.9+	22.2	32.3+	26.7	37.5+	28.6+	27.8+
L97-128	16.1+	21.3	29.6	22.8	30.4+	25.0	37.6+	23.5	25.8
L99-226	15.2	20.4	34.9+	24.1	30.4+	28.9	40.1+	27.0	27.6+
L99-233	16.5+	21.4	35.8+	25.8	30.1+	31.2	36.0+	24.7	27.7+

Table 10. First-stubble sugar per ton for five commercial and two experimental varieties at eight outfield locations in 2004.

	Heavy	Light							
Variety	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/ton)				
LCP85-384	304	261	298	282	259	265	265	283	277
HOCP85-845	308	251	282	276	273	250	259	263-	270
HOCP91-555	305	242	307	295	295+	285	291+	283	288+
HOCP96-540	304	253	296	293	244	260	261	288	275
L97-128	318	270	304	310+	283	280	278	292	292+
L99-226	320	281	324+	315+	301+	293	297+	300	304+
L99-233	307	280	291	302+	293+	272	271	266	285

Table 11. First-stubble stalk weight for five commercial and two experimental varieties at eight outfield locations in 2004.

Variety	Heavy	Light							
	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs)				
LCP85-384	1.09	1.73	1.65	1.65	1.74	1.57	1.75	1.53	1.59
HOCP85-845	1.47+	1.61	2.22+	1.52	2.07	1.82	2.09+	1.84	1.83+
HOCP91-555	1.23	2.01	1.90	1.35-	2.08	1.90+	1.81	1.83	1.77+
HOCP96-540	1.47+	2.14+	2.34+	1.52	1.93	2.24+	2.37+	1.95+	2.00+
L97-128	1.50+	1.69	2.40+	1.87	2.34+	2.04+	2.31+	1.93+	2.01+
L99-226	1.64+	2.56+	2.66+	1.92	2.46+	2.08+	2.72+	2.22+	2.28+
L99-233	1.33	1.87	1.81	1.49	1.68	1.62	1.90	1.42	1.64

Table 12. First-stubble stalk number for five commercial and two experimental varieties at eight outfield locations in 2004.

Variety	Heavy	Light							
	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(stalks/A)				
LCP85-384	19411	23971	38542	28855	29453	37787	32014	28633	29916
HOCP85-845	20809	24362	26468-	30501	27967	25658-	39707+	28677	28019
HOCP91-555	17746	22999	36645	36820+	28942	30388	37929	26208	29832
HOCP96-540	18694	23490	30644	29135	33629	23894-	31822	29408	27590
L97-128	21702	25346	24876-	24551	26893	24559-	32635	24532	25637-
L99-226	19153	15971-	26347-	25135	24666	28321-	29648	24323	24196-
L99-233	25447	23017	40837	34890+	36012	38735	38026	34818+	33973+

Table 13. Second-stubble sugar per acre for five commercial varieties and one experimental variety at nine outfield locations in 2004.

	Heavy		Light							
Variety	Allain	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/A)					
TucCP77-042	5739	4397	7300	8758+	8338	6878	*	8019	6592	6873
LCP85-384	6442	3381	5438	7079	7552	6879	5255	7555	6285	6207
HOCP85-845	6000	4466	5502	7408	7636	5974	5335	7952	6284	6284
HOCP91-555	5584	4393	3713-	8255+	6903	6405	5971	7934	5391	6061
HOCP96-540	6637	5384+	5093	7527	7482	4702-	4922	8249	6598	6288
L97-128	6166	5145+	8407+	7834	8540	6217	6222	8218	6930	7076+

* Not included in experiment

Table 14. Second-stubble cane yield for five commercial varieties and one experimental variety at nine outfield locations in 2004.

	Heavy		Light							
Variety	Allain	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(tons/A)					
TucCP77-042	22.0	15.6+	26.0+	33.9+	33.8+	26.0	*	31.6+	28.6	27.1+
LCP85-384	23.0	10.1	17.9	25.0	26.7	23.7	20.2	27.0	23.6	21.9
HOCP85-845	22.2	14.2+	18.7	27.3+	28.5	21.6	23.7	28.9	24.8	23.3
HOCP91-555	20.2	13.5+	12.1-	28.8+	25.5	22.9	24.2	28.7	19.0	21.7
HOCP96-540	24.1	16.7+	15.3	28.2+	27.7	18.1	22.3	30.6+	23.7	23.0
L97-128	21.0	15.2+	25.9+	28.4+	29.3	21.0	24.8	27.7	24.2	24.2

* Not included in experiment

Table 15. Second-stubble sugar per ton for five commercial varieties and one experimental variety at nine outfield locations in 2004.

	Heavy		Light							
Variety	Allain	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs/ton)					
TucCP77-042	261-	281-	281	259-	247-	265-	*	254	231-	255-
LCP85-384	280	336	305	282	284	291	257	280	267	287
HOCP85-845	271	315	293	271	267	275	222	275	253	271-
HOCP91-555	277	325	307	287	269	277	246	277	284	283
HOCP96-540	275	323	332+	267	271	260-	217	268	279	277-
L97-128	293	339	324	276	291	295	253	297	286	295

* Not included in experiment

Table 16. Second-stubble stalk weight for five commercial varieties and one experimental variety at nine outfield locations in 2004.

	Heavy		Light							
Variety	Allain	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(lbs)					
TucCP77-042	1.60+	1.68	1.89+	1.97+	2.01+	1.85+	*	1.99+	2.01+	1.87+
LCP85-384	1.21	1.60	1.34	1.51	1.55	1.50	1.44	1.35	1.41	1.44
HOCP85-845	1.78+	1.77	1.91+	1.80+	1.36	1.67	1.57	1.77+	1.66	1.70+
HOCP91-555	1.42	1.51	1.39	1.80+	1.43	1.55	1.70	1.57	1.62	1.55
HOCP96-540	1.49	1.75	1.72+	1.87+	1.77	1.76	1.70	2.08+	1.83+	1.77+
L97-128	1.83+	1.76	1.84+	2.00+	1.86	1.62	1.93+	2.12+	1.78	1.86+

* Not included in experiment

Table 17. Second-stubble stalk number for five commercial varieties and one experimental variety at nine outfield locations in 2004.

	Heavy		Light							
Variety	Allain	Magnolia	Alma	Bon Secour	Georgia	Glenwood	Lanaux	R. Hebert	St. John	Mean
					(stalks/A)					
TucCP77-042	27670-	19139+	27516	34493	34182	28161	*	31836-	29242	28958
LCP85-384	38230	12571	26530	33558	34397	31634	28168	40517	33844	31050
HOCP85-845	25053-	15954	19795	30466	42319	26026-	31412	32857-	30094	28219
HOCP91-555	28977-	18500	17738 -	32085	37766	29512	28708	36667	23631	28176
HOCP96-540	33090	19514+	17847 -	30763	31234	20506-	26573	29841-	26697	26229-
L97-128	22985-	17279	28213	28500	31306	25822-	25629	26537-	26992	25918-

* Not included in experiment

Table 18. Third-stubble sugar per acre for six commercial varieties at three outfield locations in 2004.

	Heavy	Light		
Variety	Allain	Bon Secour	Lanaux	Mean
		(lbs/A)		
CP70-321	3802 -	3854 -	*	3484 -
LCP85-384	5135	5817	4380	5111
HOCP85-845	5007	6498	4559	5355
HOCP91-555	5485	6559	5715	5920
HOCP96-540	6423 +	6993 +	5006	6141 +
L97-128	6554 +	6061	4960	5858

* Not included in experiment

Table 19. Third-stubble yield for six commercial varieties at three outfield locations in 2004.

	Heavy	Light		
Variety	Allain	Bon Secour	Lanaux	Mean
		(tons/A)		
CP70-321	14.2-	16.1-	*	13.7-
LCP85-384	17.7	21.7	15.2	18.2
HOCP85-845	18.4	23.4	16.8	19.5
HOCP91-555	18.2	24.9	19.2	20.7
HOCP96-540	21.8+	25.8+	16.9	21.5+
L97-128	20.6+	20.8	16.2	19.2

* Not included in experiment

Table 20. Third-stubble sugar per ton for six commercial varieties at three outfield locations in 2004.

	Heavy	Light		
Variety	Allain	Bon Secour	Lanaux	Mean
		(lbs/ton)		
CP70-321	269	240-	*	256-
LCP85-384	291	268	288	282
HOCP85-845	271	279	271	274
HOCP91-555	302	264	300	289
HOCP96-540	295	271	295	287
L97-128	318	291+	305	305+

* Not included in experiment

Table 21. Third-stubble stalk weight for six commercial varieties at three outfield locations in 2004.

Variety	Heavy	Light		Mean
	Allain	Bon Secour	Lanaux	
		(lbs)		
CP70-321	1.33	1.95+	*	1.59
LCP85-384	1.22	1.54	1.22	1.33
HOCP85-845	1.68+	1.63	1.20	1.50
HOCP91-555	1.29	1.62	1.50	1.47
HOCP96-540	1.34	1.94+	1.45	1.58
L97-128	1.53+	1.72	1.44	1.56

* Not included in experiment

Table 22. Third-stubble stalk number for six commercial varieties at three outfield locations in 2004.

Variety	Heavy	Light		Mean
	Allain	Bon Secour	Lanaux	
		(stalks/A)		
CP70-321	21582	16455-	*	18671-
LCP85-384	29181	28267	24890	27446
HOCP85-845	21892	28860	27881	26211
HOCP91-555	28440	30757	25476	28224
HOCP96-540	32609	26600	23642	27617
L97-128	28062	24193-	22750	25002

* Not included in experiment

Table 23. 2004 plant-cane means from nine outfield locations: Alma, Bon Secour, Georgia, Glenwood, Lanaux, Landry, Magnolia, R. Hebert, and St. John farms.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7200	26.6	272	1.86	29170
HOCP91-555	8588 +	29.8+	287+	2.09+	29222
HOCP96-540	9000 +	32.0+	281	2.46+	26440
L97-128	8528 +	28.6	297+	2.39+	23889-
L99-226	9538 +	32.5+	294+	2.86+	22973-
L99-233	8814 +	31.0+	283+	1.91	32955+
L00-266	7573	27.5	275	1.95	28776
HOCP00-950	9490 +	31.0+	307+	2.13+	29211

Table 24. 2004 first stubble means from eight outfield locations: Alma, Bon Secour, Georgia, Glenwood, Lanaux, Magnolia, R. Hebert, and St. John farms.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	6588	23.9	277	1.59	29916
HOCP85-845	6941	25.8	270	1.83+	28019
HOCP91-555	7598 +	26.3+	288+	1.77+	29832
HOCP96-540	7571 +	27.8+	275	2.00+	27590
L97-128	7487 +	25.8	292+	2.01+	25637-
L99-226	8396 +	27.6+	304+	2.28+	24196-
L99-233	7866 +	27.7+	285	1.64	33973+

Table 25. 2004 second-stubble means from nine outfield locations: Allain, Alma, Bon Secour, Georgia, Glenwood, Lanaux, Magnolia, R. Hebert, and St. John farms.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
TucCP77-042	6873	27.1 +	255-	1.87 +	28958
LCP85-384	6207	21.9	287	1.44	31050
HOCP85-845	6284	23.3	271-	1.70 +	28219
HOCP91-555	6061	21.7	283	1.55	28176
HOCP96-540	6288	23.0	277-	1.77 +	26229 -
L97-128	7076 +	24.2	295	1.86 +	25918 -

Table 26. 2004 third-stubble means from three outfield locations: Allain, Bon Secour, and R. Hebert farms.

Variety	Sugar / Acre	Cane Yield	Sugar / Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	3484-	13.7-	256-	1.59	18671-
LCP85-384	5111	18.2	282	1.33	27446
HOCP85-845	5355	19.5	274	1.50	26211
HOCP91-555	5920	20.7	289	1.47	28224
HOCP96-540	6141+	21.5+	287	1.58	27617
L97-128	5858	19.2	305+	1.56	25002

Table 27. Combined plant-cane means across outfield locations from 2001 to 2004.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7578	28.7	265	2.08	28120
HOCP85-845	7276	28.9	253 -	2.34 +	25025 -
HOCP91-555	7896	29.2	270	2.15	27819
HOCP96-540	8801 +	32.7 +	269	2.63 +	25343 -
L97-128	8612 +	31.3 +	275 +	2.60 +	24272 -

Table 28. Combined plant-cane means across outfield locations from 2003 to 2004.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7474	27.5	272	2.00	28273
HOCP91-555	8151 +	28.8	283 +	2.10	28174
HOCP96-540	8750 +	31.7 +	276	2.58 +	25496 -
L97-128	8469 +	29.7 +	286 +	2.43 +	24562 -
L99-226	9357 +	32.0 +	293 +	2.89 +	22912 -
L99-233	8621 +	31.3 +	275	1.96	33054 +

Table 29. Combined first-stubble means across outfield locations from 2002 to 2004.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	7286	26.7	274	1.73	31207
HOCP85-845	7048	26.8	264 -	1.97 +	27541 -
HOCP91-555	7269	26.0	280 +	1.81	29158 -
HOCP96-540	7697	28.5 +	271	2.14 +	26901 -
L97-128	7649	27.1	284 +	2.14 +	25324 -

Table 30. Combined second-stubble means across outfield locations from 2003 to 2004.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
LCP85-384	6250	22.9	276	1.51	30658
HOCP85-845	6070	23.7	259 -	1.79 +	26948 -
HOCP91-555	6276	22.7	279	1.59	28813
HOCP96-540	6310	23.7	269	1.82 +	26272 -
L97-128	6931 +	24.3	288 +	1.89 +	25989 -

Table 31. Combined third-stubble means across outfield locations from 2003 to 2004.

Variety	Sugar per Acre	Cane Yield	Sugar per Ton	Stalk Weight	Stalk Number
	(lbs/A)	(tons/A)	(lbs/ton)	(lbs)	(stalks/A)
CP70-321	4552-	17.8-	256-	1.77+	20362-
LCP85-384	6093	22.9	270	1.37	34592
HOCP85-845	5884	22.4	264	1.57	28706
HOCP91-555	6294	22.8	279	1.56	29584
HOCP96-540	6807+	25.1	274	1.77+	28475

SUCROSE LABORATORY AT ST. GABRIEL

Gert Hawkins and Kenneth Gravois
St. Gabriel Research Station

More than 3,700 samples were processed at the St. Gabriel Sucrose Laboratory during the 2004 harvest season (Table 1). Standard laboratory procedures, which include use of Octapol® clarifier, were used to measure the Brix and pol of the juice. The pol was analyzed using an autopol 880 model that could read dark samples. The juice was extracted via a three-roller mill for 3,650 samples. Fiber analysis was done on 112 samples using a pre-breaker to shred the sample. The computer program used for the sucrose laboratory assigns a sample identification number to each set processed; in addition, it indicated the number of samples analyzed in that set. The program was designed to automatically calculate sucrose and theoretical recoverable sugar based on the Brix and pol numbers. The laboratory numbers were recorded on the sample tags and returned to the researchers, along with the computer file that contains Brix, pol and theoretical recoverable sugar per ton of cane. The sucrose laboratory processed samples from September 2004 to December 2004.

Table 1. Number of sugarcane samples processed at the St. Gabriel Sucrose Laboratory during the 2004 harvest season.

Project Area	Leader	Number of Samples
Agronomy	James Griffin	555
	Chuck Kennedy	497
	Collins Kimbeng	354
	Magdi Selim	18
	Jim Wang	180
Iberia Research Station	Howard Viator	207
Plant Pathology and Crop Physiology	Jeff Hoy	220
	Jeff Hoy (fiber)	48
LCES	Ben Legendre	252
USDA	Jim Fouss	35
Variety Development	Line Trials	662
	Increase	163
	Nursery	300
	Nursery (fiber)	64
	Planting Rate	144
Other		63
TOTAL		3762

LAES SUGARCANE TISSUE CULTURE LABORATORY

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During the 2004-2005 production season, about 30,000 sugarcane plantlets were regenerated in the Louisiana Agricultural Experiment Station Sugarcane Tissue Culture Laboratory. A total of 29,520 plantlets were turned over to Certis USA, LLC, Kleentek Div., for transplanting into the greenhouse at Houma. The number of plantlets transplanted for each cultivar are listed in Table one.

Table 1. The number of tissue-culture-derived plantlets of different cultivars transplanted in the greenhouse.

Cultivar	Number of plantlets
LCP85-384	4,176
Ho98-988	3,096
HoCP96-540	7,128
L97-128	6,336
CP89-2143	2,196
L99-226	6,588
Total	29,520

THE 2004 LOUISIANA SUGARCANE VARIETY SURVEY

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A sugarcane variety survey was conducted during the summer of 2004 by the county agents in the 24 sugarcane-growing parishes of Louisiana to determine the variety makeup and distribution across the industry in the state. The information presented in this report was summarized from those individual parish surveys.

Agents in each sugarcane-producing parish collected acreage figures by variety and crop from producers in their respective parishes. Seven varieties, CP 70-321, LCP 85-384, HoCP 85-845, HoCP 91-555, Ho 95-988, HoCP 96-540 and L 97-128, were listed along with "Others" in the survey. The category of others included, but was not limited to, small acreages of CP 65-357, CP 72-370, LCP 82-89 and LHo 83-153. The crop was divided into four categories, which included plant-cane, first-stubble, second-stubble and third-stubble and older crops. Additional information was collected as needed from the local Farm Service Agency (FSA) offices regarding acres of sugarcane grown in the parishes.

Actual acreages covered by this survey for each parish, region and the statewide total are shown in Table 1. Statewide, the area planted to sugarcane reported in this survey was 458,660 acres. This is over 99% of the total acres (461,739) reported by FSA in the Louisiana Agricultural Summary for 2004 (Anonymous 2004). They also reported that there was an additional 598 acres classified as failed. Figure 1 shows the parishes where sugarcane is grown in the state. Total area planted to sugarcane for the three regions, Bayou Teche, River-Bayou Lafourche and Northern, and parishes (counties) are also shown in Table 1. The Bayou Teche region has the largest area planted to sugarcane, with 197,490 acres reported (43.1% of the total acreage), followed by the River-Bayou Lafourche region with 160,366 acres (35.0%) and the Northern area with 100,804 acres (21.9%). The total area planted to sugarcane in the state declined for the third consecutive year by approximately 4%. This is undoubtedly because of the threat of acreage reductions brought about by allotments and proportionate shares as written in the current Farm Bill.

The estimated statewide sugarcane acreage in percent by variety and crop is shown in Table 2. The leading variety for 2004 was LCP 85-384, with 91% of the total acreage followed by HoCP 91-555, CP 70-321 and HoCP 85-845, with 4, 3 and 2% of the total acreage, respectively. These four varieties have been the only varieties recommended for commercial planting for the past several years (Legendre 2001). The three remaining varieties, Ho 95-988, HoCP 96-540 and L 97-128, included in the survey were released within the past two years and the area planted to these varieties is still relatively small. However, it is expected that these new varieties will claim more acres in the future years because the area planted to LCP 85-384 will undoubtedly begin to decline. However, LCP 85-384 continued to increase in popularity among producers in 2004. Over 90% of the area in plant-cane through the third-stubble crop was planted to LCP 85-384. LCP 85-384 was released for commercial planting in the fall of 1993.

No other variety occupied more than 1% of the total acreage in the current survey although HoCP 96-540, released in 2003, occupied 1% of the area in the plant-cane crop only.

Since the prominence of LCP 85-384, there has been a trend to plant less cane each year and keep more acres in older stubble crops; however, that trend was modified for 2004 when more acres were planted in all regions than had been seen in previous years (Table 3). This was undoubtedly because of the poorer than anticipated stubble yields following 2002 when the industry was forced to harvest under less than ideal conditions for much of the crop following the passage of four tropical systems during the summer and early fall as well as the unprecedented rainfall that occurred throughout much of the harvest. This destroyed the stubble crops in many fields, forcing producers to plant more acres in 2003. Further, the continued wet weather throughout the summer and fall of 2002 did not allow many producers to plant their full compliment of plant-cane, which meant more cane had to be planted in 2003 for the 2004 harvest (Legendre and Gravois 2004). For the current survey, the Northern area had only 25.8% in third or older stubble; whereas, in 2003 it was 34.3%. On the other hand, the River-Bayou Lafourche region tends to plant more cane each year, with less of its area committed to stubble crops. However, because of the wet planting season in 2002, the River-Bayou Lafourche region had only 23.3% of its area in plant-cane in 2003. This necessitated that its producers plant more cane in 2003. The current survey shows that this region had 28.9% in plant-cane for 2004 and only 20.8% in third and older stubble. The Bayou Teche region had a near normal planting in 2002 (24.3% in plant-cane in 2003); however, there were some areas where the full compliment of cane was not planted, i.e. St. Mary Parish (Unpublished data).

LCP 85-384 was the preferred variety in all regions (Tables 4, 5 and 6). It was grown on 90% or more of the area in each of the three regions. The three remaining varieties, CP 70-321, HoCP 85-845 and HoCP 91-555 continued to lose favor by producers in all regions. However, it is anticipated that the area planted to LCP 85-384 will decrease in future years with the release of the three new varieties which have yield characteristics similar to LCP 85-384 and have shown at least moderate resistance to common rust. A series of field studies conducted by Hoy and Hollier in 2004 showed that common rust can cause significant loss of both tons of cane and sugar per acre in LCP 85-384 (Unpublished data).

No variety with the exception of LCP 85-384 showed an increase in the acreage in 2004 when compared to the previous year (Table 7) (Legendre & Gravois 2004). LCP 85-384 increased by 3%. All other varieties in the survey decreased in area from the previous year by 1 percentage point. CP 70-321 occupied 49% of the planted acreage as late as 1995; however, in the current survey it was grown on only 1% of the state's acreage. Only one other variety, CP 65-357, released in 1973, reached more than 70% of the total acreage with a high of 71% in 1980. LCP 85-384 occupied 20 percentage points more than CP 65-357 in 2004 when that variety was at its peak. LCP 85-384 is a high-yielding, excellent-stubbling variety; however, after lower cane yields were experienced during the 2003 and 2004 crops, skeptics feel that the variety is in "decline." However, much of this decline was attributed to the greater than normal amount of third and older stubble as well as the residual effect of the horrendous harvest conditions in 2002 following the four tropical systems and record rainfall that fell during the harvest (Legendre and Gravois 2004). However, for the first time in 2004 it was documented

that common rust can cause significant reductions in both cane tonnage and sugar per acre. Further, because of its tendency to lodge, more scrap is generally left in the field with this variety (Robert et al. 2004). Harvesting losses have also been documented because of its small stalks. When the speed of the extractor fan on the cane combine exceeds 700-900 rpm, there are more losses experienced through the extractor fan with LCP 85-384 because of its small stalk size (Legendre 2002).

It is anticipated that LCP 85-384 has reached its peak in popularity and that acreage in the variety will drop in coming years. The three new varieties have yield of sugar per acre equal to or exceeding that of LCP 85-384 (Robert et al. 2004). In addition to improved rust resistance, these varieties are more erect and better adapted to mechanical harvesting.

Over 90% of the Louisiana sugarcane crop is now harvested by combine to take advantage of the superior yielding ability of LCP 85-384; however, with the lower yields experienced in 2003 and 2004, many growers reverted to the whole-stalk "soldier" system for harvesting their crops. Time will tell if this trend continues. From all the data collected thus far, it appears that Ho 95-988, HoCP 96-540 and L 97-128 are better suited to mechanical harvesting when compared to LCP 85-384, and some producers might switch to them to take advantage of this one characteristic so long as they are not sacrificing yield of sugar per acre.

Most sugarcane-producing areas of the world do not place a high dependence on a single variety, as is the case in Louisiana (Tew 1987). The need to avoid genetic vulnerability was seen in Cuba several years ago when its growers suffered substantial yield losses because of a rust epidemic and the heavy dependence on one variety, B 4362. As a result, guidelines were established in Cuba advising growers not to plant more than 30% of their area to B 4362, their leading commercial variety. A similar situation occurred recently in Australia with Q124 and susceptibility to orange rust. However, once a clearly superior variety is found, the inadvisability of becoming highly dependent on a single variety must be weighed against the increased profitability anticipated from the culture of only one variety. Occasionally expectations will outweigh potential risk considerations (Tew 1987). It is becoming more apparent that the time has now come for the Louisiana industry to consider a switch to other varieties since LCP 85-384 is now considered susceptible to common rust and significant reductions in yield of sugar per acre have been demonstrated.

Another disease was found in LCP 85-384 in recent years, sugarcane yellow leaf virus (Grisham et al. 2001); it appears that the variety is tolerant to this disease at least for the moment. However, it is entirely possible that this new virus is also taking its toll on yield of this variety. In a continuing effort to lessen the dependence of the industry on one variety, the Louisiana variety development program is constantly striving to develop other new, superior varieties that are as good as or better than LCP 85-384; however, the task has not been an easy one (Ken Gravois, personal communication).

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Table 1. Total area planted to sugarcane in Louisiana by region and parish (county), 2004[1].

Bayou Teche region		River-Bayou Lafourche region		Northern region	
Parish	Acres	Parish	Acres	Parish	Acres
Acadia	3,527	Ascension	13,877	Avoyelles	20,741
Calcasieu	2,809	Assumption	40,900	East Baton Rouge	528
Cameron	38	Iberville	35,192	Evangeline	1,680
Iberia	59,192	Lafourche	29,383	Pointe Coupee	32,109
Jeff Davis	5,988	St. Charles	2,149	Rapides	12,715
Lafayette	15,459	St. James	24,588	St. Landry	17,803
St. Martin	33,000	St. John	4,344	West Baton Rouge	15,228
St. Mary	44,797	Terrebonne	9,933		
Vermilion	32,680				
Total	197,490	Total	160,366	Total	100,804
Total all regions: 458,660					

[1] Acreage based on information obtained in variety surveys from 24 parishes by the county agents in 2004.

Figure 1. Parishes (counties) in Louisiana where sugarcane is grown.

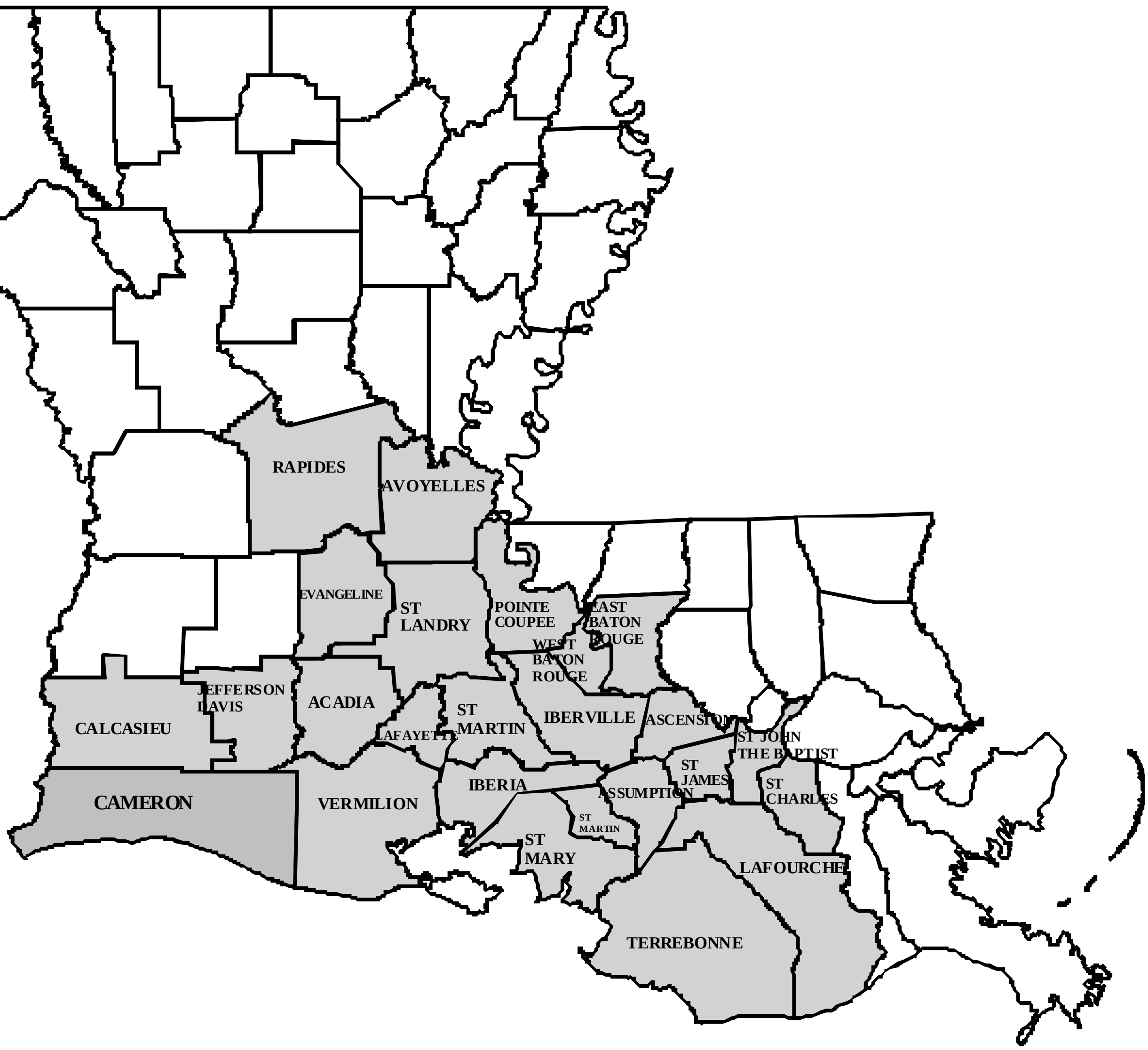

Table 2. Estimated statewide sugarcane acreage percentage by variety and crop, all regions, 2004[1].

Variety	Plant-cane	First-stubble	Second-stubble	Third-stubble and older	Total
	----------%				----------
CP 70-321	1	1	2	2	2
LCP 85-384	91	91	89	91	91
HoCP 85-845	2	2	4	4	3
HoCP 91-555	4	5	4	2	4
Ho 95-988	<1	0	0	0	<1
HoCP 96-540	1	<1	0	0	<1
L 97-128	<1	0	0	0	<1
Other	<1	<1	<1	<1	<1
Total acres Percent total crop (%)	125,214 27.3	117,876 25.7	111,454 24.3	104,116 22.7	458,660

[1] Based on information obtained in variety surveys from 24 parishes by county agents in 2004.

Table 3. Estimated sugarcane distribution by region and crop, 2004[1].

Crop	Bayou Teche	River-Bayou Lafourche	Northern	State Total
Plant-cane Area (acres) Percent (%)	52,335 26.5	46,346 28.9	26,209 26.0	125,214 27.3
First-stubble Area (acres) Percent (%)	50,755 25.7	40,252 25.1	26,915 26.7	117,876 25.7
Second-stubble Area (acres) Percent (%)	49,372 25.0	40,412 25.2	21,673 21.5	111,454 24.3
Third-stubble and older Area (acres) Percent (%)	45,028 22.8	33,356 20.8	26,007 25.8	104,116 22.7
Total acres	197,490	160,366	100,804	458,660

[1] Based on information obtained in variety surveys from 24 parishes by county agents in 2004.

Table 4. Estimated area planted to sugarcane in percent by variety and crop for the Bayou Teche region, 2004[1].

Variety	Plant-cane crop (%)	First-stubble crop (%)	Second-stubble crop (%)	Third-stubble crop & older (%)	Total (%)
CP 70-321	2	3	3	4	3
LCP 85-384	90	93	91	90	91
HoCP 85-845	1	1	2	4	2
HoCP 91-555	5	3	4	2	4
Ho 95-988	<1	0	0	0	<1
HoCP 96-540	2	<1	0	0	<1
L 97-128	<1	0	0	0	<1
Others	<1	<1	<1	<1	<1
Totals	100	100	100	100	100

[1] Based on information obtained in variety surveys from 24 parishes by county agents in 2004.

Table 5. Estimated area planted to sugarcane in percent by variety and crop for the River/Bayou Lafourche region, 2004[1].

Variety	Plant-cane crop (%)	First-stubble crop (%)	Second-stubble crop (%)	Third-stubble crop & older (%)	Total (%)
CP 70-321	<1	1	1	2	1
LCP 85-384	93	92	89	89	91
HoCP 85-845	3	3	6	7	4
HoCP 91-555	2	4	4	2	3
Ho 95-988	<1	0	0	0	<1
HoCP 96-540	2	<1	0	0	<1
L 97-128	<1	0	0	0	<1
Others	<1	<1	<1	1	1
Totals	100	100	100	100	100

[1] Based on information obtained in variety surveys from 24 parishes by county agents in 2004.

Table 6. Estimated area planted to sugarcane in percent by variety and crop for the Northern region, 2004[1].

Variety	Plant-cane crop (%)	First-stubble crop (%)	Second-stubble crop (%)	Third-stubble crop & older (%)	Total (%)
CP 70-321	1	1	2	1	1
LCP 85-384	90	87	86	96	90
HoCP 85-845	2	4	7	2	4
HoCP 91-555	6	8	5	1	5
Ho 95-988	<1	0	0	0	0
HoCP 96-540	1	<1	0	0	0
L 97-128	<1	0	0	0	0
Others	<1	<1	<1	<1	<1
Totals	100	100	100	100	100

[1] Based on information obtained in variety surveys from 24 parishes by county agents in 2004.

Table 7. Louisiana sugarcane variety trends, by variety and years, all regions, 2000-2004[1].

	Area planted to sugarcane by variety and years (%)					
Variety	2000	2001	2002	2003	2004	1 yr. Change
CP 70-321	13	8	5	3	2	-1
LCP 85-384	71	78	85	88	91	+3
HoCP 85-845	8	7	6	4	3	-1
HoCP 91-555	<1	1	3	4	3	-1
Ho 95-988	0	0	0	0	<1	0
HoCP 96-540	0	0	0	<1	<1	0
L 97- 128	0	0	0	0	<1	0
Others	<1	<1	<1	<1	<1	0
Totals	100	100	100	100	100	

[1] Based on annual variety surveys from 24 parishes by county agents, 2000-2004.

TARGET REGION AMPLIFICATION POLYMORPHISM (TRAP) FOR ASSESSING GENETIC DIVERSITY IN SUGARCANE GERMPLASM COLLECTIONS

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ABSTRACT

Target Region Amplification Polymorphism (TRAP) is a fairly new PCR-based molecular marker technique which uses gene-based information for primer design. A fixed primer of about 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 PCA 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* genotype 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 ratify the TRAP as a potentially useful marker technique for genetic diversity studies in sugarcane germplasm collections.

INTRODUCTION

The genus *Saccharum* is composed of six species, namely S. *officinarum, S. barberi*, *S. sinense, S. spontaneum, S. robustum* and *S. edule* (Brandes, 1958). The modern *Saccharum spp* (cultivated sugarcane) is believed to have originated from complex hybridization events (termed 'nobilization') between *Saccharum officinarum*, *S. barberi, S. sinense* and the wild related species *S. spontaneum* (Sreenivasan et al., 1987). Until the end of the 19th century, cultivated sugarcane comprised mainly of the vegetatively propagated *S. officinarum* (the main sugar-producing cane) together with *S. barberi* and *S. sinense* (Jannoo et al., 1999). *S. officinarum*, however, is believed to have evolved through hybridisation of species such as *Erianthus*

arundinaceus, *S. spontaneum* and *S. robustum* (Daniels *et al*., 1975), whereas *S. barberi* and *S sinense* are believed to be natural hybrids between *S. officinarum* and *S. spontaneum* (Daniels and Roach, 1987). Mukherjee (1957) coined the term *Saccharum* complex consisting of four closely related interbreeding genera *viz*., *Saccharum, Erianthus* (=sect. Ripidium), *Narenga* and *Sclerostachya,* all of which are supposedly implicated in the origin of sugarcane. Daniels *et al.* (1975) revised this grouping to include *Miscanthus* sect. Diandra Keng, but the phylogenetic relationship between members of the group remains unclear (Irvin, 1999).

A better understanding of the genetic diversity and inter-relationships among members of the *Saccharum* complex will facilitate exploitation of this germplasm in improving sugarcane. Traditional methods which combined agronomic and morphological characteristics have been useful in identifying and describing differences between members of the *Saccharum* complex (Artschwager and Brandes, 1958, Skinner, 1972; Skinner et al. 1987). However, members of the *Saccharum* complex are predominantly outcrossing and are maintained by vegetative propagation. As such, they are highly heterozygous and display enormous plasticity in the phenotypic expression of traits. Although morphological traits can be used to identify and classify clones, most of the traits are influenced by the environment under which the clones are grown or selected. Variability caused by genotype x environment interactions and inadvertent mislabeling of clones can adversely influence data derived from phenotypic evaluation and clonal records.

With the advent of molecular markers, it is now possible to make direct inferences about genetic diversity and inter-relationships among organisms at the DNA level without the confounding effects of the environment and/or faulty records. Indeed, a vast number of molecular marker techniques such as isoenzymes (Glaszmann et al., 1989), RFLP (D'Hont et al., 1994; Jannoo et al., 1999; Coto et al., 2002), ribosomal DNA (Glaszmann et al., 1990 ; Pan et al., 2000), microsatellites (Piperidis et al., 2001; Pan et al., 2002), AFLP (Besse et al., 1998; Lima et al., 2002) and molecular cytogenetics (D'Hont et al., 1996) have been instrumental in explaining genetic diversity and inter-relationships among accessions in sugarcane germplasm collections.

The underlying goal for studying genetic diversity and inter-relationships among germplasm collections is to eventually use that information to facilitate the development of better performing varieties of the cultivated species. The results from genetic diversity studies may, therefore, be more useful if the segments of the genome sampled or measured correspond to segments bearing genes of interest to the breeding program. Current molecular marker tools, such as RFLP, RAPD, AFLP, gSSR, have unarguably been very useful in dissecting the level and pattern of genetic diversity in sugarcane germplasm collections. However, the polymorphism generated by these marker techniques are randomly distributed across the genome and only those that can be associated with traits through QTL studies would be of immediate interest to the breeder. Even when QTL analysis is performed, the underlying association is often based upon distal rather than actual linkage. Transferability of QTLs between populations remains a looming question in the minds of many plant breeders.

Molecular markers for crop improvement, ideally, should be based on functionally characterized candidate genes which would increase the probability of direct trait association.

The large genome size, high ploidy level and complicated genome organization of sugarcane makes it a complex and recalcitrant crop to study and improve using genetics approaches. Sugarcane would benefit greatly from a candidate gene approach to molecular markers. Access to increasing numbers of EST sequences obtained from diverse cDNA libraries, coupled with freely available bioinformatics tools, now allow us to explore new opportunities in sugarcane molecular marker research.

The Target Region Amplification Polymorphism (TRAP) is a simple PCR-based marker technique which uses the EST information to generate polymorphism (Hu and Vick, 2003). A fixed primer of about 18 nucleotides is designed from EST sequences or genes of interest, and an arbitrary primer of about the same length is designed with either an AT- or GC-rich motif to anneal with an intron or exon, respectively (Hu and Vick, 2003; Li and Quiros, 2001). The objectives of this study were to evaluate the potential of TRAP markers for assessing genetic diversity and inter-relationships in sugarcane germplasm collections and to verify if indeed TRAP marker binding sites correspond to genes of interest.

MATERIALS AND METHODS

Plant material and DNA extraction

Thirty genotypes, representing species of *Saccharum*, *Miscanthus* and *Erianthus,* were used in the study (Table 1). Representing *Saccharum* species were S. *officinarum, S. barberi*, *S. sinense, S. spontaneum, S. robustum* as well as cultivars, cultivar-derived mutants and interspecific hybrids. The genotypes DW1 and DW2 are cultivar-derived genetic mutants from the cultivar LCP83-137 (Burner, 1999). The genotypes 16 Low and 40 High are first generation interspecific hybrids from a cross between LA Stripe (S. *officinarum*) x SES 147b (*S. spontaneum*) and are being retained in the collection because of their low and high sucrose content, respectively. These genotypes form part of the germplasm collection maintained at the USDA Sugarcane Research Unit at Houma, Louisiana. Young leaves were collected from each genotype, frozen immediately in ice and stored at -80 C. The leaves were later ground to a powder in liquid nitrogen. Genomic DNA was extracted using the Plant DNeasy Mini Kit (Qiagen, Valencia, CA) following the manufacturer's protocol. Concentrations of extracted DNA were estimated by known concentration of lambda DNA in 1% agarose gel.

TRAP Markers

Primer design

The design of fixed primers was based on the method reported by Hu and Vick (2003). The nucleotide sequences of six genes of interest were obtained from the GenBank database at NCBI. Of the six selected genes, five are believed to be involved in carbohydrate metabolism, while the remaining one is believed to play an important role in cold tolerance. The primers were designed using the Primer3 software (http://frodo.wi.mit.edu/cgi-bin/primer3/primer3_www.cgi) (Rozen and Skaletsky, 2000), out of which only the forward primer was used as fixed primer. The primer optimum size, maximum size and minimum size were set to 18 nt. The optimum T_m, maximum T_m and minimum T_m were set to 53^oC, 55^oC and 50^oC, respectively. The genes, GenBank accession numbers and designed primer sequences used in this study are given in Table 2.

Arbitrary reverse primer sequences were obtained from Li and Quiros (2001). These primers comprise three selective nucleotides at the 3' end, four nucleotides of AT- or GC-rich content in the core region and 11 nucleotides as filler sequences at the 5' end. In addition, the basic rules of primer design such as self- complementarity and maintenance of 40-60% GC content were upheld (Table 2).

PCR protocol

TRAP reactions were performed based on the protocol of Hu and Vick (2003). Each of the six fixed primers was combined with each of three arbitrary primers for a total of 18 primer combinations. Each reaction was carried out in a total volume of 20μL containing 1.5μL of 10x PCR buffer, 1.0μL of 25mM $MgCl_2$, 1.0μL each of 10μM fixed and arbitrary primers, 1.0μL of 10μM dNTPs (Promega, Madison, WI), 0.35μL of 5U *Taq* polymerase (Promega, Madison, WI) and 1.0μL of 50-80ng genomic DNA. The conditions for PCR were as follows: an initial denaturing step was performed at 94^{o}C for 4 min followed by 5 cycles at 94^{o}C for 45 s, 35^{o}C for 45 s and 72^{o}C for 1 min, followed by 35 cycles at 94^{o}C for 45 s, 53^{o}C for 45 s and 72^{o}C for 1 min with a final extension step at 72^{o}C for 7 min. All the PCR reactions were performed on an *i-cycler* (BioRad Labs, Hercules, CA). After PCR, the amplified products were run on 7% polyacrylamide denaturing gel for 2.0 hrs at 110 W. Silver staining procedure was employed to develop the gel and to detect the bands.

Statistical Analysis

Bands from the TRAP gel were scored, as '1' for presence and '0' for absence, in all genotypes. Only readable bands were scored. Ambiguous bands were ignored and excluded from the analysis. Allelic diversity at a given locus can be measured by Polymorphism Information Content (PIC) wherein a marker can distinguish two alleles taken at random from a population and it was calculated as follows:

$$PIC = 1- \Sigma f_i^2$$

where f_i is the frequency of the i^{th} allele (Weir 1990). Considering the number of alleles at a locus along with their relative frequencies in a given population, an estimate of the discriminatory power of a marker can be obtained by calculating the PIC (Vuylsteke et al 2000). Jaccard-similarity coefficient (1908) was used to calculate the estimate of genetic similarity (GS) among pairs of genotypes as follows: $GS_{ij} = a/(a+b+c)$ where GS_{ij} is the genetic similarity measurement between individuals *i* and *j*, the number of polymorphic bands present in both individuals is represented by *a* whereas *b* and *c* are the number of bands present in individual *i* and *j* respectively but not in their counterparts. The GS matrix was used to perform cluster analysis using the Unweighted Pair Group Method with Arithmetic mean (UPGMA) algorithm (Sneath and Sokal, 1973) following the Sequential Agglomerative Hierarchical Nested (SAHN) cluster analysis. The co-phenetic values were calculated to test the goodness of fit between the clusters in the dendrograms and the similarity index matrix. In addition, Principal Coordinate Analysis (PCA) was performed to supplement the findings obtained from cluster analysis. All the above analyses were performed employing different modules of NTSYS-PC software, version 2.11L (Rohlf, 2000). For the purpose of comparison between clusters and also to determine the robustness of the cluster, bootstrap analysis was done with 10,000 replications using the PAUP

version 4.0b10 software (Sinauer Associates Inc., MA) which employs Nei and Li (1979) method for cluster development.

RESULTS AND DISCUSSION

TRAP marker polymorphism and PIC values

The summary of TRAP markers produced by the 18 primer combinations (six fixed/ forward primers in combination with three arbitrary reverse primers) across all 30 genotypes is given in Table 3. The 18 primer combinations generated a total of 600 unambiguous bands of which 529 (88%) were polymorphic. The bands ranged in size from 100 to 700 bp. The number of bands detected by individual primer combinations ranged from 15 (SuSy + Arbi1) to 58 (CDPK + Arbi 3) with an average of 33. These two primer combinations were also responsible for the least (14 in SuSy + Arbi1) and the most (48 in CDPK + Arbi 3) number of polymorphic bands produced for an average of 29 polymorphic band per primer combination. Polymorphism was generally high (> 50%), ranging from 72% to 100%. The high level polymorphism could be attributed to the complex genetic structure of sugarcane with high (aneu)ploidy comprising 80-140 homo(eo)logous chromosomes. Similar high levels of polymorphism have been reported in *Saccharum* species by Besse et al. (1998) and Lima et al. (2002) using AFLP markers. The Polymorphism Information Content (PIC), which measures information content as a function of a marker system's ability to distinguish between genotypes (Weir, 1990), varied among the primer combinations, ranging from 0.11 in CDPK + Arbi 1 to 0.36 in PODK + Arbi2 with an average of 0.24. The PIC values indicate a good discriminatory power of the dominant TRAP marker system. Comparable PIC values have been reported using dominant markers like RAPD and AFLP in African plantain (Ude et al 2003) and AFLP in wheat (Bohn et al 1999).

For the 18 TRAP primer combinations, the Jaccard's GS estimates ranged from 0.33 (Kalingpong and Miscanthus) to 0.94 (Dwarf 1 and Dwarf 2) with a mean of 0.68. A dendrogram with a co-phenetic value of 0.963 was generated (Fig. 1) based on 435 pair-wise GS estimates. A co-phenetic value of > 0.8 is said to indicate a strong goodness of fit for dendrograms (Rohlf, 2000). Bootstrap, based on 10,000 resampling of the data set, and cluster analyses following the Nei and Li (1979) method produced a similar dendrogram (data not shown). This further confirmed the robustness of the dendrogram obtained by the UPGMA method based on Jaccard's similarity coefficient (Fig 1).

Genetic diversity and relationships among genotypes

Genetic diversity and relationships among the genotypes in this study were depicted by both cluster and PCA (Figs. 1 and 2). A separate analysis was performed for the three cold tolerance-related primer combinations (i.e. CDPK/ Arbi1, 2 and 3). Because the results did not differ from the one derived from using the 15 sucrose-related primer combinations, the data were merged and used for one combined analysis. The dendrogram from cluster analysis revealed two distinct groups among the *Saccharum* species. Group I comprised the genotypes representing *S. officinarum*, *S. sinense, S. barberi, S. robustum* along with cultivars, cultivar-derived mutants and hybrids, and Group II comprised all the *S. spontaneum* genotypes. The single *Erianthus* (Kalingpong) and *Miscanthus* genotypes were each placed distinctly in the dendrogram supporting the taxonomic evidence which assigned each of them to a separate genus (Daniels et

al., 1975). Remarkably similar results were obtained from the PCA (Fig. 2). The first three axes in the PCA explained a cumulative variation of 42.23 percent. As with the cluster analysis, all the *S. spontaneum* genotypes formed a well individualized group while the rest of the *Saccharum* species along with the cultivars, cultivar-derived mutants and hybrids clustered together as one interrelated group. *Miscanthus* and *Erianthus* (Kalingpong) were placed distinctly, again lending credence to the claim that they are separate genera.

The strong differentiation between *Erianthus* and *Saccharum* as revealed by TRAP markers was previously demonstrated using rDNA spacers (Al-Janabi et al., 1994), RFLP (Burnquist et al., 1992), AFLP (Besse et al., 1998), 5S RNA intergenic spacers (Pan et al., 2000), and sugarcane- (Cordeiro et al., 2003) as well as maize- (Selvi et al., 2003) derived microsatelite markers. Similarly, evidence from microsatellite markers (Cordeiro et al., 2003) and 5S RNA intergenic spacers (Pan et al., 2000) had previously been used to document the distinction between *Miscanthus* and *Saccharum* species.

Although no distinct sub-groups were found within Group I, the clustering of genotypes in this group seems to be in accordance with the ancestral relationships among these species (Fig 1). *S. robustum* is believed to be one of the progenitors of *S. officinarum* (Brandes, 1958; Daniels and Roach, 1987). Significant similarities have been reported between *S. robustum* and *S. officinarum* with regard to morphology, cytology and physiology; however, they differed in fiber and sugar content (Irvine, 1999). The high degree of similarity between *S. robustum* and *S. officinarum* has also been revealed using RAPD (Nair et al., 1999) and microsatellite markers derived from maize (Selvi et al., 2003).

The *S. barberi* and *S. sinense* genotypes were found within the same sub-group albeit along with a *S. robustum* genotype. *S. barberi* and *S. sinense* might differ enough to be distinct (Glaszmann et al., 1990), but Whalen (1991) contends that those minor differences are not enough to classify them as two separate species. *S. barberi* and *S. sinense* are thought to be interspecific hybrids between *S. officinarum and S spontaneum* (Brandes, 1958; Daniels and Roach, 1987) and this has been substantiated using evidence from RFLP (Lu et al., 1994), RAPD (Nair et al., 1999), maize-derived microsatellite markers (Selvi et al., 2003) and GISH analyses (D'Hont, 1993).

It was also not surprising that cultivars were found in Group I, indicating their closer relationship with *S. officinarum* compared to *S. spontaneum.* Most of the cultivars bred after the turn of the 20th century are interspecific hybrids between *S. officinarum* and *S. spontaneum.* However, cultivars inherited a greater proportion of the *S. officinarum* genome as 'nobilization' involved several backcrosses to the *S. officinarum* parent during which this parent transmitted the somatic chromosome number to its progeny (Bhat and Gill, 1985; Bremer, 1961; Sreenivasan et al., 1987; D'Hont et al., 1996). Moreover, the genes for sucrose accumulation within cultivars were contributed by the sucrose producing parent, *S. officinarum,* and most of the primers used in this study were designed from sucrose-related gene sequences.

The closest relationship in the dendrogram was found between the two cultivar-derived dwarf mutants, which is in agreement with the origin of these genotypes. Except for the

legendary cultivar POJ2878, all the contemporary cultivars were found in the same sub-group albeit with a *S. officinarum* genotype. This is hardly surprising since these contemporary cultivars are more closely related relative to POJ2878. However, it was interesting to note that within this sub-group, LCP85-384 clustered closer to HoCP85-845 than it did to either of its parents, namely CP77-310 (female) and CP77-407 (male). LCP85-384 and HoCP85-845 share a common heritage in that their grandparents are full siblings. But the closer association between these genotypes, relative to that between LCP85-384 and its parents, is possibly due to the effects of breeding and selection, which are not accounted for by pedigree history. Furthermore, the primers employed in this study were designed to preferentially amplify a small segment of the genome, that is, segments associated with sucrose content and cold tolerance. The effect of selection, especially for sucrose-related genes, coupled with the fact that only a small portion of the genome was being assayed, could explain why the genotypes in Group I failed to form distinct subgroups and clustered instead as one interrelated group. In another study using maize-derived microsatellite markers, *S. barberi* and *S. sinense* genotypes grouped together but the group was placed in between the *S. officinarum* and *S spontaneum* cluster (Selvi et al., 2003). It is worth noting that only the sucrose-producing species occurred in Group I.

The average GS within and among groups of genotypes or species was computed as an additional measure to assess genetic diversity (Table 4). Only groups or species represented by at least four genotypes were considered. The estimates showed that the least amount of similarity existed among the *S. spontaneum* genotypes (0.68), indicating the relatively higher level of heterozygosity and polymorphism that exists within this species. *S. spontaneum* is generally accepted as the most diverse of the *Saccharum* species in terms of geographical distribution, chromosome number (2n = 40-128) and morphology (Daniels and Roach, 1987). *S. spontaneum* is considered an untapped resource for sugarcane germplasm improvement in Louisiana. The major traits of interest are disease resistance, cold tolerance and ratooning ability and TRAP markers could potentially be useful during introgression breeding. Compared to *S. spontaneum*, genetic similarity was higher among *S. officinarum* < *S. robustum* < cultivars. Genetic diversity has generally been reported as being very low among cultivated sugarcane because very few progenitor clones were involved in the initial ‘nobilization’ event, and the products from ‘nobilization’ became the foundation clones for most breeding programs. Arro (2005) reported a much higher level of genetic similarity (83.0 %) among 63 sugarcane cultivars from Louisiana using a similar set of TRAP markers. Selection for high sucrose content and the fact that only a small segment of the genome relating to sucrose content was being assayed would obviously contribute to inflate genetic similarity values.

The highest genetic similarity among groups was obtained between cultivars and *S. officinarum* (0.74) followed by *S. robustum* and *S. officinarum* (0.74). These results provide additional support that *S. robustum* is a likely progenitor of *S. officinarum* (Sreenivasan et al., 1987) and that cultivars inherited most of their sucrose-related genes from *S. officinarum.* The least amount of similarity was observed between *S. officinarum* and *S. spontaneum* (0.62), reflecting the distinctiveness of these two species.

Genus and/or species specific markers

Generally, very few bands were discrete across species or genus. The main types of uniqueness found were situations where a band was either present or absent among all genotypes of a species, but, the same band was polymorphic among the other species or genotypes. For example, whereas a Susy + Arbi 2 (500-600bp) fragment was polymorphic among *S. spontaneum* and cultivars, this fragment was uniquely absent in all the *S. officinarum, S. robustum, S. barberi*, *S. sinense*, *S. officinarum* x *S. spontaneum* hybrids, cultivar-derived dwarf genotypes and present in the two *Erianthus* and *Miscanthus* genotypes. Fragment Susy + Arbi 3 (350-400bp) was absent in all *S. spontaneum, Erianthus* and *Miscanthus* genotypes and present among the rest of the genotypes except among cultivars where it was present in three of the five genotypes. But the most significant fragment was SuPS + Arbi1 (600-700bp) which was present in the two *Erianthus* and *Miscanthus* genotypes but, more important, in all the cultivars and *S. officinarum* genotypes and absent in all *S. spontaneum* genotypes. Fragments unique to either *S. officinarum* or *S. spontaneum* are of significance to the Louisiana introgression breeding program because *S. officinarum* and *S. spontaneum* are being used as sources of genes to increase sucrose content and stress tolerance, respectively. Another interesting fragment was produced by SAI + Arbi 2 (600-700bp), which was absent among all the *Saccharum* species and present in the two *Erianthus* and *Miscanthus* genotypes. Such a fragment could be useful in distinguishing *Saccharum* from other genera.

Sequencing of amplified products

The power of TRAP markers over other marker systems relies on their ability to reveal trait-based polymorphism among genotypes since it is assumed that the TRAP primer binding sites would correspond to genes of interest. It is, therefore, necessary to verify if indeed the amplified products correspond to genes of interest. To this end, from two primer combinations (StSy + Arbi3 and CDPK + Arbi2), we sequenced monomorphic bands from a *S. spontaneum* (SES 147b) and *S. officinarum* (La Stripe) genotype. These bands were excised from a PAGE gel, re-amplified and sequenced directly. A fragment of 535 bp from *S. spontaneum* (StSy + Arbi3) showed homology (E= 5.7) with an EST (Accession # AF079258) of a *Sorghum bicolor* granule-bound starch synthase gene. A similar level of homology (E = 5.7) was found with the ESTs of the granule-bound starch synthase genes of *Cymbopogon pospischilii* (Accession # AF079248), *Heteropogon contortus* (Accession # AF079253) and *Coelorachis selloana* (Accession # AY062271.1). Much higher levels of homology were found with a mRNA sequence of *Zea mays* endosperm transcriptome (E= 6e-37; Accession # BT018673.1) and a cDNA clone corresponding to chromosome 3 of *Oryza sativa* (E= 2e-15; Accession # AK105342.1).

We were interested in further analyzing the sorghum EST sequence because sorghum is considered a relative of sugarcane based on comparative mapping studies (Paterson et al., 1995; Ming et al., 1998; Ming et al. 2002). The sorghum EST sequence showed a 100% match with a segment of the 535 bp sequence from *S. spontaneum*. A BLASTn search using the sorghum sequence pulled up, among other sequences, the same EST of *Saccharum officinarum* (Accession # AF446084) from which the 'StSy' fixed primer was designed.

Another fragment of 295 bp from *S. spontaneum* (CDPK + Arbi2) showed homology (86%; E = 0.19) with a segment of mRNA corresponding to a putative receptor-like protein kinase gene of *Oryza sativa.* In addition it also showed homology (86%; E = 0.19) with a segment of a clone from chromosome 5 of *Oryza sativa* containing a putative receptor-like protein kinase gene. Other sequencing efforts, including sequences from the *S. officinarum* genotype, were not successful, resulting in unduly high content of undefined bases (N), perhaps because the fragments were sequenced directly without cloning. These sequences were considered not suitable for BLASTn analysis. However, the fact that those fragments that yielded good sequences showed homology with the appropriate GenBank sequences confirms that TRAP markers could be useful in measuring genetic diversity around the gene of interest.

In conclusion our study demonstrates that TRAP markers would be a valuable tool for assessing genetic diversity in sugarcane germplasm collections. The pattern of aggregation revealed in the cluster and PCA, together with evidence from sequencing analysis, seems to suggest that the TRAP primer binding sites do correspond to genes of interest. It was also possible to identify some species and genus specific fragments which will be useful for identifying true hybrids during introgression breeding. But, the most significant use of TRAP markers for introgression breeding would come from being able to associate alleles with contributing either favorably or unfavorably toward the performance of a trait and using that information during selection.

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Table 1. Description of the 30 genotypes used for TRAP marker analysis.

Number	Clone name	Genera or species †	Code
1	Kalingpong	*Erianthus*	Er
2	Dwarf 1	*Saccharum* species hybrid (Cultivar-derived mutant)	DW1
3	Dwarf 2	*Saccharum* species hybrid (Cultivar-derived mutant)	DW2
4	16 Low	*Saccharum* species hybrid (F_1 between *S. officinarum and S. spontaneum*)	Hy1
5	40 High	*Saccharum* species hybrid (F_1 between *S. officinarum and S. spontaneum*)	Hy2
6	POJ2878	*Saccharum* species hybrid (Cultivar)	Cu1
7	LCP 85-384	*Saccharum* species hybrid (Cultivar)	Cu2
8	CP 77-310	*Saccharum* species hybrid (Cultivar)	Cu3
9	CP 77-407	*Saccharum* species hybrid (Cultivar)	Cu4
10	LCP 85-845	*Saccharum* species hybrid (Cultivar)	Cu5
11	Miscanthus	*Miscanthus*	Mi
12	Ganapathy	*S. barberi*	Sb1
13	Chin	*S. barberi*	Sb2
14	La Stripe	*S. officinarum*	So1
15	La Purple	*S. officinarum*	So2
16	Cuba	*S. officinarum*	So3
17	IN84-068A	*S. officinarum*	So4
18	NG 57-54	*S. robustum*	Sr1
19	NG 57-159	*S. robustum*	Sr2
20	Molokai 5573	*S. robustum*	Sr3
21	IMP72-232	*S. robustum*	Sr4
22	NG77-218	*S. robustum*	Sr5
23	Chukche	*S. sinense*	Ssi
24	SES 147B	*S. spontaneum*	Ssp1
25	Coimbatore	*S. spontaneum*	Ssp2
26	MPTH97-213	*S. spontaneum*	Ssp3
27	MPTH97-200	*S. spontaneum*	Ssp4

Table 1. Continued.

Number	Clone name	Genera or species †	Code
28	MPTH97-107	*S. spontaneum*	Ssp5
29	PIN84-1B	*S. spontaneum*	Ssp6
30	Molokai1032B	*S. spontaneum*	Ssp7

† The original sugarcane cultivars were derived from crossing mainly between *S. officinarum and S. spontaneum* followed by several generations of backcrosses to *S. officinarum.* Present day cultivars are selections from cultivar x cultivar crosses.

Table 2. Sequences of fixed and arbitrary primers used for TRAP markers.

	Gene	Sequence (5'→ 3')	GenBank accession number
Fixed primers	Sucrose Synthase (SuSy)	GGAGGAGCTGAGTGTTTC	AF263384
	Sucrose Phosphate Synthase (SuPS)	CGACAACTGGATCAACAG	AB001338
	Pyruvate Orthophosphate DiKinase (PODK)	CGTAAAGATTGCTGTGGA	AF194026
	Soluble Acid Invertase (SAI)	AGGACGAGACCACACTCT	AF062735
	Calcium Dependent Protein Kinase (CDPK)	ACAGAACCACCAAAGGAG	CF572977
	Starch Synthase (StSy)	GGCAAGAAGAAGTTCGAG	AF446084
Arbitrary primers	Arbi 1	GACTGCGTACGAATTAAT	
	Arbi 2	GACTGCGTACGAATTGAC	

Table 3. Total number of bands, number of polymorphic bands, percent polymorphism and Polymorphism Information Content (PIC) for each of 18 TRAP primer combinations.

Primer combination	Bands observed	Polymorphic bands	Percent Polymorphism	PIC value
SuSy + Arbi 1	20	20	100.00	0.32
SuSy + Arbi 2	32	32	100.00	0.28
SuSy + Arbi 3	15	14	93.33	0.20
SuPS + Arbi 1	19	17	89.47	0.33
SuPS + Arbi 2	48	47	97.91	0.24
SuPS + Arbi 3	29	21	72.42	0.14
SAI + Arbi 1	39	34	94.87	0.26
SAI + Arbi 2	28	28	100.00	0.22
SAI + Arbi 3	46	40	86.95	0.21
StSy + Arbi 1	41	31	75.60	0.20
StSy + Arbi 2	50	41	82.00	0.24
StSy + Arbi 3	28	28	100.00	0.21
PODK + Arbi 1	36	31	86.11	0.27
PODK + Arbi 2	29	22	75.86	0.36
PODK + Arbi 3	32	27	84.37	0.29
CDPK + Arbi 1	29	29	100.00	0.11
CDPK + Arbi 2	21	19	90.47	0.25
CDPK + Arbi 3	58	48	82.75	0.23
Total	600	529		
Average	33.33	29.38	88.14	0.24

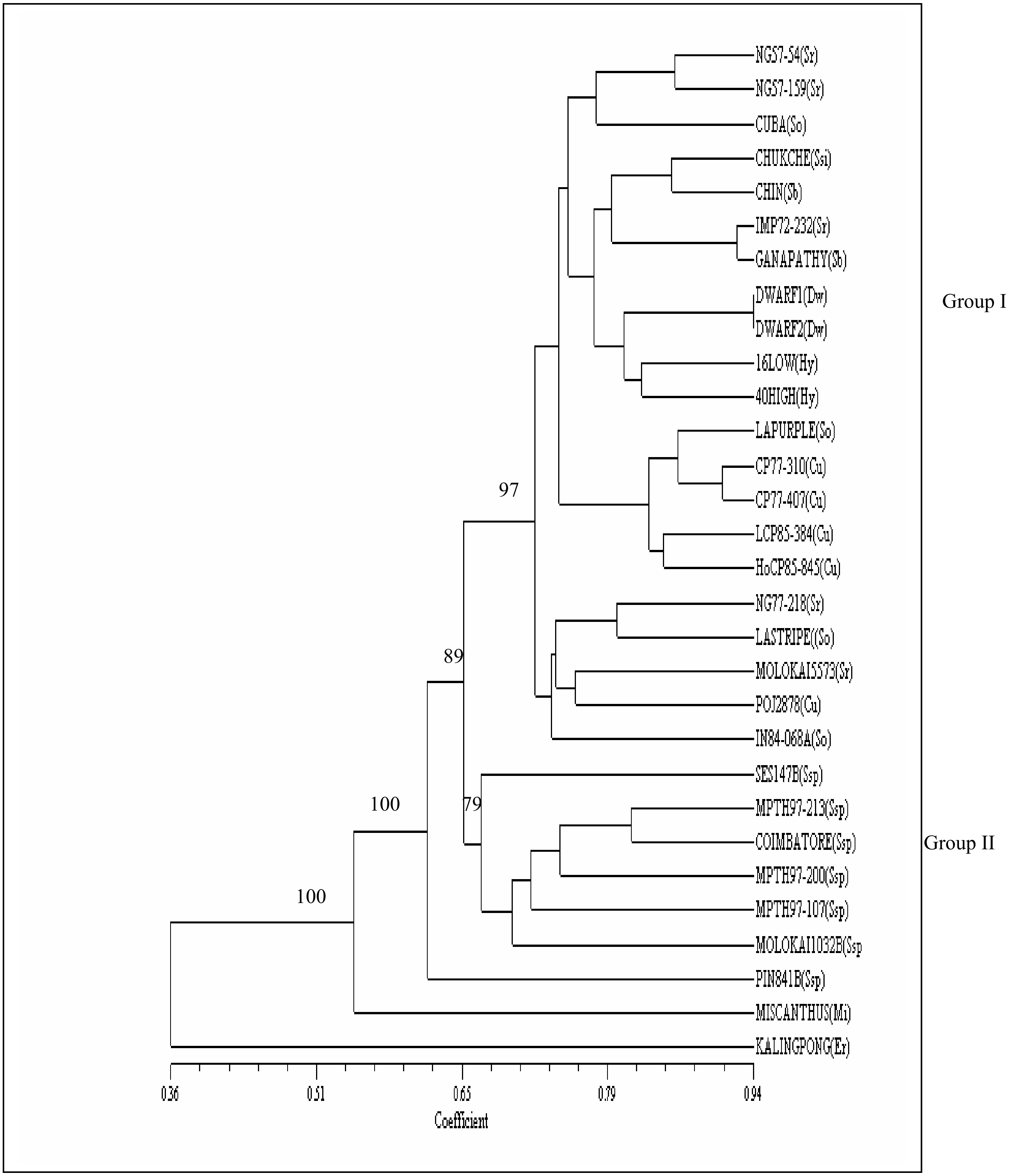

Fig 1. Grouping among 30 genotypes from a sugarcane germplasm collection based on 18 TRAP primer combinations using the UPGMA method. Numbers represent values from boostrap analysis (see Materials and Methods).

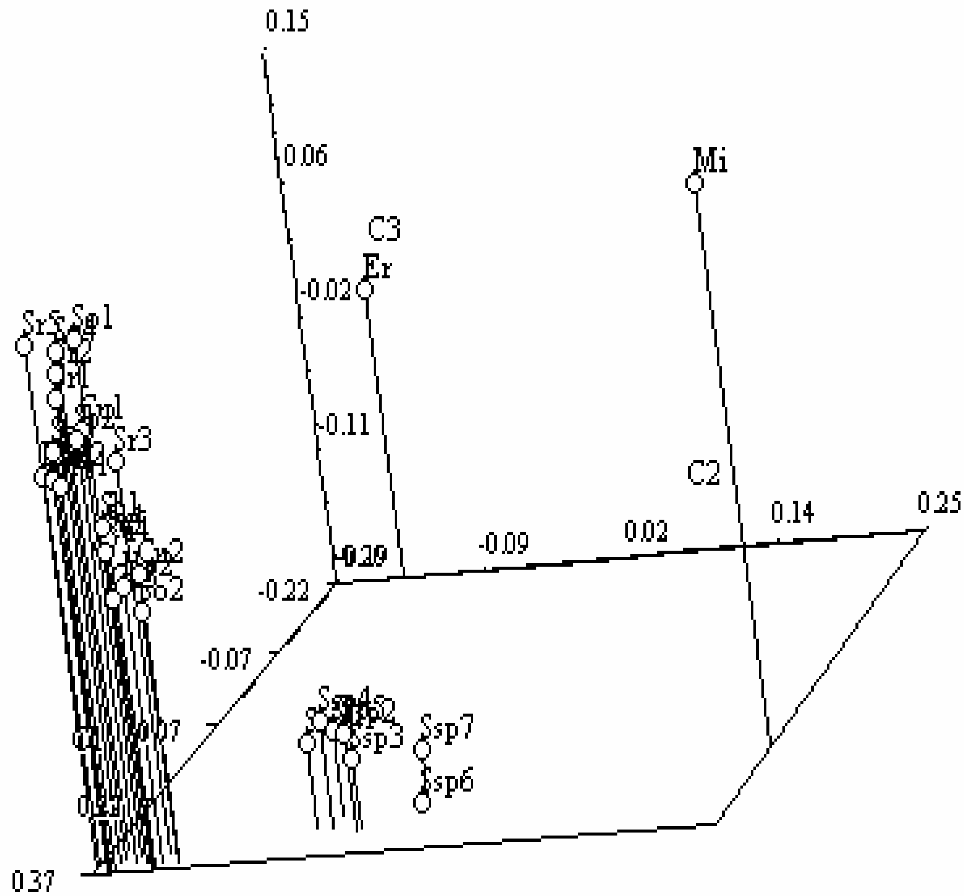

Fig 2. Association among 30 genotypes from a sugarcane germplasm collection as revealed by PCA of genetic distances based on 18 TRAP primer combinations.

Table 4. Mean genetic similarity (GS) within and between *Saccharum* species.

	S. officinarum	*S. spontaneum*	*S. robustum*	Cultivars
S. officinarum	0.71			
S. spontaneum	0.62	0.68		
S. robustum	0.74	0.63	0.76	
Cultivars	0.74	0.66	0.73	0.80

Numbers in diagonal indicate 'within' GS estimates

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GENETIC LINKAGE MAP OF SUGARCANE (*SACCHARUM* SPP.) BASED ON SRAP AND TRAP MARKERS

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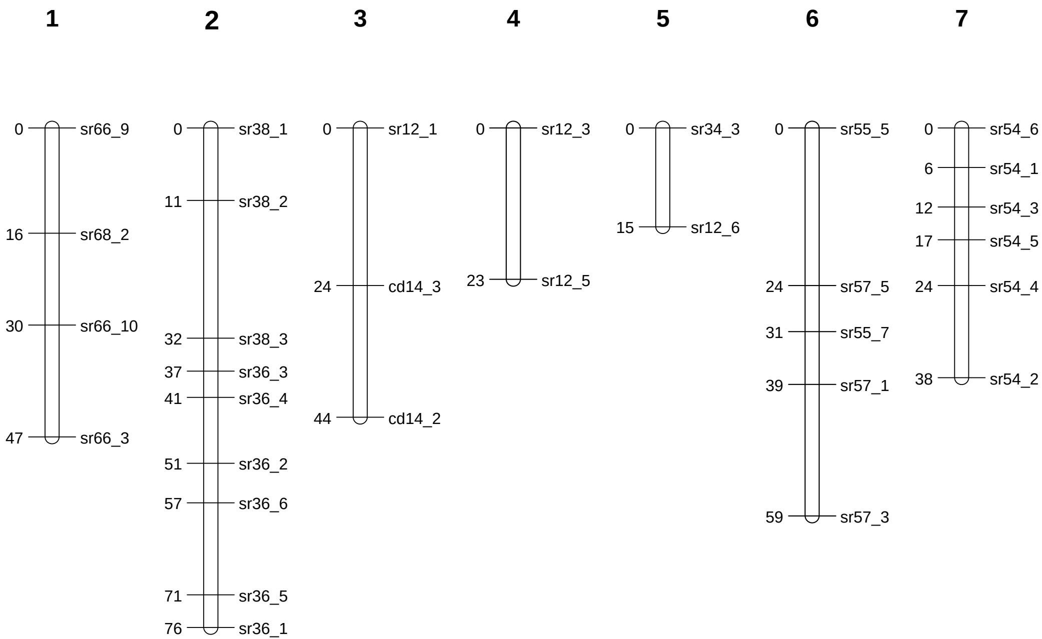
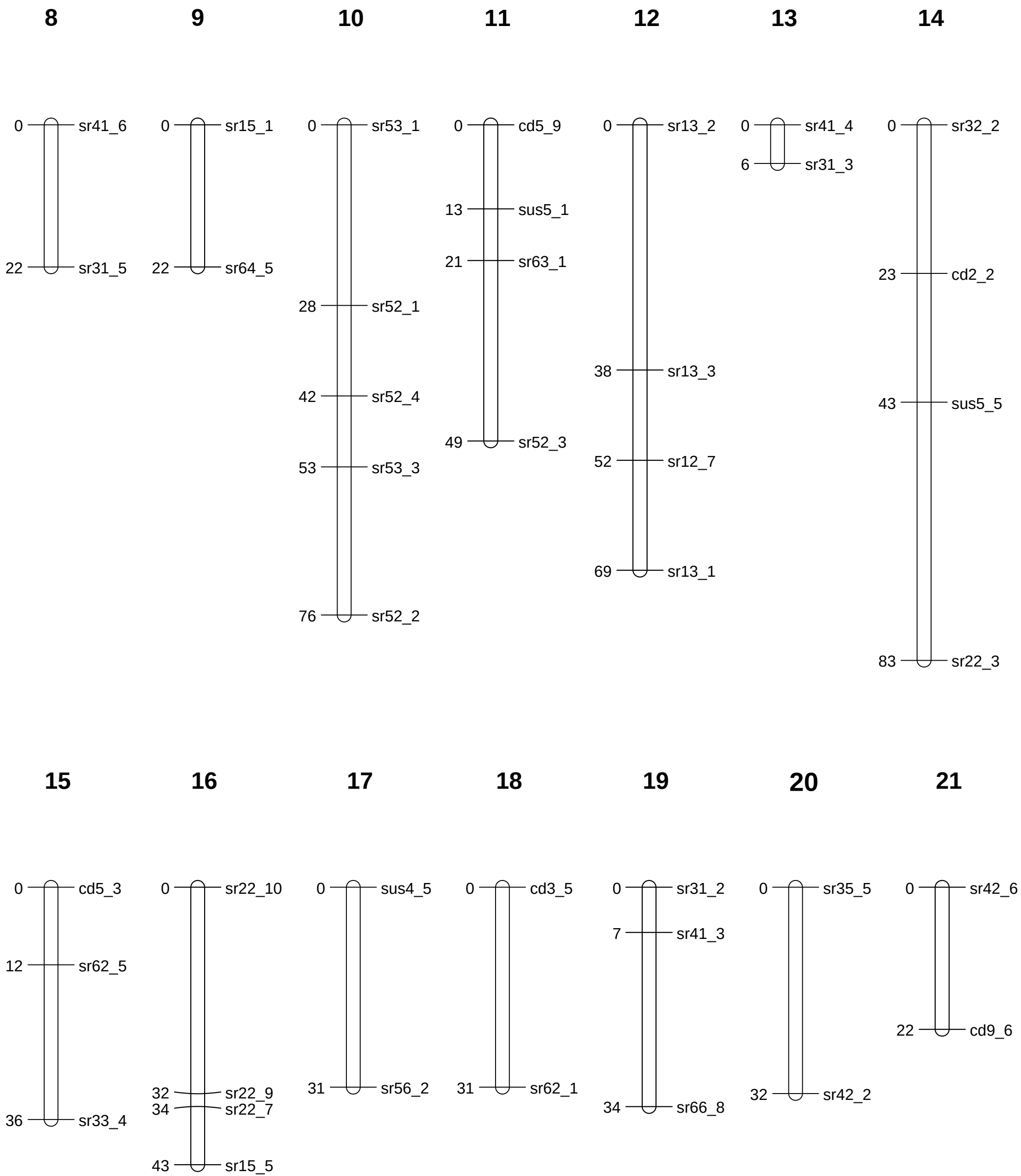
SUMMARY

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) (Li and Quiros, 2001). 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 primers as the forward primer in combination with a reverse primer, which is similar to a SRAP primer (Hu and Vick, 2003).

The mapping population consists 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 dose and 88 double dose) and 70 (52 single dose and 18 double dose) polymorphic markers, respectively. A LOD score of 3.0 to 7.0 with a threshold recombination value of 0.4 was employed for map construction, based on the Kosambi mapping function, using the JoinMap ver. 3.0 software. Of the 255 markers, 117 were grouped into 43 co-segregation groups while the rest remain ungrouped (Fig 1). The genome coverage for these 117 markers is 1311 cM, with an average of ~11 cM between any two markers. The mapping work is being continued with additional SRAP and TRAP primer combinations together with AFLP markers to further saturate the genome. We intend to evaluate the mapping population in field trials with a view of mapping QTLs. Our preliminary results show that SRAP and TRAP markers have a potential to be employed in mapping and marker assisted selection in sugarcane breeding programs.

Total markers employed:	255
Linked markers:	117 markers (SD+DD)
% of linked markers:	46%
Genome coverage:	1311 cM
Average distance between two markers:	11 cM
SRAP markers:	185 (97 SD +88 DD)
TRAP markers:	70 (52 SD+ 18 DD)

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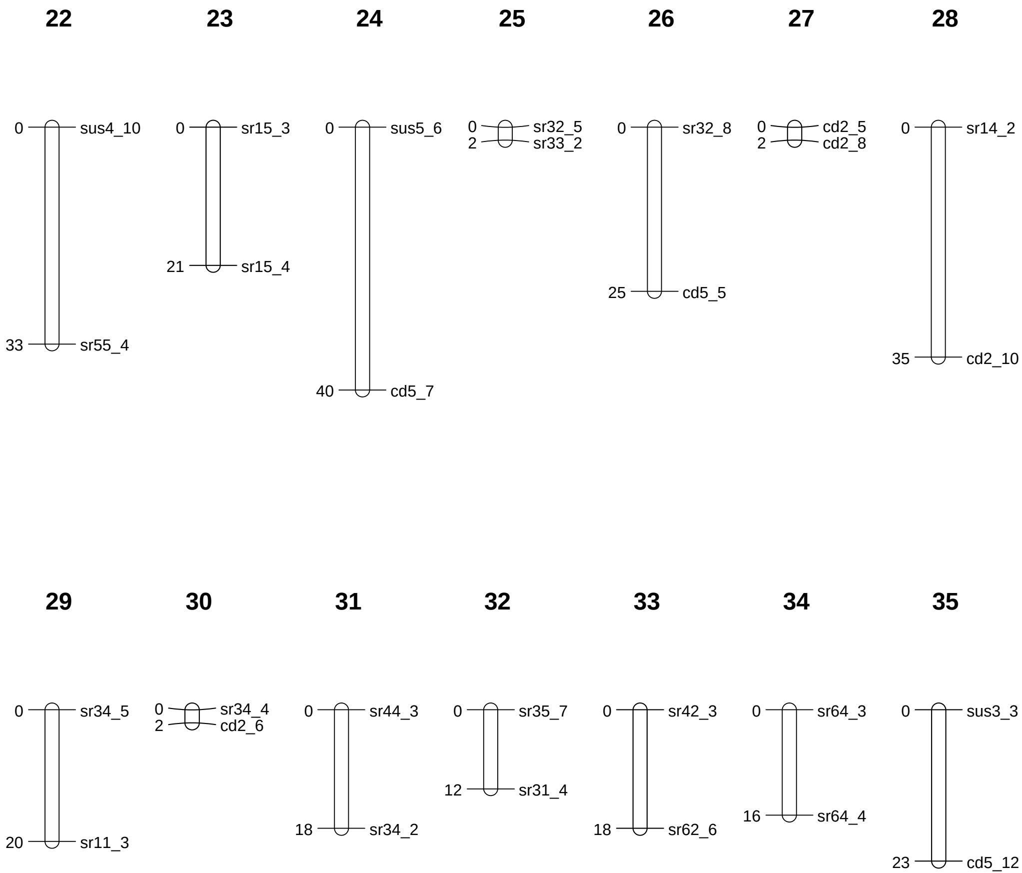
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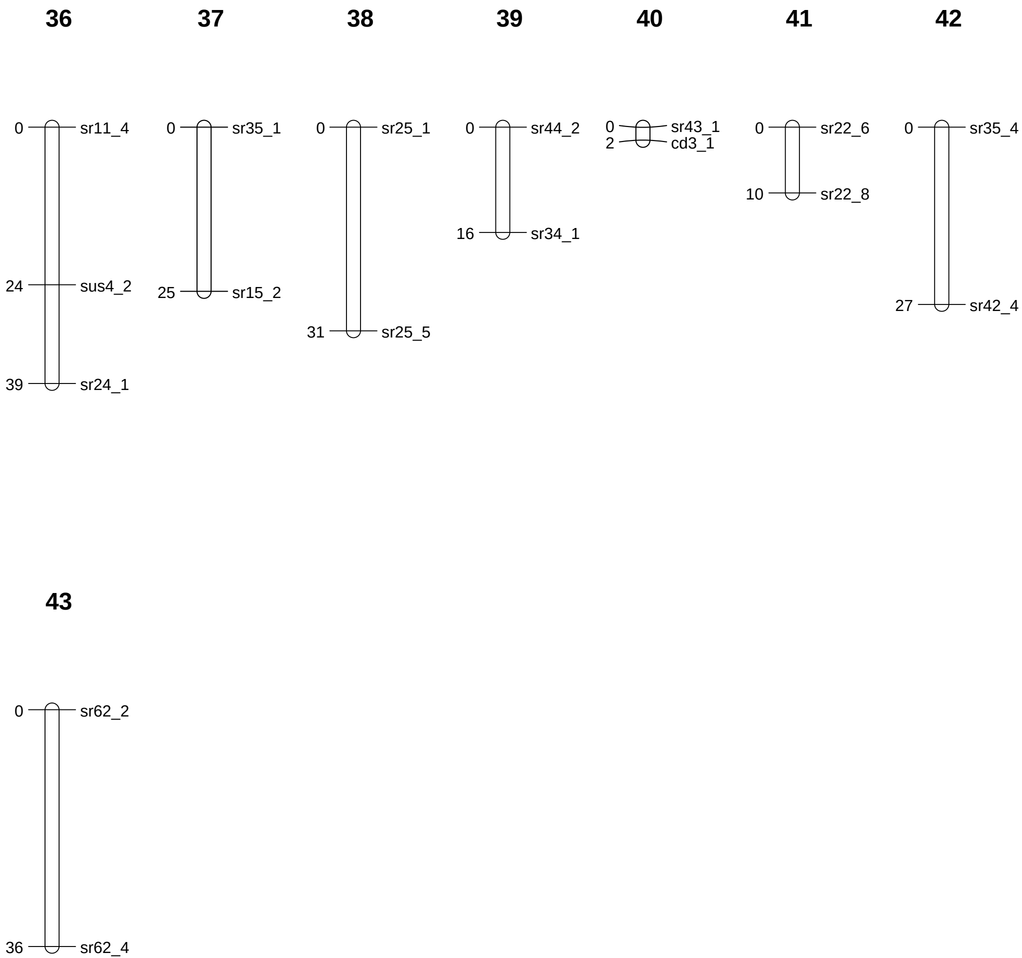

Fig 1. Sugarcane SRAP and TRAP map with 117 markers distributed over 43 co-segregation groups. Numbers on the left indicate map distances. Locus names appear on the right of the linkage groups and the prefix, sr, indicates SRAP markers while all others represent TRAP markers.

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MONITORING THE MOVEMENT OF THE MEXICAN RICE BORER FROM THE TEXAS RICE BELT TOWARD LOUISIANA

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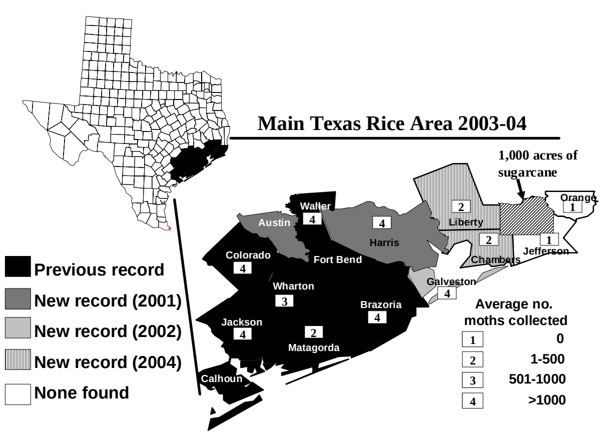
Pheromone trap sampling for the Mexican rice borer (MRB), *Eoreuma loftini* (Dyar) (Lepidoptera: Crambidae), was continued during 2004 adjacent to sugarcane or rice fields in Southeast Texas and Southwest Louisiana. These cooperative studies between Texas A&M and the LSU AgCenter were initiated in 2000 to define the insect's range and assess its increasing threat to Louisiana.

In May 2004, two bucket-type MRB pheromone traps were set up in each county of the Texas Rice Belt (Chambers, Liberty, Matagorda, Jefferson, Orange, Waller, Colorado, Wharton, Brazoria, Galveston, Jefferson and Jackson). Extensive monitoring was also conducted in two western Louisiana parishes (Calcasieu and Jefferson Davis) adjacent to sugarcane fields. Traps were additionally placed at two sugarcane mills in Iberia and St. Mary parishes. The synthetic female *E. loftini* sex pheromone (Luresept®) was used as lure and periodically replaced every 4-6 weeks. An insecticidal strip (Vaportape ® II) was placed in each bucket to kill all trapped insects and prevent them from damaging each other. Insecticidal strips were replaced every 6 weeks. The traps were attached to a metal pole at a height of 3 to 4 feet above ground. Traps were monitored every week from May to November in 2004 in Texas, and every two weeks from June to December in Louisiana.

In 2004, MRB were found in the newly infested counties of Chambers adjacent to sugarcane fields and Liberty adjacent to rice in Texas (See Figure). The insect is still not known to occur in Louisiana, but now occurs within 30 miles of the state border. From 1980 to 2001, the average rate of MRB spread toward Louisiana was 14.7 miles/yr. The rate slowed down to 12.2 miles/yr from 2001 to 2004. Assuming spread rates to remain constant, the distance between trap locations must not exceed 12.2 miles if yearly movement is to be detected. The accuracy of moth spread rate estimates decreases as distances between traps increase. Reducing distances between traps may assist in developing a more efficient monitoring program.



In addition to extensive participation by Texas rice belt county agents, western Louisiana sugarcane parish agents, personnel from both the Texas Department of Agriculture (S.S. Nilakhe) and the Louisiana Department of Agriculture and Forestry (Tad Hardy) supervised collection efforts.

Table 1. Pheromone trap collections of Mexican rice borer (*Eoreuma loftini*) moths in Southeast Texas during 2004[1].

Texas Counties	May	June	July	August	September	October	November	December	Total
Brazoria	115	240	284	531	1678	1569	216	-	4633
Chambers	0	0	0	0	3	3[2]	0	-	6
Colorado	109	211	171	248	649	1699	421	-	3478
Galveston	55	238	127	220	250	82	24	-	1311
Jackson	-	212	139	137	166	202	19	-	875
Liberty	0	0	0	42	138	152	81	-	413
Matagorda	88	24	33	54	127	70	-	-	396
Waller	26	144	144	219	389	824	154	4	1904
Wharton	22	117	25	6	113	206	75	-	564
No MRB Collected									
Jefferson	0	0	0	0	0	0	0		0
Orange	0	0	0	0	0	0	0		0

[1] Number of moths per two traps per month.
[2] Observed by Jerry W. McGee in two pheromone traps near Winnie on October 2; however, at routine collection time several days later, moths had disappeared from the trap.

EFFECTS OF DROUGHT STRESS AND SUGARCANE VARIETY ON RESISTANCE TO THE MEXICAN RICE BORER

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Cooperative studies on the Mexican rice borer, *Eoreuma loftini* (Dyar), between the LSU AgCenter and Texas A&M Research Stations at Beaumont and Weslaco continued in 2004. Greenhouse oviposition experiments on both sugarcane and rice were initiated in 2003 and completed in 2004. Sugarcane varieties LCP 85-384 and HoCP 85-845 were used under drought and non-drought stressed conditions at the 5 and 11 internode stage. Rice varieties Cocodrie and XL8 were used at the 3-4 leaf tillering stage, 6-7 leaf tillering stage, boot stage, and heading stage. Seven experiments were conducted with 4 treatments per experiment. The oviposition tests started with the release of 30 male and 30 female moths in each cage. The experiment ended 6 days after initial moth release. Number of leaves, number of dry leaves, dry weight, water potential (sugarcane only), number of tillers (rice only), number of eggs, number of egg masses and location on plant were recorded. Levels of free amino acid were also determined in sugarcane and rice leaves in selected experiments using high performance liquid chromatography.

A preliminary analysis of the data is presented in Table 1. On sugarcane, the majority of the variation in oviposition (94%), based on the number of eggs per plant, can be explained by methionone, dry leaves, and threonine, in respective order of importance. MRB oviposits in cryptic sites on dried sugarcane leaves located on the lower part of the plant, i.e. between soil surface level and 30 inches height. In our study, 100% (22,146) of the eggs on sugarcane were laid on dry leaves or dry tips of leaves. Enhanced MRB injury under stress conditions may partially be explained by increased oviposition on stressed sugarcane plants with more dry leaves. On rice plants where free amino acid data was collected, 97% of the variation in oviposition is explained by alanine levels. Oviposition on rice did not occur exclusively on dry leaves, with a significant portion of egg masses laid on green leaves or inserted behind leaf sheaths. The physical properties of the rice plant may therefore not be as important as its chemical quality.

A 2-year field study also assessed the role that irrigation, when used in combination with variety selection and insecticide application, plays on the effective management of MRB. To achieve the degree of insecticidal control shown in Figure 1, seven applications at the 8oz/acre rate of Confirm (tebufenozide) were sprayed every 2 weeks (June to mid August). In this four replication test, the untreated (non-irrigated) LCP 85-384 had an average of 66% MRB bored internodes across both years, compared to nearly 35% under the heavy insecticide pressure. Irrigation reduced injury levels in both varieties, which can be explained by the decreased attractiveness for oviposition on non-stressed sugarcane. Injury in both resistant and susceptible varieties still exceeded an average across both years of 23 and 35% MRB bored internodes, respectively, in untreated, irrigated plots. As shown in Figure 1, all management tactics were necessary to reduce injury below 10% MRB-bored internodes for both varieties in 2003, which was obtained only for the resistant variety (HoCP 85-845) in 2004.

Varieties Ho 95-988, L 97-128 and LCP 85-384 were evaluated for resistance to MRB at Ganado (TX) in 2004 (data not shown). A randomized complete block design was used with 5 replications. Differences were not detected among varieties for % MRB bored internodes (57.0 for Ho 95-988, 54.4 for LCP 85-384, and 47.4 for L 97-128).

Table 1. Oviposition preference estimates of the Mexican rice borer from greenhouse experiments, Weslaco, TX 2003-2004.

Crop	**Variety**	**Stage**	**Stress (sugarcane only)**	**Oviposition preference estimates**[1]
Sugarcane	LCP 85-384	5 internodes	Non drought stressed	0.533
			Drought stressed	1.000
		11 internodes	Non drought stressed	0.646
			Drought stressed	0.575
	HoCP 85-845	5 internodes	Non drought stressed	0.318
			Drought stressed	0.683
		11 internodes	Non drought stressed	0.245
			Drought stressed	0.558
Rice	Cocodrie	Tillering 3-4 leaves		0.000
		Tillering 6-7 leaves		0.032
		Boot		0.160
		Heading		0.181
	XL8	Tillering 3-4 leaves		0.000
		Tillering 6-7 leaves		0.149
		Boot		0.320
		Heading		0.219

[1]Standardized oviposition preference estimates ranging from 1.000 (most attractive treatment) to 0.000 (least attractive treatment) based on number of eggs laid per plant adjusted for across experiment variability.

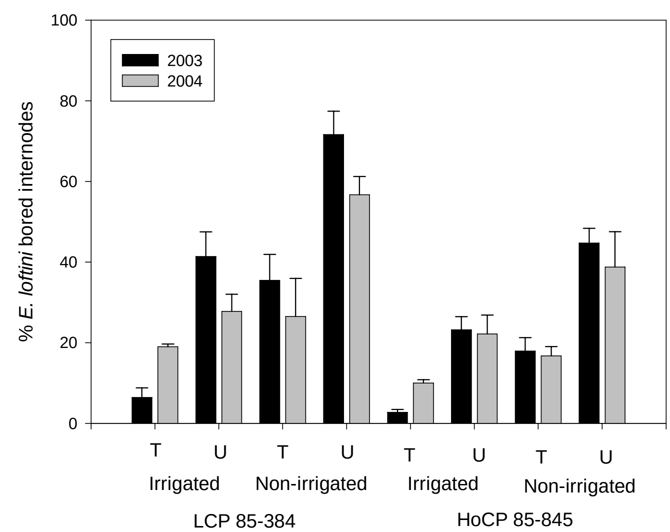

Fig. 1. Mean (± SEM) *E. loftini* percentage of bored internodes in sugarcane irrigation, cultivar, and insecticide (T=treated; U=untreated) experiment at Ganado, TX, 2003-2004.

This research is part of a Ph.D. Dissertation Research Program of Francis Reay-Jones. Appreciation is also expressed for participation and cooperation to additional technical personnel at Texas A&M Research Centers in Weslaco and Beaumont, respectively; and to Allan Showler at USDA-ARS, Kika de la Garza Subtropical Agricultural Research Center, Weslaco, TX.

ASSESSMENT OF VARIETAL RESISTANCE TO THE SUGARCANE BORER

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Sugarcane resistance to the sugarcane borer (SCB), *Diatraea saccharalis*, is categorized as a combination of physical characteristics that hinder boring (i.e. rind hardness, leaf-sheath appression), variety specific tolerance to boring, and antibiosis mechanisms that contribute to differences in survival in larvae that have bored into the stalks. The extent of this resistance also is influenced by the severity of infestations. Heavy borer pressure results in more bored internodes even in varieties considered highly resistant. Several factors contributing to seasonal area-wide SCB infestation levels include weather conditions, predator and parasite numbers, indigenous borer populations, and effectiveness of insecticidal controls. Expansive acreage of varieties with elevated moth production increases endemic SCB populations and imposes additional pressure on the remaining acreage of more resistant varieties. A minimal component in the practice of host plant resistance in entomology involves the encouragement of breeding programs not to release varieties more susceptible to key insect pests than those varieties already commonly grown. This is particularly important when there is evidence that the susceptible variety has the potential to enhance pest populations. For this reason, we also report moth production for each variety in these tests.

Nine sugarcane varieties of the L02, HoCP01 series, kept in the variety development program and four standard varieties (HoCP 91-555, HoCP 85-845, LCP 85-384, and US 02-99) were evaluated for resistance/susceptibility to SCB during 2004. All varieties were planted on September 29, 2003, near Burns Point at the Bozo Luke farm in St. Mary Parish in a randomized complete block design with 4 replications each. No chemical controls for SCB were applied in the test, and SCB predation from fire ants was suppressed by applying Karate to the soil on July 7, 2004, and Dursban on July 22, 2004. A 16-stalk sample was cut from each plot on November 26, 2004, (four replications = 64 stalks per variety). Sample stalks were examined to determine the number of bored internodes, moth emergence holes, and the total number of internodes at the end of the season.

Significant differences among the varieties were detected, with HoCP01-561 (52.76% bored internodes) being the most susceptible. Among the standard varieties tested, HoCP 91-555 was the most susceptible (38.1% bored internodes) and HoCP 85-845 was the most resistant (14.8% bored internodes). Emergence per acre from each variety also differed significantly, with the highest numbers emerging from Ho95-988 (91,643), and the lowest number (13,687) emerging from the most resistant commercial variety to sugarcane borer, HoCP 85-845. Theses results are presented in Table 1.

Table 1. Sugarcane borer injury and moth production in plant-cane L02, HoCP00 series varieties and four commercial varieties during 2004, Bozo Luke Farm near Burns Point, Louisiana. Test was planted September 29, 2003, samples harvested November 26, 2004.

Variety	% Bored internodes	Stalks/acre*	Moths/acre production
HoCP 01-561	52.76a	31763	84370a
HoCP 01-517	43.7ab	27301	66546ab
L 02-324	38.4abc	35415	71937ab
HoCP 91-555	38.1abc	36762	81566a
LCP 85-384	35.4abcd	36981	64139ab
HoCP 01-564	29.1bcd	31914	37898abc
HoCP 01-551	26.7bcd	32973	45338abc
L 02-316	25.7bcd	31082	35939abc
L 02-325	23.0bcd	29698	32482abc
HoCP 01-523	22.8bcd	37661	40603abc
US 2-99	21.7bcd	-	-
L 02-342	21.4cd	35393	38711abc
HoCP 85-845	14.9d	31120	18477bc

Means within columns followed by the same letter are not significantly different ($P \leq 0.05$, LSD).
*Stand counts provided by Dr. Kenneth Gravois, St. Gabriel Station.
-No separate field test was conducted for this variety and stand counts were unavailable.

Acknowledgment: The sugarcane entomology program would like to express appreciation for help from other members of the sugarcane variety development and breeding program for their assistance in cutting the seed-cane, and helping to select the varieties for evaluation. Additionally, Dr. W. H. White (USDA-ARS) provided the USDA varieties used in these studies.

SMALL PLOT ASSESSMENT OF INSECTICIDES AGAINST THE SUGARCANE BORER

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Department of Entomology

A study was conducted at the Louisiana State University AgCenter Sugar Research Station, St. Gabriel, La., (Iberville Parish), to evaluate eight different insecticide treatments, in addition to an untreated check, for season-long control of the sugarcane borer (SCB) *Diatraea saccharalis* (F.) (Lepidoptera: Crambidae) in a randomized complete block design with five replications. Insecticide treatments were applied to 3-row plots (6 ft x 30 ft) of variety HoCP91-555 on 19 Jul and 10 Aug using a CO_2 sprayer mounted on an all-terrain vehicle with an 8005 flat-fan nozzle (one per row) delivering 10 gpa at 35 psi. In first week of July 2004 Lorsban 15G (15lb/acre) was applied to suppress fire ant predation on SCB larvae. SCB injury to sugarcane was assessed by counting the number of bored internodes and total number of internodes from 80 randomly selected stalks from each of eight treatments and the untreated check (16 stalks per plot) from each plot at the time of harvest (4 November). Data was analyzed using a one-way analysis of variance (Proc Mixed) with means separated with Tukey's HSD ($P<0.05$).

All of the insecticide-treated plots resulted in less than 18% bored internodes (economic injury level) and were significantly different from the untreated check of 50.7% bored internodes as shown in Table 1. None of the insecticides differed significantly from each other.

Table 1. Results of small plot test on (SCB) *Diatraea saccharalis* (F.), St. Gabriel Research Station, 2004.

Treatment/ Formulation[a]	Rate (oz/A)	% Bored Internodes[b]
Baythroid 2E	2.1	11.0b
Mustang Max 0.8EC	4	11.4b
Confirm 2F	8	12.2b
Denim	0.09	12.9b
Diamond 0.83EC	8.00	13.6b
XR-225 DOW	0.016	15.2b
Diamond 0.83EC	12	16.9b
Karate Z	1.92	17.3b
Check		50.7a
F-value		35.4

[a]All treatments were applied with Latron CS-7 at 0.25% vol/vol.
[b]Means within column followed by the same letter are not significantly different ($P<0.05$, Tukey's HSD).

AERIAL INSECTICIDAL CONTROL OF THE SUGARCANE BORER AND NON-TARGET ARTHROPODS ASSESSMENT

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Aerial insecticidal control of SCB was evaluated in a randomized complete block experimental design with four replications using variety ‘LCP 85-384’ plant-cane sugarcane at Broussard Plantation, Cheneyville, La., in Rapides Parish. Insecticide treatments were randomly assigned to field plots (almost 5 acres/treatment/plot). All insecticide sprays were applied with water on 16 Jul and 13 Aug using a Turbo Thrush Commander aircraft (60-foot spray swath) calibrated to deliver 5 gpa. All treatments were applied with the surfactant Latron CS-7 at a rate of 0.25% vol/vol. SCB infestations were monitored weekly and plots were initially treated when 5% of the sugarcane stalks contained live larvae in the leaf sheaths. Relative soil-surface associated arthropod abundance was determined using three pitfall traps placed in the center row of each plot at 100-ft intervals, 100-ft from the beginning of the plot (100 ft, 200 ft, 300 ft). Ethylene glycol was used to preserve specimens in pitfall traps which were then identified and sorted to family level in the laboratory. Pre-treatment pitfall trap sampling was conducted from 11 Jun to 2 Jul, and from 2 to 15 Jul. Trap assessment of treatments was conducted from 20 Jul to 4 Aug, 4 to 17 Aug, and 17 Aug to 2 Sept.

Both rates of novaluron (Diamond 0.83EC) had significantly lower end of season SCB percent bored internodes than either tebufenozide (Confirm 2F) or the untreated check, and novaluron-treated plots also had significantly fewer moth emergence holes than the untreated plots (Table 1). None of the insecticides tested had a measurable impact on ants, spiders, or other non-target arthropods over the entire sampling period (Table 2). However, during the fourth sampling period (4-17 Aug), no click beetles were collected in the lower rate novaluron-treated plots, and a trend was observed for a lower number in the higher rate novaluron-treated plots.

Table 1. Aerial application study for control of the sugarcane borer, Broussard Plantation, Chenyville, Louisiana, 2004.

Treatment/ Formulation	Rate oz/acre	%bored internodes	No. exit holes[a]
Novaluron 0.83EC	8.0	1.58c	0.0b
Novaluron 0.83EC	12.0	2.45c	277.4b
Tebufenozide 2F	8.0	7.88b	1664.6ab
Untreated control		19.29a	2496.9a
P > F		< 0.0001	0.0073

Means within the same column followed by the same letter are not significantly different (*P* < 0.05; Tukey’s HSD).
[a] Estimated as the product of the mean number of exit holes and the number of stalks per acre.

Table 2. Mean number of non target arthropods in treated and control plots at Broussard Plantation, Chenyville, Louisiana.

		Average no. arthropods/trap/sampling period								
Treatment/ formulation	Rate oz/ac	Ants	Crickets	Spiders	Ground beetles	Click beetles	Rove beetles	Scarab beetles	Other beetles	Other insects
Novaluron 0.83EC	8.0	48.9a	5.8a	9.5a	2.0a	0.9a	1.8a	1.3a	1.4a	7.5a
Novaluron 0.83EC	12.0	61.0a	4.1a	8.7a	2.7a	0.9a	1.4a	2.0a	1.1a	7.1a
Tebufenozide 2F	8.0	41.6a	6.4a	9.7a	2.7a	1.4a	1.4a	0.9a	1.5a	8.8a
Untreated control		38.9a	6.5a	8.8a	2.0a	1.4a	2.0a	0.7a	1.8a	7.1a
F value[a]		1.34	0.26	0.16	0.11	0.63	0.19	0.68	0.93	0.09
P > F		0.3216	0.8528	0.9215	0.9531	0.6126	0.9036	0.5849	0.4661	0.9636

[a] df = 3.9

Count data was analyzed using a generalized linear mixed model with a repeated measures statement for the five sampling dates and a Poisson distribution. Means followed by the same letter are not significantly different ($P < 0.05$).

Insecticide plots were treated 16 Jul and 13 Aug.

PATHOLOGY RESEARCH

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Pathology research addresses the important diseases affecting sugarcane in Louisiana. The overall program goal is to minimize losses to diseases in the most cost-effective manner possible. Projects receiving major emphasis during 2004 were billet planting, ratoon stunting disease (RSD) management, breeding and selection of disease-resistant varieties, evaluating the effect of rust on yield of LCP 85-384, assessing the threat posed by yellow leaf, and improving our understanding of root disease. Research results on billet planting are reported separately.

RATOON STUNTING DISEASE

RSD testing was conducted by the Sugarcane Disease Detection Lab for the seventh year during 2004. RSD was monitored in fields on commercial farms, in the American Sugar Cane League Variety Release Program, in the Local Quarantine (to provide healthy source material for commercial seedcane production through tissue culture), and at all levels of Kleentek® seedcane production (Table 1). In 1997, the first year of on-farm testing, the number of farms with RSD detected in at least one field, the frequency of fields with RSD-infected cane (across the entire industry), and the frequency of stalks within a field with RSD averaged 83, 51, and 12%, respectively. In 2004, these statistics had decreased to 14, 7, and 1%, respectively. RSD no longer exhibits a typical pattern for a disease spread mechanically during planting and harvest, in which infection levels increase progressively with more harvests and higher levels of disease are detected in ratoon or stubble crops, although infection levels were higher in fields of ratoon crops than plant cane, except for second ratoon (Table 2). The incidence of RSD was lower in recent progeny of tissue culture produced seedcane compared to “field-run” cane (Table 3). The frequency of stalk infection in field-run cane was only 3%. However, many of the fields listed as field-run were LCP 85-384 from Kleentek® seedcane that had been increased more than three times. There is very little heat-treated progeny in the industry any more. Factors associated with reductions in RSD are planting of certified healthy seedcane and widespread planting of LCP 85-384, a variety with some resistance to RSD spread. The testing results are encouraging. However, the sample size (20 stalks per field) used for RSD testing on farms is too small to reliably detect low levels of RSD infection. The results suggest that RSD is persisting on many farms in the industry at a low level. The frequency of detection on farms was 32% in 2003, when an effort was made to test more fields per farm and more farms were tested. This situation could lead to a resurgence of RSD, if a susceptible variety becomes widely planted in the future. If farmers continue to use a healthy seedcane program, they have the opportunity to eliminate RSD from their farms.

Results were collected from third ratoon of an RSD spread experiment comparing rates of disease spread in different varieties caused by harvest with a whole stalk or chopper harvester. The highest rates of RSD spread again occurred in LCP 82-89 and HoCP 91-555. Rates of RSD spread caused by the two harvester types were compared, and the whole stalk harvester caused more disease spread than the chopper harvester.

Table 1. RSD testing summary for 2004.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	89	10	1787
Variety Release Program	1° & 2° stations	-	23	1163
Goosecreek®	Foundation stock	-	0	0
Helena®	Foundation stock	-	8	15
Kleentek®	Foundation stock	-	24	49
Kleentek®	1° increase farms	14	2	241
Kleentek®	2° increase farms	26	2	512
Local Quarantine	LSUAC	-	20	116
Research	LSUAC	-	-	985
Totals		129	-	4,898

Table 2. RSD field and stalk infection frequencies in different crop cycle years for all varieties combined during 2004.

Crop Year	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Plant cane	35	2.9	647	0.2
First ratoon	23	13.0	459	3.1
Second ratoon	11	0	221	0
Older ratoons	20	10.0	460	1.3
Totals	89	6.7	1787	1.2

Table 3. RSD field and stalk infection frequencies as affected by healthy seedcane programs for all varieties combined during 2004.

Seedcane program	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Heat-treated	3	0	30	0
Kleentek®	37	2.7	742	0.1
Goosecreek®	6	0	120	0
Field-run	26	15.4	585	3.1

SUGARCANE YELLOW LEAF

Sugarcane yellow leaf virus (SCYLV) causes yellow leaf, our most recent disease in Louisiana. Research is continuing to determine the potential impact under Louisiana conditions and develop appropriate disease management practices. Results have been obtained from two experiments to determine the effect of SCYLV on yield of LCP 85-384 (conducted in cooperation with Dr. Mike Grisham at the USDA-ARS Sugarcane Research Unit Ardoyne experimental farm). No significant yield loss was detected in plant cane or first ratoon, but a 2.2 ton yield loss was detected in second ratoon in the first experiment. In the second experiment, tonnage yields in plant cane were 36.9 and 34.3 tons/acre in control and virus-infected plots, respectively.

A tissue-blot, enzyme immunoassay using imprints from leaf mid-veins was used in the Sugarcane Disease Detection Lab for the detection of SCYLV (Table 4). Testing on commercial farms was expanded during 2004. The testing results from 40 fields on 10 farms indicated that the average infection levels were 80% for farms, 52% for fields, and 5% for stalks. These results are similar to a survey conducted in single fields on 42 farms in 2002, in which 48% of the fields and 7% of stalks were infected. Yellow leaf was included in the seedcane certification standards for the first time during 2004, and Louisiana Department of Agriculture and Forestry inspectors collected leaves from Kleentek and Goosecreek seedcane fields during the June inspection. The LSU AgCenter Sugarcane Disease Detection Lab then tested the samples for SCYLV. No tested field exceeded the yellow leaf infection standard. It is hoped that providing the industry with near-virus-free seedcane will prevent a buildup of virus infection levels in commercial fields and help prevent this disease from becoming a problem in the future.

Table 4. Sugarcane yellow leaf virus testing summary for 2004.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	46	5	1744
LSUAC	St. Gabriel & Iberia	-	8	502
Helena	Foundation stock	-	8	15
Kleentek®	Foundation stock	-	24	110
Kleentek®	1° increase farms	57	7	2135
Kleentek®	2° increase farms	62	5	2413
Local Quarantine	LSU AgCenter	-	20	113
Research	LSUAgCenter	-	-	2166
Totals		165		10,682

SELECTION OF DISEASE RESISTANT VARIETIES

Experimental varieties in the selection program are screened and rated for resistance to mosaic, smut, and leaf scald. Natural mosaic infection levels were determined in breeding program outfield yield trials. Little infection was detected in experimental varieties during 2004. Smut resistance in experimental varieties was evaluated in an inoculated test in which stalks were dipped in a smut spore suspension then planted during August 2003. Smut infection levels were determined during July 2004 and compared to infection levels in varieties with known resistance reactions. Within the experimental varieties, 29 (88%), 2 (6%), and 2 (6%) of 35 were rated as resistant, moderately susceptible, and highly susceptible to smut, respectively (Table 5). Leaf scald also was evaluated in experimental varieties using an inoculated test. During June, shoots were cut above the growing point and sprayed with leaf scald bacteria. Symptoms were evaluated later in the growing season, and clones were rated for their resistance level (Table 6). Four (12%), 26 (74%), and 5 (14%) of 35 experimental varieties were rated as resistant, moderately susceptible, and highly susceptible to leaf scald.

RUST IMPACT ON LCP 85-384 YIELD

Two experiments were conducted to evaluate the impact of brown rust on yield of LCP 85-384. Experiments were located in Iberia and St. Mary parishes in plant-cane fields. A combination of three fungicides was applied at two-week intervals to attempt to control natural infection by rust. Tebuconazol (Folicur, 6 oz FP per acre), propiconazol (Tilt, 6 oz FP per acre), and azoxystrobin (Quadris, 6.2 oz FP per acre) were applied with a backpack sprayer to 4 row x 60 ft. plots replicated four times. Fungicide treatments were started and stopped at different times during the epidemic period in an attempt to determine when rust might cause yield loss to occur. Severe rust developed only at the Iberia Parish location (Table 7). Rust significantly reduced stalk weight, tons of cane per acre, and sugar per acre. It did not significantly affect stalk population, fiber, or sucrose content. Application of fungicides only at the beginning of the epidemic in April or only at the end of the epidemic during June did not result in a yield increase (Table 7). Sugar per acre was only increased when fungicides were applied during April through June and during May and June. Sugar per acre was not increased by fungicide treatments at the St. James location (Table 8).

ROOT DISEASE

A basic research project is in progress addressing the effects of root disease on sugarcane growth and productivity. Pythium root rot and nematodes have been shown to be constraints to sugarcane growth and yield. However, evidence suggests that long-term cultivation of sugarcane can result in the development of a total soil microorganism community that is detrimental to sugarcane growth. Indirect evidence for this can be seen in the high yields obtained when cane is planted in “new ground” with no recent history of sugarcane cultivation. Three sites with paired fields, one with a long-term sugarcane cultivation history and one with no recent cultivation history, were compared previously for culturable microorganisms present in the rhizosphere soil (soil in close proximity to roots exposed to root exudates). Differences in the pattern of utilization of multiple substrates (potential food sources) were detected between soils from fields with and without a recent sugarcane cropping history. Differences also were detected between

soil microbial communities from fields with and without a sugarcane cropping history in the quantity and type of culturable microorganisms. An additional site of paired fields was compared during 2004, and differences between "new" and "old" fields were detected.

These differences provide information about the possible changes in microbial community makeup that can result from sugarcane monoculture. We are attempting to identify the organisms that account for the differences in community makeup in soil from "new" and "old" ground fields. The hope is that improved understanding of the effects of the total soil microbial community on sugarcane root development will allow us to determine ways to manipulate or manage the community to promote root system health and improve plant growth.

Table 5. Smut infection level and resistance ratings for experimental varieties determined from an inoculated test during 2004.

Variety	Infection (%)	Rating[x]	Variety	Infection (%)	Rating[x]
CP 65-357	12	4	HoCP 01-534	1	2
CP 70-321	0	1	HoCP 01-544	1	2
CP 73-351	66	9	HoCP 01-551	0	1
CP 74-383	63	9	HoCP 01-553	0	1
TucCP 77-42	0	1	HoCP 01-558	0	1
CP 81-335	10	4	HoCP 01-561	0	1
LCP 85-384	0	1	HoCP 01-564	20	5
L 97-128	0	1	L 02-316	0	1
L 98-209	1	2	L 02-320	0	1
L 99-226	1	2	L 02-322	0	1
L 99-233	4	2	L 02-323	0	1
HoCP 00-927	0	1	L 02-324	1	2
HoCP 00-930	5	3	L 02-325	0	1
HoCP 00-950	0	1	L 02-326	1	2
L 01-283	0	1	L 02-333	39	7
L 01-292	0	1	L 02-336	34	7
L 01-299	17	5	L 02-341	0	1
HoCP 01-517	0	1	L 02-342	1	2
HoCP 01-520	0	1	L 02-343	0	1
HoCP 01-523	0	1	L 02-353	2	2
HoCP 01-529	0	1	L 02-354	0	1

[x]Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

Table 6. Leaf scald resistance ratings for experimental varieties determined from an inoculated test during 2004.

Variety	Rating[x]	Variety	Rating[x]	Variety	Rating[x]
CP 65-357	7	L 01-283	4	L 02-316	3
CP 70-321	6	L 01-292	6	L 02-320	2
CP 73-351	6	L 01-299	7	L 02-322	5
CP 74-383	9	HoCP 01-517	6	L 02-323	6
TucCP 77-42	4	HoCP 01-520	4	L 02-324	5
CP 81-335	6	HoCP 01-523	7	L 02-325	6
LCP 85-384	1	HoCP 01-529	5	L 02-326	3
L 97-128	5	HoCP 01-534	4	L 02-333	8
L 98-209	5	HoCP 01-544	5	L 02-336	5
L 99-226	5	HoCP 01-551	5	L 02-341	6
L 99-233	6	HoCP 01-553	5	L 02-342	5
HoCP 00-927	4	HoCP 01-558	3	L 02-343	7
HoCP 00-930	5	HoCP 01-561	5	L 02-353	5
HoCP 00-950	8	HoCP 01-564	5	L 02-354	5

[x]Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

Table 7. Effect of rust on plant cane yield of LCP 85-384, Iberia Parish, 2004.

Fungicide treatment dates						Sugar/acre (lbs)
None						7308 B
4/8	4/20*					7538 B
4/8	4/20*	5/7	5/19**			8390 AB
4/8	4/20*	5/7	5/19**	6/1	6/19	9330 A
		5/7	5/19**	6/1	6/19	9095 A
				6/1	6/19	7538 B

* Rust first observed.

** Rust very evident.

Table 8. Effect or rust on plant cane yield of LCP 85-384, St. James Parish, 2004.

Fungicide treatment dates					Sugar per acre (lbs)
None					6378
4/5	4/22				5663
4/5	4/22	5/6	5/21*		6876
4/5	4/22	5/6	5/21*	6/9	6339
		5/6	5/21*	6/9	6767
				6/9	5901

* Rust first observed.

WEED CONTROL RESEARCH WITH LABELED AND NEW HERBICIDES

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For the 2004 growing season research was conducted at the St. Gabriel Research Station and in Assumption, Lafayette, Iberia, St. James, St. Martin, St. Mary, and West Baton Rouge parishes.

Valor

Application of Valor in March to emerged sugarcane caused severe injury but recovery was rapid as growth rate increased with the warmer temperatures. Sugarcane was not injured with Valor as a directed application at layby. Application of Valor in the fall to emerged plant-cane was injurious and plants did not recover before winter. Excellent winter weed control without crop injury was obtained with Valor applied to the soil at planting.

DuPont K-4

Research evaluated rate and timing of application of DuPont K-4. Response of LCP 85-384 was evaluated for Dupont K-4 applied at 4 lb/A in the spring followed by 2 lb/A at layby and 3 lb/A in the spring followed by 3 lb/A at layby. These rates provided for a total of 6 lb/A, which is the label limit. Sugarcane injury was not observed, but weed control was compromised when only 2 lb/A was applied at layby. This led to a follow-up study where DuPont K-4 was applied with Prowl at rates of 4 lb/A + 4 qt/A (K-4 + Prowl), 3 lb/A + 4 qt/A, 3 lb/A + 3 qt/A, and 4 lb/A + 3 qt/A. These herbicide combinations provided excellent broad spectrum weed control with no crop injury. The cost of the combinations, however, would determine their utility. In another study, significant injury to LCP 85-384 occurred when either DuPont K-4 (4 lb/A) or Direx was applied postemergence overtop in March, April, or May. For the March application, maximum air temperature for the period seven days before and seven days after application ranged from 67^o to 81^o F with an average of 75.1^o. For the April application maximum air temperature for the 15-day period ranged from 66^o to 87^o with an average of 79.9^o. For the May application, maximum air temperature for the 15-day period ranged from 81^o to 89^o with an average of 86.4^o. Reduced sugarcane and sugar yield occurred only for the mid-May application of the herbicides. It can be concluded that the response is temperature related and, if temperature at the time of application is around 85^o, Dupont K4 or Direx should not be applied overtop of sugarcane.

Envoke

When applied alone Envoke at 0.3 oz/A did not provide complete control of rhizome johnsongrass or itchgrass, but did control morningglory (tie-vines) and nutsedge. Combinations of Envoke with Asulox/Asulam provided complementary broadleaf and grass weed control. Envoke at 0.3 oz/A applied with Asulox/Asulam at 2 qt/A (half rate) controlled large rhizome johnsongrass equal to or better than Asulox/Asulam applied alone at 4 qt/A (full rate). Envoke at 0.2 oz/A applied with Asulox/Asulam at 2 qt/A controlled itchgrass better than Asulox/Asulam applied alone at 4 qt/A. Weed death occurred three to four weeks after application, depending on species and growing conditions. Envoke applied overtop of sugarcane caused some yellowing

and white banding on leaves present in the whorl at application and slight stunting, but recovery was rapid and sugarcane yield was not affected.

Note: Specific data for all weed control experiments conducted in 2004 are presented in the Weed Science 2004 Annual Research Report and can be viewed at www.lsuagcenter.com/weedscience.

REDUCED TILLAGE AND RESIDUE MANAGEMENT IN SUGARCANE

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Sugarcane is a perennial crop, and in Louisiana four to six harvests are made from a single planting. Traditionally sugarcane row shoulders and middles are tilled to promote crop growth, eliminate ruts, incorporate residue from the previous crop, incorporate fertilizer, and control weeds. The row top (usually 24 inches wide) is not disturbed over the entire crop cycle. Although some form of reduced tillage is used in most agronomic crops, sugarcane growers have been slow to adopt reduced tillage practices.

In 2002, herbicides were applied in March at several locations after sugarcane was either off-barred (tillage of row shoulders and middles) or not off-barred. Sugarcane shoot population assessed around 4 weeks after herbicide application was as much as 12% greater where rows were not off-barred. Weed control was excellent in all experiments. At one site at layby in May, soil moisture was greater and sugarcane was taller in plots that had not been off-barred in March. Sugarcane height throughout the growing season was equal whether or not sugarcane had been off-barred.

Research in 2002 and 2003 evaluated the effect of off-bar tillage in March (with or without) and tillage at layby in May (with or without) on weed control and sugarcane growth. For these experiments, residue from the previous crop had been removed by burning or had naturally decayed and therefore was not a limiting factor. Dupont K4 (a premix of hexazinone and diuron) herbicide was used and weeds were not a detriment to sugarcane growth or yield regardless of tillage program. Soil temperature in the sugarcane drill for the March tillage and no-tillage treatments did not differ. Early-season sugarcane shoot population and late-season stalk population both years were each equivalent for the full tillage (off-bar plus layby tillage) and the no tillage program. Sugarcane and sugar yield were not negatively affected when tillage operations were eliminated.

Research in 2004 evaluated the possible interaction between tillage and management of sugarcane residue remaining after harvest in respect to weed control, sugarcane growth, and sugarcane and sugar yield. For the three experiments, a randomized complete block design with a factorial arrangement of treatments was used. Factor A represented crop residue management (removal by burning, mechanical removal using a Sunco Trash Tiger®, or no removal), Factor B represented off-bar tillage in March (with or without), and factor C represented tillage at layby in May (with or without). Results confirmed those of previous research which showed that eliminating tillage is not detrimental to sugarcane growth or sugar yield when weeds are effectively controlled. Tillage efficiency in March (off-bar tillage) was not reduced where the residue was mechanically removed from the row top and placed in the row middle. When residue remained on the soil surface, some suppression of winter weed emergence and growth occurred but a spring herbicide application was still needed. Based on sugarcane and sugar yield, mechanical removal of residue was as effective as burning. Sugar yield was reduced when sugarcane residue was not removed from the row top compared with burning and mechanical removal in only one of the three experiments. Reasons for this inconsistency in response are being investigated.

INFLUENCE OF HERBICIDE RATE AND APPLICATION METHOD ON RESIDUAL CONTROL OF RED MORNINGGLORY

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In 2004, field experiments were conducted in West Baton Rouge Parish, La., to evaluate preemergence (PRE) control of red morningglory (*Ipomoea coccinea* L.) with various herbicides. In each experiment the experimental design was a randomized complete block with four replications and plot size was 10 ft by 20 ft. Herbicide treatments were applied on June 10 using a tractor-mounted, compressed air sprayer calibrated to deliver 15 GPA. To evaluate residual activity of the herbicides, red morningglory control data were collected 5, 7, 9, and 11 weeks after treatment (WAT). To eliminate weed competition as a variable, Liberty (glufosinate) was applied at 1 qt/A after each rating to control all vegetation.

In the red morningglory preemergence experiment, treatments included Spartan (sulfentrazone) at 3, 4, 5, 6, 7, and 8 oz/A; Aatrex (atrazine) at 1, 2, 3, and 4 qt/A; Valor (flumioxazin) at 2, 4, 6, and 8 oz/A; Dupont K4 (a premix of hexazinone and diuron) at 2, 3, and 4 lb/A; and Sencor (metribuzin) at 2 and 3 lb/A. Red morningglory control 5 WAT was at least 90% with Spartan at 4, 5, 6, 7 and 8 oz/A; atrazine at 3 and 4 qt/A; Dupont K4 at 3 and 4 lb/A; Sencor at 3 lb/A; and Valor at 4, 6, and 8 oz/A. Spartan at 3 oz/A, Dupont K4 at 2 lb/A, and Valor at 2 oz/A controlled red morningglory less than 80% 5 WAT. 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 more than 71% and atrazine at 1 qt/A, both rates of Sencor, and Valor at 2 and 4 oz/A controlled red morningglory no more than 50%. At 9 WAT, the five highest rates of Spartan provided at least 75% control of red morningglory and the low rate of Spartan and both rates of Dupont K4 were the only other treatments that controlled red morningglory at least 50%. At 11 WAT, the five highest rates of Spartan controlled red morningglory 71 to 76% and all other treatments provided less than 50% control.

In another experiment, treatments included Treflan (trifluralin) at 2 qt/A plus Spartan at 4, 5.3, 6.7, and 8 oz/A pre-plant incorporated (PPI), Treflan at 2 qt/A PPI followed by Spartan PRE at the same rates, Treflan PPI alone, and Spartan PRE alone. All PPI treatments were incorporated with a field cultivator equipped with a rear rolling basket. Red morningglory control 5 WAT was at least 95% when Spartan was applied PRE, but was 85 to 94% when Spartan was incorporated. At 7 WAT, the 4 oz/A rate of Spartan applied PRE controlled red morningglory as well as the higher rates. By 9 WAT, red morningglory control was no more than 76% when Spartan at 4 to 6.7 oz/A was incorporated. Spartan at 4 oz/A applied PRE, however, was still providing equivalent control to the 8 oz/A rate 9 WAT. Spartan at 8 oz/A controlled red morningglory 9 WAT 86 to 89%, but by 11 WAT control was no more than 80%.

These results clearly show that reported red morningglory control failures with atrazine are directly related to lack of long-term residual activity. This can be attributed to a change in cultural practices where herbicides at layby are applied in early to mid May as opposed to late May and early June. Findings show that for most effective red morningglory control at layby, herbicide application should be delayed as long as possible. Under severe red morningglory infestations, Spartan should be used rather than atrazine, Valor, Dupont K4, or Sencor because Spartan provided longer residual control. Spartan is more effective when applied to the soil surface rather than incorporated.

SUGARCANE FALLOW PROGRAMS: WEED CONTROL AND ECONOMICS

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Optimizing input costs with the objective of maximizing net profits are concepts that have been slowly adopted by sugarcane producers in part because of industry stability. A reduction in tillage operations both in crop and in the fallow period can significantly reduce input costs. Research is under way to evaluate the effect of reduced tillage programs on weed control and sugarcane growth and yield. After three to five years of production, sugarcane plant populations in Louisiana are reduced to the point that replanting is warranted. Fields are fallowed to address problems with drainage and perennial weeds such as bermudagrass [*Cynodon dactylon* (L.) Pers.] and johnsongrass [*Sorghum halapense* (L.) Pers.]. Ineffective control of perennial weeds in fallow can have an economic impact in both the plant-cane crop (first production year) and in successive crops. A study was conducted at St. Gabriel, La., to evaluate various weed control programs in fallowed sugarcane fields, specifically to compare mechanical destruction of sugarcane stubble followed by tillage, soil-applied herbicide, and/or Roundup UltraMAX applications (conventional programs) with a no-till system where Roundup UltraMAX was used to kill sugarcane stubble and weeds. Another study conducted in Henderson, La., evaluated only the conventional programs. At both locations, standard herbicide programs at planting and throughout the first production year were implemented to allow for direct comparison of the effectiveness of the fallow treatments.

At the Henderson location sugarcane shoot emergence 36 and 247 days after planting (DAP) was not negatively affected by any of the conventional fallow programs. Bermudagrass ground cover 86 and 247 DAP showed that tillage alone provided little control of bermudagrass (45 and 73% ground cover, respectively). However, bermudagrass control where tillage and Roundup UltraMAX were used was excellent (≤5% ground cover) throughout the first production year. By August of the first production year, sugarcane height and stalk population were less where tillage alone was used in fallow compared to the other programs. Sugarcane growth reduction where only tillage was used in fallow was reflected in reduced sugarcane and sugar yields of approximately 40% compared with the other conventional programs. Even though the tillage alone program was the lowest cost input program ($34.00/A), net returns were $216 to $291/A higher for the other programs. This was because of the significant sugar yield reduction observed where a tillage alone program was used in the fallow period.

At the St. Gabriel location, differences in shoot population, sugarcane height, sugarcane or sugar yield for the first production year were not negatively affected by the fallow treatments. Unlike the Henderson location, weeds were not a limiting factor at St. Gabriel since weeds were effectively managed in both no-till and conventional tillage programs. Therefore, the effectiveness of fallow weed control programs were based on economics where net returns (NR) were compared to the tillage only program (NR=$0.00/A). At St. Gabriel, based on inputs and yields, the most economical program for fallow was the combination of 4 tillage operations and 1 glyphosate application (NR=$8.23/A). However, a no-till system can be used in fallow fields to manage weeds equal to or better than conventional tillage programs without negatively affecting sugarcane production and can be economically competitive (NR=$-1.71/A) with a tillage only fallow program.

Other experiments were conducted at St. Gabriel, La., to evaluate control of LCP 85-384 sugarcane with various rates of glyphosate and at Henderson, La., to evaluate 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-tall sugarcane. In a no-till system less expensive glyphosate formulations could be used to decrease input cost without sacrificing sugarcane stubble destruction.

BILLET PLANTING RESEARCH

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Research continued to develop methods to maximize the chances of success with billet planting. During 2004, results were obtained from billet planting experiments conducted at the St. Gabriel Research Station at St. Gabriel, La. The experiments included LCP 85-384 first and second stubble experiments comparing billet date and rate of planting and an experiment in second stubble comparing billet and whole stalk planting in HoCP 85-845 and HoCP 91-555.

Yield differences were detected in first stubble of the date of planting test planted in 2002 (Table 1). An early August planting date was not included in this experiment. Instead, a late planting date during mid-October was included. As in plant-cane, the mid-August planting date produced the highest yield, and the October planting date produced the lowest yield. Yield differences were not detected in plant-cane or first stubble of the date of planting test planted in 2001 (Table 2), but in second stubble, the yield of the August 23 planting date was significantly higher than the yield obtained from the August 28 planting date.

In first stubble of the rate of billet planting experiment planted in 2002, stalk population was lower, as in plant-cane, for the one and three billet planting rates for both planting dates. However, this was partially offset by a higher stalk weight (data not shown). The tonnage and sugar per acre yields from the August planting date were lowest for the one and 12 stalk planting rates (Table 3). The highest yield was obtained from the three stalk planting rate. There was no consistent pattern evident in second stubble of the rate of planting experiment planted in 2001 (Table 4). The lowest yields were obtained from the three billet planting rate for the August date and the 12 billet planting rate for the September date.

HoCP 85-845 and HoCP 91-555 responded well to billet planting in plant-cane and first stubble. In second stubble, numerical differences in favor of the whole stalk plantings were evident, but the differences were not significant due to variability in the results (Table 5).

The results obtained during 2004 were similar to those from experiments in previous years. A planting date outside the traditional planting period (in this case, an October planting date) produced lower yield through a 3-year crop cycle. Stubble yields were generally similar for billet plantings made from mid-August to late-September. Low billet planting rates produced reduced stalk populations and lower yields in plant-cane, but there was no consistent pattern to yields in the stubble crops. As long as large gaps do not occur in the plant-cane stand, the stubbling ability of LCP 85-384 provides some ability to recover during the subsequent stubble crops.

It is not certain whether future varieties will respond the same way as LCP 85-384. Previous research showed that varieties vary in tolerance to billet planting. Early results with HoCP 91-555 and HoCP 85-845 are promising. Experimental varieties being considered for

release to the industry will need to be evaluated for billet planting tolerance. Therefore, seven varieties, LCP 85-384, Ho 95-988, HoCP 96-540, L 97-128, L 99-226, L 99-233, and L 00-266, were planted during Fall 2004 in replicated experiments comparing billet and whole stalk planting at the St. Gabriel Research Station.

It is very important to do a good job planting billets. Billets are more sensitive than whole stalks to any planting problem. The research results from this and previous years suggest that practices to maximize the chance of success with billet planting include: providing a well prepared seed-bed, planting long (20-24 inch) billets with a low level of physical damage, planting at a high rate (more than three running billets in the furrow), covering with a uniform layer of no more than 3 inches of packed soil, and providing good drainage and careful weed control.

Table 1. Effect of date of planting on 2003 plant-cane and 2004 first stubble yields of billet planted LCP 85-384 at the St. Gabriel Research Station.

	Tons cane per acre		Sugar per acre (lbs.)	
Date of planting	Plant-cane	First stubble	Plant-cane	First stubble
August 18	36.9 a	32.2 a	7116 a	5888
August 27	34.1 ab	28.1 ab	6534 ab	5466
September 13	32.3 b	30.6 ab	6285 b	5569
October 18	26.8 c	26.3 b	5072 c	4921

Average values for the different yield components followed by the same letter were not significantly different (P = 0.05).

Table 2. Effect of date of planting on 2002 plant, 2003 first stubble, and 2004 second stubble yields of billet planted LCP 85-384 at the St. Gabriel Research Station.

	Tons cane per acre			Sugar per acre (lbs.)		
Date of planting	Plant-cane	1st stubble	2nd stubble	Plant-cane	1st stubble	2nd stubble
August 23	44.0	30.5	35.5 a	8943	5192	6489 a
August 28	42.1	29.3	29.7 b	8496	5259	5203 b
September 17	46.0	31.2	32.5 ab	9199	5323	5657 ab
September 28	45.4	31.5	33.7 ab	8854	5351	5882 ab

Average values for the different yield components followed by the same letter were not significantly different (P = 0.05).

Table 3. Effect of rate of planting on 2003 plant-cane and 2004 first stubble yields of LCP 85-384 planted as billets at five rates on two dates at the St. Gabriel Research Station.

	Tons cane per acre				Sugar per acre (lbs)			
	Aug 15		Sep 16		Aug 15		Sep 16	
Rate	Plant-cane	1st stubble	Plant-cane	1st stubble	Plant-cane	1st stubble	Plant-cane	1st stubble
1 billet	36.6 b	33.1 b	33.8 c	36.7	7074 b	7037 b	6421 c	7782 ab
3 billets	41.2 ab	38.0 ab	45.1 ab	43.8	8034 ab	7790 ab	8508 b	9332 a
6 billets	45.4 a	42.3 a	43.6 b	39.0	8811 ab	8554 a	8616 b	8357 ab
9 billets	46.1 a	41.5 a	46.6 ab	36.6	9275 a	8243 ab	9133 ab	7492 b
12 billets	45.3 a	33.6 b	53.0 a	37.4	9172 ab	7046 b	10854 a	7952 ab

Average values for different yield components within a date of planting followed by the same letter were not significantly different among the different planting rates (P = 0.05).

Table 4. Effect of rate of planting on 2002 plant-cane, 2003 first stubble, and 2004 second stubble yields of LCP 85-384 planted as billets at five rates on two dates.

	Plant-cane sugar per acre		First stubble sugar per acre		Second stubble sugar/acre	
Rate	Aug 23	Sep 17	Aug 23	Sep 17	Aug 23	Sep 17
1 billet	6734 b	6442 c	5787 ab	6051	5821 ab	5522 b
3 billets	8355 a	6913 bc	5489 b	6136	5377 b	5963 ab
6 billets	8773 a	8747 a	6454 a	6027	5990 ab	5937 ab
9 billets	8656 a	8068 abc	6083 ab	6105	6176 ab	6817 a
12 billets	9525 a	8383 ab	5895 ab	5682	6480 a	5379 b

Average values for tons of cane per acre within a column (crop cycle year and date) followed by the same letter were not significantly different (P = 0.05).

Table 5. Comparison of yields obtained from 2002 plant-cane, 2003 first stubble, and 2004 second stubble for two varieties, HoCP 91-555 and HoCP 85-845, planted as billets and whole stalks at the St. Gabriel Research Station.

		Tons cane/acre			Sugar/acre (lbs.)		
Variety	Treatment	2002	2003	2004	2002	2003	2004
HoCP 91-555	Billet	49.4	34.4	30.0	8786	6923	6898
	Whole stalk	43.5	33.8	36.2	7519	7003	8515
HoCP 85-845	Billet	39.1	36.2	30.9	7901	6839	6847
	Whole stalk	35.8	39.2	32.5	7037	7469	7048

Yields were not significantly different (P = 0.05).

CULTURAL PRACTICES RESEARCH IN SUGARCANE IN 2004

Chuck Kennedy and Allen Arceneaux

In cooperation with
St. Gabriel Research Station and
USDA, ARS, MSA Soil and Water Research, Baton Rouge, LA

SUMMARY

Field experiments were conducted in 2004 to test the effects of management practices on yield and yield components of sugarcane.

The residual effect of previous harvest date on yields of a second stubble crop was most negative when plant-cane and first stubble harvests were in October. The variety HoCP91-555 yielded better with later first stubble harvests than later plant-cane harvests. LCP85-384 yields were less affected. The depth of soil cover over billets and apparent quality of seed material (plant cane vs stubble cane) of LCP85-384 interacted only slightly for cane and sugar yield response. Yields were lower at a cover depth of 4 to 5 in. Best yields across planting sources occurred at a cover depth of 3 to 4 in. Cane and sugar yield of third stubble LCP85-384 following burning the previous harvest=s residue was not significantly different than any other residue management program, including leaving the residue undisturbed and untreated. Soil quality after 3 years of maintaining these residue management treatments was only slightly changed among them. Base CEC was slightly higher where residue was maintained. Bulk density, water-filled pore space %, and soil respiration varied among treatments. Reducing residue particle size resulted in higher soil respiration rates, especially when soil incorporated. Yields in that study averaged higher when residue particles were reduced in size ± soil incorporated and averaged lowest when residue was left undisturbed.

OBJECTIVES

This research is designed to provide information on cultural practices in an effort to help cane growers produce maximum economic yields and thereby a more profitable production system. This annual progress report is presented to provide the latest available data on certain practices and not as a final recommendation for growers to use all of these practices. Recommendations are based on several years of research data.

RESULTS

Harvest Date on Subsequent Yields

It is well established that later harvest of sugarcane often results in higher natural sugar yield. Date of harvest for plant-cane crops and stubble crops also can affect subsequent stubble yields. HoCP91 -555 was affected by time of stubble harvest even if plant-cane was harvested late. Except for October harvests of previous crops (plant cane and 1st stubble), LCP85-384 was not affected by date of harvest of the previous crop. The data indicate ‘555’ is more sensitive to

previous harvest effects than ‘384’, but both are limited when plant-cane is harvested early (Figs. 1, 2)

Residue Management

Yields and residue.

We did not find a significant difference in residue from Jan. 2004 to March 2005 for residue plots amended with UAN, stabilized urea, or molasses compared to the untreated check. Yield ranged from 20.3 to 22.2 T/ac., whole-stalk sample CRS ranged from 178 to 185.6 lbs/T and Lbs sugar/ac. ranged from 3673 to 3836. There were no statistically significant differences (data not presented).

Soil quality factor response under residue management practices.

These data were collected on a Commerce series, but somewhat heavy soil at the end of the third year of this experiment. The effects on soil chemistry were minimal. Cations and therefore base CEC was statistically different among treatments (Table 1), 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 60 lb N 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 range for all treatments (Table 2). Soil respiration measurements were not different when absolutely compared (Table 3). When adjusting to a constant temperature (25^{o} C) and /or % water-filled pore space (60%), results were generally to significantly 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 because of residue treatment and rainfall (Figs 3, 4). Bulk density differences also played a role in these results by affecting the pore space percentage. In conclusion, results of 3 years of continued residue management treatments on a heavy soil had minimal effects on soil quality.

Residue size reduction and other treatments on soil respiration of a light-textured soil.

This study was initiated in the winter of 2004. There were eight treatments; Burn, Sweep, residue untreated, residue + 30oz/ a surfactant, residue incorporated, residue reduced in size, residue reduced + 30oz/ a surfactant, and residue reduced and incorporated. Soil respiration data, based on three measurements taken in March 2004, indicate residue reduced and incorporated resulted in a significant decomposition rate compared to other treatments (Fig 5). Yields were statistically equivalent among all treatments, but the trend indicated highest average yields were obtained when residue particle size was reduced (Fig. 6).

Depth of Cover and Seed Source

We found a cover depth of 4-5 in. to be optimal in 2003. That depth resulted in numerically to significantly lower yields in 2004 compared to a cover depth of 3-4 in. (Figs 7, 8). As would be expected, seed source did not exacerbate the response as much this year as in the planting year.

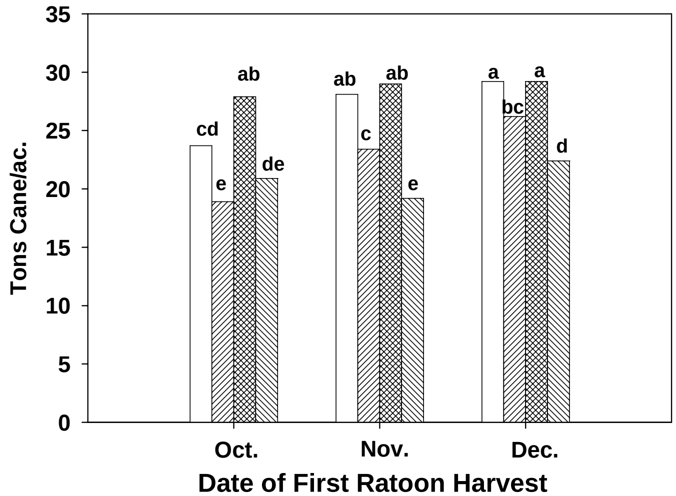

Fig. 1. The effect of harvest date and previous harvest date on second ratoon cane yield of two varieties. Bars with the same letter are NS at *P≤0.05*.

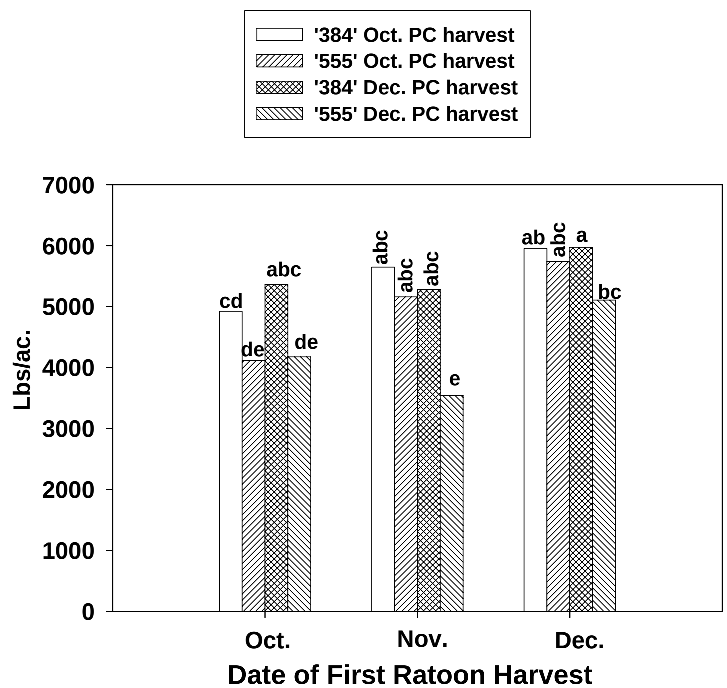

Fig. 2. The effect of harvest date and previous harvest date on second ratoon sugar yield of two varieties Bars with the same letter are NS at *P≤0.05*.

Table 1. The effect of sugarcane harvest residue management practices on soil nutrient status after three years. Numbers in a given column followed by the same letter or no letter are not statistically (95% chance) different.

Treatment	Org. Matter	pH	P	Ca	Mg	K	Na	Base CEC
	% dm		---------------	---------------	----- ug/g----	---------------	---------------	-meq/100g--
Burn	2.00	5.89	191	2576c	729c	264b	51	19.8b
Untreated	2.08	5.83	184	2845ab	814a	294a	51	21.9a
Swept	2.04	5.88	187	2875ab	808a	284ab	52	22.0a
Molasses	2.12	5.77	200	2734abc	793abc	275ab	50	21.1ab
UAN	2.01	5.89	196	2947a	829a	296a	51	22.5a
SuperU	1.99	5.82	186	2803abc	798abc	282ab	51	21.5ab
Till	1.93	5.90	189	2682bc	793abc	280ab	53	20.9ab
Rem.w/oBurn	1.99	5.68	193	2564c	732bc	268b	50	19.7b

Table 2. The effect of sugarcane harvest residue management practices on soil quality factors after three years.

Treatment	Bulk Density	Soil Strength Top 3/9/04	Soil Strength Side 3/9/04	Soil Strength Top 3/23/04	Soil Strength Side 3/23/04	Water Stable Aggregates
	-------g/cc-------	--PSI----------------------------------				----% >250 m----
Burn	1.21ab	36.4a	30.2	45.7	44	74.3
Untreated	1.27ab	29.6abc	27.6	42.0	42.7	82.1
Swept	1.33a	34.4ab	22.6	41.7	43.4	81.8
Molasses	1.17ab	32.0abc	28.3	42.5	39.3	76.4
UAN	0.99c	29.5abc	24.2	39.9	47.4	80.9
SuperU	1.20ab	33.8ab	22.2	43.8	45.9	73.6
Till	1.10bc	24.2c	34.7	35.7	41.0	76.9
Rem. w/o Burn	1.24ab	26.8bc	27.9	43.8	44.5	75.0

Numbers in a given column followed by the same letter or no letter are not statistically (95% chance) different.

Table 3. The effect of sugarcane harvest residue management practices after three years on soil respiration/biological activity. Average of two measurements.

Treatment	Soil respiration Absolute†	Soil respiration Adj. 25†	Soil respiration Adj. 25/60†
	-------------------------------------	--------Lbs CO2-C/ac/day-------	-------------------------------------
Burn	13.9	14.3bc	18.1
Untreated	12.5	18.2abc	24.6
Swept	11.0	11.5c	17.4
Molasses	17.5	24.6a	28.8
UAN	15.7	22.0ab	27.8
SuperU	12.5	18.1abc	25.0
Till	19.9	24.5a	27.4
Rem. w/o Burn	10.7	11.5bc	16.9

Numbers in a given column followed by the same letter or no letter are not statistically (95% chance) different.
† Absolute= unadjusted measurements in the field; Adj.25= measurements adjusted to 25C; Adj. 25/60= measurements adjusted to 25C and 60% WFPS. The absolute measurement reflects what is occurring under field conditions, which may differ among treatments. Adjusted measurements reflect the potential activity if major controlling factors were equal.

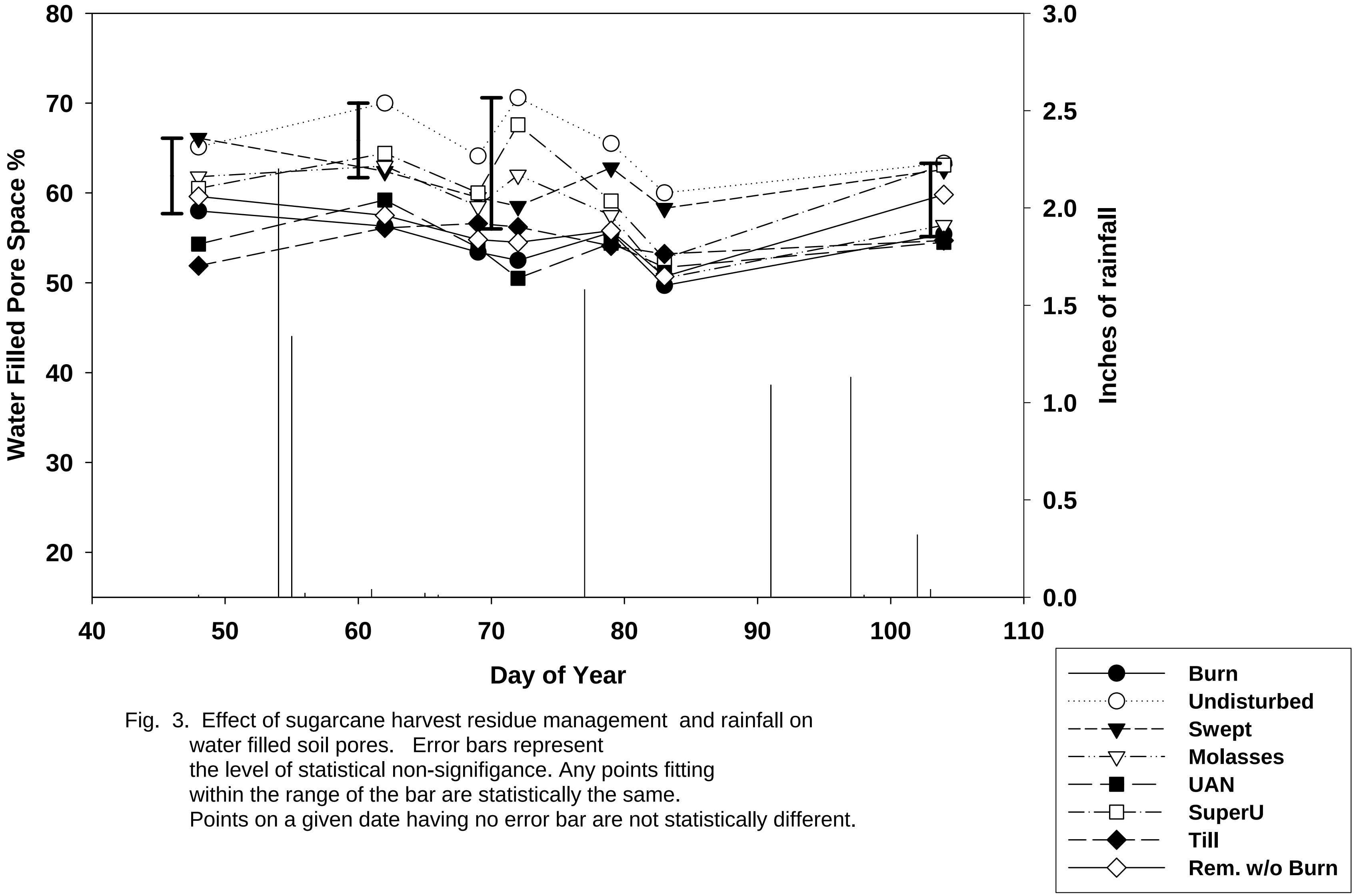

Fig. 3. Effect of sugarcane harvest residue management and rainfall on water filled soil pores. Error bars represent the level of statistical non-signifigance. Any points fitting within the range of the bar are statistically the same. Points on a given date having no error bar are not statistically different.

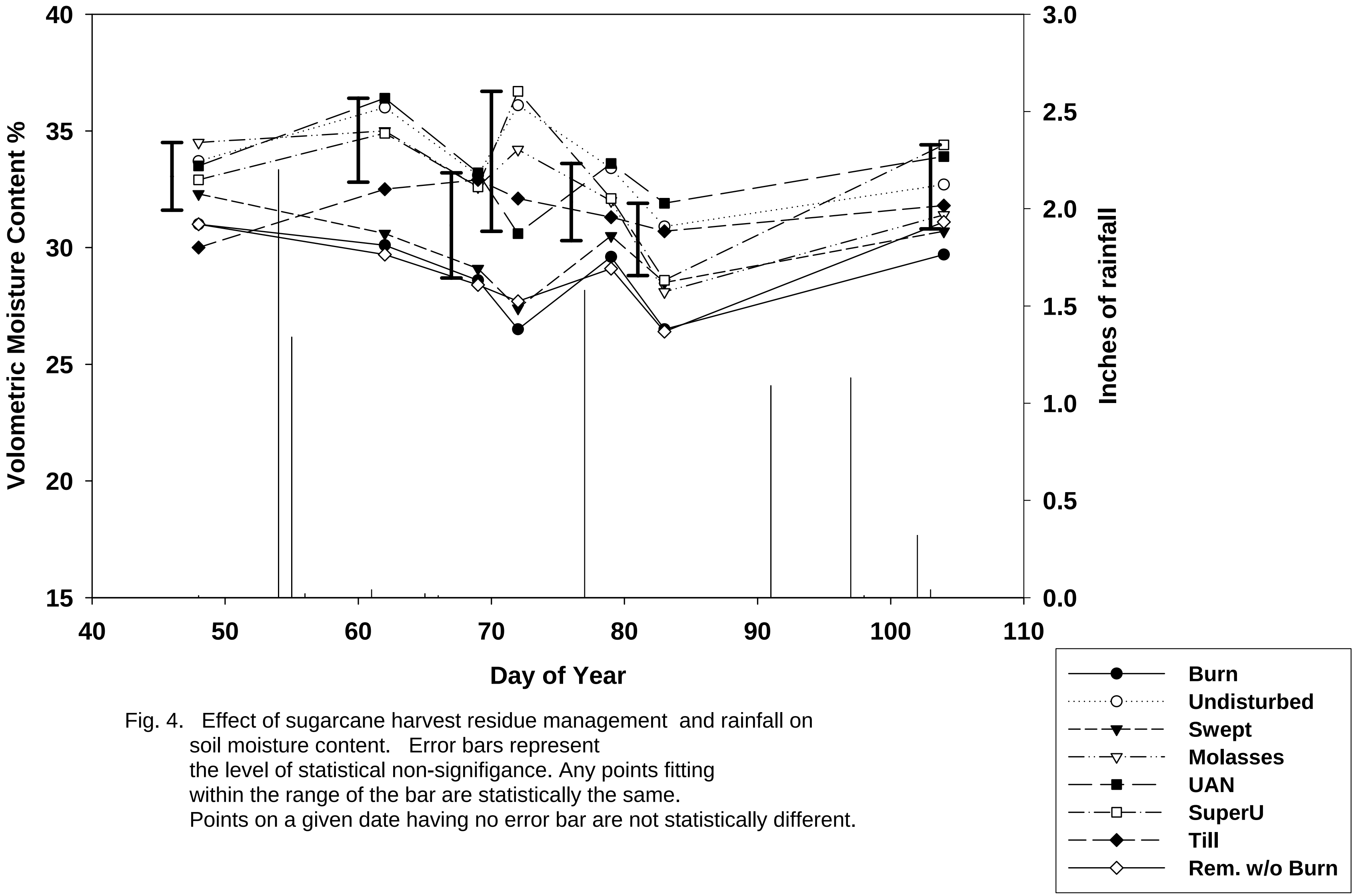

Fig. 4. Effect of sugarcane harvest residue management and rainfall on soil moisture content. Error bars represent the level of statistical non-signifigance. Any points fitting within the range of the bar are statistically the same. Points on a given date having no error bar are not statistically different.

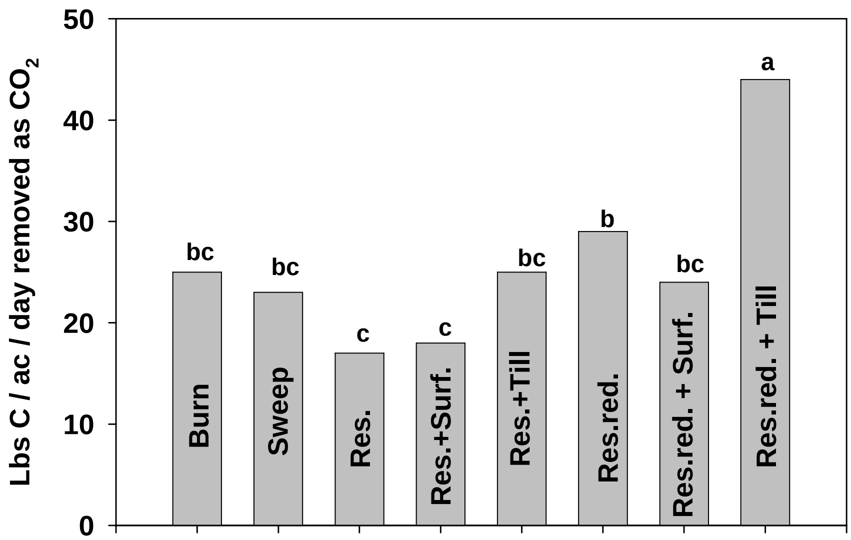

Fig. 5. Reducing residue size increased the amount of decomposition (Carbon removed/ac/day) especially when soil incorporated.

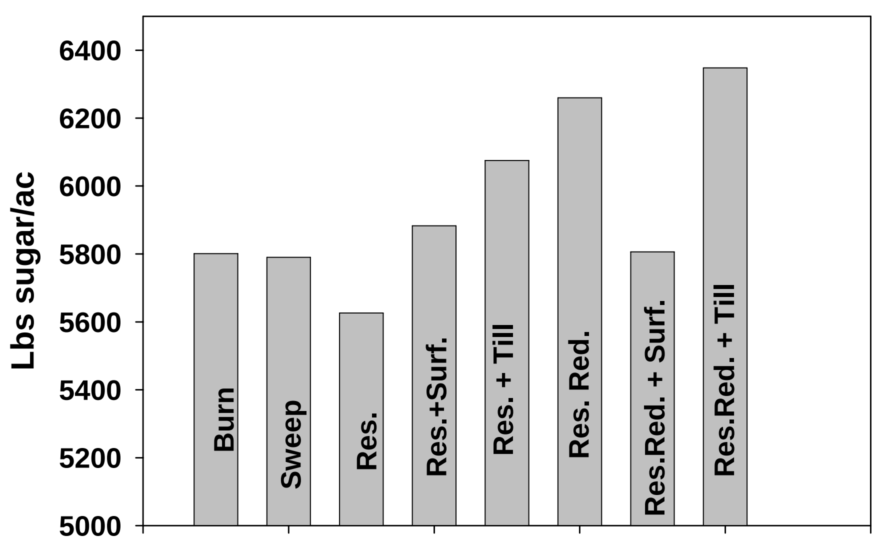

Fig. 6. Reduction of Residue Particle Size resulted in higher average yields (not statistically different).

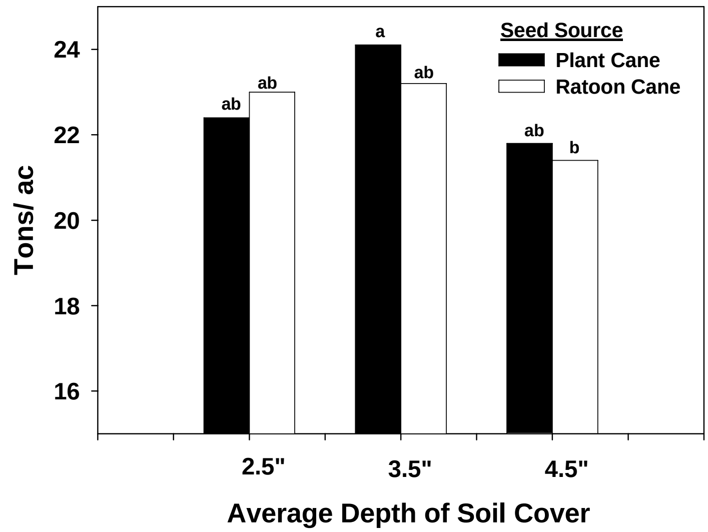

Fig. 7. The effect of depth of soil cover and planting seed source on cane yield of 1st stubble LCP85-384 on light soil

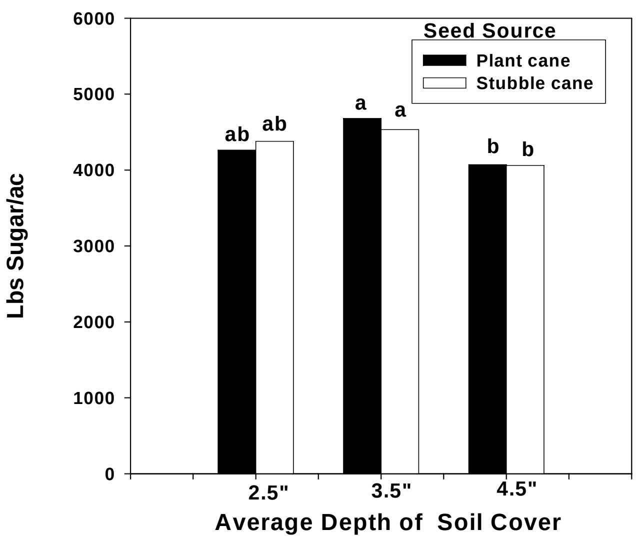

Fig. 8. The effect of seed source and depth of soil cover on sugar yield of LCP85-384. Bars with the same letter are NS at *P≤0.05.*

LONG-TERM COMBINE-TRASH STUDY

H. P. Viator, John Richard and Greg Williams
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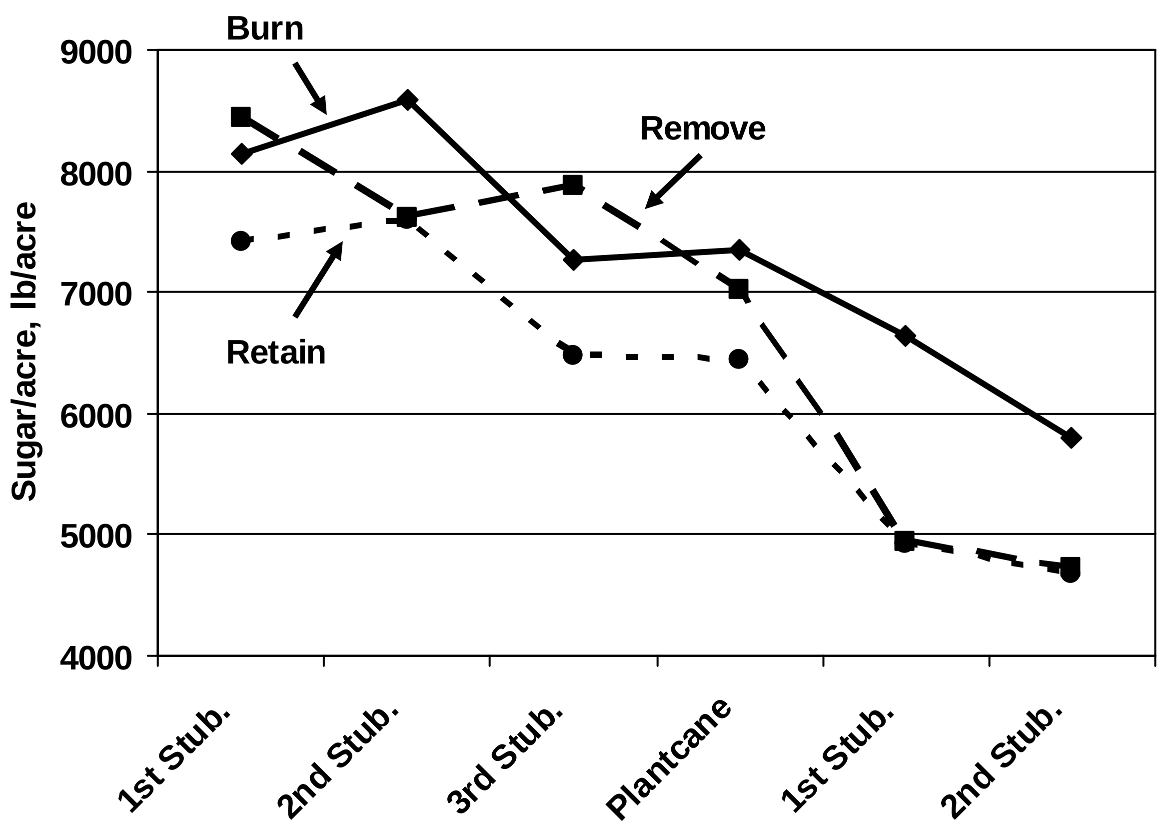
SUMMARY

Second stubble of the second cane cycle of a long-term study of the effects of combine-trash management was harvested in 2004. Of particular interest are the changes in soil fertility over time and the effects of residue management on successive crop cycles (plant-cane through final stubble). Cycle two second stubble yields were 5,791, 4,722 and 4,680 pounds of sugar/acre for the standing burn, physical trash removal from row tops and full trash retention treatments, respectively. Their ranking is consistent with treatment effects for the previous harvests (averages of all crops in both cycles for the three treatments are 7,294, 6,771 and 6,257 pounds of sugar/acre (P=.01), respectively). Sugar per acre trend lines for the six crops across two cycles of production clearly show that retained residue lowers productivity on the average and that burning the crop standing prior to harvest produces the highest yields consistently.



Research partially supported by a grant from the American Sugar Cane League.

SOIL FERTILITY RESEARCH IN SUGARCANE

Chuck Kennedy, Allen Arceneaux, Ben Legendre
Sonny Viator, and Alfred Guidry
in cooperation with
St. Gabriel Research Station, the Louisiana Cooperative Extension Service and
Sugarcane Farmers

SUMMARY

Several different field experiments were conducted in 2004 to test the effects of fertilizer inputs on the yield and yield components of current sugarcane varieties. Results of a two-location outfield test to determine the optimum rate of N fertilizer for LCP 85-384 indicated the optimum rate was on the low end of present recommendations. Because of the climatic conditions during the growing season in 2004, results of ratoon crop response to N application rates varied slightly from those of previous years in this large outfield study. Cane yield optimized at higher rates at the St. James location, but was similar to previous findings at Alma (Pointe Coupee). CRS declined with increasing N application rate at both locations. Thus, sugar yields were optimized at lower rates than cane yield. Remote reflectance and SPAD (chlorophyll) readings were also taken to assess these methods for monitoring N status of sugarcane. Nitrogen fertilizer rates from 0 to 120 lb N/ac had a marginal effect on cane or sugar yield of plant-cane crops for three varieties. Nitrogen use efficiency for biomass declined with increasing N rate, but was more variable for LCP85-384 than the other varieties Broadcasting full or split applications of stabilized urea (Super U) in early February and/or sidedressing full or split applications of regular urea in April into plots where harvest residue remained, was swept to middles, or burned resulted in no significant differences among treatments. The use of starter fertilizer applications at planting produced a response in plant-cane yields for LCP85-384. Additional products used in conjunction with normal fertilizer inputs were also studied.

OBJECTIVES

This research was designed to provide information on soil fertility in an effort to help cane growers produce maximum economic yields and increase profitability in sugarcane production. This annual progress report is presented to provide the latest available data on certain practices and not as a final recommendation for growers to use all of these practices. Recommendations are based on several years of research data.

RESULTS AND DISCUSSION

<u>Rates of spring-applied N fertilizer:</u>

The effect of N fertilizer rate on yield of LCP 85-384 was tested at two large outfield locations. The N rate for optimum cane yield ($\geq$ 90% of maximum yield and not statistically different) varied with location and was higher than found previously at one location (Fig. 1). The response of CRS to N application was negative with increasing N rate (Fig. 2). Thus, sugar yield reflected the decline in CRS and resulted in a response to N application rate that was similar to or less than that found in previous years for these locations (Fig. 3). Because of the

size of these tests, these locations were used to assess the possibility of using remote reflectance or a chlorophyll (SPAD) meter to rapidly assess the N status of the crop. Each method identified a response to N application by the crop (Figs. 4,5), but differences between locations indicate drawing a direct relationship between leaf N status and these methods may not work as well as establishing a direct relationship between these methods and relative yield.

The variety LCP85-384 produced numerically higher yield than CP70-321 and significantly higher than HoCP91-555. The response pattern indicated a trend for greater average N-use efficiency relative to the other two varieties at native N levels (Fig.6). LCP85-384, however, had less response to fertilizer N relative to the other varieties until a rate of 120 Lb N/a was applied. The lack of incremental response to applied N by this variety in this test would indicate that other factors may have interfered.

N application and Harvest Residue Management:

Cane yield of 3rd stubble LCP85- 384 was not significantly different among all treatments of [N application X residue management] treatments (Figs. 7, 8). All yields were lower than 24 T/a and 4500 lbs/a sugar. Thus, climatic limitations during the growing season may have affected a lack of response among the treatments.

Starter fertilizers:

The use of some starter fertilizers on billet-planted LCP 85-384 improved plant-cane yield and sugar compared to others (Fig.9, 10). The use of 15-45-45 or 0-45-45 lbs/a $N\text{-}P_2O_5\text{-}K_2O$ at planting produced yields that averaged as high or higher than applying P and K in the spring. Applying only N as a starter was not effective and tended to depress yields. Additionally, using N rates > 15 lbs/a in starter formulations was not beneficial.

Fertilizer Adjuvants:

The use of Helena Corporation products in addition to standard fertility practices did not result in any significant yield response (Table 1). The application of Asset + Hydrahume did result in higher average yields than the check at both locations (not statistically significant).

ACKNOWLEDGMENTS

The authors wish to express appreciation for the financial support of the American Sugar Cane League and Helena Chemical Company.

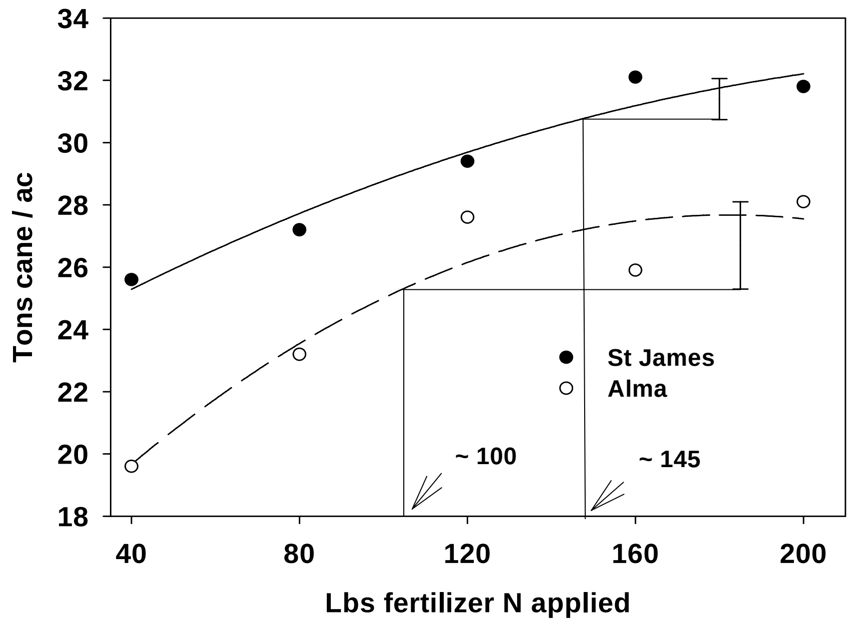


Fig. 1. The effect of fertilizer N application rate on cane yield of LCP85-384 stubble crops grown on light soil, 2004

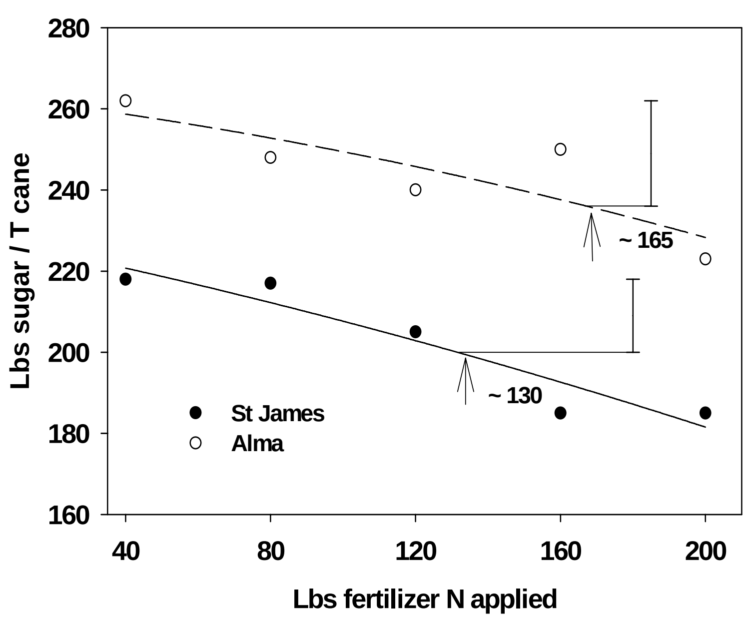


Fig. 2. The effect of fertilizer N application rate on CRS of ratoon LCP85-384 grown on light soil, 2004.

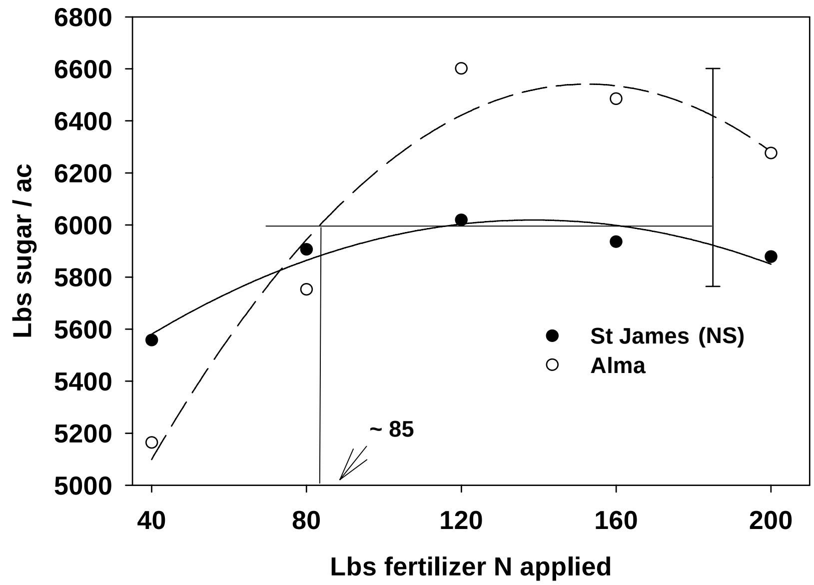


Fig. 3. The effect of N fertilizer application rate on sugar yield of ratoon LCP85-384 grown on light soil.

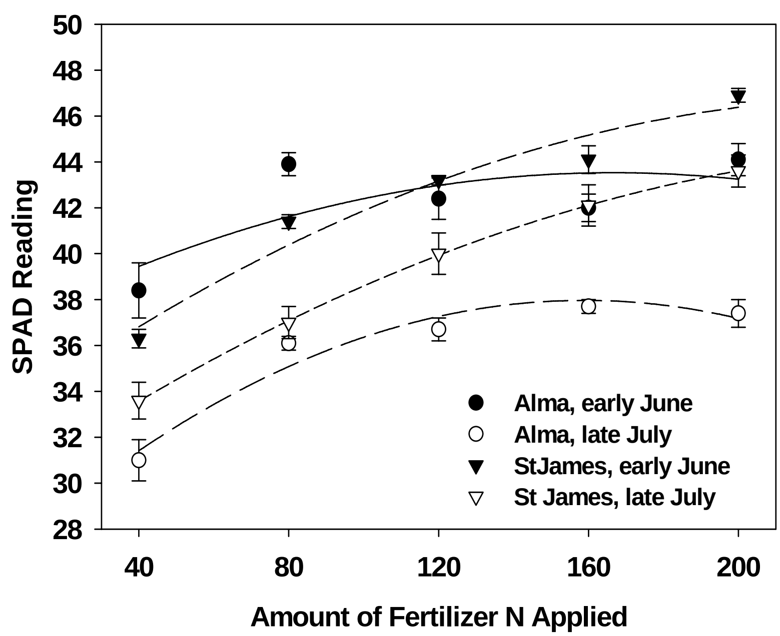


Fig. 4. Chlorophyll (SPAD) meter reading response to fertilizer N application rate.

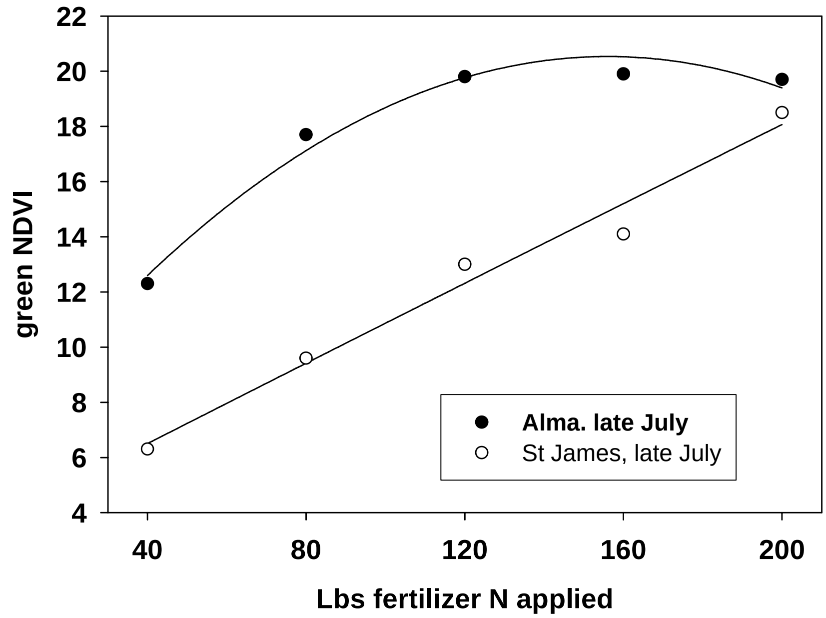


Fig. 5. Remote reflectance response to fertilizer N application rate.

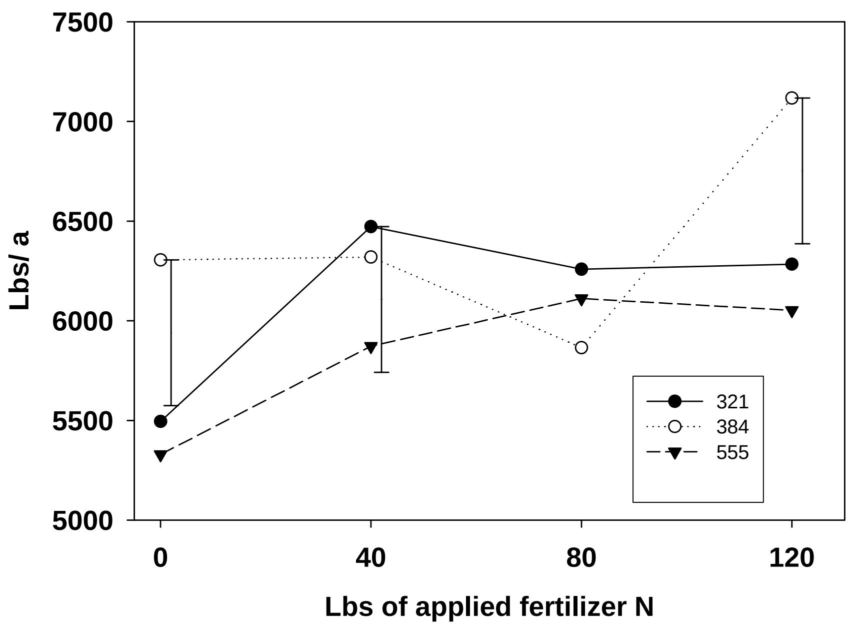


Fig. 6. Variety sugar yield response to fertilizer N application rate. ⌶ = LSD $_{0.05}$

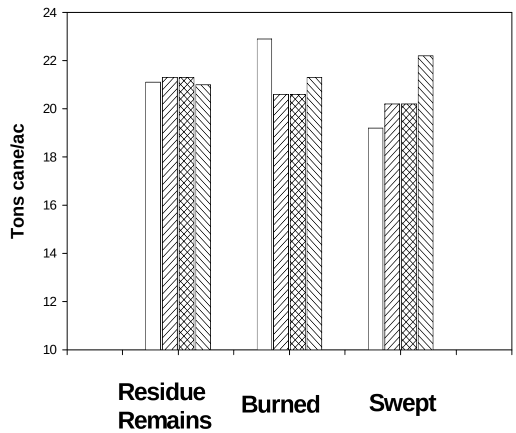
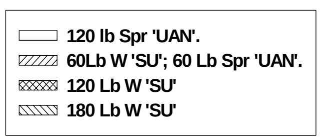


Fig. 7. The effect of N fertilization method and residue management on cane yield of 3rd stubble LCP85-384.



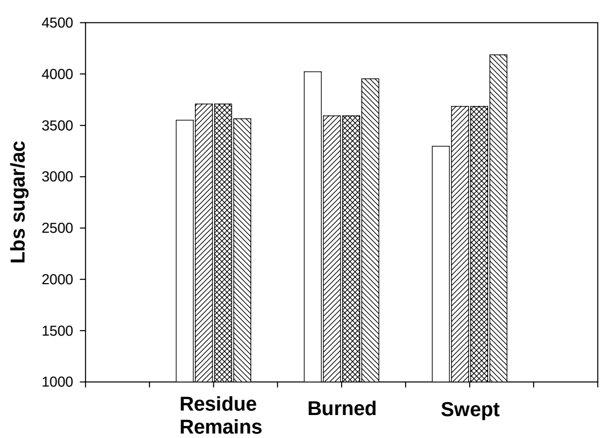


Fig. 8. The effect of N fertilization method and residue management on sugar yield of 3rd stubble LCP85-384.

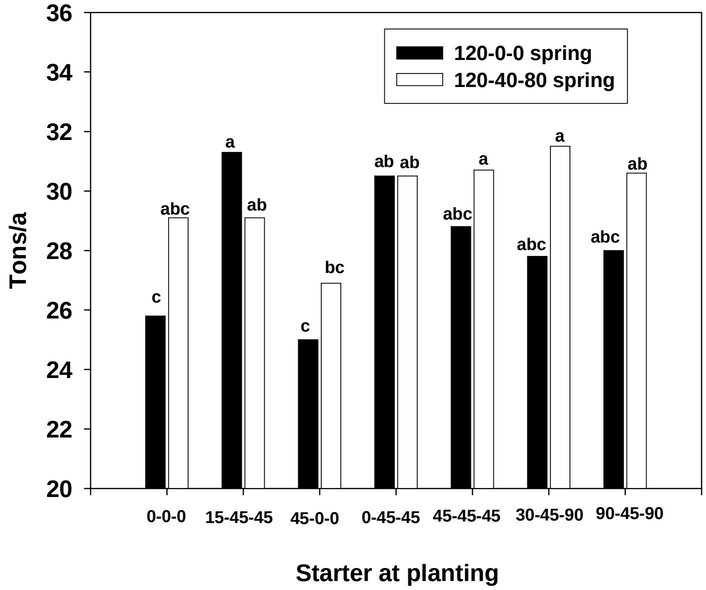


Fig. 9. The plant cane response of LCP85-384 to starter fertilizer applications in relation to different spring fertilizer inputs. Cane yield on clay soil.

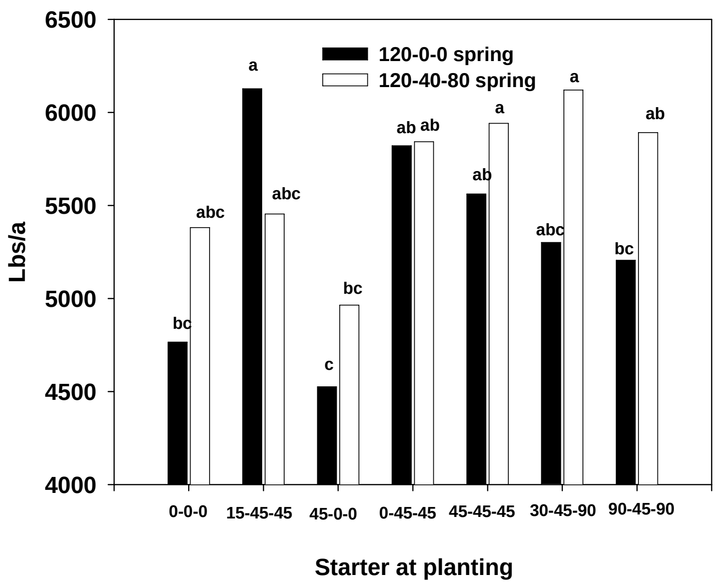


Fig. 10. The plant cane response of LCP85-384 to starter fertilizer applications in relation to different spring fertilizer inputs. Sugar yield on clay soil.

Table 1. The response of LCP85-384 and HoCP91-555 to soil- or foliar-applied adjuvants in addition to normal fertilization.

	Location†							
	St Gab	Iberia	St Gab	Iberia	St Gab	Iberia	St Gab	Iberia
Treatment	Stalk Population		Cane Yield		TRS		Sugar Yield	
	---No. x 10^{-3}------		-----Tons / a------		------Lbs / T------		-------Lbs/a-------	
Check‡	29.5	47.9	32.4	22.9	244	240	6494	5461
Asset¶	29.7	50.0	32.4	20.5	242	251	6428	5134
Hydrahume¶	27.2	51.1	30.6	22.9	245	233	6156	5253
Asset + Hyd.¶	29.8	45.9	33.0	28.0	247	250	6699	7020
25-0-0 CoRoN§	30.1	47.2	30.0	22.5	241	249	5896	5632
10-0-10 CoRoN§	29.8	47.1	30.3	24.1	242	239	6021	5752

† St Gab = HoCP91-555 plant-cane on light soil; Iberia = LCP85-384 stubble cane on light soil.

‡ The check consisted of 80 lb N + 80 lb K at St Gabriel and 140 lb N at Iberia. All plots received this input.

¶ Soil applied in April; Asset=8oz/ac, Hydrahume = 1:20 gpa

§ 1 gpa at lay-by and again14 d later.

THE RESPONSE OF LCP 85-384 TO THE APPLICATION OF SILICATE SLAG

H. P. Viator, John Richard and Greg Williams
Iberia Research Station

Summary of Experiment 1:

A silicate slag sugarcane study was planted on a Patoutville silt loam soil containing 63 ppm of silica (acetic acid extracted) in September 2000 with first progeny Kleentek variety LCP 85-384 billets. The six calcitic lime (Domino by-product) and silicate slag (a by-product of the steel industry) treatments are given in table 1. As an average of plant-cane and three stubble crops in the production cycle, plots receiving silicate slag at the rate of 2 tons per acre produced higher amounts of sugar (P=.05) and cane (P=.05) than both the check and limed plots. Placing slag beneath seed pieces at planting did not improve yields. The failure of the 2 T/A calcitic lime treatment to produce statistically comparable yields to the 2 T/A slag treatment suggests that the yield response to slag was caused by silica and not calcium. Other equivalent-rate slag and lime comparisons were not as convincing, though all slag treatments were numerically higher than the lime treatments. Also, leaf silica content (table 2) was higher for the slag treatments. The additional 3,320 pounds of sugar/acre over the four years clearly justifies the cost of silicate slag application at 2 tons/acre on this soil with low silica content.

Table 1. The effects of treatments on the yields of LCP 85-384 average over four crops in the cycle.

Treatment no.	Lime	Silicate slag	Placement	Sugar	Tonnage
	T/A	T/A		Lb/A	T/A
1	0	0	-	8969	35.3
2	1	0	Mixed into rows	8681	34.3
3	2	0	Mixed into rows	8613	34.9
4	0	1	Mixed into rows	9405	36.8
5	0	2	Mixed into rows	9799	38.8
6	0	1	Placed under cane	8962	36.8
LSD (.05) =				796	3.00

Table 2. Treatment difference for leaf silica content and HCL extracted silica.

Treatment No.	Lime	Silicate slag	Placement	Leaf silica	HCL extracted soil Si
	T/A	T/A		%	mg kg^{-1}
1	0	0		1.24	284
2	1	0	Mixed into rows	1.27	274
3	2	0	Mixed into rows	1.26	296
4	0	1	Mixed into rows	1.36	332
5	0	2	Mixed into rows	1.61	332
6	0	1	Placed under cane	1.73	321

Summary of Experiment 2:

A silicate slag rate study was initiated in 2002 with LCP 85-384 on a Jeanerette silt loam soil containing approximately 60 ppm (acetic acid extracted) of silica. Slag was applied prior to planting at the rates of 0, 0.5, 1.0, 1.5, 2.0 and 3.0 tons/acre. None of the plant-cane parameters responded significantly to slag. Both sugar (P=.006) and cane (P=.02) yield in first stubble, however, were significantly affected by the slag treatments, as shown in the table below. It is clear, based on the range in soil pH that slag functioned as a liming agent. Soil pH ranged from 5.3 for the check plots to 7.4 for the highest rate of applied slag. The design of the experiment does not allow for the partitioning of the effects of liming and silica on sugarcane yield. Leaf silica content increased with increasing rates of slag (data not shown) suggesting the increase in yield may have been partly due to the direct effects of silica.

Table 1. The effects of slag application rates on LCP 85-384 first stubble.

Treatment	Sugar	Cane	TRS	Soil pH
T/A	Lb/A	T/A	Lb/T	
Check	5745	23.8	242	5.3
0.5	6475	25.9	250	6.1
1.0	6680	26.5	251	6.3
1.5	6574	26.6	247	7.3
2	7308	29.0	252	7.1
3	6757	27.4	246	7.4
LSD (.05) =	702	2.74	NS	

SITE-SPECIFIC NITROGEN FERTILIZATION OF SUGARCANE

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R. G. Downer, Department of Experimental Statistics

SUMMARY

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 sugarcane 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, 80, 160 or 240 pounds/acre) were superimposed in a randomized block design on a 25-acre 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 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 lb/acre ^{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% 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 sugarcane 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.

Research partially supported by a grant from the American Sugar Cane League.

IMPACT OF SUGARCANE MULCH MANAGEMENT STRATEGIES ON WATER QUALITY AND CROP YIELD

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Keywords: mulch, nitrogen, phosphorus, soil erosion, sugarcane

INTRODUCTION

Since 1995, the sugarcane industry in Louisiana gradually developed a new harvesting system which involves the use of a combine harvester that cuts the cane stalks into billets, which are directly loaded into wagons for transport to the mill. Extractor fans in the combine harvester separate leaf-material from the billets and the plant residue is deposited on the soil surface. Historically, this sugarcane residue has been removed by burning. In recent years this burning of the residue has become objectionable to the general public because of health issues related to inhalation of the smoke. Increasingly, it is difficult to justify this method as a Best Management Practice of residue management. Environmental concerns about burning and public concerns for clean air, especially in newly developed suburban areas adjacent to sugarcane plantations, have moved the sugar industry toward green harvesting that leaves the residue on the surface. Because of these concerns, there is a need to find economical alternatives for residue management to identify benefits from residue with respect to reducing soil erosion and improving surface water quality. The primary purpose of this project was to evaluate the effect of post-harvest residue (mulch cover) on the field with respect to surface water quality. This project evaluated three management strategies with primary focus on mulch residue and its effect on soil erosion, surface water quality, and crop yields. The treatments include (1) burning the mulch after harvest and cultivating in the spring; (2) sweeping the mulch off of the top of the row after harvest and cultivating in the spring; and (3) leaving the mulch on the field after harvest and cultivating in the spring. Treatment 1 is the common method by which sugarcane mulch is managed in Louisiana. Treatments 2 and 3 are proposed sugarcane residue management practices for use by Louisiana sugarcane farmers. Sugarcane plant population, yields, and quality of surface runoff water were measured for each treatment.

MATERIALS AND METHODS

The experimental site was at the Louisiana Agricultural Experiments Station's St. Gabriel Research Station located 20 km south of Baton Rouge. Six leveed plots 0.25 ha in size (nine rows spaced 1.8 m apart and 140 m long) and sloped 0.1% were located on a Commerce silt loam soil (Aeric Fluvaquent, fine-silty, mixed, non-acid, thermic) (Camp 1976 and Rogers et al. 1985). The sugarcane cultivar HoCP91-555 was planted on September 19, 2001.

To measure and sample surface runoff, a sump was installed on the low side of each plot. A float-controlled electric sump pump was installed in each sump to discharge the runoff through a water meter and into a surface drainage ditch. An automatic water sampler at each sump was used to collect runoff samples. Runoff samples were analyzed by the Department of Agricultural

Chemistry for total solids, nitrogen, phosphorus, and potassium. Nitrogen was determined by an automated colorimetric procedure developed by Wall and Gehrke (1979). Phosphorus and potassium were determined by an EPA Method 200.2. (Martin et al., 1991). These analyses determined the total concentration in both solution and solids. Using the amount of surface runoff that was measured with the water meters and concentrations provided by the Department of Agricultural Chemistry, total loadings were calculated.

RESULTS AND DISCUSSION

The sugarcane was planted in September 19, 2001, and was harvested December 9, 2002, and October 28, 2003. Table 1 shows the sugarcane (biomass) yields for each treatment for 2002 and 2003. The biomass yields for 2002 were 74,180 kg/ha for all treatments. The yields for 2003 were 76,600; 72650; and 69630 kg/ha for the burned, mulch, and swept treatments, respectively. The yields increased 3.3% for the burned treatment and decreased 2.0% and 6.1% for the mulch and swept treatments, respectively. Table 2 shows the sugar yields for each treatment for 2002 and 2003. The amount of sugar produced during 2002 was 8400 kg/ha for all treatments. The yields for 2003 were 9273, 8070, and 7885 kg/ha for the burned, mulch, and swept treatments, respectively. The amount of sugar increased from 2002 to 2003, 10.4% for the burned treatment and decreased 4.0% and 6.2% for the mulch and swept treatments, respectively. During 2003, the burned treatment increased yields while the mulch and swept treatments decreased yields.

Table 1. Annual sugarcane (biomass) yields (kg/ha).

Treatment	Year 2002	Year 2003	% Difference
Burned	74180	76600	+3.3
Mulch	74180	72650	-2.0
Swept	74180	69630	-6.1

Table 2. Annual sugar yields (kg/ha).

Treatment	Year 2002	Year 2003	% Difference
Burned	8400	9273	+10.4
Mulch	8400	8070	-4.0
Swept	8400	7885	-6.1

During the period from September 1, 2001, to December 31, 2002, the rainfall was 2016 mm (102% normal) (Table 3) and the runoff was 653 mm. During the period January 1 to December 31, 2003, the rainfall was 1306 mm (87% normal) (Table 4). The runoff was 444 mm, 472 mm, and 456 mm for the burned, mulch, and swept treatments, respectively. There was not a significant difference among the runoff values.

Table 3. Rainfall and runoff for 2001-2002 at St. Gabriel, Louisiana.

Month	Rain (mm)	Runoff (mm)
Sep 2001	107	47
Oct 2001	121	34
Nov 2001	26	0
Dec 2001	65	10
Jan 2002	129	48
Feb 2002	38	6
Mar 2002	166	42
Apr 2002	107	34
May 2002	31	0
Jun 2002	148	19
Jul 2002	164	5
Aug 2002	50	4
Sep 2002	320	82
Oct 2002	259	149
Nov 2002	107	46
Dec 2002	178	127
Total	2016	653

Rain 102% Normal

The average annual soil losses for September 1, 2001, to December 31, 2002, were 29,292 kg/ha (Table 5). A large portion of the soil erosion occurs during the first year of the sugarcane cycle. During this period, the rows are bare and the soil is loose following the fallow period. Winter rains that fell soon after planting in the amount of 486 mm (24% of the total) caused 19,408 kg/ha of soil losses (665 of the total). Soil erosion during the second crop year was 64% smaller. This was because the rows were covered with vegetation and the soil has consolidated. During the period January 1 to December 31, 2003, the soil losses were 3465, 4295, and 4182 kg/ha (Table 6) for the burned, mulch, and swept treatments, respectively. The burned results were 19% smaller than for the mulch.

Table 4. Rainfall and runoff for 2003 at St. Gabriel, Louisiana.

Month	Rain (mm)	Runoff (mm)		
		Mulch	Swept	Burned
Jan	22	0	0	0
Feb	135	88	81	81
Mar	97	62	60	58
Apr	141	90	90	90
May	6	0	0	0
Jun	165	17	14	11
Jul	142	27	24	21
Aug	175	26	24	24
Sep	117	29	30	29
Oct	84	31	38	30
Nov	150	70	74	70
Dec	72	32	21	30
Total	1306	472	456	444

Rain 87% Normal

The average annual nitrogen losses for September 1, 2001, to December 31, 2002, were 12.80 kg/ha (Table 5). During the period January 1 to December 31, 2003, the nitrogen losses were 8.18, 11.33, and 8.67 kg/ha (Table 7) for the burned, mulch, and swept treatments, respectively. The burned results were 28% smaller than for the mulch. There was not a reduction of nitrogen losses during the second year.

The average annual phosphorus losses for September 1, 2001, to December 31, 2002, were 17.43 kg/ha (Table 5). During the period January 1 to December 31, 2003, the phosphorus losses were 7.65, 9.07, and 9.51 kg/ha (Table 8) for the burned, mulch, and swept treatments, respectively. The burned results were 16% smaller than for the mulch. Phosphorus losses were 28% smaller during the second year.

The average annual potassium losses for September 1, 2001, to December 31, 2002, were 137.91 kg/ha (Table 5). During the period January 1 to December 31, 2003, the potassium losses were 55.42, 57.31, and 56.42 kg/ha (Table 9) for the burned, mulch, and swept treatments, respectively. The burned results were 3% smaller than for the mulch. The potassium losses were 47% smaller during the second year.

Table 5. Soil, nitrogen, phosphorus, and potassium losses for 2001-2002 at St. Gabriel, Louisiana.

Month	Soil (kg/ha)	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)
Sep 2001	2057	2.36	1.90	11.40
Oct 2001	14182	2.08	2.52	16.65
Nov 2001	0	0.00	0.00	0.00
Dec 2001	1152	0.21	0.48	2.46
Jan 2002	1858	0.47	1.02	8.56
Feb 2002	159	0.07	0.04	0.37
Mar 2002	1967	0.69	0.97	8.70
Apr 2002	2514	0.74	2.09	13.42
May 2002	0	0.00	0.00	0.00
Jun 2002	872	0.45	1.58	8.55
Jul 2002	72	0.07	0.04	0.47
Aug 2002	62	0.06	0.02	0.38
Sep 2002	570	1.13	0.76	10.18
Oct 2002	1379	2.42	3.45	26.03
Nov 2002	322	0.74	1.28	9.84
Dec 2002	2126	1.31	1.28	20.90
Total	29292	12.80	17.43	137.91

CONCLUSIONS

The burned treatment increased biomass yields by 3.3% and sugar yields by 10.4%. There was a reduction in biomass and sugar yields from the swept and mulch treatments. There was 29,292 kg/ha soil erosion from the plots during the first year. The soil erosion for the second year was 64% smaller. The soil erosion from the burned treatment was 19% smaller than for the mulch. There was not a difference in nitrogen losses between the first and second years. During the second year, the burned results were 28% smaller than for the mulch. Phosphorus losses were 28% smaller during the second year. The burned results were 16% smaller than for the mulch. The potassium losses were 47% smaller during the second year. The burned results were 3% smaller than for the mulch.

Table 6. Soil losses for 2003 at St. Gabriel, Louisiana.

Month	Soil Losses (kg\ha)		
	Mulch	Swept	Burned
Jan	0	0	0
Feb	551	500	827
Mar	350	417	363
Apr	1176	1363	602
May	0	0	0
Jun	325	246	98
Jul	304	265	225
Aug	333	280	291
Sep	219	205	202
Oct	263	218	209
Nov	568	521	508
Dec	206	167	140
Total	4295	4182	3465

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Table 7. Nitrogen losses for 2003 at St. Gabriel, Louisiana.

Month	Nitrogen Losses (kg\ha)		
	Mulch	Swept	Burned
Jan	0.00	0.00	0.00
Feb	2.52	1.63	1.38
Mar	0.46	0.74	0.78
Apr	3.41	2.08	1.45
May	0.00	0.00	0.00
Jun	1.09	0.82	1.42
Jul	1.46	1.61	1.19
Aug	0.70	0.63	0.65
Sep	0.44	0.46	0.48
Oct	0.79	0.42	0.32
Nov	0.14	0.15	0.14
Dec	0.32	0.13	0.37
Total	11.33	8.67	8.18

Table 8. Phosphorus losses for 2003 at St. Gabriel, Louisiana.

Month	Phosphorus Losses (kg\ha)		
	Mulch	Swept	Burned
Jan	0.00	0.00	0.00
Feb	1.74	1.34	0.96
Mar	1.02	1.74	1.64
Apr	2.24	3.43	1.65
May	0.00	0.00	0.00
Jun	0.24	0.19	0.11
Jul	0.25	0.21	0.17
Aug	0.30	0.27	0.37
Sep	0.27	0.27	0.24
Oct	0.36	0.31	0.26
Nov	2.07	1.52	1.62
Dec	0.58	0.23	0.63
Total	9.07	9.51	7.65

Table 9. Potassium losses for 2003 at St. Gabriel, Louisiana.

Month	Potassium Losses (kg\ha)		
	Mulch	Swept	Burned
Jan	0.00	0.00	0.00
Feb	7.90	7.84	4.34
Mar	2.54	3.61	4.39
Apr	6.00	6.01	5.16
May	0.00	0.00	0.00
Jun	1.55	1.45	0.91
Jul	2.26	1.90	1.64
Aug	3.18	2.80	3.93
Sep	4.08	4.22	3.73
Oct	3.84	4.70	3.45
Nov	20.00	20.40	21.40
Dec	5.96	3.49	6.47
Total	57.31	56.42	55.42

ECONOMIC RESEARCH IN SUGARCANE IN 2004

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Projected costs and returns for the various stages of sugarcane production in Louisiana were estimated for the 2004 crop year. Production and tillage practices, as well as application rates for fertilizer, herbicides and insecticides, were updated. Input suppliers and equipment dealers were surveyed in 2003 for current input prices. Specific operations for which production costs were estimated included field operations on fallow land, seedbed preparation, cutting and planting heat-treated seed-cane, planting cultured seed-cane, field operations on plant-cane, first stubble, second stubble, and third stubble, succession planting, as well as the costs of harvesting with whole-stalk and combine harvesters. Costs and returns were estimated for tenant-operators, reflecting the predominant land tenure situation, and reflect a mill payment of 39% of production and a land rent payment of 20% of the "after milling crop" proceeds (12.2 percent of production). Total costs of production plus overhead for crop cycles through harvest of second, third and fourth stubble were estimated and breakeven prices to cover direct and total specified production costs were estimated for one-fifth and one-sixth share rental arrangements. Summary breakeven prices to cover production costs through harvest of third stubble for alternative yield levels are shown in Table 1.

An economic study was completed which estimated the cost differences between whole-stalk and billet sugarcane planting methods in Louisiana. Sugarcane planting costs were estimated for four types of planting systems: hand planting, whole-stalk machine planting, and one-row and three-row billet planting. Planting ratios and labor requirements were determined from data collected from growers using the various planting methods. Whole-stalk planting ratios were 7.5/1 for hand planting and 5.5/1 for machine planting, while planting ratios for billet planters was 3.0/1. Total planting costs per acre of plant-cane planted were estimated at $579 for whole-stalk hand planting, $578 for whole-stalk machine planting, $712 for one-row billet planting and $673 for three-row billet planting. Calculations reveal that increasing the planting ratio for billet planters could significantly reduce planting costs. Opportunity costs of increased seed-cane acreage were found to be a significant economic factor in the evaluation of billet planters. This study was conducted in cooperation with Dr. Jeff Hoy, Department of Plant Pathology and Crop Physiology, LSU AgCenter, and was published in the 2004 Journal of the American Society of Sugarcane Technologists.

Table 1. Projected Breakeven Selling Prices for Raw Sugar for Selected Yield Levels, Harvest Through Third Stubble, Tenant-Operators, Louisiana, 2004

	Selected Yield Levels				
	-20%	-10%	Base	+10%	+20%
Cane yield per harvested acre[1] (tons)	27.9	31.1	34.9	38.4	41.9
Sugar yield per harvested acre[2] (lbs)	5,584	6,212	6,980	7,678	8,376
Sugar yield per rotational (farm)	4,257	4,736	5,321	5,853	6,386
One-Fifth Land Share Rent:					
	----------pounds of sugar per rotational acre------				
Share of production per rotational					
Mill share (39.0%)	1,660	1,847	2,075	2,283	2,490
Landlord share (12.2%)	519	578	649	714	779
Grower share (48.8%)	2,077	2,311	2,597	2,857	3,116
	---------------dollars per pound of sugar-----------				
Breakeven price to recover[4]:					
Direct costs	0.155	0.141	0.129	0.119	0.111
Total specified costs	0.208	0.187	0.171	0.158	0.146
Total costs plus overhead	0.245	0.220	0.201	0.185	0.171
One-Sixth Land Share Rent:					
	----------pounds of sugar per rotational acre------				
Share of production per rotational					
Mill share (39.0%)	1,660	1,847	2,075	2,283	2,490
Landlord share (10.2%)	434	483	543	597	651
Grower share (50.8%)	2,163	2,406	2,703	2,974	3,244
	---------------dollars per pound of sugar-----------				
Breakeven price to recover[4]:					
Direct costs	0.149	0.135	0.124	0.114	0.107
Total specified costs	0.200	0.180	0.164	0.151	0.141
Total costs plus overhead	0.235	0.212	0.193	0.177	0.164

[1] Average farm yield across harvested acreage of plant-cane, 1st stubble, 2nd stubble, and 3rd stubble (base yield of 36 tons plant-cane, 37 tons 1st stubble, 34 tons 2nd stubble, 33 tons 3rd stubble).
[2] Average yield in tons per acre multiplied by a 200 CRS.
[3] Assumes standard land rotation of 20% each of fallow, plant-cane, 1st stubble, 2nd stubble and 3rd stubble.
[4] Breakeven prices are calculated by dividing grower's share of production into direct costs, total specified costs, and total specified costs plus overhead. No adjustment is made for molasses payments, hauling rebate, or other adjustments.

Table 2. Estimated planting costs for 100 acres of plant-cane, whole-stalk planting

Planting cycle phase:	Whole-stalk hand plant [1] Acres Required	Whole-stalk hand plant [1] Total Cost	Whole-stalk machine plant [2] Acres Required	Whole-stalk machine plant [2] Total Cost
	--acres--	-dollars-	--acres--	-dollars-
Cultured seed-cane	1.8	1,937	3.3	3,603
First seed-cane expansion	13.3	7,516	18.2	9,560
Second seed-cane expansion	100.0	48,473	100.0	44,681
Total cost to plant 100 acres		57,926		57,843
Total planting cost per acre		579		578
Variable planting cost per acre		399		405

[1] Whole-stalk planted seed-cane planted by hand with a 7.5:1 planting ratio.
[2] Whole-stalk planted seed-cane using a one-row whole stalk planter with a 5.5:1 planting ratio.

Table 3. Estimated planting costs for 100 acres of plant-cane, billet planting, 3:1 planting ratio

Planting cycle phase:	One-row billet plant [1] Acres Required	One-row billet plant [1] Total Cost	Three-row billet plant [2] Acres Required	Three-row billet plant [2] Total Cost
	--acres--	-dollars-	--acres--	-dollars-
Cultured seed-cane	11.1	12,243	11.1	12,714
First seed-cane expansion	33.3	17,020	33.3	16,991
Second seed-cane expansion	100.0	41,956	100.0	37,631
Total cost to plant 100 acres		71,219		67,336
Total planting cost per acre		712		673
Variable planting cost per acre		496		457

[1] Billet planted seed-cane using a one-row billet planter with a 3.0:1 planting ratio.
[2] Billet planted seed-cane using a three-row billet planter with a 3.0:1 planting ratio.

Table 4. Estimated opportunity cost of additional seed-cane acreage required by billet planters

Planting operation:	Seed-cane acres required [1] Whole-stalk machine planter	Seed-cane acres required [1] One-row billet planter	Additional seed-cane acres required
	--acres--		
Plant cultured seed-cane	3.3	11.1	7.8
Plant first seed-cane expansion	18.2	33.3	15.1
Plant second seed-cane expansion	100.0	100.0	-
Total additional seed-cane acres			22.9
Opportunity cost of additional seed-cane acreage per acre of plant-cane planted [2]			$321

[1] Seed-cane acres required to plant 100 acres of plant-cane. Planting ratios: one-row machine whole stalk planter 5.5/1, one-row billet planter 3.0/1.
[2] Opportunity cost calculated as 22.9 acres x 7,000 lbs per acre x $0.20 per lb / 100 acres.

TIMING OF APPLICATION OF GLYPHOSATE TO MAXIMIZE SUGAR PER ACRE AND POSSIBLE ALTERNATIVES TO THE USE OF GLYPHOSATE IN ENHANCING THE YIELD OF SUGAR OF LOUISIANA SUGARCANE IN 2004

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SUMMARY

This experiment shows that when applying glyphosate in August, the treatment-to-harvest interval should be shortened to 28 days after treatment (DAT) to insure maximizing the yield of sugar per acre (S/A). Although there is still a loss of yield of tons cane per acre (TC/A) associated with glyphosate treatments at 28 DAT, the increase in the yield of theoretical recoverable sugar per ton of cane (TRS/TC) more than compensates for the loss of TC/A. However, with the early application date, by delaying harvest beyond 42 DAT could possibly reduce overall S/A when compared to untreated cane even though the increase in TRS/TC might exceed 35-50 lb. The overall reduction in S/A is caused by the significant reduction in TC/A associated with the glyphosate treatment. However, it appears that by delaying glyphosate treatments by one month (September 14 vs. August 18), it is more likely that S/A will be significantly increased regardless of the post-harvest interval. This experiment supports the current recommendations that glyphosate be applied to LCP 85-384 at the equivalent rate of Polado-L at 6 oz/A or 0.1875 lb ae/A. Lower rates are not as effective while higher rates for LCP 85-384 appear excessive and may result in lowering of overall S/A.

In the 2004 experiment, both Test I and II had identical treatments with the only difference being that the second application of those treatments was deferred by one month (September 14 vs. August 18). Post-harvest sampling dates were the same for the two experiments at 28, 42 and 56 DAT. When averaging across all treatments and dates of sampling, there was a significant increase of 1,928 lb (8784 vs. 6856 lb) of S/A in favor of the later treatment date, September 14. This would indicate that the Louisiana sugarcane industry could significantly increase its overall yield of S/A by delaying harvest by one month in keeping with the historical startup date of October 15. Further, by delaying the harvest by one month and averaging across all treatments and dates of sampling, TC/A and TRS/TC would be increased by 4.2 tons and 29 lb, respectively. Mean stalk length (MSL) and mean stalk weight (MSW) would also be increased by 8.7 in and 0.27 lb, respectively by delaying the harvest by one month. There were similar trends when comparing each treatment independently for the two treatment dates and averaging over the three sampling dates.

This experiment also indicates that more studies should be conducted with Palisade, especially at the higher rates. Palisade apparently increases S/T without reducing TC/A as much as seen with most of the glyphosate treatments.

INTRODUCTION

In Louisiana, a sugarcane crop cycle usually consists of a fall-planted crop (plant-cane), which grows very little during winter and is harvested about one year after planting, and two or more stubble (ratoon) crops. The region has a 7- to 9-month growing season that extends from late February/early March to late November or until the first freeze of the winter season causes a cessation of growth. The harvest generally occurs from late September to early January. Consequently, sugarcane is relatively immature at the beginning of harvest and sucrose levels are usually low, generally increasing as the harvest season advances, depending upon the variety. Sucrose levels in juice and yield of sugar per ton of cane and per acre are affected greatly by variety and weather conditions during the growing season and harvest. A combination of high incident light, cool nights and drying soil prior to and during the harvest period retards vegetative growth and promotes sucrose accumulation (natural ripening) (Legendre 1975).

Artificial ripening of sugarcane has been made possible by the development of plant growth regulators such as chemical ripeners that hasten sugarcane maturation and increase sugar yield (Nickell 1984). Glyphosate [N-(phosphonomethyl)glycine], one of the most effective chemical ripeners used on a world-wide basis, apparently influences the way dry matter is partitioned, increasing the ratio of sucrose to fiber (Osgood et al. 1981). However, glyphosate treatment usually decreases cane yield in the crop by slowing cane growth after treatment, thus reducing stalk weight. In Louisiana, the effectiveness of glyphosate for ripening sugarcane is strongly dependent upon variety, treatment-harvest interval and growing season.

Until the 2003 harvest season, the only glyphosate formulation labeled for use in Louisiana was Polado-L® (Monsanto Company) which was also labeled for sucrose enhancement in Florida, Hawaii, Texas and Puerto Rico. The label stipulates that it was to be used only in stubble crops, a rate range of 4 to 14 ounces per acre of the formulated product (contains 4 lb of glyphosate acid in each gallon in the isopropyl amine salt form) and a treatment-harvest interval of 35 to 49 days. For the 2003 harvest, a second formulation of glyphosate, Touchdown iQ® (Syngenta) was labeled for use in Louisiana. The Touchdown iQ label also stipulates use only in stubble crops at a rate of 8 to 10 ounces per acre of the formulated product (contains 3 lb of glyphosate acid in each gallon in the diammonium salt form) and a treatment harvest interval of 21 to 35 days. A third glyphosate formulation, Roundup WeatherMAX (Monsanto Company) was labeled for the 2004 crop year. In Louisiana, WeatherMAX is labeled at 3.5 to 12 ounces per acre of the formulated product (contains 4.5 lb of glyphosate acid in each gallon in the potassium salt form). None of the labeled products are labeled for plant-cane crops because of possible phytotoxicity to crown buds which could adversely affect regrowth (stubbling), thus having the potential to reduce plant stands and yields in the subsequent stubble crop.

Slow stand development in spring is commonly observed in glyphosate-treated sugarcane in Louisiana. Millhollon and Legendre (1996) found that annual glyphosate (Polado-L) ripener treatments will usually increase mean annual sugar yield, but the magnitude of the increase will depend on variety tolerance to the treatments. They found that CP 70-321 appeared to have adequate tolerance to annual treatments, whereas LCP 85-384 can show extreme

sensitivity. This prompted a reduction in the rate of Polado-L from 8 oz/A to 6 oz/A for LCP 85-384.

Currently, glyphosate is used on approximately 250-300,000 acres in Louisiana each crop year, netting the state's sugarcane growers, processors and landlords an estimated $22.1 million in increased gross revenues each year. However, all current glyphosate formulations are not labeled for plant-cane use and typically cause a loss of cane yield in the crop being treated. Further, there is potential for these products to cause yield reduction in the subsequent stubble crop. Therefore, additional research is needed to find alternative ripeners that can be used on the plant-cane crop and be harvested at a reduced treatment-harvest interval. Additionally, alternative ripeners should be developed that have little or no impact on cane yield and will not affect the subsequent stubble crop.

Polado-L is currently formulated without added surfactant. Although it is suggested that a quality non-ionic surfactant be added with Polado-L if weather conditions warrant, research has demonstrated that the use of a surfactant can improve the efficacy of the product. On the other hand, both Touchdown iQ and WeatherMAX are formulated with surfactants.

The first objective of this field experiment was to test the efficacy of the three labeled glyphosate formulations at several rates and post-treatment harvest dates when applied in mid August and mid September. A second objective of this experiment was to look at other potential ripeners. Because of the possibility of glyphosate-tolerant sugarcane varieties being developed in the future, the use of glyphosate as a ripener would be effectively eliminated. From 1983 to 1986, Legendre (unpublished data), showed that two products, Fusilade (fluazifop-P-butyl) (Syngenta) and Arsenal (imazapyr) (BASF), had the potential to ripen sugarcane under Louisiana conditions; however, the testing of both products was discontinued because the companies expressed no commercial interest. One potential new ripener, Palisade® (trinexapac-ethyl), a growth regulator from Syngenta, was included in the 2004 studies.

PROCEDURES

In two field experiments, the same chemical ripener treatments were applied to adjacent fields of LCP 85-384 in the plant-cane crop on August 28 (Test I) and September 14 (Test II), 2004, in water at a broadcast rate of 8 gal/A with a CO_2 sprayer and hand-held boom. The fields had been cultivated and fertilized according to recommended practices; insecticides were applied as required to control the sugarcane borer. A nonionic surfactant, Induce® (0.25% v/v)(Helena), was added to all spray solutions of Polado-L only. Each experiment consisted of 14 treatments: Polado-L at 4, 6 and 8 oz of the formulated product per acre (0.1250, 0.1875 and 0.2500 lb ae/A, respectively), Roundup WeaterMAX at 3.6, 5.3 and 7.1 oz of the formulated product per acre (0.1250, 0.1875 and 0.2500 lb ae/A, respectively), Touchdown iQ at 5.30, 6.65, 8.00 and 10.70 oz of the formulated product per acre (0.1250, 0.1562, 0.1875 and 0.2500 lb ae/A, respectively), Palisade at 0.223, 0.267 and 0.312 lb ai/A and an untreated check serving as a control. A 36-inch band was sprayed over sugarcane foliage so that most of the leaves were wet by the spray. Plots in each of the two experiments were one-row (6 ft) by 50 ft long with a 5-foot alley and with buffer rows on either side of treated row, arranged in a randomized complete block design with three replications. All plots of the two experiments were ultimately harvested green by

combine at 56 days after treatment for both experiments. The mulch residue remained on the fields after harvest.

From each plot of the two experiments, fifteen-stalk samples were taken at random along the row at 28, 42 and 56 days after treatment (DAT). Stalks were stripped of all leaves and topped approximately 4-6 in below the apical meristem (bud). Following hand sampling at 56 DAT, each plot was harvested by a cane combine (Cameco Model 2500) operating at approximately 3.5 mph and an extractor fan speed of 950 rpm. All cane from each plot was weighed in the wagon equipped with load cells and the weights recorded. Data collected and/or calculated from each plot included millable stalks per acre prior to sampling and for each date of sampling, mean stalk weight (MSW), mean stalk length (MSL), estimated tons of cane per acre (TC/A)(MSW multiplied by millable stalk count/A and divided by 2000), Brix by refractometer, sucrose by polarimetry, purity (the ratio of sucrose to Brix), the yield of theoretical recoverable sugar per ton of cane (TRS/TC) and yield of sugar per acre (S/A)(TC/A multiplied by TRS/TC) . From weighed plots, the yield of tons cane per acre (TC/A) was calculated adjusted to the plot size. All values for TC/A, whether estimated or weighed, were adjusted downward by applying a factor of 0.86 as a deduction for trash content. Plots were rated for regrowth through the residue on November 16, 2004 using a scale of 1-9 with 1 representing excellent stands and 9 representing very poor stands.

Data were analyzed using the Proc Mixed Procedure of the SAS (v 8.2) software package. Data were balanced and least square means were calculated. Mean separation was accomplished by the PDIFF option (P = 0.05).

RESULTS AND DISCUSSION

There were no significant differences from control plots in the number of millable stalks per acre for each treatment when averaged across the three replications of the two field studies conducted in 2004 - Test I (treated, August 18) and Test II (treated, September 14) (Table 1). These counts were used to calculate the estimated yield of tons cane per acre (TC/A) for each test by multiplying the average count for each treatment by the mean stalk weight (MSW) for each plot in the two tests (Tables 2-7).   For comparison purposes, only estimated TC/A will be used since weighed TC/A could only occur after the last sampling date at 56 days after treatment (DAT).

For Test I, there were no significant differences in the yield of sugar per acre (S/A) at either 28 or 56 DAT (Tables 2-4). At 42 DAT, there was a significant increase in S/A for all of the Palisade treatments and two of the Touchdown iQ treatments (5.30 and 8.00 oz/A). The S/A for all other treatments at 28 and 42 DAT, although not significantly different from control, were numerically higher; however, by 56 DAT there were several of the treatments, Palisade at 0.223 and 0.312 lb/A, Polado-L at 4 and 8 oz/A and all rates of Roundup WeatherMAX and Touchdown iQ, where S/A were numerically lower when compared to control. These data are very significant in that there was a perception by many producers that glyphosate actually reduced S/A, especially when applied in August for early harvest in mid to late September. These data do show that early glyphosate treatments do generally reduce TC/A by negatively impacting mean stalk length (MSL) and MSW, especially at the higher rates (Tables 2-4). In

general, the longer the treatment-to-harvest interval, the greater will be the measured reduction in MSW and possibly TC/A (Legendre and Finger 1987). The results of the current experiment are similar to those reported by Millhollon and Legendre (1996) where they indicated that repeated application of glyphosate reduced TC/A although S/A was not significantly reduced due to the increase in TRS/TC. However, in Test I, the increase in TRS/TC more than compensated for any loss of TC/A (Tables 2-4). Although glyphosate is classified as a herbicide, at the lower rates recommended for use as a ripener, it acts as a plant growth regulator significantly reducing MSL, regardless of the rate applied. Further, glyphosate also tended to reduce MSW although not as dramatic as the effect on MSL.

It appeared that Palisade which is classified as growth regulator, not a herbicide, had a less dramatic effect on TC/A and MSW although there was a significant reduction in MSL at the higher rates. There was a numerical increase in S/A at 28 DAT and a significant increase at 42 DAT for all three Palisade treatments. However, there was only limited response in S/A at 56 DAT. It appeared that the low rate of Palisade (0.223 lb/A) had less of an impact on increasing TRS/TC than any of the glyphosate treatments used in this experiment. However, at the higher rates, the increase in TRS/TC was comparable to that of any of the glyphosate treatments although there was a greater impact on reducing MSW at 56 DAT.

For Test II, all glyphosate treatments resulted in a numerical increase in S/A when compared to control at 24 DAT (Tables 5-7). Further, Polado-L at 8 oz/A, Roundup WeatherMAX at 3.6 oz/A and Touchdown iQ at 8.00 oz/A resulted in a significant increase in S/A at 28 DAT. Most all glyphosate treatments showed a significant increase in S/A at 42 DAT and 5 of the 10 treatments showed a significant increase in S/A at 56 DAT. TC/A, MSL or MSW were not generally affected by any of the glyphosate treatments on any of the sampling dates although MSL was negatively affected at 56 DAT (Tables 5-7). However, this decrease in MSL did not translate into a general reduction in TC/A. With no exceptions, TRS/TC was increased significantly by all glyphosate treatments, regardless of the rate or post-treatment interval (Tables 5-7).

In Test II, only the high rate of Palisade (0.312 lb/A) significantly increased S/A at both 42 and 56 DAT (Tables 5-7). No Palisade treatment increased (or decreased) S/A or had any significant affect on TC/A, TRS/TC, MSL or MSW at 28 DAT (Tables 5-7). At 42 DAT, the high rate of Palisade resulted in a significant increase in both TC/A and TRS/TC. TRS/TC was also significantly increased by Palisade at the two other rates tested at 42 DAT (Tables 5-7). At 56 DAT, the application of Palisade increased TRS/TC for the mid and high rates.

Both Test I and II had identical treatments with the only difference being that the second application of those treatments was deferred by one month (September 14 vs. August 18). Post-harvest sampling dates were the same for the two experiments at 28, 42 and 56 DAT. When averaging across all treatments and dates of sampling, there was a significant increase of 1,928 lb (8784 vs. 6856 lb) of S/A in favor of the later treatment date, September 14 (data not shown). This would indicate that the Louisiana sugarcane industry could significantly increase its overall yield of S/A by delaying harvest by one month in keeping with the historical startup date of October 15. Further, by delaying the harvest by one month and averaging across all treatments and dates of sampling, TC/A and TRS/TC would be increased by 4.2 tons and 29 lb, respectively

(data not shown). MSL and MSW would also be increased by 8.7 in and 0.27 lb, respectively by delaying the harvest by one month (data not shown). There were similar trends when comparing each treatment independently for the two treatment dates and averaging over the three sampling dates (data not shown).

This experiment shows that when applying glyphosate in August, the treatment-to-harvest interval should be shortened to 28 DAT to insure maximizing S/A. Although there is still a loss of TC/A associated with glyphosate treatments at 28 DAT, the increase in TRS/TC more than compensates for the loss of TC/A. However, with the early application date, by delaying harvest beyond 42 DAT could possibly reduce overall S/A when compared to untreated cane even though the increase in TRS/TC might exceed 35-50 lb. The overall reduction in S/A is caused by the significant reduction in TC/A associated with the glyphosate treatment. However, it appears that by delaying glyphosate treatments by one month (September 14 vs. August 18), it is more likely that S/A will be significantly increased regardless of the post-harvest interval. Overall, this experiment supports the current recommendations that glyphosate be applied to LCP 85-384 at the equivalent rate of Polado-L at 6 oz/A or 0.1875 lb ae/A (Legendre 2001).

This experiment also indicates that more studies should be conducted with Palisade, especially at the higher rates. Palisade apparently increases S/T without reducing TC/A as much as seen with most of the glyphosate treatments.

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Table 1. Number of millable stalks per acre for each treatment averaged across the three replications for each of the two tests, Test I and Test II, in the 2004 field experiment 1/.

Treatment	**Stalk Number Test I (counts)**	**Stalk Number Test II (counts)**
Control	44,189	42,302
Palisade @ 0.223 lb/A	41,576	41,769
Palisade @ 0.267 lb/A	44,480	40,753
Palisade @ 0.312 lb/A	44,189	42,495
Polado @ 4 oz/A	41,140	39,204
Polado @ 6 oz/A	42,495	41,672
Polado @ 8 oz/A	42,350	42,011
RdUp Weather Max @ 3.6 oz/A	40,124	41,576
RdUp Weather Max @ 5.3 oz/A	42,060	40,511
RdUp Weather Max @ 7.1 oz/A	41,285	43,705
Touchdown iQ @ 5.30 oz/A	44,964	43,754
Touchdown iQ @ 6.65 oz/A	45,109	41,818
Touchdown iQ @ 8.00 oz/A	41,092	40,172
Touchdown iQ @ 10.70 oz/A	42,253	42,834

1/ Millable stalk counts were conducted on August 11, 2004.

Table 2. Effect of 13 chemical ripener treatments when applied in mid August on yield of sugar per acre (Sugar/A), tons cane per acre (TC/A) and theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk length (MSL) and mean stalk weight (MSW) when harvested at 28 days after treatment 1/.

Treatment	**Sugar/A (lbs)**	**TC/A (tons)**	**TRS/TC (lbs)**	**MSL (in)**	**MSW (lb)**
Control	5572	31.2	178	86.6	1.64
Palisade @ 0.223 lb/A	6282	30.4	206 +	83.5	1.70
Palisade @ 0.267 lb/A	6438	29.2	219 +	78.0 -	1.52
Palisade @ 0.312 lb/A	6314	29.3	216 +	79.8 -	1.54
Polado @ 4 oz/A	6073	27.3	222 +	77.4 -	1.54
Polado @ 6 oz/A	6557	29.2	224 +	77.2 -	1.60
Polado @ 8 oz/A	5961	26.9	221 +	78.5 -	1.48 -
RdUp Weather Max @ 3.6 oz/A	5657	25.9 -	219 +	77.3 -	1.50 -
RdUp Weather Max @ 5.3 oz/A	6063	26.8	226 +	78.7 -	1.48 -
RdUp Weather Max @ 7.1 oz/A	5779	26.0 -	222 +	75.3 -	1.47 -
Touchdown iQ @ 5.30 oz/A	6156	28.3	218 +	77.7 -	1.46 -
Touchdown iQ @ 6.65 oz/A	6287	29.3	215 +	78.7 -	1.50 -
Touchdown iQ @ 8.00 oz/A	5939	26.0 -	229 +	76.5 -	1.47 -
Touchdown iQ @ 10.70 oz/A	5783	26.5	219 +	77.7 -	1.46 -

1/ Treated, August 18, 2004; Sampled, September 14, 2004. TC/A based on estimated yield (mean stalk weight multiplied by the stalk count for each plot). (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 3. Effect of 13 chemical ripener treatments when applied in mid August on yield of sugar per acre (Sugar/A), tons cane per acre (TC/A) and theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk length (MSL) and mean stalk weight (MSW) when harvested at 42 days after treatment 1/.

Treatment	**Sugar/A (lbs)**	**TC/A (tons)**	**TRS/TC (lbs)**	**MSL (in)**	**MSW (lb)**
Control	5851	30.0	196	86.6	1.58
Palisade @ 0.223 lb/A	7751 +	32.4	239 +	85.3	1.81
Palisade @ 0.267 lb/A	7471 +	30.1	248 +	81.9	1.58
Palisade @ 0.312 lb/A	7629 +	31.5	241 +	83.5	1.66
Polado @ 4 oz/A	7285	28.3	258 +	79.5 -	1.61
Polado @ 6 oz/A	7207	29.0	248 +	78.7 -	1.59
Polado @ 8 oz/A	6948	27.5	253 +	78.0 -	1.51 -
RdUp Weather Max @ 3.6 oz/A	6466	27.3	236 +	80.1 -	1.58
RdUp Weather Max @ 5.3 oz/A	6695	27.7	241 +	80.3 -	1.53 -
RdUp Weather Max @ 7.1 oz/A	6950	28.7	242 +	82.2	1.62
Touchdown iQ @ 5.30 oz/A	7523 +	29.2	256 +	79.5 -	1.51 -
Touchdown iQ @ 6.65 oz/A	6587	29.1	226 +	81.4	1.50 -
Touchdown iQ @ 8.00 oz/A	7391 +	28.7	257 +	79.8 -	1.62
Touchdown iQ @ 10.70 oz/A	6614	27.2	244 +	80.1 -	1.49 -

1/ Treated, August 18, 2004; Sampled, September 29, 2004. TC/A based on estimated yield (mean stalk weight multiplied by the stalk count for each plot). (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 4. Effect of 13 chemical ripener treatments when applied in mid August on yield of sugar per acre (Sugar/A), tons cane per acre (TC/A) and theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk length (MSL) and mean stalk weight (MSW) when harvested at 56 days after treatment 1/.

Treatment	**Sugar/A (lbs)**	**TC/A (tons)**	**TRS/TC (lbs)**	**MSL (in)**	**MSW (lb)**
Control	7644	31.4	243	87.1	1.68
Palisade @ 0.223 lb/A	7279	30.0	243	80.8 -	1.65
Palisade @ 0.267 lb/A	8080	30.0	269 +	80.3 -	1.46
Palisade @ 0.312 lb/A	7403	27.8	266 +	76.1 -	1.41
Polado @ 4 oz/A	6565	25.0 -	264 +	76.9 -	1.65
Polado @ 6 oz/A	8163	29.9	273 +	76.6 -	1.54
Polado @ 8 oz/A	7584	28.1	270 +	75.1 -	1.57
RdUp Weather Max @ 3.6 oz/A	7479	27.1	276 +	76.6 -	1.58
RdUp Weather Max @ 5.3 oz/A	7623	28.5	267 +	78.0 -	1.63
RdUp Weather Max @ 7.1 oz/A	7587	29.0	261 +	76.1 -	1.45
Touchdown iQ @ 5.30 oz/A	7535	27.1	278 +	76.1 -	1.49
Touchdown iQ @ 6.65 oz/A	7477	28.9	259	78.2 -	1.48
Touchdown iQ @ 8.00 oz/A	7199	26.2	275 +	73.8 -	1.68
Touchdown iQ @ 10.70 oz/A	7093	26.6	268 +	73.5 -	1.41

1/ Treated, August 18, 2004; Sampled and harvested by cane combine, October 12, 2004. TC/A based on estimated yield (mean stalk weight multiplied by the stalk count for each plot). (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 5. Effect of 13 chemical ripener treatments when applied in mid September on yield of sugar per acre (Sugar/A), tons cane per acre (TC/A) and theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk length (MSL) and mean stalk weight (MSW) when harvested at 28 days after treatment 1/.

Treatment	**Sugar/A (lbs)**	**TC/A (tons)**	**TRS/TC (lbs)**	**MSL (in)**	**MSW (lb)**
Control	7366	31.9	231	88,4	1.76
Palisade @ 0.223 lb/A	7714	31.5	245	86.1	1.76
Palisade @ 0.267 lb/A	7344	30.1	245	85.6	1.72
Palisade @ 0.312 lb/A	8188	33.2	247	88.2	1.82
Polado @ 4 oz/A	8055	31.5	256 +	86.9	1.87
Polado @ 6 oz/A	6840	27.2 -	253 +	84.0	1.52
Polado @ 8 oz/A	8852 +	35.0	253 +	88.2	1.94
RdUp Weather Max @ 3.6 oz/A	8918 +	33.9	263 +	85.0	1.90
RdUp Weather Max @ 5.3 oz/A	8471	33.1	256 +	86.9	1.90
RdUp Weather Max @ 7.1 oz/A	7799	30.9	253 +	85.8	1.65
Touchdown iQ @ 5.30 oz/A	8439	32.8	257 +	83,7	1.74
Touchdown iQ @ 6.65 oz/A	8137	31.4	259 +	85.0	1.76
Touchdown iQ @ 8.00 oz/A	8517 +	33.2	257 +	88.2	1.92
Touchdown iQ @ 10.70 oz/A	8368	33.1	254 +	85.6	1.80

1/ Treated, September 14, 2004; Harvested, October 12, 2004. TC/A based on estimated yield (mean stalk weight multiplied by the stalk count for each plot). (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 6. Effect of 13 chemical ripener treatments when applied in mid September on yield of sugar per acre (Sugar/A), tons cane per acre (TC/A) and theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk length (MSL) and mean stalk weight (MSW) when harvested at 42 days after treatment 1/.

Treatment	**Sugar/A (lbs)**	**TC/A (tons)**	**TRS/TC (lbs)**	**MSL (in)**	**MSW (lb)**
Control	7248	31.7	229	92.9	1.75
Palisade @ 0.223 lb/A	7567	30.4	249 +	86.1 -	1.69
Palisade @ 0.267 lb/A	8431	32.9	256 +	92.1	1.88
Palisade @ 0.312 lb/A	9188 +	36.2 +	254 +	93.7	1.98
Polado @ 4 oz/A	9611 +	33.3	289 +	91.1	1.98
Polado @ 6 oz/A	8482	30.8	276 +	88.2	1.72
Polado @ 8 oz/A	8880 +	32.9	270 +	90.3	1.83
RdUp Weather Max @ 3.6 oz/A	10184 +	35.4	288 +	88.2	1.98
RdUp Weather Max @ 5.3 oz/A	9213 +	33.2	278 +	90.3	1.91
RdUp Weather Max @ 7.1 oz/A	8997 +	32.7	276 +	87.9	1.74
Touchdown iQ @ 5.30 oz/A	8970 +	33.0	271 +	90.3	1.76
Touchdown iQ @ 6.65 oz/A	9101 +	32.5	280 +	89.0	1.81
Touchdown iQ @ 8.00 oz/A	8381	29.6	284 +	85.3 -	1.71
Touchdown iQ @ 10.70 oz/A	9240 +	33.1	279 +	90.3	1.80

1/ Treated, September 14, 2004; Harvested, October 26, 2004. TC/A based on estimated yield (mean stalk weight multiplied by the stalk count for each plot). (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 7. Effect of 13 chemical ripener treatments when applied in mid September on yield of sugar per acre (Sugar/A), tons cane per acre (TC/A) and theoretical recoverable sugar per ton of cane (TRS/TC), mean stalk length (MSL) and mean stalk weight (MSW) when harvested at 56 days after treatment 1/.

Treatment	Sugar/A (lbs)	TC/A (tons)	TRS/TC (lbs)	MSL (in)	MSW (lb)
Control	8618	34.1	253	92.4	1.89
Palisade @ 0.223 lb/A	8653	32.9	263	87.9	1.83
Palisade @ 0.267 lb/A	8215	30.1	273 +	85.3 -	1.72
Palisade @ 0.312 lb/A	9863 +	36.9	267 +	90.3	2.02
Polado @ 4 oz/A	9316	31.3	298 +	85.6 -	1.86
Polado @ 6 oz/A	9336	30.9	302 +	83.7 -	1.73
Polado @ 8 oz/A	10107 +	34.2	296 +	89.5	1.89
RdUp Weather Max @ 3.6 oz/A	9249	30.9	299 +	85.0 -	1.73
RdUp Weather Max @ 5.3 oz/A	9980 +	33.7	297 +	86.4 -	1.93
RdUp Weather Max @ 7.1 oz/A	8663	29.6 -	293 +	85.8 -	1.58 -
Touchdown iQ @ 5.30 oz/A	10322 +	36.0	287 +	93.2	1.91
Touchdown iQ @ 6.65 oz/A	10661 +	35.3	302 +	86.6 -	1.97
Touchdown iQ @ 8.00 oz/A	9600	32.4	296 +	85.8 -	1.88
Touchdown iQ @ 10.70 oz/A	9849 +	34.0	291 +	88.5	1.84

1/ Treated, September 14, 2004; Harvested, November 10, 2004. TC/A based on estimated yield (mean stalk weight multiplied by the stalk count for each plot). (+) or (-) denotes values in a column are statistically higher or lower than control, respectively.

Table 8. Regrowth ratings for Test I in the fall following harvest 1/.

Treatment	Regrowth
Control	3
Palisade @ 0.223 lb/A	3
Palisade @ 0.267 lb/A	4
Palisade @ 0.312 lb/A	3
Polado @ 4 oz/A	6
Polado @ 6 oz/A	8
Polado @ 8 oz/A	8
RdUp Weather Max @ 3.6 oz/A	6
RdUp Weather Max @ 5.3 oz/A	7
RdUp Weather Max @ 7.1 oz/A	9
Touchdown iQ @ 5.30 oz/A	7
Touchdown iQ @ 6.65 oz/A	7
Touchdown iQ @ 8.00 oz/A	7
Touchdown iQ @ 10.70 oz/A	9

1/ Test I treated August 18, 2004; Harvested by cane combine October 12, 2004; Rated November 16, 2004; Plots were rated for regrowth (shoot number and uniformity of shoots on the row) using a rating scale of 1-9 with 1 representing excellent and uniform stands and 9 representing very poor and irregular stands.

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